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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
L9289.02149B
Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

and invented by:

Kenichi MIYOSHI
Osamu KATO
Junichi AIZAWA

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☒ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: 10/089,605

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: ____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: ____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 68 pages and including the following:
   - a. ☒ Descriptive Title of the Invention
   - b. ☐ Cross References to Related Applications *(if applicable)*
   - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   - d. ☐ Reference to Sequence Listing, a Table, or a Computer Program Listing Appendix
   - e. ☒ Background of the Invention
   - f. ☒ Brief Summary of the Invention
   - g. ☒ Brief Description of the Drawings *(if filed)*
   - h. ☒ Detailed Description
   - i. ☒ Claim(s) as Classified Below
   - j. ☒ Abstract of the Disclosure

10521625 . 121802

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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   - a. ☒ Formal Number of Sheets **17**
   - b. ☐ Informal Number of Sheets ______
4. ☒ Oath or Declaration
   - a. ☐ Newly executed *(original or copy)* ☐ Unexecuted
   - b. ☒ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   - c. ☒ With Power of Attorney ☐ Without Power of Attorney
   - d. ☐ <u>*DELETION OF INVENTOR(S)*</u>
     Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☒ Incorporation By Reference *(usable if Box 4b is checked)*
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ CD ROM or CD-R in duplicate, large table or Computer Program (Appendix)
7. ☐ Application Data Sheet (See 37 CFR 1.76)
8. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   - a. ☐ Computer Readable Form (CRF)
   - b. ☐ Specification Sequence Listing on:
     - i. ☐ CD-ROM or CD-R (2 copies); or
     - ii. ☐ Paper
   - c. ☐ Statement(s) Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

9. ☐ Assignment Papers *(cover sheet & document(s))*
10. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
11. ☐ English Translation Document *(if applicable)*
12. ☒ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
13. ☒ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
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Docket No.
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Accompanying Application Parts (Continued)

17. ☒ Additional Enclosures *(please identify below):*

Confirmation Claim for Priority

Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

18. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

10/21623 .121802

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

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Total Pages in this Submission

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	20	- 20 =	0	x	$18.00	$0.00
Indep. Claims	2	- 3 =	0	x	$84.00	$0.00
Multiple Dependent Claims (check if applicable) ❑						$0.00
					BASIC FEE	$740.00
OTHER FEE *(specify purpose)*						$0.00
					TOTAL FILING FEE	$740.00

☒ A check in the amount of **$740.00** to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **19-4375** as described below. A duplicate copy of this sheet is enclosed.

- ❑ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ❑ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Signature

Dated: **December 18, 2002**

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10321623.121802

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application

Inventors: Kenichi MIYOSHI, et al.

Appln. No.: New Continuation Application of 10/089,605 filed April 1, 2002

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Please amend the above-captioned application as follows:

IN THE SPECIFICATION

Please insert the following paragraph at page 1, between lines 4 and 5:

--This is a continuation of application number 10/089,605 filed April 1, 2002.--

IN THE CLAIMS

Please amend claims 1-20 to read as follows (Exhibit I contains a marked up version):

1. (Amended) A communication terminal apparatus used in a communication system in which communication resources are allocated

to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising:

a measurer that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates said downlink channel quality;

wherein said notification signal includes information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

2. (Amended) The communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good.

3. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits with transmission power increased in proportion to a notification signal that indicates that said downlink channel quality is good.

4. (Amended) The communication terminal apparatus according to claim 3, further comprising a controller that controls transmission power of a pilot signal,

wherein said transmitter transmits with a notification signal that indicates said downlink channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates said downlink channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

5. (Amended) The communication terminal apparatus according to claim 3, further comprising:

a table that indicates a correspondence between a notification signal and transmission power; and

a rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus,

wherein said transmitter adjusts a notification signal to predetermined transmission power based on said table.

6. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits after performing conversion to a code word with a size of a code word minimum

distance proportional to a notification signal that indicates that said downlink channel quality is good.

7. (Amended) The communication terminal apparatus according to claim 6, further comprising:

a table that indicates a correspondence between a notification signal and a code word; and

a rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus,

wherein said transmitter converts a notification signal to a predetermined code word based on said table.

8. (Amended) The communication terminal apparatus according to claim 2, further comprising a determiner that determines a communication mode indicated by a combination of modulation method and coding method based on channel quality,

wherein said transmitter makes a notification signal a signal that indicates a communication mode.

9. (Amended) The communication terminal apparatus according to claim 2, wherein:

said measurer measures pilot signal reception quality; and said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value.

10. (Amended) The communication terminal apparatus according to claim 1, wherein:

said measurer measures pilot signal reception quality; and

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality value.

11. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

12. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

13. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

14. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurer that measures reception power of a notification signal;

a detector that detects a notification signal whose reception power is less than a predetermined threshold value; and

a determiner that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

15. The base station apparatus according to claim 14, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

16. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurer that measures likelihood of a notification signal;

a detector that detects a notification signal whose likelihood is less than a predetermined threshold value; and

a determiner that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

17. The base station apparatus according to claim 16, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

18. (Amended) A radio communication method, wherein:

a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of said downlink channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and

said base station determines downlink communication resource allocation in accordance with a notification signal.

19. (Amended) The radio communication method according to claim 18, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good.

20. The radio communication method according to claim 18, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to

information for which an amount of change is large within information used to indicate a reception quality value.

REMARKS

This application is directed to original claims 1-20 which are amended for clarity. The amendments are considered to be non-narrowing and no estoppel should be deemed to attach thereto.

Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

Date: December 16, 2002

James E. Ledbetter
Registration No. 28,732

JEL/spp

ATTORNEY DOCKET NO. L9289.02149B

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Exhibit I

1. (Amended) A communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising:

a [measuring device] measurer that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates said downlink channel quality;

wherein said [transmitter transmits a] notification signal [having] includes information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

2. (Amended) The communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good.

3. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits with transmission power increased in proportion to a notification signal that indicates that said downlink channel quality is good.

4. (Amended) The communication terminal apparatus according to claim 3, further comprising a controller that controls transmission power of a pilot signal [,];

wherein said transmitter transmits with a notification signal that indicates said downlink channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates said downlink channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

5. (Amended) The communication terminal apparatus according to claim 3, further comprising:

a table that indicates a correspondence between a notification signal and transmission power, and a [rewriting device] rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus[;],

wherein said transmitter adjusts a notification signal to predetermined transmission power based on said table.

6. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that said downlink channel quality is good.

7. (Amended) The communication terminal apparatus according to claim 6, further comprising:

a table that indicates a correspondence between a notification signal and a code word; and

a [rewriting device] rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus[;],

wherein said transmitter converts a notification signal to a predetermined code word based on said table.

8. (Amended) The communication terminal apparatus according to claim 2, further comprising a [determination device] determiner that determines a communication mode indicated by a combination of modulation method and coding method based on channel quality[;],

wherein said transmitter makes a notification signal a signal that indicates a communication mode.

9. (Amended) The communication terminal apparatus according to claim 2, wherein:

said [measurement device] measurer measures pilot signal reception quality; and

said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value.

10. (Amended) The communication terminal apparatus according to claim 1, wherein:

said [measurement device] measurer measures pilot signal reception quality; and

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality value.

11. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

12. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

13. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

14. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a [measurement device] measurer that measures reception power of a notification signal;

a detector that detects a notification signal whose reception power is less than a predetermined threshold value; and

a [determination device] determiner that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

15. The base station apparatus according to claim 14, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

16. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a [measurement device] measurer that measures likelihood of a notification signal;

a detector that detects a notification signal whose likelihood is less than a predetermined threshold value; and a [determination device] determiner that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

17. The base station apparatus according to claim 16, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

18. (Amended) A radio communication method, wherein:

a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of said downlink channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and said base station determines downlink communication resource allocation in accordance with a notification signal.

19. (Amended) The radio communication method according to claim 18, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good.

20. The radio communication method according to claim 18, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a reception quality value.

DESCRIPTION

COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

Technical Field

The present invention relates to a communication terminal apparatus, base station apparatus, and radio communication method to be used in a cellular communication system.

Background Art

In a cellular communication system, one base station performs radio communication with a plurality of communication terminals simultaneously, and therefore, as demand has increased in recent years, so has the need for higher transmission efficiency.

One technology that has been proposed for increasing the transmission efficiency of a downlink from a base station to a communication terminal is HDR (High Data Rate). HDR is a communication method whereby a base station performs scheduling for allocating communication resources to communication terminals by time division, and also sets a transmission rate for each communication terminal according to the downlink channel quality.

The operations by which a base station and communication terminals perform radio communication with HDR are described below. First, the base station transmits a pilot signal to each communication terminal. Each communication terminal estimates the downlink channel quality using a CIR (desired carrier to interference ratio) based on the pilot signal, etc., and finds a transmission rate at which communication is possible. Then, based on the transmission rate at which communication is possible, each communication terminal selects a communication mode, which is a combination of packet length, coding method, and modulation method, and transmits a data rate control (hereinafter referred to as "DRC") signal indicating the communication mode to the base station.

The type of modulation method that can be used in each system is predetermined as BPSK, QPSK, 16QAM, 64QAM, and so forth. Also, the type of coding that can be used in each system is predetermined as 1/2 turbo code, 1/3 turbo code, 3/4 turbo code, and so forth. Further, a plurality of transmission rates that can be used in each system are predetermined according to a combination of packet length, modulation method, and coding method. Each communication terminal selects a combination whereby communication can be performed most efficiently with the current downlink channel quality, and transmits a DRC signal indicating the selected communication mode to the base station. Generally, DRC signals are represented by numbers from 1 to N, with a higher number indicating a proportionally better downlink channel quality.

Based on the DRC signal transmitted from each communication terminal, the base station sets a transmission rate for each communication terminal, and sends a signal to each communication terminal via a control channel indicating communication resource allocation to each communication terminal. Generally, taking improvement of system transmission efficiency into consideration, communication resources are allocated with priority to the communication terminal that has the best downlink channel quality—that is to say, the communication terminal that transmits the highest-numbered DRC signal.

The base station then transmits data only to the relevant communication terminal in its allocated time. For example, if time t1 has been allocated to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

In this way, data transmission efficiency has conventionally been increased for the overall system by setting a transmission rate for each communication terminal according to channel quality by means of HDR, and performing communication resource allocation with priority to a communication terminal with a high transmission rate at which communication is possible.

However, if the communication mode determined by a communication terminal is received erroneously by the base station due to deterioration of the channel conditions on the uplink from the communication terminal to the base station, or the like, the base station will transmit data using that erroneous mode. As the determined communication mode and the communication mode of data transmitted to the communication terminal are different, the communication terminal cannot demodulate or decode the data.

Also, when a base station such as that described above has allocated time t1 to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

Due to the above, a problem arises in that, if the communication mode determined by a communication terminal is received erroneously by the base station, there will be an interval during which time-divided communication resources are not used, and downlink throughput falls.

Disclosure of Invention

It is an object of the present invention to provide a communication terminal apparatus, base station apparatus, and radio communication method that make it possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

In order to achieve the above-described object, in the present invention, with respect to information, among information indicative of downlink channel quality, which has a possibility of decreasing the downlink throughput when the information is received erroneously in a base station, a communication terminal provides such information with less susceptibility to errors in the propagation path to transmit. It is thereby possible to prevent the downlink throughput from decreasing.

Brief Description of Drawings

FIG.1 is a graph illustrating DRC signal selection frequency in a base station;

FIG.2 is a block diagram showing a configuration of a base station according to Embodiment 1 of the present invention;

FIG.3 is a block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention;

FIG.4 is a drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention;

FIG.5 is a block diagram showing another configuration of a base station according to Embodiment 1 of the present invention;

FIG.6 is a block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention;

FIG.7 is a drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention;

FIG.8 is a block diagram showing the configuration of a base station according to Embodiment 3 of the present invention;

FIG.9 is a block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention;

FIG.10 is a block diagram showing a configuration of a base station according to Embodiment 4 of the present invention;

FIG.11 is a block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention;

FIG.12 is a block diagram showing another configuration of a base station according to Embodiment 4 of the present invention;

FIG.13 is a block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention;

FIG.14 is a block diagram showing the configuration of a communication terminal according to Embodiment 6 of the present invention;

FIG.15 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 6 of the present invention;

FIG.16 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 7 of the present invention; and

FIG.17 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 8 of the present invention.

Best Mode for Carrying out the Invention

With reference now to the accompanying drawings, embodiments of the present invention will be explained in detail below.

(Embodiment 1)

As stated above, a base station allocates communication resources with priority to the communication terminal with the best downlink channel quality. In other words, a base station selects the highest-numbered DRC signal, and allocates communication resources with priority to the communication terminal that transmitted that selected DRC signal. Thus, DRC signal selection frequency is as shown in FIG.1. FIG.1 is a graph illustrating DRC signal selection frequency in a base station. In this figure, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better channel quality.

As shown in FIG.1, the higher the number of a DRC signal, the greater is the frequency of its selection by the base station. That is to say, the better the downlink channel quality of a communication terminal, the higher is the frequency with which communication resources are allocated to that communication terminal. This kind of relationship arises from the fact that there are many communication terminals, and there is an increased probability of there being a communication terminal with good downlink channel quality.

Thus, the selection frequency of each DRC signal differs according to channel quality. That is to say, since a DRC signal indicating that downlink channel quality is good tends to be selected with greater frequency, there is a high probability that downlink throughput will fall if a DRC signal indicating that downlink channel quality is good is received erroneously. Also, since a DRC signal indicating that downlink channel quality is poor tends to be selected with lower frequency, there is little effect of producing a fall in downlink throughput if a DRC signal indicating that downlink channel quality is poor is received erroneously.

Thus, a communication terminal according to Embodiment 1 of the present invention transmits at proportionally higher transmission power a DRC signal indicating that downlink channel quality is good. Also, a base station according to Embodiment 1 of the present invention excludes DRC signals with reception power lower than a predetermined threshold value in performing communication resource allocation.

FIG.2 is a block diagram showing a configuration of a base station according to Embodiment 1 of the present invention.

In FIG.2, an allocation section 101 determines communication resource allocation to each communication terminal based on DRC signals excluding DRC signals detected by unused DRC detection sections 116 described later herein from among DRC signals extracted by demodulators 114 described later herein. Then, based on the determined communication resource allocation, the allocation section 101 notifies a buffer 102 for output of downlink transmit data, indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104.

The buffer 102 holds downlink transmit data, and outputs downlink transmit data for a predetermined communication terminal to the adaptive coding section 103 in accordance with the directions of the allocation section 101. The adaptive coding section 103 codes the output signal from the buffer 102 in accordance with the directions of the allocation section 101, and outputs the resulting signal to the adaptive modulator 104. The adaptive modulator 104 modulates the output signal from the adaptive coding section 103 in accordance with the directions of the allocation section 101, and outputs the resulting signal to a spreading section 105. Spreading section 105 spreads the output signal from the adaptive modulator 104, and outputs the resulting signal to a multiplexer 108.

A modulator 106 modulates a pilot signal and outputs it to a spreading section 107. Spreading section 107 spreads the output signal from the modulator 106, and outputs the resulting signal to the multiplexer 108.

The multiplexer 108 performs time multiplexing of the spread pilot signal with the spread downlink transmit data at predetermined intervals, and outputs the resulting signal to a transmit RF section 109. The transmit RF section 109 converts the frequency of the output signal from the multiplexer 108 to radio frequency, and outputs the resulting signal to a duplexer 110.

The duplexer 110 transmits the output signal from the transmit RF section 109 as a radio signal from an antenna 111 to a communication terminal. Moreover, the duplexer 110 outputs the signals transmitted from each communication terminal and received by antenna 111 to receive RF section 112.

A receive RF section 112 converts the frequency of a radio frequency signal output from the duplexer 110 to baseband, and outputs the resulting signal to a despreading section 113. The despreading section 113 despreads the baseband signal using the spreading code used to spread the DRC signal, and outputs the resulting signal to the demodulator 114 and a reception power calculation section 115.

The demodulator 114 demodulates the output signal from the despreading section 113 and extracts the DRC signal, and outputs this signal to the allocation section 101.

The reception power calculation section 115 measures the reception power of the despread DRC signal, which is output to the unused DRC detection section 116. In the unused DRC detection section 116 is set a predetermined threshold value, as described later herein, and a DRC signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 101.

A despreading section 113, demodulator 114, reception power calculation section 115, and unused DRC detection section 116 are provided for each communication terminal. From each demodulator 114 a DRC signal for the corresponding communication terminal is output, and from each unused DRC detection section 116 a detection result for the corresponding communication terminal is output.

FIG.3 is a block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention. In FIG.3, a communication mode determination section 201 determines a communication mode indicating a combination of modulation method and coding method based on a CIR measured by a CIR measurement section 219 described later herein, and outputs the result to a DRC signal creation section 202. The communication mode determination section 201 also indicates the downlink receive data demodulation method to an adaptive demodulator 216, and indicates the downlink receive data decoding method to an adaptive decoding section 217, based on the determined communication mode.

The DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode output from the communication mode determination section 201, and outputs this DRC signal to a modulator 203 and DRC power controller 205.

Modulator 203 modulates the DRC signal and outputs the resulting signal to a spreading section 204. spreading section 204 spreads the output signal from modulator 203 and outputs the resulting signal to the DRC power controller 205. The DRC power controller 205 refers to a transmission power table 206 that shows the correspondence between DRC numbers and transmission power, controls the DRC signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209 described later herein, and outputs the DRC signal that has undergone transmission power control to a multiplexer 210. The actual method of controlling DRC signal transmission power will be described later herein.

A modulator 207 modulates the pilot signal and outputs the resulting signal to a spreading section 208. Spreading section 208 spreads the output signal from modulator 207 and outputs the resulting signal to the pilot power controller 209. The pilot power controller 209 controls the transmission power of the pilot signal, and outputs the pilot signal that has undergone transmission power control to the multiplexer 210. The pilot power controller 209 also outputs the pilot signal transmission power to the DRC power controller 205.

The multiplexer 210 performs time multiplexing of the DRC signal that has undergone transmission power control and the pilot signal that has undergone transmission power control at predetermined intervals, and outputs the resulting signal to a transmit RF section 211. The transmit RF section 211 converts the frequency of the output signal from the multiplexer 210 to radio frequency, and outputs the resulting signal to a duplexer 212.

The duplexer 212 transmits the output signal from the transmit RF section 211 as a radio signal from an antenna 213 to the base station. Also, a signal transmitted as a radio signal by the base station and received as a radio signal by the antenna 213 is output by the duplexer 212 to a receive RF section 214.

The receive RF section 214 converts the frequency of the radio frequency signal output from the duplexer 212 to baseband, and outputs the resulting signal to a despreading section 215 and a despreading section 218.

Despreading section 215 despreads the data component of the baseband signal and outputs the resulting signal to the adaptive demodulator 216. The adaptive demodulator 216 demodulates the output signal from despreading section 215 in accordance with the directions of the communication mode determination section 201, and outputs the resulting signal to the adaptive decoding section 217. The adaptive decoding section 217 decodes the output signal from the adaptive demodulator 216 in accordance with the directions of the communication mode determination section 201, and obtains receive data.

Despreading section 218 despreads the pilot signal component of the baseband signal and outputs the resulting signal to a CIR measurement section 219. The CIR measurement section 219 measures the CIR of the pilot signal output from despreading section 218, and outputs the result to the communication mode determination section 201.

Next, the procedure for transmission/reception of signals between the base station shown in FIG.2 and the communication terminal shown in FIG.3 will be described.

First, at the start of communication, a pilot signal is modulated by the modulator 106 in the base station, is spread by spreading section 107, and is output to the multiplexer 108. Only the spread pilot signal is output from the multiplexer 108 to the transmit RF section 109. The spread pilot signal is frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

A radio signal of only the pilot signal component transmitted as a radio signal from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to baseband by the receive RF section 214. The pilot signal component of the baseband signal is despread by despreading section 218, and output to the CIR measurement section 219.

Next, in the CIR measurement section 219, the CIR of the pilot signal output from despreading section 218 is measured, and based on the CIR, the communication mode is determined by the communication mode determination section 201. Then a DRC signal with a number corresponding to the communication mode is created by the DRC signal creation section 202.

The DRC signal is modulated by modulator 203, spread by spreading section 204, and output to the DRC power controller 205. In the DRC power controller 205, the DRC signal transmission power is controlled based on the transmission power of the pilot signal output from the pilot power controller 209, and the ratios of pilot signal transmission power to DRC signal transmission power set beforehand in the transmission power table 206.

The contents set in the transmission power table 206 will be described below. FIG.4 is a drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention.

The transmission power table 206 shows the correspondence between DRC numbers and DRC signal transmission power, set so that the higher the DRC number, the higher is the transmission power. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the transmission power table 206, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power.

As explained above, the frequency of selection by the base station tends to be proportional to the downlink channel quality indicated by a DRC signal, and therefore in this embodiment, transmission power is higher, and susceptibility to errors lower, the better the downlink channel quality indicated by a DRC signal. As a result, the probability of a DRC signal that indicates that downlink channel quality is good being received erroneously can be made lower than the probability of a DRC signal that indicates that downlink channel quality is poor being received erroneously. In other words, the probability of a DRC signal with a high frequency of selection by the base station being received erroneously can be made lower than the probability of a DRC signal with a low frequency of selection by the base station being received erroneously.

The DRC signal transmission power values set in the transmission power table 206 are expressed as a ratio to the pilot signal transmission power. Here, as shown in FIG.4, the settings are arranged so that DRC number 3 in the middle of DRC numbers 1 to 5 is taken as a reference, and DRC signals indicating a lower number than DRC number 3 are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a higher number than DRC number 3 are transmitted at higher transmission power than the pilot signal transmission power. That is to say, the settings are arranged so that DRC signals indicating a poorer channel quality than a predetermined channel quality (here, the channel quality corresponding to a DRC signal with DRC number 3) are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a better channel quality than the predetermined channel quality are transmitted at higher transmission power than the pilot signal transmission power.

Thus, with this embodiment, by setting DRC signals for which transmission power is increased and DRC signals for which transmission power is decreased in comparison with conventional DRC signal transmission power (here, that is, pilot signal transmission power), and making the total of DRC signal transmission power increases and decreases ±0 dB, it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors while keeping average DRC signal transmission power constant compared with a conventional system. That is to say, it is possible to proportionally reduce susceptibility to errors of DRC signals indicating that downlink channel quality is good without reducing uplink capacity compared with a conventional system.

Also, since, in this way, DRC signals indicating that downlink channel quality is poor (DRC signals with DRC numbers 1 and 2 in FIG.4) are transmitted at lower transmission power than in a conventional system, it is possible to reduce power consumption in a communication terminal that is located far from the base station and for which there is a high probability of transmitting a DRC signal indicating that downlink channel quality is poor. That is to say, in the case of a communication terminal that transmits a DRC signal indicating that downlink channel quality is poor, whereas the DRC signal was previously transmitted at transmission power that was high to begin with, according to this embodiment the DRC signal transmission power can be made lower than that high transmission power, enabling communication terminal power consumption to be greatly reduced.

As the frequency of selection by a base station is low to begin with for a DRC signal indicating that downlink channel quality is poor, there is almost no effect of producing a fall in throughput due to transmitting a DRC signal indicating that downlink channel quality is poor at lower transmission power than previously in this way.

Also, with this embodiment, DRC signals indicating that uplink channel quality is good (DRC signals with DRC numbers 4 and 5 in FIG.4) are transmitted at higher transmission power than in a conventional system.

However, there is a high possibility of a DRC signal indicating that uplink channel quality is good being transmitted from a communication terminal located comparatively near the base station. Also, due to pilot signal transmission power control that is performed constantly on an uplink, the transmission power of a pilot signal transmitted from a communication terminal located comparatively near the base station (that is, the conventional DRC signal transmission power) is low to begin with. Therefore, in the case of a communication terminal that transmits a DRC signal indicating that uplink channel quality is good, DRC signal transmission power remains low and power consumption remains low even though the previously originally low DRC signal transmission power increases, and so there is almost no effect on power consumption.

In the DRC power controller 205, the DRC signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 206. Then, in the DRC power controller 205, the transmission power of the DRC signal output from spreading section 204 is adjusted to this obtained transmission power, and a DRC signal that has been subjected to transmission power control is output to the multiplexer 210. To give a specific example, if the number of the DRC signal output from the DRC signal creation section 202 to the DRC power controller

205 is 5, the transmission power of the DRC signal output from spreading section 204 is adjusted to a transmission power 2 dB lower than the transmission power of the pilot signal output from the pilot power controller 209.

The DRC signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by the transmit RF section 211, and transmitted to the base station as a radio signal from the antenna 213 via the duplexer 212.

The radio signal transmitted from the communication terminal is received by the antenna 111 of the base station, and input to the receive RF section 112 via the duplexer 110. The signal input to the receive RF section 112 is frequency-converted to baseband, despread by the despreading section 113 using the spreading code used to spread the DRC signal, and output to the demodulator 114 and reception power calculation section 115.

In the demodulator 114 the output signal from the despreading section 113 is demodulated, and the DRC signal is extracted and output to the allocation section 101.

Here, since a DRC signal indicating that downlink channel quality is poor is transmitted by a communication terminal at lower transmission power than in a conventional system, the probability of a DRC signal indicating that downlink channel quality is poor being received erroneously by the base station is increased. Also, as stated above, if communication resource allocation is performed based on an erroneously received DRC signal, downlink throughput will fall.

Thus, in the reception power calculation section 115, the reception power of the despread DRC signal is measured, and is output to the unused DRC detection section 116. The lowest reception power at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest (a DRC signal with DRC number 1 in FIG.4) has been set beforehand in the unused DRC detection section 116 as a threshold value. Then, in the unused DRC detection section 116, a DRC signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 101. A DRC signal detected by the unused DRC detection section 116 is a DRC signal that is not used by the allocation section 101 in determining communication resource allocation.

In the allocation section 101, communication resource allocation to each communication terminal is determined based on the DRC signals remaining after DRC signals detected by the unused DRC detection section 116 have been excluded from the DRC signals extracted by the demodulator 114.

Thus, in a base station according to this embodiment, a DRC signal of reception power lower than the lowest reception power at which a DRC signal indicating that downlink channel quality is poorest is not received erroneously is excluded. That is to say, in a base station according to this embodiment, a notification signal susceptible to errors is excluded in determining downlink communication resource allocation. Therefore, according to a base station of this embodiment, even though a DRC signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on an erroneous DRC signal.

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

A base station according to this embodiment may also be configured as shown in FIG.5. FIG.5 is a block diagram showing another configuration of a base station according to Embodiment 1 of the present invention. That is to say, a base station may be configured in such a way that the reception power calculation section 115 and unused DRC detection section 116 shown in FIG.2 are replaced by a likelihood calculation section 301 and unused DRC detection section 302. In the following description, parts identical to those in FIG.2 are assigned the same reference numerals as in FIG.2 and their detailed explanations are omitted.

In FIG.5, the likelihood calculation section 301 calculates a likelihood that indicates the probable degree of certainty of a DRC signal, and outputs the calculation result to the unused DRC detection section 302. The lowest likelihood at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest has been set beforehand in the unused DRC detection section 302 as a threshold value. Then, in the unused DRC detection section 302, a DRC signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 101.

In this way the same kind of effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG.5.

(Embodiment 2)

In a communication terminal according to Embodiment 2 of the present invention, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted.

FIG.6 is a block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 203, spreading section 204, DRC power controller 205, and transmission power table 206 shown in FIG.3 are replaced by a code word selector 401, code word table 402, modulator 403, and spreading section 404. In the following description, parts identical to those in FIG.3 are assigned the same reference numerals as in FIG.3 and their detailed explanations are omitted.

The code word selector 401 refers to the code word table 402, converts a DRC signal created by the DRC signal creation section 202 to a predetermined code word, and outputs the code word to modulator 403. Modulator 403 modulates the code word and outputs it to spreading section 404. Spreading section 404 spreads the output signal from modulator 403 and outputs the resulting signal to a multiplexer 210.

Next, the operation of a communication terminal according to this embodiment will be described.

First, the contents set in the code word table 402 will be described. FIG.7 is a drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention.

The code word table 402 shows the correspondence between DRC numbers and code words after DRC signal conversion, set so that the higher the DRC number, the larger is the code word minimum distance of the code word to which the DRC signal is converted. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the code word table 402, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which the DRC signal is converted.

Here, "code word distance" is the number of bits that differ between code words, and "code word minimum distance" is the minimum number of bits by which a particular code word differs with respect to all other code words. To be specific, the code word for a DRC signal with DRC number 5 is "111111111", and this code word "111111111" differs by a minimum of 6 bits when compared with any of the code words corresponding to DRC signals with DRC numbers 1 to 4. Therefore, the code word minimum distance of the code word for a DRC signal with DRC number 5 is 6. Similarly, the code word minimum distance of the code word for a DRC signal with DRC number 4 is 3.

Thus, the code word for a DRC signal with DRC number 5 is less likely to be mistaken for another code word than the code word for a DRC signal with DRC number 4. That is to say, the larger code word minimum distance of a code word, the less likely it is to be mistaken for another code word.

In the code word selector 401, a DRC signal output from the DRC signal creation section 202 is converted to a code word set in the code word table 402, and output to modulator 403. To give a specific example, if the DRC signal output from the DRC signal creation section 202 is a number 5 DRC signal, it is converted to code word "111111111".

Following conversion, the code word is modulated by modulator 403 and spread by spreading section 404. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

Also, according to this embodiment, it is possible to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high without increasing DRC signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal without increasing communication terminal power consumption.

Moreover, according to this embodiment, it is possible to change the degree of insusceptibility to errors of code words corresponding to DRC signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

(Embodiment 3)

A base station according to Embodiment 3 of the present invention transmits to a communication terminal a control signal for table rewriting based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined, and a communication terminal according to Embodiment 3 of the present invention rewrites the contents of a transmission power table or code word table based on a control signal transmitted from the base station.

FIG.8 is a block diagram showing the configuration of a base station according to Embodiment 3 of the present invention. As shown in this figure, a base station according to this embodiment is configured by further providing the configuration shown in FIG.2 with a detection rate calculation section 501, control signal creation section 502, modulator 503, and spreading section 504. In the following description, parts identical to those in FIG.2 are assigned the same reference numerals as in FIG.2 and their detailed explanations are omitted.

In FIG.8, the detection rate calculation section 501 calculates the rate of detection by the unused DRC detection section 116 and outputs the result to the control signal creation section 502. That is to say, the detection rate calculation section 501 calculates the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined. Based on the detection rate, the control signal creation section 502 creates a control signal for table rewriting (hereinafter referred to as "table rewrite signal"), which is output to modulator 503. Modulator 503 modulates the table rewrite signal and outputs it to spreading section 504. Spreading section 504 spreads the output signal from modulator 503 and outputs the resulting signal to the multiplexer 108.

FIG.9 is a block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured by further providing the configuration shown in FIG.3 with a despreading section 601, demodulator 602, and table rewriting section 603. In the following description, parts identical to those in FIG.3 are assigned the same reference numerals as in FIG.3 and their detailed explanations are omitted.

In FIG.9, despreading section 601 despreads a baseband signal using the spreading code used to spread the table rewrite signal, and outputs the resulting signal to the demodulator 602. The demodulator 602 demodulates the output signal from despreading section 601 and extracts the table rewrite signal, which is output to the table rewriting section 603. The table rewriting section 603 rewrites the contents of the transmission power table in accordance with the table rewrite signal.

Next, the procedure for transmission/reception of signals between the base station shown in FIG.8 and the communication terminal shown in FIG.9 will be described.

First, in the detection rate calculation section 501 of the base station, the detection rate of the unused DRC detection section 116 is calculated and is output to the control signal creation section 502. The detection rate can be calculated, for example, from the number of detections in a predetermined time.

A predetermined threshold value for the detection rate has been set in the control signal creation section 502, and this threshold value is compared with the detection rate calculated by the detection rate calculation section 501. If the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be increased is created, and is output to modulator 503. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all DRC signal transmission power values to be increased simultaneously from their current values.

The table rewrite signal is modulated by modulator 503, spread by spreading section 504, and output to the multiplexer 108. The spread table rewrite signal is multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

The radio signal transmitted from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to baseband by the receive RF section 214. The baseband signal is despread by despreading section 601 and demodulated by the demodulator 602, and the table rewrite signal is extracted. The extracted table rewrite signal is output to the table rewriting section 603.

The contents of the transmission power table 206 are then rewritten by the table rewriting section 603 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 increases all the transmission power values set in the transmission power table 206.

In the above description, the configuration is such that the table rewriting section 603 rewrites the contents of the transmission power table 206, but this embodiment may also be applied to a communication terminal according to Embodiment 2, and a configuration may be used whereby the table rewriting section 603 rewrites the contents of the code word table 402 shown in FIG.6.

In this case, if the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, the control signal creation section 502 of a base station according to this embodiment creates a table rewrite signal ordering all code word minimum distances set in the code word table 402 to be increased. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all code word minimum distances of code words corresponding to DRC signals to be increased simultaneously from their current values. Then the table rewriting section 603 rewrites the contents of the code word table 402 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 rewrites the code words set in the code word table 402 with code words all of whose code word minimum distances are larger than at present.

Thus, according to this embodiment, the contents of the transmission power table or code word table are rewritten based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined. In other words, in this embodiment, transmission power table or code word table contents are rewritten adaptively in accordance with variations in the communication environment. That is to say, according to this embodiment, when the communication environment deteriorates and the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined reaches or exceeds a predetermined threshold value, the transmission power of each DRC signal is increased, or the code word minimum distance of the code word corresponding to each DRC signal is increased, thereby enabling the DRC signal error occurrence rate to be held down even when the communication environment deteriorates.

In this embodiment, the predetermined detection rate threshold value is decided upon considering appropriately the environment in which the communication system is used.

Moreover, with this embodiment, it is also possible to further set a second predetermined threshold value in the control signal creation section 502 to create a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be decreased when the detection rate calculated by the detection rate calculation section 501 falls below this second threshold value. By this means, it is possible to reduce DRC signal transmission power when DRC signal reception quality becomes excessive, thereby enabling communication terminal power consumption to be decreased.

Furthermore, in this embodiment, table rewriting is performed based on the rate of detection by the unused DRC detection section 116, but it is also possible to rewrite a table based on the distribution of DRC signals used in determining communication resource allocation from among DRC signals transmitted from mobile stations, so that that distribution is optimized. In this case, the base station shown in FIG.8 is configured with the detection rate calculation section replaced by a used DRC distribution determination section, which determines the distribution of DRC signals used in communication resource allocation determination based on DRC signals output from the demodulator 114 and detection results output from the unused DRC detection section 116, and outputs a signal indicating that distribution to the control signal creation section 502. The control signal creation section 502 then creates a table rewrite signal based on the signal indicating the distribution output from the used DRC distribution determination section.

(Embodiment 4)

A communication terminal according to Embodiment 4 of the present invention transmits at higher transmission power in proportion to CIR information that indicates that downlink channel quality is good. A base station according to Embodiment 4 of the present invention excludes CIR information for which the reception power is lower than a predetermined threshold value in performing communication resource allocation.

In above-described Embodiment 1, a communication terminal determines the communication mode based on the CIR and transmits a DRC signal corresponding to that determined communication mode to the base station at predetermined transmission power, and the base station determines communication resource allocation to each communication terminal based on the DRC signals. DRC signal can be represented with far fewer bits than other information indicating downlink channel quality (such as a downlink CIR, for example), and therefore use of a DRC signal has the advantage of enabling the downlink channel utilization efficiency to be increased. On the other hand, since a communication terminal must be provided with a table for communication mode determination, a table for DRC signal creation, and so forth to determine the communication mode and create a DRC signal, there are the disadvantages of increased communication terminal power consumption and apparatus size.

Thus, in this embodiment, a communication terminal transmits CIR information to the base station at predetermined transmission power, and the base station determines the communication mode based on the CIR information and then determines communication resource allocation to each communication terminal. As a result, although there is the disadvantage of a slight decrease in the uplink channel utilization efficiency, the fact that communication terminals do not have to determine the communication mode and create a DRC signal, and do not need to be provided with a communication mode determination table, DRC signal creation table, and so forth, offers the major advantage of enabling communication terminal power consumption and apparatus size to be reduced. Also, in this embodiment, it is possible for CIR information for a plurality of terminals to be compared in the base station, and the correct communication mode to be determined with certainty, making this embodiment particularly useful in cases such as those where it is not possible for the communication mode to be determined simply from the CIR in each communication terminal.

A base station according to this embodiment and a communication terminal according to this embodiment will be described below. FIG.10 is a block diagram showing a configuration of a base station according to Embodiment 4 of the present invention. In the following description, parts identical to those in FIG.2 are assigned the same reference numerals as in FIG.2 and their detailed explanations are omitted.

In FIG.10, a demodulator 701 demodulates the output signal from a despreading section 113, and extracts a signal that contains CIR information (hereinafter referred to as "CIR signal"), which is output to an allocation section 704.

A reception power calculation section 702 measures the reception power of the despread CIR signal, which is output to an unused CIR detection section 703. In the unused CIR detection section 703 is set a predetermined threshold value in the same way as in Embodiment 1, and a CIR signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 704.

A despreading section 113, demodulator 701, reception power calculation section 702, and unused CIR detection section 703 are provided for each communication terminal. From each demodulator 701 a CIR signal for the corresponding communication terminal is output, and from each unused CIR detection section 703 a detection result for the corresponding communication terminal is output.

The allocation section 704 determines communication resource allocation to each communication terminal based on CIR information indicated by CIR signals excluding CIR signals detected by the unused CIR detection sections 703 from among the CIR signals extracted by the demodulators 701. Then, based on the determined communication resource allocation, the allocation section 704 notifies a buffer 102 for output of downlink transmit data, and outputs the CIR information to a communication mode determination section 705.

Based on the CIR information output from the allocation section 704, the communication mode determination section 705 determines the communication mode, which indicates a combination of modulation method and coding method, and outputs a signal indicating this communication mode to a modulator 706. In addition, based on the determined communication mode, the communication mode determination section 705 indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104. Modulator 706 modulates the signal indicating the communication mode and outputs it to a spreading section 707. Spreading section 707 spreads the output signal from modulator 706 and outputs the resulting signal to a multiplexer 108.

FIG.11 is a block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention. In the following description, parts identical to those in FIG.3 are assigned the same reference numerals as in FIG.3 and their detailed explanations are omitted.

In FIG.11, a CIR information creation section 801 creates a CIR signal indicating a CIR measured by a CIR measurement section 219, and outputs it to a modulator 802 and CIR information power controller 804. Modulator 802 modulates the CIR signal and outputs it to a spreading section 803. Spreading section 803 spreads the output signal from modulator 802 and outputs the spread signal to the CIR information power controller 804. The CIR information power controller 804 refers to a transmission power table 805 that shows the correspondence between CIR level and transmission power, and controls the CIR signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209, and outputs the CIR signal that has undergone transmission power control to a multiplexer 210.

A despreading section 807 despreads the baseband signal using the spreading code used to spread the signal indicating the communication mode, and outputs the despread signal to a communication mode detection section 808. The communication mode detection section 808 demodulates the output signal from despreading section 807 and detects the communication mode. Then, based on the detected communication mode, the communication mode detection section 808 indicates the downlink receive data demodulation method to an adaptive demodulator 216 and indicates the downlink receive data decoding method to an adaptive decoding section 217.

Next, the procedure for transmission/reception of signals between the base station shown in FIG.10 and the communication terminal shown in FIG.11 will be described.

First, in the communication terminal shown in FIG.11, the CIR of the pilot signal output from despreading section 218 is measured by the CIR measurement section 219, and a CIR signal is created by the CIR information creation section 801.

The CIR signal is modulated by modulator 802, spread by spreading section 803, and output to the CIR information power controller 804. In the transmission power table 805, the correspondence between CIR level and CIR signal transmission power is shown in the same way as in Embodiment 1, set so that the CIR signal transmission power increases in proportion to the level of the CIR. That is to say, in the settings in transmission power table 805, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power. Also, as in Embodiment 1, the CIR signal transmission power values set in the transmission power table 805 are expressed as a ratio to the pilot signal transmission power.

In the CIR information power controller 804, the CIR signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 805. Then, in the CIR information power controller 804, the transmission power of the CIR signal output from spreading section 803 is adjusted to this obtained transmission power, and a CIR signal that has been subjected to transmission power control is output to the multiplexer 210.

The CIR signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

In the base station shown in FIG.10, the output signal from the despreading section 113 is demodulated by demodulator 701, and the demodulated CIR signal is extracted and output to the allocation section 704. In the reception power calculation section 702, the reception power of the despread CIR signal is measured, and is output to the unused CIR detection section 703. The lowest reception power at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 703 as a threshold value, as in Embodiment 1. Then, in the unused CIR detection section 703, a CIR signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 704. A CIR signal detected by the unused CIR detection section 703 is a

CIR signal that is not used by the allocation section 704 in determining communication resource allocation.

In the allocation section 704, communication resource allocation to each communication terminal is determined based on the CIR shown by CIR signals remaining after CIR signals detected by the unused CIR detection section 703 have been excluded from the CIR signals extracted by the demodulator 701, and CIR information is output to the communication mode determination section 705.

In the communication mode determination section 705, the communication mode is determined based on CIR information output from the allocation section 704, and a signal indicating this communication mode is output to modulator 706. The signal indicating the communication mode is modulated by modulator 706, spread by spreading section 707, multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to the communication terminal as a radio signal from an antenna 111 via a duplexer 110.

In the communication terminal shown in FIG.11, a baseband signal is despread by despreading section 807, and the despread signal is output to the communication mode detection section 808. In the communication mode detection section 808, the output signal from despreading section 807 is demodulated and the communication mode is detected, and based on the detected communication mode, the downlink receive data demodulation method is indicated to the adaptive demodulator 216 and the downlink receive data decoding method is indicated to the adaptive decoding section 217.

Thus, according to this embodiment, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

Also, according to this embodiment, as in Embodiment 1, a CRI signal of reception power lower than the lowest reception power at which a CIR signal indicating that downlink channel quality is poorest is not received erroneously is excluded, and therefore, even though a CIR signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on erroneous CIR information.

A base station according to this embodiment may also be configured as shown in FIG.12. FIG.12 is a block diagram showing another configuration of a base station according to Embodiment 4 of the present invention. That is to say, a base station may be configured in such a way that the reception power calculation section 702 and unused CIR detection section 703 shown in FIG.10 are replaced by a likelihood calculation section 901 and unused CIR detection section 902. In the following description, parts identical to those in FIG.10 are assigned the same reference numerals as in FIG.10 and their detailed explanations are omitted.

In FIG.12, the likelihood calculation section 901 calculates a likelihood that indicates the probable degree of certainty of a CRI signal, and outputs the calculation result to the unused CIR detection section 902. The lowest likelihood at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 902 as a threshold value. Then, in the unused CIR detection section 902, a CIR signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 704.

In this way the same effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG.12.

(Embodiment 5)

In a communication terminal according to Embodiment 5 of the present invention, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted.

FIG.13 is a block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 802, spreading section 803, CIR information power controller 804, and transmission power table 805 shown in FIG.11 are replaced by a code word selector 1001, code word table 1002, modulator 1003, and spreading section 1004. In the following description, parts identical to those in FIG.11 are assigned the same reference numerals as in FIG.11 and their detailed explanations are omitted.

The code word selector 1001 refers to the code word table 1002, converts a CIR signal created by the CIR information creation section 801 to a predetermined code word, and outputs it to modulator 1003. Modulator 1003 modulates the code word and outputs it to spreading section 1004. Spreading section 1004 spreads the output signal from modulator 1003 and outputs the resulting signal to a multiplexer 210.

Next, the operation of a communication terminal according to this embodiment will be described.

In the same way as in above-described Embodiment 2, the code word table 1002 shows the correspondence between CIR level and code words after CIR signal conversion, set so that the higher the CIR level, the larger is the code word minimum distance of the code word to which the CIR signal is converted. That is to say, in the settings in the code word table 1002, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which the CIR signal is converted.

In the code word selector 1001, a CIR signal output from the CIR information creation section 801 is converted to a code word set in the code word table 1002, and output to modulator 1003. Following conversion, the code word is modulated by modulator 1003 and spread by spreading section 1004. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

Thus, according to this embodiment, as in Embodiment 2, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

Also, according to this embodiment, as in Embodiment 2, it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high without increasing CIR signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information without increasing communication terminal power consumption.

Moreover, according to this embodiment, as in Embodiment 2, it is possible to change the degree of insusceptibility to errors of code words corresponding to CIR signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

(Embodiment 6)

A communication terminal according to Embodiments 6 to 8 of the present invention transmits with less susceptibility to errors in the propagation path in proportion to information for which the amount of change is large within CIR information. In other words, a communication terminal according to Embodiments 6 to 8 of the present invention transmits with less susceptibility to errors in the propagation path in proportion to information that indicates a broad value within CIR information.

The meaning of "information for which the amount of change is large" and "information that indicates a broad value" here can be illustrated by a specific example. If a CIR value is indicated by a value with a decimal fraction (such as 8.7 dB), then the above-mentioned information refers to the integer part (here, "8"). In this case, since the amount of change per unit of the integer part is 1 dB, while the amount of change per unit of the fractional part is 0.1 dB, the integer part is "information for which the amount of change is large". Therefore, if an integer part is received erroneously by a base station, the degree of error is large compared with the case where a fractional part is received erroneously, and the probability of an erroneous communication mode being determined is higher—that is to say, the probability of downlink throughput falling is higher.

Also, CIR information is normally converted to a code word with a limited number of bits before being transmitted to a base station, and there are also limits on the transmission power and spreading code spreading factor that can be used in transmitting CIR information. There are thus limits to making CIR information overall insusceptible to errors, and it is difficult to do so.

Thus, in Embodiments 6 to 8 of the present invention, within the above-described limitations on transmission of CIR information, transmission is performed with insusceptibility to errors in the propagation path made proportional to "information for which the amount of change is large" within the above limitations so that, at least "information for which the amount of change is large" (that is, "information that indicates a broad value") of CIR information is received correctly.

A communication terminal according to Embodiment 6 of the present invention is described below. A communication terminal according to Embodiment 6 of the present invention performs conversion to, and transmits, a code word with a code length proportional to the value of the upper digit in a CIR value.

FIG.14 is a block diagram showing the configuration of a communication terminal according to Embodiment 6 of the present invention. In the following description, parts identical to those in FIG.11 are assigned the same reference numerals as in FIG.11 and their detailed explanations are omitted.

In FIG.14, a CIR signal creation section 1101 converts a CIR value measured by a CIR measurement section 219 to a code word and creates a CIR signal, and outputs the created CIR signal to a multiplexer 210. At this time, the CIR signal creation section 1101 creates a CIR signal by performing conversion to a code word with a code length proportional to the value of the upper digit in the CIR value.

Next, the configuration of the CIR signal creation section 1101 will be described. FIG.15 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 6 of the present invention.

In FIG.15, an upper digit information generation section 1201 outputs the value of the upper digit in the CIR value output from the CIR measurement section 219 to a 6-bit coding section 1203. A lower digit information generation section 1202 outputs the value of the lower digit in the CIR value output from the CIR measurement section 219 to a 4-bit coding section 1204. To give a specific example, if the CIR value output from the CIR measurement section 219 is 8.7 dB, the upper digit information generation section 1201 outputs the value of the integer part, "8", to the 6-bit coding section 1203, and the lower digit information generation section 1202 outputs the value of the fractional part, "7", to the 4-bit coding section 1204.

The 6-bit coding section 1203 converts the value output from the upper digit information generation section 1201 (here, "8") to a 6-bit code word, and outputs the 6-bit code word to a time multiplexer 1205. The 4-bit coding section 1204 converts the value output from the lower digit information generation section 1202 (here, "7") to a 4-bit code word, and outputs the 4-bit code word to the time multiplexer 1205. It is herein assumed that the number of bits that can be used to indicate a CIR value is ten.

The time multiplexer 1205, by storing the 6-bit code word in the first half of a slot and storing the 4-bit code word in the following latter half of the slot, performs time multiplexing of the code word for the integer part of the CIR value (that is, the code word corresponding to the value of the upper digit) and the code word for the fractional part of the CIR value (that is, the code word corresponding to the value of the lower digit). The time multiplexer 1205 then outputs the time-multiplexed 10-bit code word to a modulator 1206 as a CIR signal. It is herein assumed that one slot is composed of 10 bits, with the integer part of a CIR value represented by the preceding 6 bits and the fractional part of a CIR value represented by the succeeding 4 bits.

The modulator 1206 modulates the CIR signal and outputs it to the spreading section 1207. The spreading section 1207 spreads the output signal from the modulator 1206 and outputs the resulting signal to the multiplexer 210.

Next, the operation of a communication terminal with the above configuration will be described.

In the 6-bit coding section 1203, the value of the upper digit in the CIR value (here, "8") is converted to a 6-bit code word, and the value of the lower digit in the CIR value (here, "7") is converted to a 4-bit code word.

As the number of different code words that can be represented by 6 bits is 2^6, and the number of different code words that can be represented by 4 bits is 2^4, the code word minimum distance between code words can be made larger for code words represented by 6 bits. Therefore, a code word represented by 6 bits is less susceptible to being mistaken for another code word than a code word represented by 4 bits. That is to say, in this embodiment, the value of the upper digit of a CIR value is less susceptible to errors.

Thus, with a communication terminal according to this embodiment, within the limitation of 10 bits available to indicate a CIR value, by performing conversion to a code word of a code length proportional to the value of the upper digit in a CIR value, it is possible to perform transmission with insusceptibility to errors made proportional to the value of the upper digit for which the amount of change is large. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

In this embodiment, a case has been described where the upper digit value is converted to a 6-bit code word and the lower digit value is converted to a 4-bit code word. However, as long as the number of bits of the code word corresponding to the upper digit value is greater than the number of bits of the code word corresponding to the lower digit value, there are no particular limitations on these numbers of bits.

(Embodiment 7)

A communication terminal according to Embodiment 7 of the present invention transmits with transmission power increased in proportion to the value of the upper digit in a CIR value.

A communication terminal according to this embodiment differs from a communication terminal according to Embodiment 6 only in the internal configuration of the CIR signal creation section 1101, and therefore only the CIR signal creation section 1101 will be described in the following description.

FIG.16 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 7 of the present invention. In the following description, parts identical to those in FIG.15 are assigned the same reference numerals as in FIG.15 and their detailed explanations are omitted.

The CIR signal creation section 1101 shown in FIG.16 converts a CIR value measured by a CIR measurement section 219 to a code word, and then creates a CIR signal, increasing transmission power in proportion to the value of the upper digit.

In FIG.16, a 5-bit coding section 1301 converts the value output from an upper digit information generation section 1201 to a 5-bit code word and outputs the 5-bit code word to a modulator 1303, and a 5-bit coding section 1302 converts the value output from a lower digit information generation section 1202 to a 5-bit code word and outputs the 5-bit code word to a modulator 1304. Thus, in this embodiment, both the upper digit value and the lower digit value are converted to 5-bit code words, and therefore there is no difference between them in insusceptibility to errors from a code word standpoint.

Modulator 1303 modulates the code word output from 5-bit coding section 1301, and outputs it to an upper digit spreading section 1305. Modulator 1304 modulates the code word output from 5-bit coding section 1302, and outputs it to a lower digit spreading section 1306.

The upper digit spreading section 1305 spreads the output signal from modulator 1303, and outputs the spread signal to an upper digit power controller 1307. The lower digit spreading section 1306 spreads the output signal from modulator 1304, and outputs the spread signal to a lower digit power controller 1308. At this time, the upper digit spreading section 1305 and lower digit spreading section 1306 perform their respective spreading processing using different spreading codes of the same spreading factor. That is to say, the upper digit value of the CIR value and the lower digit value of the CIR value are spread using different spreading codes that have the same spreading factor.

Based on the transmission power of a pilot signal output from a pilot power controller 209, the upper digit power controller 1307 controls the transmission power of the signal indicating the upper digit value of the CIR value, and outputs the signal that has undergone transmission power control to a code multiplexer 1309. Similarly, based on the transmission power of the pilot signal output from the pilot power controller 209, the lower digit power controller 1308 controls the transmission power of the signal indicating the lower digit value of the CIR value, and outputs the signal that has undergone transmission power control to the code multiplexer 1309. The actual transmission power control method will be described later herein.

The code multiplexer 1309 multiplexes the signal indicating the upper digit value of the CIR value and the signal indicating the lower digit value of the CIR value in the same time slot. That is to say, the code multiplexer 1309 performs code multiplexing of the signal indicating the upper digit value and the signal indicating the lower digit value.

Next, the operation of a communication terminal with the above configuration will be described.

In the upper digit power controller 1307, a signal indicating the upper digit value of a CIR value is adjusted to a transmission power whose only predetermined value is higher than the pilot signal transmission power. In the lower digit power controller 1308, a signal indicating the lower digit value of the CIR value is adjusted to a transmission power whose only predetermined value is lower than the pilot signal transmission power. That is to say, the transmission power is increased in proportion to the value of the upper digit in the CIR value.

Thus, a communication terminal according to this embodiment can transmit with insusceptibility to errors made proportional_to the upper digit value for which the amount of change is large by transmitting with transmission power increased in proportion to the upper digit value of a CIR value. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

Also, in this embodiment, by increasing transmission power of the upper digit value compared with conventional CIR signal transmission power (here, the pilot signal transmission power), and decreasing transmission power of the lower digit value by the amount by which it is increased for the upper digit value, giving a total transmission power increase/decrease value of ±0 dB, the overall CIR signal transmission power is kept the same as conventional CIR signal transmission power. Thus, according to this embodiment, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value while keeping CIR signal transmission power the same as in a conventional system. That is to say, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value without reducing uplink capacity compared with a conventional system.

(Embodiment 8)

A communication terminal according to Embodiment 8 of the present invention transmits with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit in a CIR value.

A communication terminal according to this embodiment differs from a communication terminal according to Embodiment 6 or 7 only in the internal configuration of the CIR signal creation section 1101, and therefore only the CIR signal creation section 1101 will be described in the following description.

FIG.17 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 8 of the present invention. In the following description, parts identical to those in FIG.15 or FIG.16 are assigned the same reference numerals as in FIG.15 or FIG.16 and their detailed explanations are omitted.

The CIR signal creation section 1101 shown in FIG.17 converts a CIR value measured by a CIR measurement section 219 to a code word, and then creates a CIR signal, with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit.

In FIG.17, an upper digit spreading section 1401 spreads the output signal from modulator 1303 and outputs the resulting signal to a time multiplexer 1205, and a lower digit spreading section 1402 spreads the output signal from modulator 1304 and outputs the spread signal to the time multiplexer 1205. At this time, the upper digit spreading section 1401 performs spreading processing with a spreading code of the same kind as used by the lower digit spreading section 1402 and with a higher spreading factor than that of the lower digit spreading section 1402. That is to say, the upper digit value of the CIR value is spread with a higher spreading factor than the lower digit value. As a result, insusceptibility to errors in the propagation path is proportional to the upper digit value.

Thus, a communication terminal according to this embodiment can transmit with insusceptibility to errors made proportional to the upper digit value for which the amount of change is large by transmitting with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit in a CIR value. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

Also, in this embodiment, the spreading factor for the upper digit value is increased compared with a conventional CIR signal spreading factor, and the spreading factor for the lower digit value is decreased by the amount by which it is increased for the upper digit value. By this means, the amount of data sent in one slot is kept the same as for a conventional CIR signal. Thus, according to this embodiment, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value without reducing the amount of data sent in one slot.

It is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 1 and a communication terminal according to above-described Embodiment 2. Moreover, it is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 4 and a communication terminal according to above-described Embodiment 5. Furthermore, it is also possible to implement the present invention by combining the respective communication terminals according to above-described Embodiments 6 to 8. In addition, it is also possible for the transmission power table provided in a communication terminal according to above-described Embodiment 4 and the code word table provided in a communication terminal according to above-described Embodiment 5 to be rewritten as appropriate based on a control signal from the base station, in the same way as in above-described Embodiment 3.

Also, in above-described Embodiments 1 to 8, a case has been described where a pilot signal is time-multiplexed, but above-described Embodiments 1 to 8 are not limited to this, and can also be applied to a case where a pilot signal is code-multiplexed.

Moreover, in above-described Embodiments 1 to 8, a CIR has been used as a value that indicates pilot signal reception quality, but this is not a limitation, and any value may be used as long as it is a value that indicates reception quality.

Furthermore, in above-described Embodiments 1 to 5, the predetermined threshold value set in the unused DRC detection section or the unused CIR detection section is assumed to be a fixed value, but a configuration may also be used whereby the threshold value is varied adaptively in accordance with the DRC signal error rate or CIR signal error rate.

In addition, in above-described Embodiments 6 to 8, either time multiplexing or code multiplexing may be used when multiplexing code words.

Also, in above-described Embodiments 6 to 8, an example has been given in which a CIR value is represented by one integer-part digit and one fractional-part digit. However, this is not a limitation, and above-described Embodiments 6 to 8 may all be implemented for CIR values represented by a plurality of digits.

Moreover, in above-described Embodiments 6 to 8, the value of the upper digit of a CIR value has been described as "information for which the amount of change is large". However, "information for which the amount of change is large" does not necessarily correspond to the size of a digit. For example, if a method is used whereby a CIR value is represented by an integer by first indicating a broad value of 0 db, 2 dB, 4 dB, 6 dB … changing by 2 dB at a time, and adding information indicating the presence or absence of an increment of 1 dB for that broad value, a value changing by 2 dB at a time is "information for which the amount of change is large". With this method, to represent a CIR value of 7 dB, for example, CIR information that includes information indicating 6 dB and information indicating that there is an increment of 1 dB is transmitted to the base station. At this time, the communication terminal apparatus transmits the information indicating 6 dB with greater insusceptibility to errors than the information indicating that there is an increment of 1 dB, in the same way as in above-described Embodiments 6 to 8.

As described above, according to the present invention it is possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

This application is based on Japanese Patent Application No.2000-234420 filed on August 2, 2000, and Japanese Patent Application No.2000-285405 filed on September 20, 2000, entire content of which is expressly incorporated by reference herein.

CLAIMS

1. A communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates channel quality;

wherein said transmitter transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

2. The communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

3. The communication terminal apparatus according to claim 2, wherein said transmitter transmits with transmission power increased in proportion to a notification signal that indicates that channel quality is good.

4. The communication terminal apparatus according to claim 3, further comprising a controller that controls transmission power of a pilot signal;

wherein said transmitter transmits with a notification signal that indicates channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

5. The communication terminal apparatus according to claim 3, further comprising:

a table that indicates a correspondence between a notification signal and transmission power; and

a rewriting device that rewrites contents of said table in accordance with a control signal from a base station apparatus;

wherein said transmitter adjusts a notification signal to predetermined transmission power based on said table.

6. The communication terminal apparatus according to claim 2, wherein said transmitter transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that channel quality is good.

7. The communication terminal apparatus according to claim 6, further comprising:

a table that indicates a correspondence between a notification signal and a code word; and

a rewriting device that rewrites contents of said table in accordance with a control signal from a base station apparatus;

wherein said transmitter converts a notification signal to a predetermined code word based on said table.

8. The communication terminal apparatus according to claim 2, further comprising a determination device that determines a communication mode indicated by a combination of modulation method and coding method based on channel quality;

wherein said transmitter makes a notification signal a signal that indicates a communication mode.

9. The communication terminal apparatus according to claim 2, wherein:

said measurement device measures pilot signal reception quality; and

said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value.

10. The communication terminal apparatus according to claim 1, wherein:

said measurement device measures pilot signal reception quality; and

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality value.

11. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

12. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

13. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

14. A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurement device that measures reception power of a notification signal;

a detector that detects a notification signal whose reception power is less than a predetermined threshold value; and

a determination device that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

15. The base station apparatus according to claim 14,

further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

16. A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurement device that measures likelihood of a notification signal;

a detector that detects a notification signal whose likelihood is less than a predetermined threshold value; and

a determination device that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

17. The base station apparatus according to claim 16, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

18. A radio communication method, wherein:

a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and

said base station determines downlink communication resource allocation in accordance with a notification signal.

19. The radio communication method according to claim 18, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

20. The radio communication method according to claim 18, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a reception quality value.

ABSTRACT

A communication mode determination section 201 determines the communication mode based on the CIR measured by a CIR measurement section 219; a DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode; and a DRC power controller 205 refers to a transmission power table 206 showing the correspondence between DRC numbers and transmission power, and, based on the transmission power of the pilot signal output from a pilot power controller 209, increases transmission power in proportion as the DRC signal indicates that downlink channel quality is good.

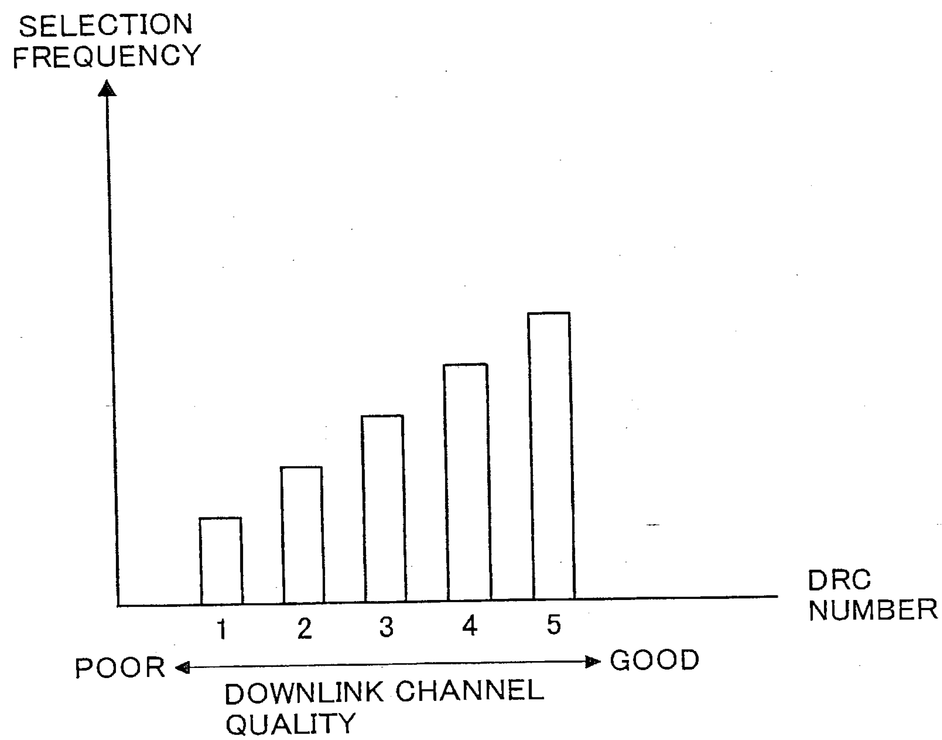

SELECTION FREQUENCY
DRC NUMBER
1
2
3
4
5
POOR
GOOD
DOWNLINK CHANNEL QUALITY

FIG.1

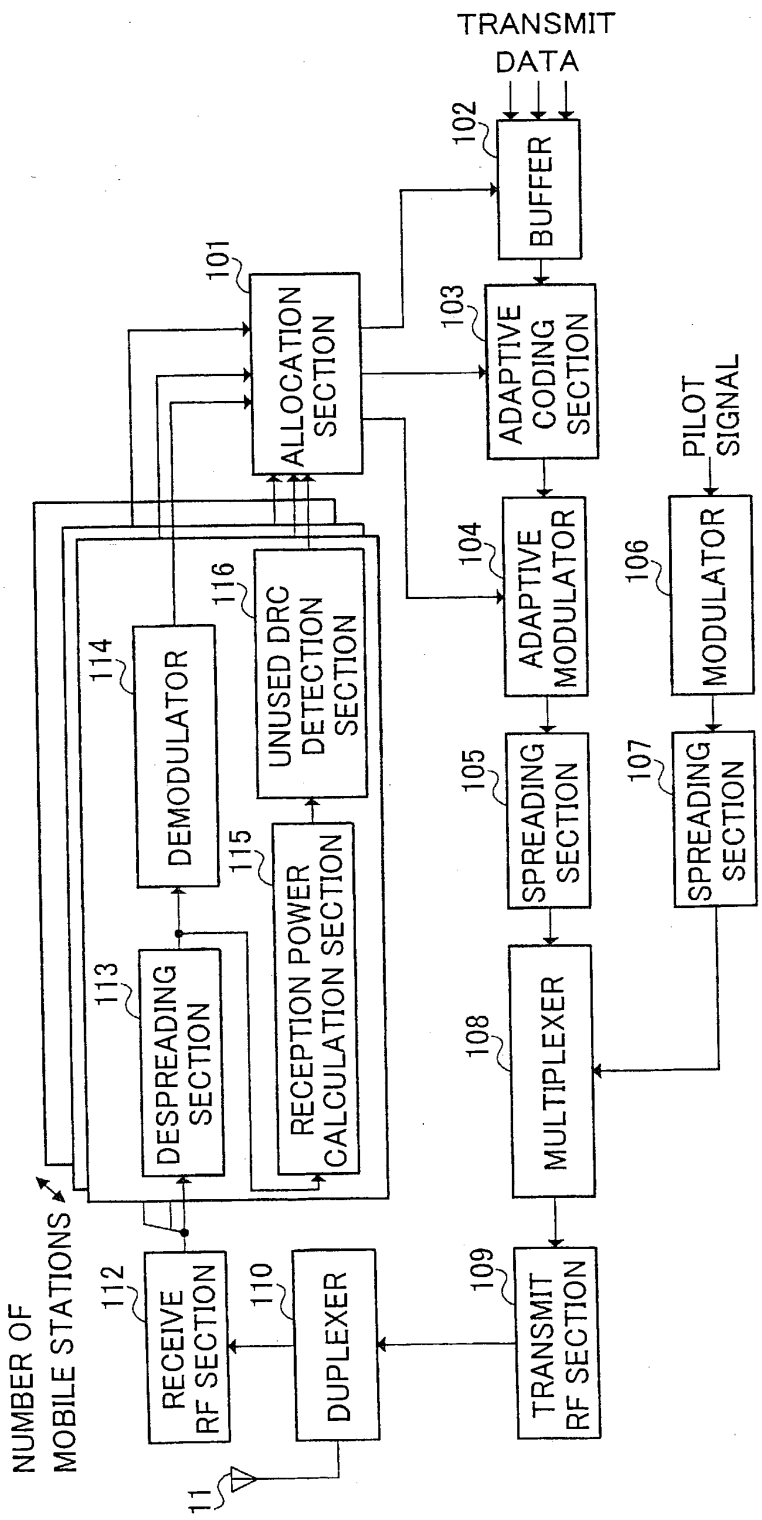
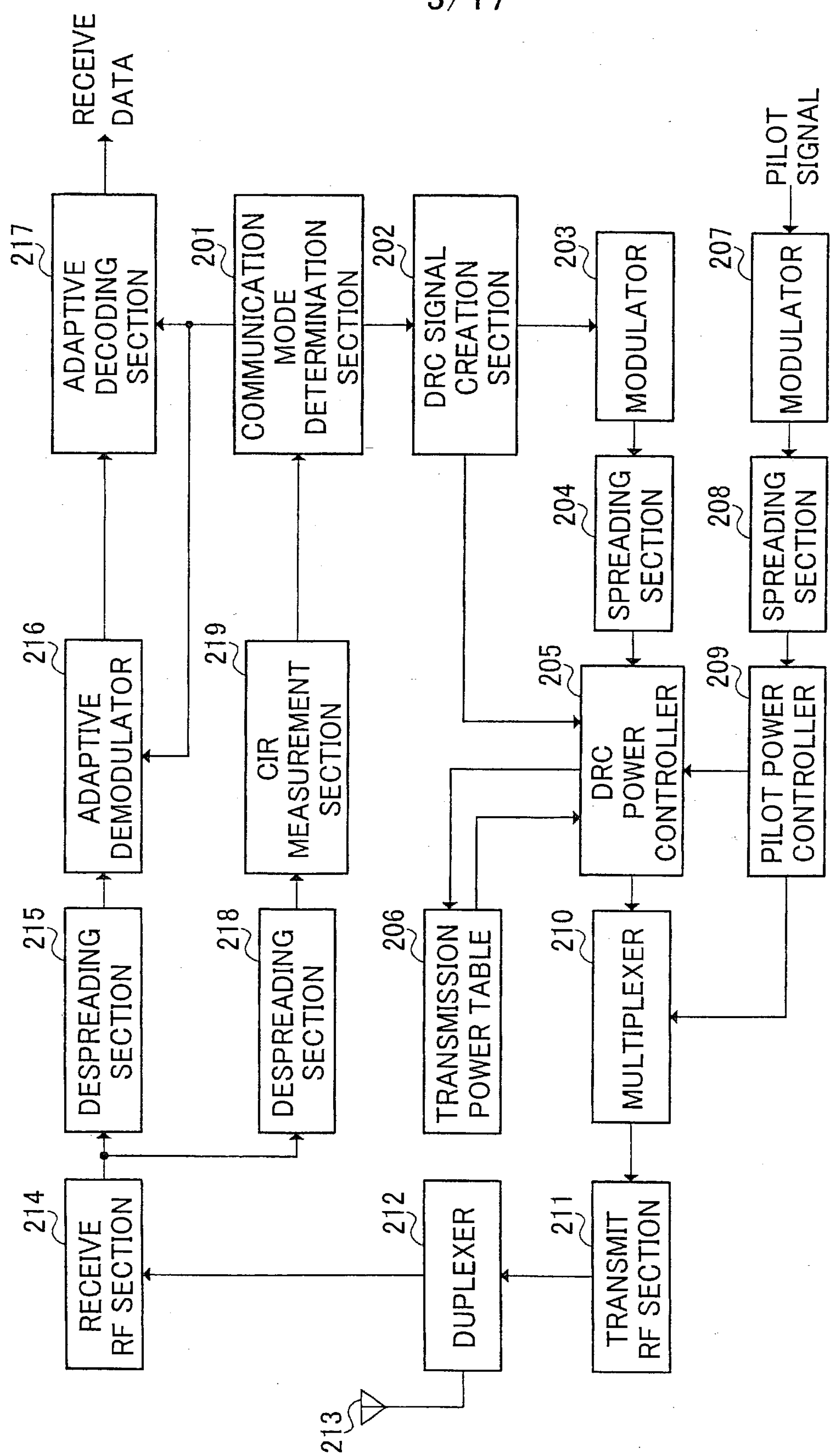

TRANSMIT DATA
102
BUFFER
101
ALLOCATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
104
ADAPTIVE MODULATOR
106
MODULATOR
105
SPREADING SECTION
107
SPREADING SECTION
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
NUMBER OF MOBILE STATIONS
113
DESPREADING SECTION
114
DEMODULATOR
115
RECEPTION POWER CALCULATION SECTION
116
UNUSED DRC DETECTION SECTION

FIG.2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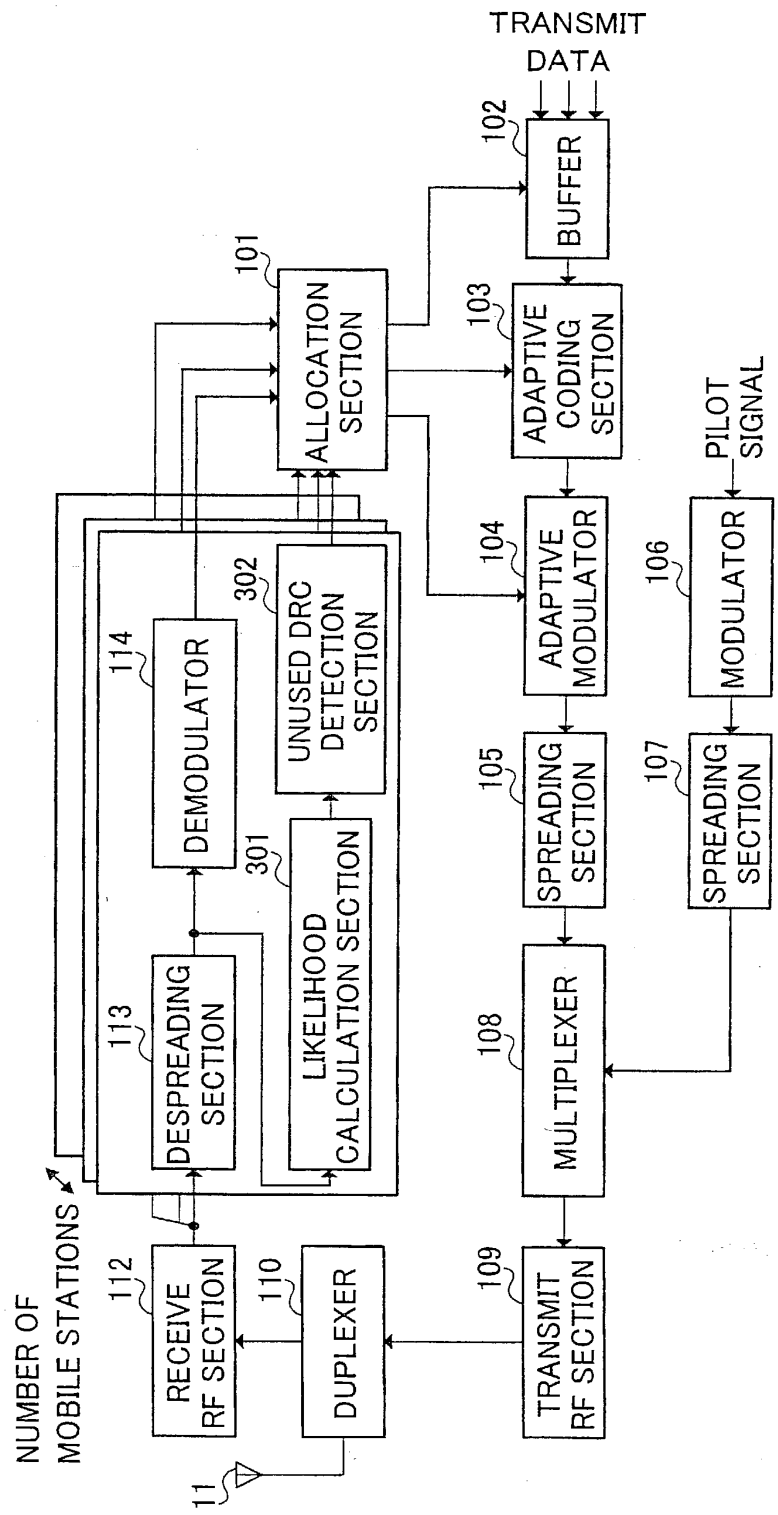
MODULATOR
207
MODULATOR
PILOT SIGNAL
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
204
SPREADING SECTION
208
SPREADING SECTION
205
DRC POWER CONTROLLER
209
PILOT POWER CONTROLLER
215
DESPREADING SECTION
218
DESPREADING SECTION
206
TRANSMISSION POWER TABLE
210
MULTIPLEXER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

FIG.3

DRC NUMBER	TRANSMISSION POWER (RATIO TO PILOT SIGNAL TRANSMISSION POWER)
1	−2dB
2	−1dB
3	0dB
4	+1dB
5	+2dB

FIG.4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106
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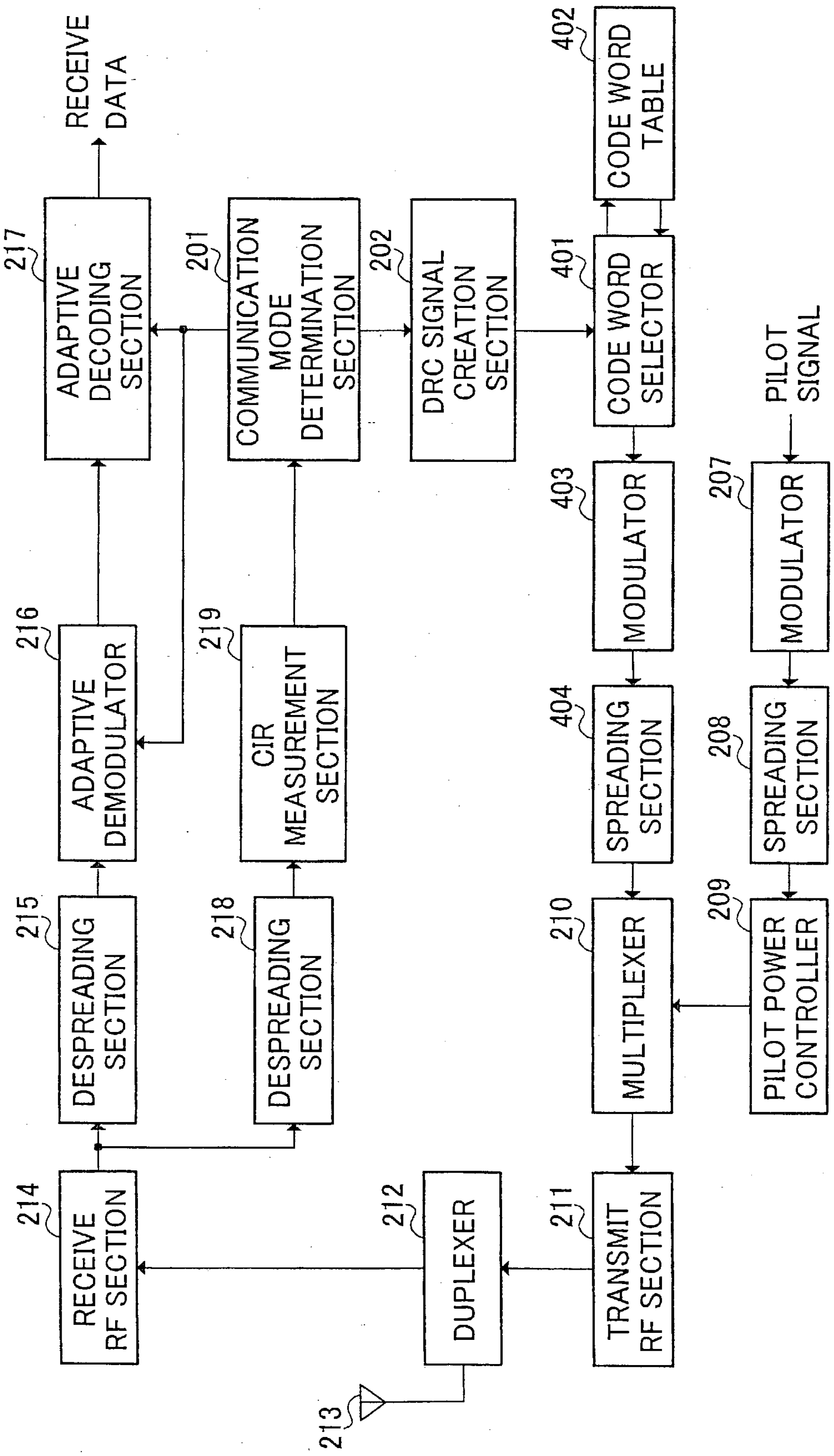
302
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
105
SPREADING SECTION
107
SPREADING SECTION
301
LIKELIHOOD CALCULATION SECTION
113
DESPREADING SECTION
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

FIG.5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CODE WORD SELECTOR
PILOT SIGNAL
216
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219
CIR MEASUREMENT SECTION
403
MODULATOR
207
MODULATOR
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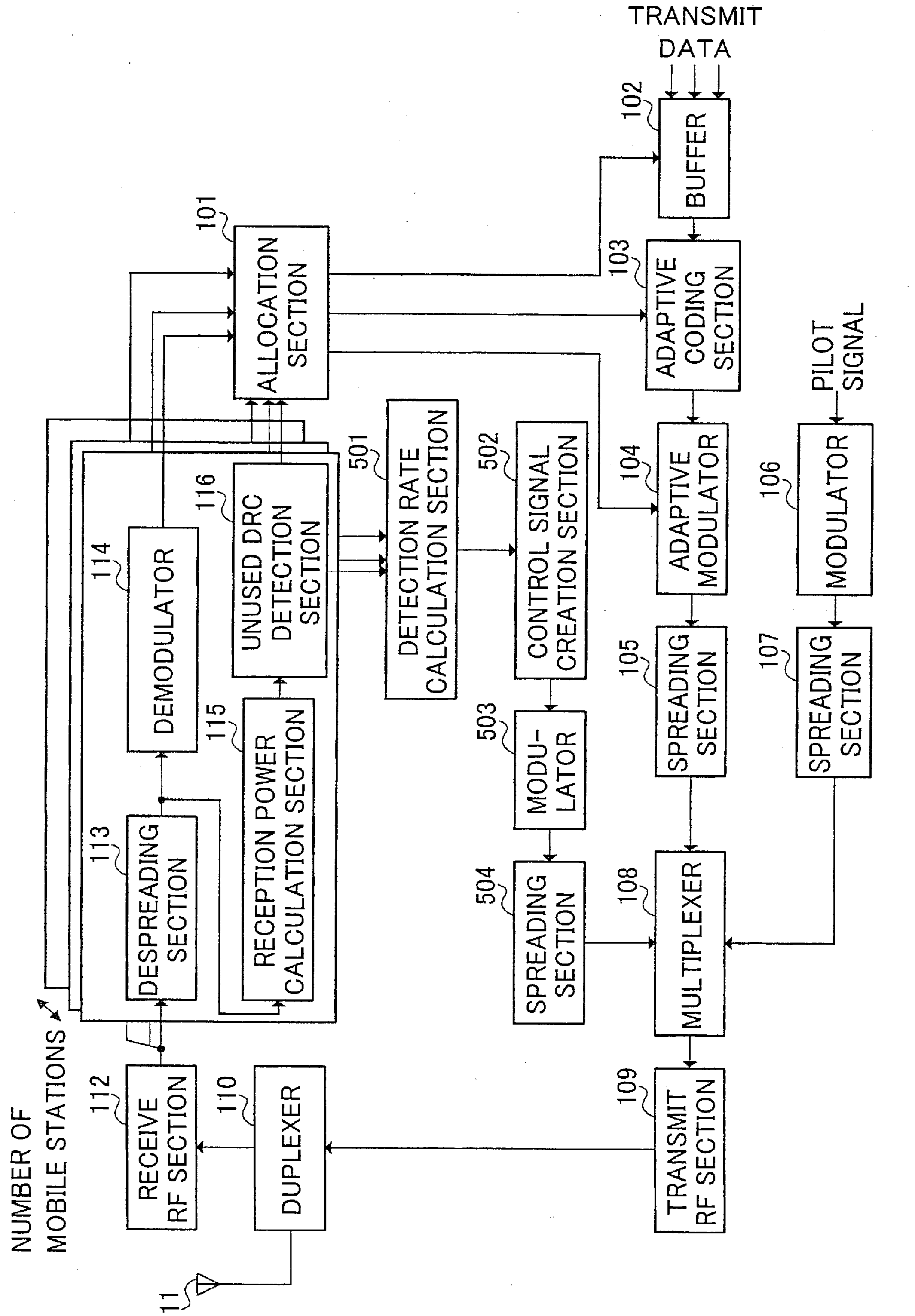
DESPREADING SECTION
218
DESPREADING SECTION
404
SPREADING SECTION
208
SPREADING SECTION
210
MULTIPLEXER
209
PILOT POWER CONTROLLER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

FIG.6

DRC NUMBER	CODE WORD	CODE WORD MINIMUM DISTANCE
1	000000000	1
2	000000001	1
3	000000110	2
4	000111000	3
5	111111111	6

FIG.7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PILOT SIGNAL
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DETECTION RATE CALCULATION SECTION
502
CONTROL SIGNAL CREATION SECTION
104
ADAPTIVE MODULATOR
106
MODULATOR
116
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
115
RECEPTION POWER CALCULATION SECTION
113
DESPREADING SECTION
503
MODU-LATOR
105
SPREADING SECTION
107
SPREADING SECTION
504
SPREADING SECTION
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
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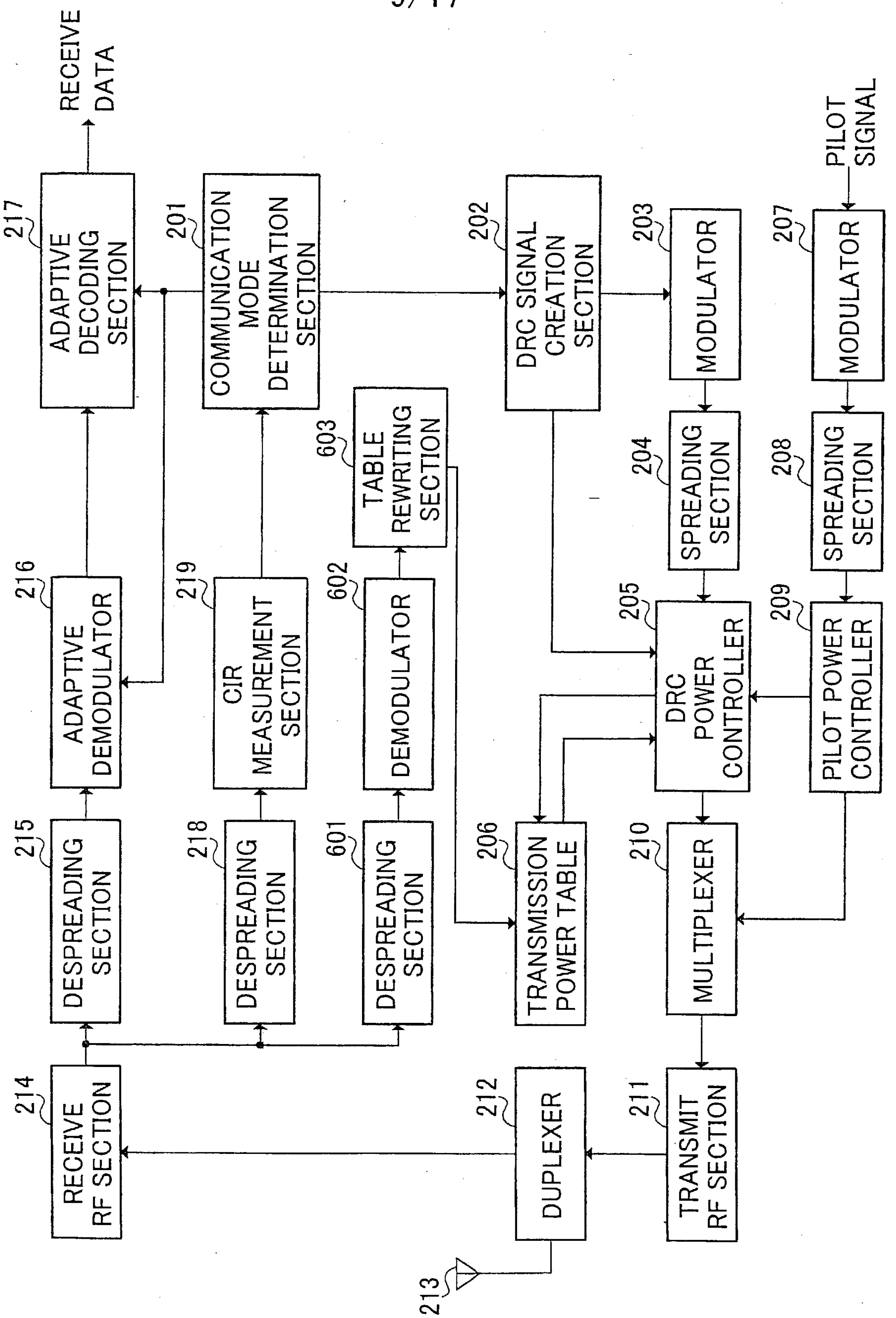
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

FIG.8



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207 MODULATOR
PILOT SIGNAL
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204 SPREADING SECTION
208 SPREADING SECTION
216 ADAPTIVE DEMODULATOR
219 CIR MEASUREMENT SECTION
602 DEMODULATOR
205 DRC POWER CONTROLLER
209 PILOT POWER CONTROLLER
215 DESPREADING SECTION
218 DESPREADING SECTION
601 DESPREADING SECTION
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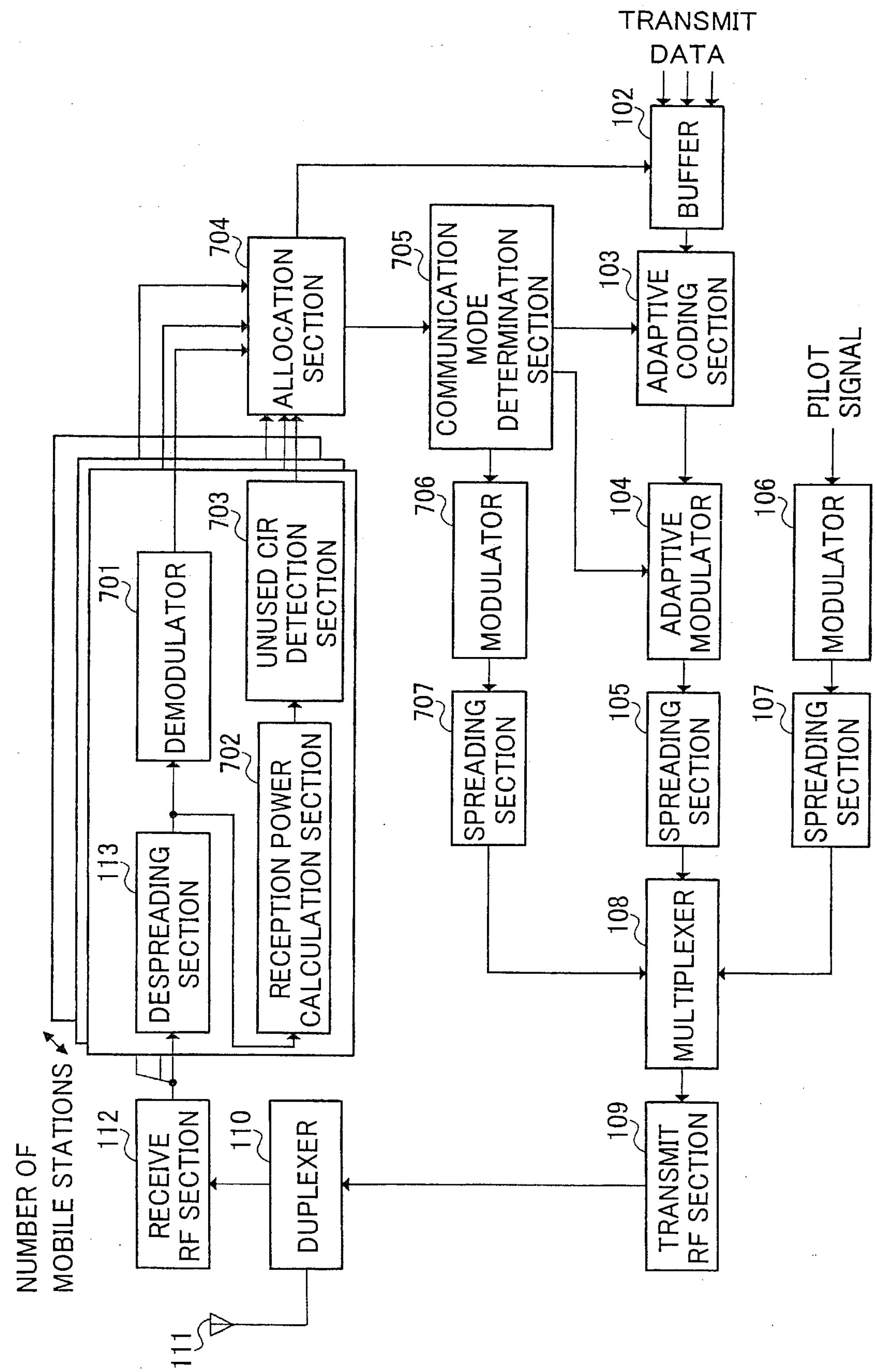
210 MULTIPLEXER
214 RECEIVE RF SECTION
212 DUPLEXER
211 TRANSMIT RF SECTION
213

FIG.9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PILOT SIGNAL
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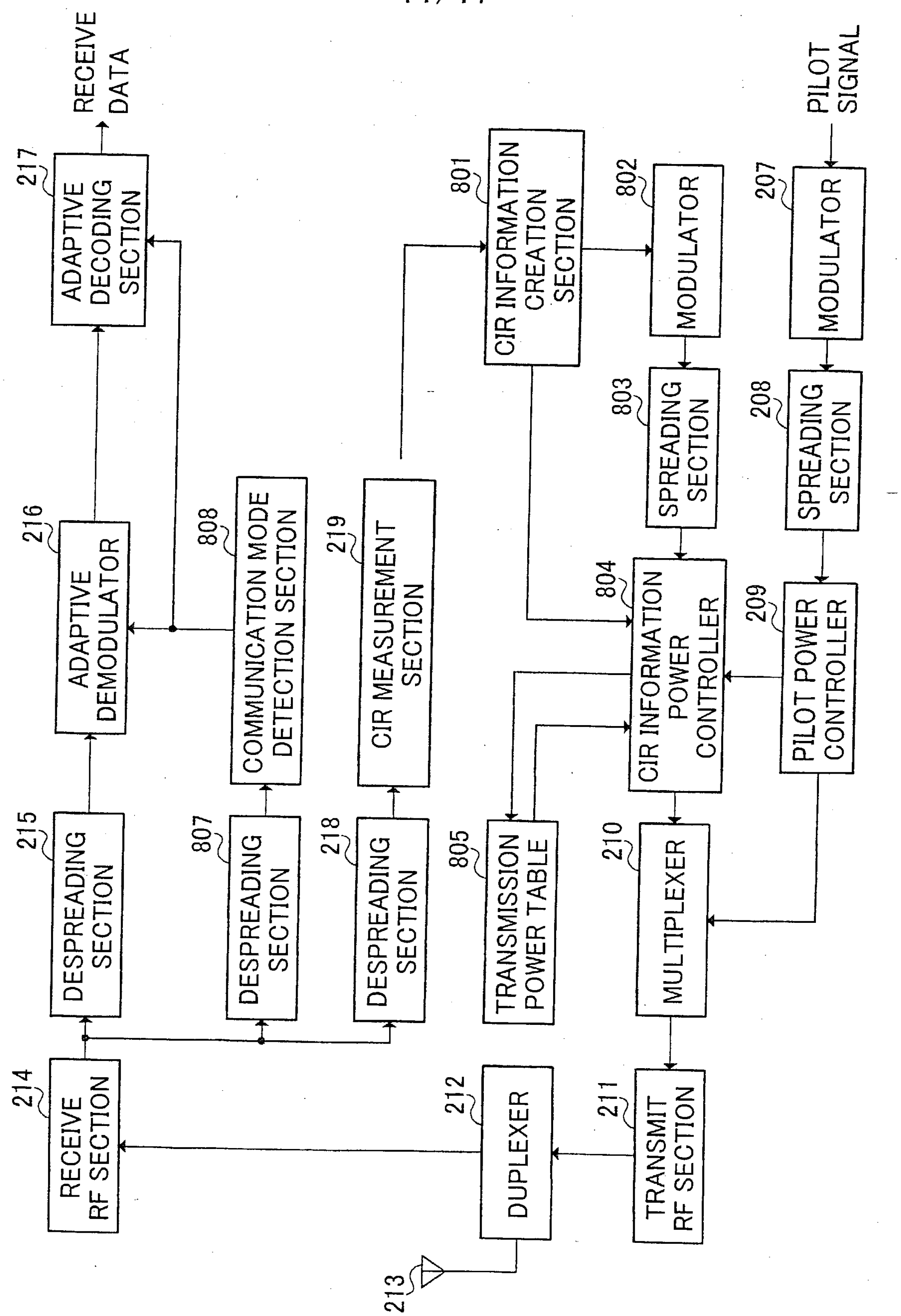
701
DEMODULATOR
706
MODULATOR
104
ADAPTIVE MODULATOR
106
MODULATOR
702
RECEPTION POWER CALCULATION SECTION
113
DESPREADING SECTION
707
SPREADING SECTION
105
SPREADING SECTION
107
SPREADING SECTION
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

FIG.10



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807
DESPREADING SECTION
219
CIR MEASUREMENT SECTION
218
DESPREADING SECTION
801
CIR INFORMATION CREATION SECTION
805
TRANSMISSION POWER TABLE
212
DUPLEXER
213
802
MODULATOR
803
SPREADING SECTION
804
CIR INFORMATION POWER CONTROLLER
210
MULTIPLEXER
211
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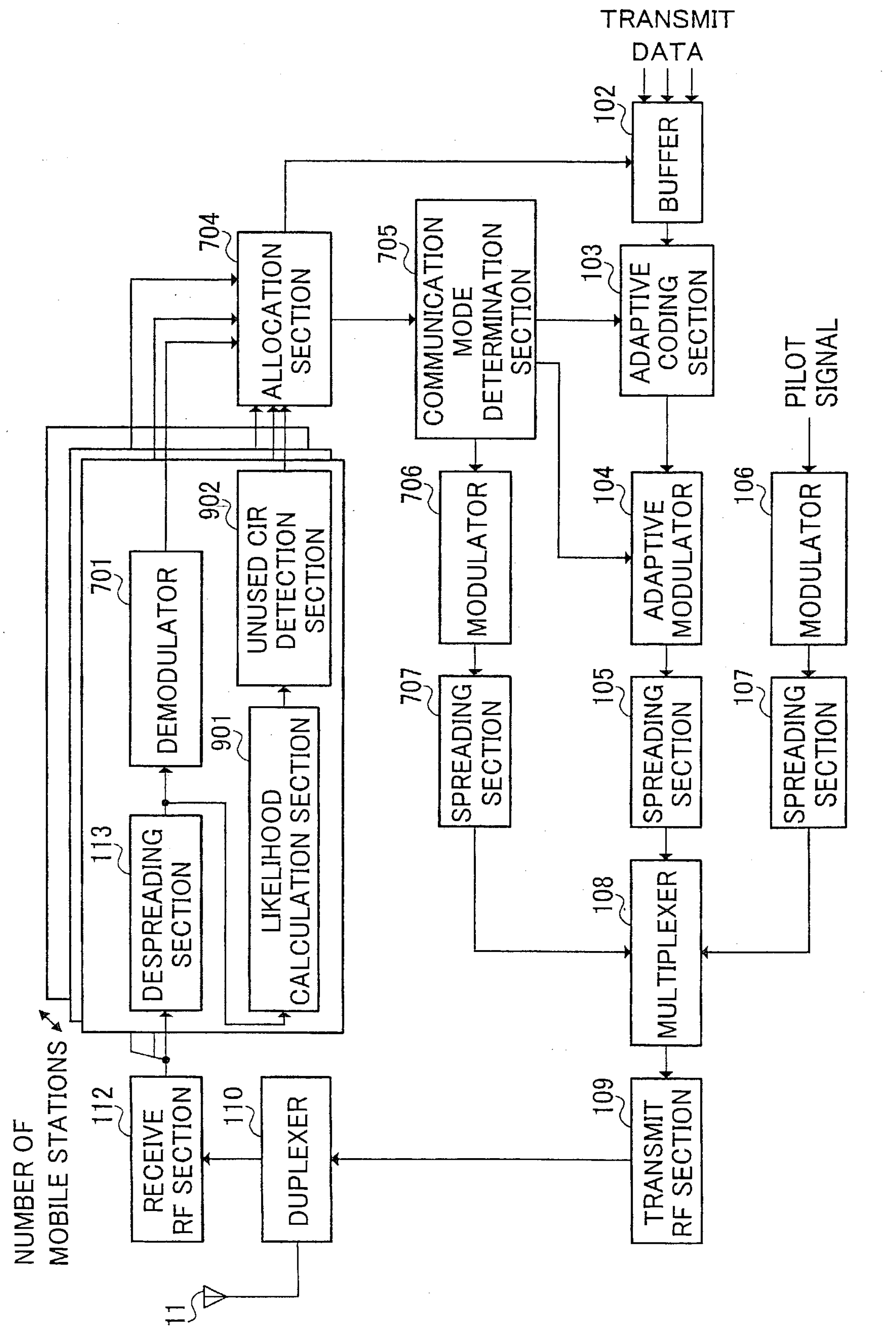
PILOT SIGNAL
207
MODULATOR
208
SPREADING SECTION
209
PILOT POWER CONTROLLER

FIG.11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SPREADING SECTION
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MULTIPLEXER
108
TRANSMIT RF SECTION
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DUPLEXER
110
111
RECEIVE RF SECTION
112
NUMBER OF MOBILE STATIONS
DESPREADING SECTION
113
DEMODULATOR
701
LIKELIHOOD CALCULATION SECTION
901
UNUSED CIR DETECTION SECTION
902
ALLOCATION SECTION
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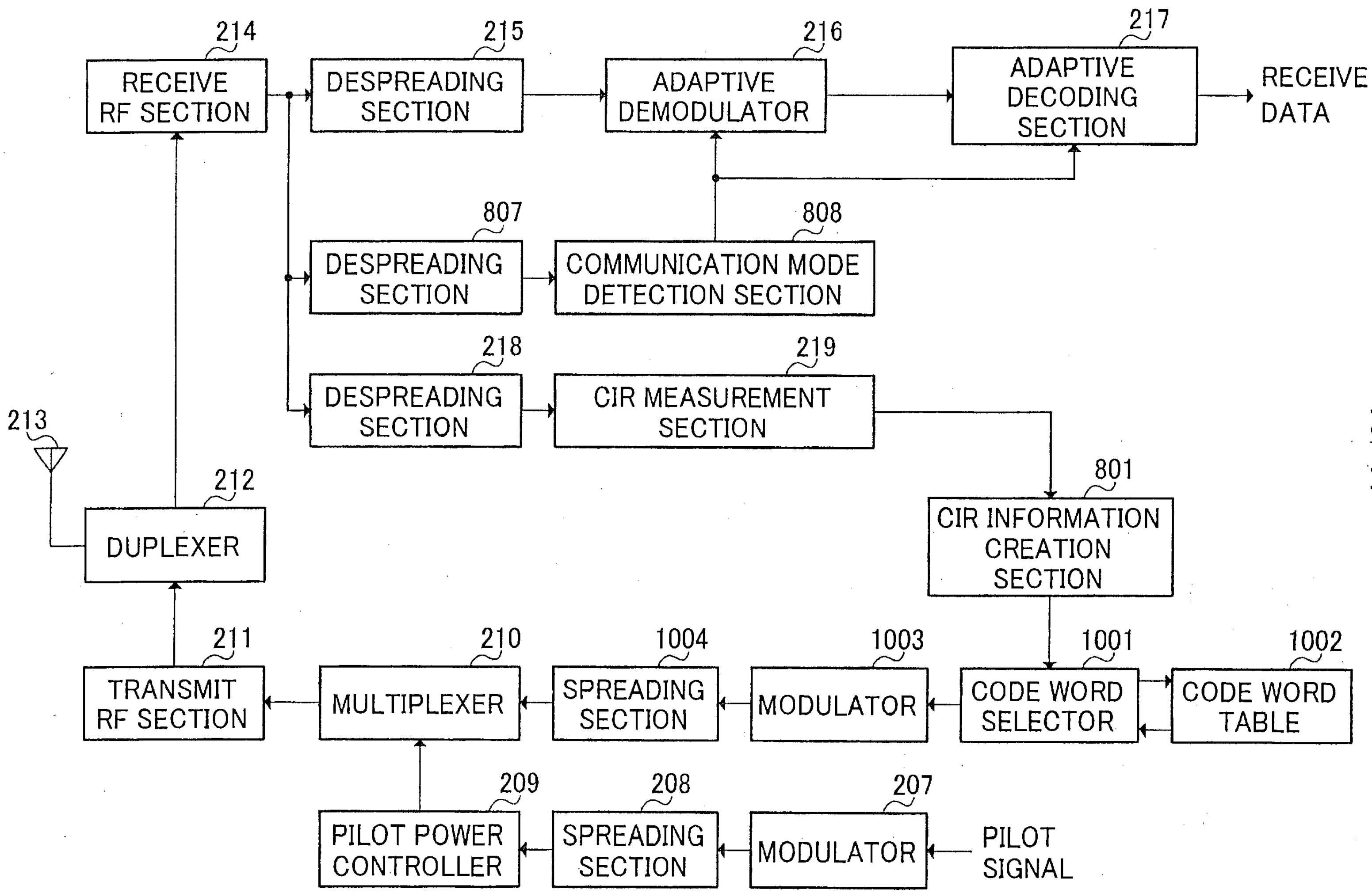
COMMUNICATION MODE DETERMINATION SECTION
705
MODULATOR
706
SPREADING SECTION
707

FIG.12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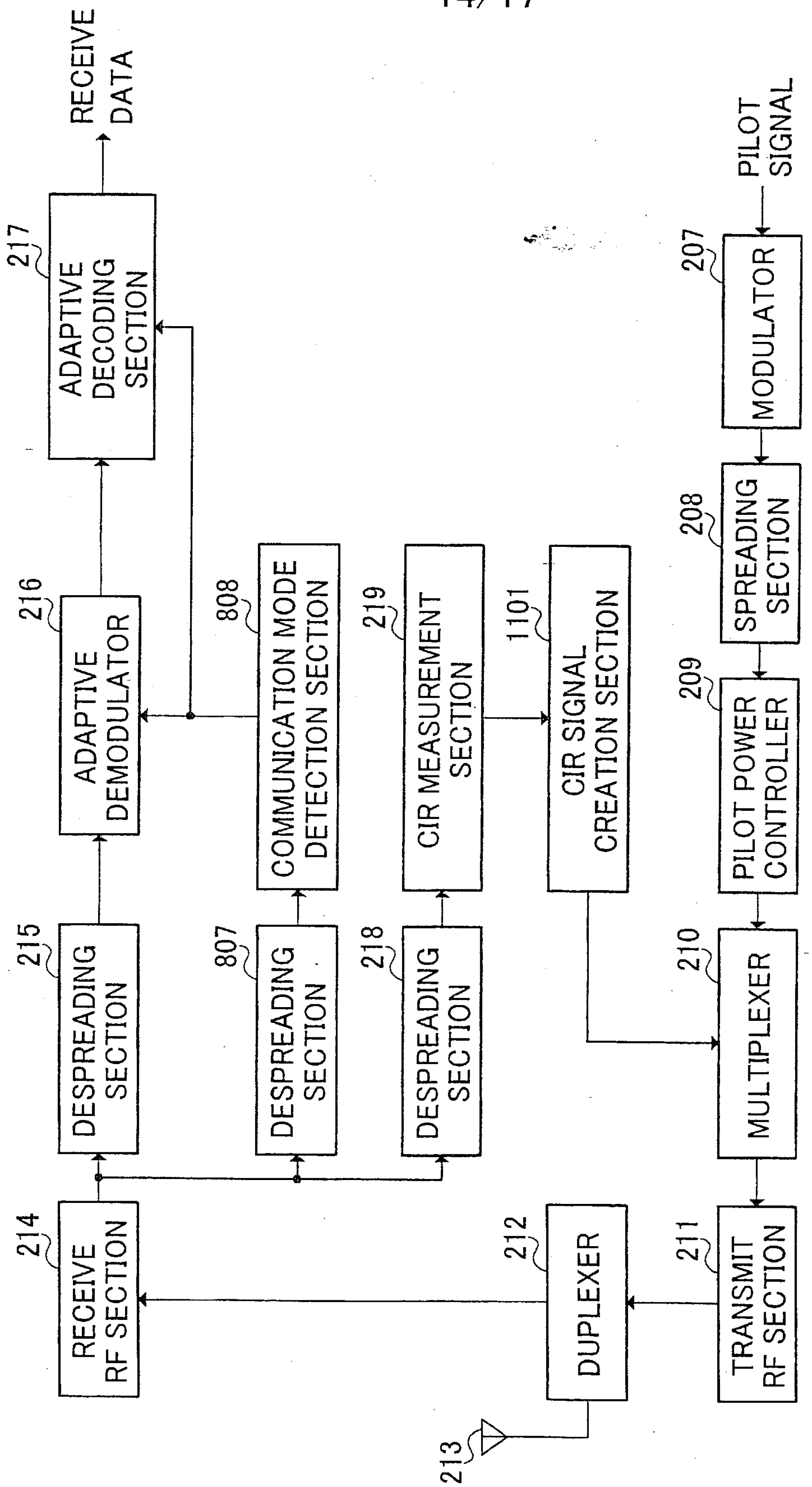
808
COMMUNICATION MODE DETECTION SECTION
218
DESPREADING SECTION
219
CIR MEASUREMENT SECTION
213
212
DUPLEXER
801
CIR INFORMATION CREATION SECTION
211
TRANSMIT RF SECTION
210
MULTIPLEXER
1004
SPREADING SECTION
1003
MODULATOR
1001
CODE WORD SELECTOR
1002
CODE WORD TABLE
209
PILOT POWER CONTROLLER
208
SPREADING SECTION
207
MODULATOR
PILOT SIGNAL

FIG.13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DESPREADING SECTION
219
CIR MEASUREMENT SECTION
218
DESPREADING SECTION
1101
CIR SIGNAL CREATION SECTION
212
DUPLEXER
213
PILOT SIGNAL
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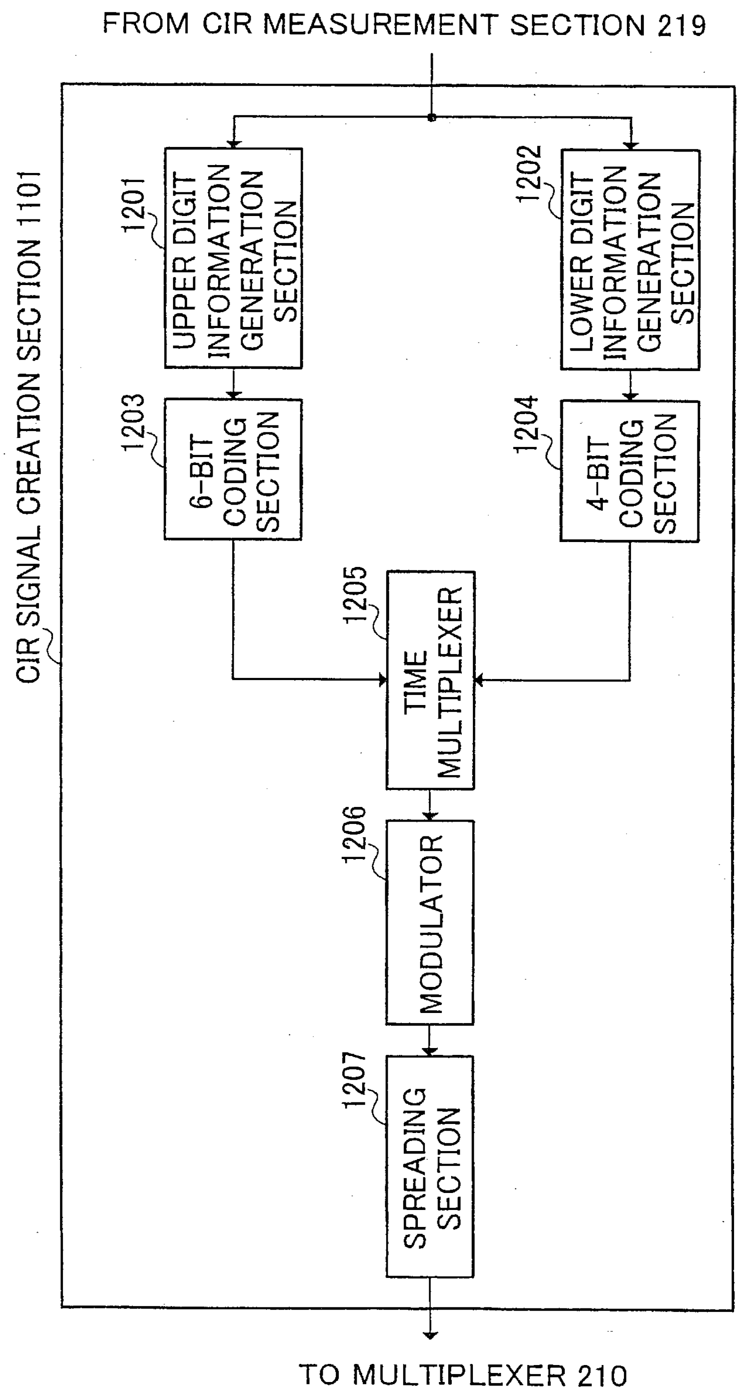
SPREADING SECTION
209
PILOT POWER CONTROLLER
210
MULTIPLEXER
211
TRANSMIT RF SECTION

FIG.14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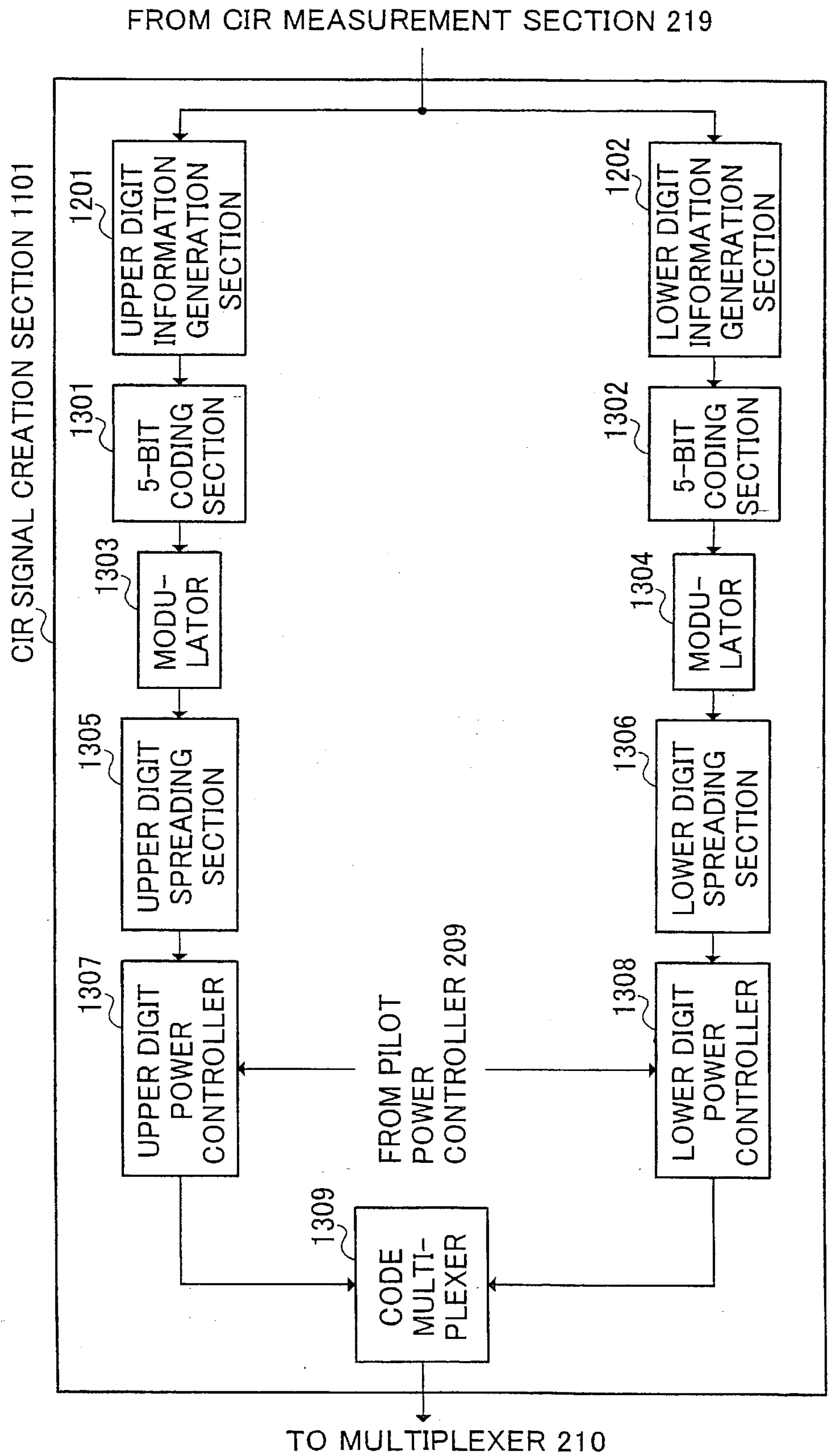
LOWER DIGIT INFORMATION GENERATION SECTION
1203
6-BIT CODING SECTION
1204
4-BIT CODING SECTION
1205
TIME MULTIPLEXER
1206
MODULATOR
1207
SPREADING SECTION
TO MULTIPLEXER 210

FIG.15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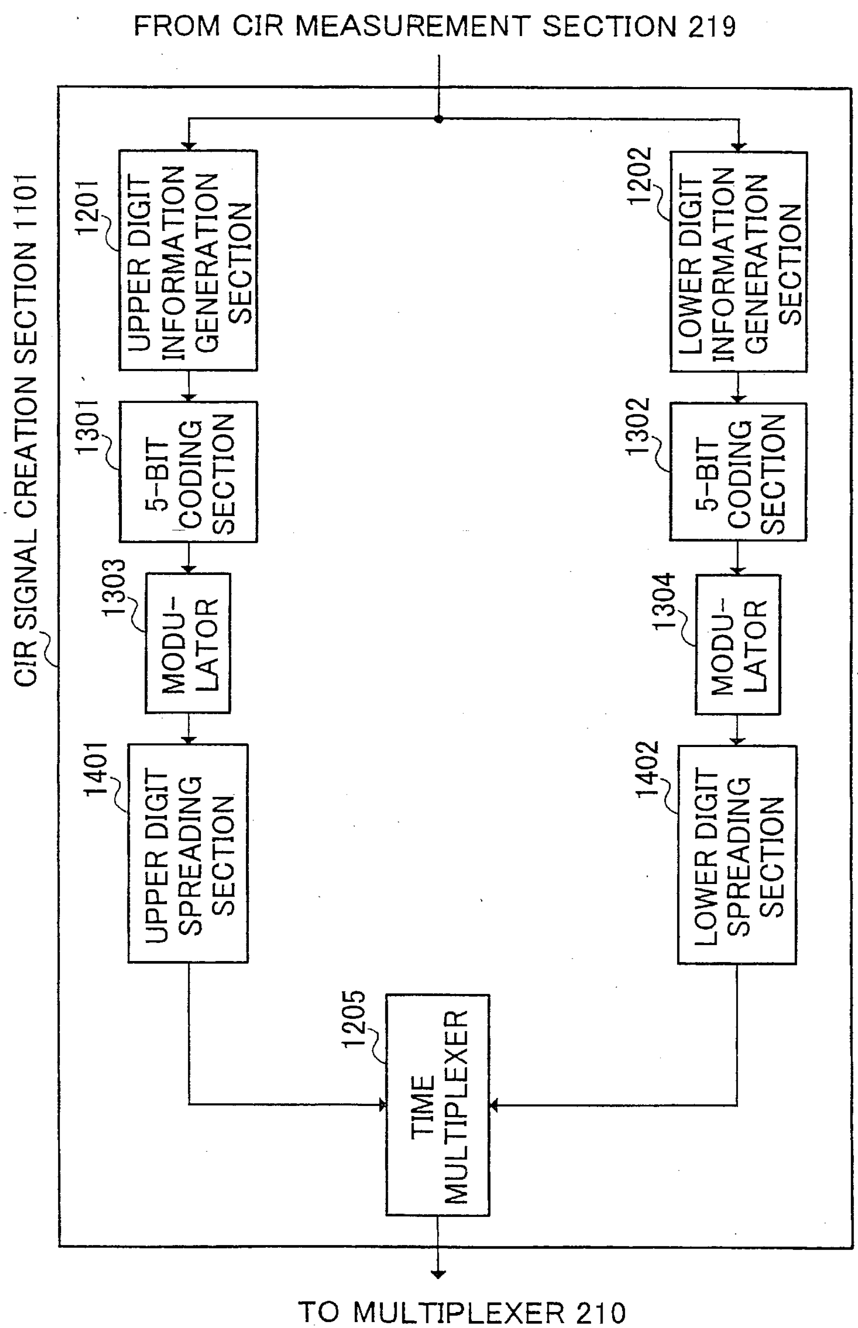
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1301
5-BIT CODING SECTION
1302
5-BIT CODING SECTION
1303
MODU-LATOR
1304
MODU-LATOR
1305
UPPER DIGIT SPREADING SECTION
1306
LOWER DIGIT SPREADING SECTION
1307
UPPER DIGIT POWER CONTROLLER
1308
LOWER DIGIT POWER CONTROLLER
FROM PILOT POWER CONTROLLER 209
1309
CODE MULTI-PLEXER
TO MULTIPLEXER 210

FIG.16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1201
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1301
5-BIT CODING SECTION
1303
MODU-LATOR
1401
UPPER DIGIT SPREADING SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1302
5-BIT CODING SECTION
1304
MODU-LATOR
1402
LOWER DIGIT SPREADING SECTION
1205
TIME MULTIPLEXER
TO MULTIPLEXER 210

FIG.17

10321623 .121802

APPLICATION FOR UNITED STATES PATENT
Declaration for Patent Application

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on

the invention entitled: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

the specification of which 2 (file no ______)

(check at least one) 3 [x] is attached hereto
4 [ ] was filed on ______ as (5) U.S. Application Serial No.______
6 [ ] and was amended ______ (if applicable)

Use this portion only if you are entering the U.S. National phase based on a PCT International Application designating the U.S.

7 [x] was filed as PCT international application
8 Number PCT/JP01/06654
9 on 2/August/2001
and was amended under PCT Article(s) 19 and/or 34
10 on ______ (if applicable).
11 priority date claimed in PCT International Application

(Country)	(Number)	(Day/Month/Year Filed)
JAPAN	2000-234420	2/August/2000
JAPAN	2000-285405	20/September/2000

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended, by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application (s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date earlier than that of the application(s) on which priority is claimed.

Prior (Foreign) Application(s) any Priority Claims Under 35 U.S.C. 119 — Priority Claimed

12a

(Country)	(Number)	(Day/Month/Year Filed)	Yes	No
			[ ]	[ ]
			[ ]	[ ]

Priority Claim(s) from U.S. Provisional Application(s) – I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

12b

Application No.	Day/Month/Year Filed	Application No.	Day/Month/Year Filed

Do not use this portion to identify a PCT application if the parent application is the U.S. National phase of the PCT application

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between filing date of the prior application and the national or PCT international filing date of this application.

13

(U.S. Application Number)	(U.S. Filing Date)	Status (patented, pending, abandoned)

I hereby appoint the following attorneys of the firm of Stevens, Davis, Miller & Mosher, L.L.P. as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office:

James E. Ledbetter, Reg. No. 28732; Thomas P. Pavelko, Reg. No. 31689; and Anthony P. Venturino, Reg. No. 31674.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO STEVENS, DAVIS, MILLER & MOSHER, L.L.P., 1615 L Street, N.W., Suite 850, Washington, D.C. 20036, TELEPHONE (202) 408-5100, FACSIMILE (202) 408-5200.

See page 2 for signature lines

other side for instructions for completing this form

I"STRUCTIONS FOR COMPLETION OF THIS "ORM

line 1 Insert the same title as is used on th ,pecification and in the assignment.

line 2 Is optional but is provided so that you can use it to identify more readily an application prior to the time that the Patent Office application serial number is assigned. We suggest that the specification, drawings and declaration always bear a file number since it can help to get the papers together in case they become inadvertently separated. In instances where the specification is filed without a signed declaration form (under 37 CFR §1.53) a file number on a later-received separate form will assist us in associating it with the correct case.

line 3 Check this box if the specification, claims and drawing (if any) are attached to this declaration form, e.g., when filing a new patent application.

lines 4-5 Are only used in an instance where the application is already on file and the declaration from is being separately filed, e.g.,when the application was originally filed without a signed declaration or where the Patent Office has required a new declaration because of a deficiency in the original declaration. In such an instance the Patent Office will require that lines 4 and 5 be completed with the filing date and application serial number already assigned.

line 6 Is used in conjunction with line 5 but only when there have been one or more amendments to the specification or claims. Line 6 is also used when the Examiner requires a new declaration because claims inserted by amendment cover subject matter not originally claimed (37 CFR §1.67).

lines 7-11 Are for PCT (Patent Cooperation Treaty) cases and are used only when you are entering the U.S. National phase (Chapter I or II) based upon a previously filed PCT International application designating the U.S.

line 7 Check this box if this is a PCT National Phase application.

line 8 Insert PCT International application number.

line 9 Insert date of filing of PCT International application.

lines 10-11 Insert the date of all amendments filed in the PCT International application. Such amendments are optional, so this line at times will not be used.

line 12a Is used in the following instances:

(i) If a single priority is being claimed from a foreign application you need to list only the first-filed application; you do not need to list other countries if all applications were filed within one year of the U.S. filing.

(ii) If multiple priorities are being claimed, from a plurality of applications filed in one or more countries, you must list the first filed application for each aspect of the invention. Example: if aspect A of the invention was disclosed in an application filed 11 months earlier in country X and aspect B was disclosed 9 months earlier in an application filed in country Y, then the applications in both countries X and Y must be identified. Only the first application for each aspect of the invention needs to be identified provided all applications on that aspect were filed within one year prior to the U.S. filing.

(iii) If a non-priority application is being filed you must list all applications in all countries where corresponding foreign applications were filed more than one year prior to the U.S. filing. This is so the Examiner can check to see if any of those applications were published or patented early enough to be prior art against the U.S. application.

(iv) If there are more than two applications to be listed we suggest that you type in on this form only "See attached Schedule A" and then list all of the previous applications on an attached sheet.

line 12b Is used to claim priority under 35 USC §119(e) based on a provisional application filed within one year of the filing of the instant application. More than one provisional application may be identified provided neither was filed more than one year earlier.

line 13 This block is used only in instances where there is a previously filed U.S. non-provisional application which was copending at the time the present application was (or is being) filed. that previous application could be a U.S. non-provisional application or the National Phase of a PCT allocation. In such a case the present application may be entitled to the priority of the previous application's U.S. filing date (and consequently the foreign priority thereof) provided the present application is identified as a continuing application (continuation, divisional or continuation-in-part) of the earlier (parent) application. If the foregoing is applicable, please fill in one line for each such prior application.

line 14 Type the inventor's proper legal name in the order specified, e.g., "John B. JONES" or "J. Bob JONES" if the inventor so prefers. It is not acceptable to use only initials such as "J. B. JONES."

line 15 The inventor's "signature" may be his (or her) usual manner of signing but it is preferable that the inventor simply write his (or her) name in his (or her) own cursive handwriting in the same order as on line 14, e.g., given name, middle initial and Family name.

line 16 Insert the actual date of signature.

line 17 Insert simply the city and state or country, e.g., "Paris, France", of the inventor's residence, not citizenship. No street address or postal code is required on this line.

line 18 Insert the inventor's citizenship. The statement of citizenship (or subject of) is a statutory requirement (35 USC §115). Simply the name of the country of citizenship, e.g., "Japan" is sufficient.

line 19 Insert the inventor's mailing address. The purpose of requiring the post office address is to enable the Patent Office to communicate directly with the inventor if desired, such as in the case of death of the U.S. attorney. It should be the address where the inventor customarily receives his (or her) mail and should include the postal code. If applicable it can be the inventor's business address or address at place of employment.

Applicants are reminded that the U.S. Patent and Trademark Office has very strict requirements as to proper execution of an application. The applicant should make sure that he reviews the declaration, prior to signing to make sure the declaration properly identifies the application and all relevant information; and should review the specification and claims (including drawings, if any) before signing the declaration. Failure to do so will require the filing of a supplemental declaration --- 37 CFR §1.67(c).

Any handwritten changes to the specification, claims or drawings must be in ink personally by all of the inventors prior to signing the declaration and the adjacent left margin must be initialed and dated by all of the inventors, e.g., "JBJ 6-9-91".

Please let us know if there are any questions regarding proper completion of this form. Thank you.

An assignment, a separate document requiring separate signature and dating may be enclosed. Please look for it and sign and date it in the same manner as in lines 15 and 16 above.

STEVENS, DAVIS, MILLER & MOSHE" L.L.P.

I hereby declare that all statements made herein of n /n knowledge are true and that all statements made on in: tion and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by ıne or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

PAGE 2 OF U.S.A. DECLARATION FORM

14a	Typewritten Full Name of Sole or First Inventor	Kenichi		MIYOSHI
		Given Name	Middle Name	Family Name
15a	Inventor's Signature	Kenichi		Miyoshi
16a	Date of Signature	March	3	2002
		Month	Day	Year
17a	Residence	Yokohama-shi	Kanagawa	JAPAN
		City	State or Province	Country
18a	Citizenship	JAPAN		
19a	Post Office Address *(Insert complete mailing address, including country)*	11-4-1305, Nokendaihigashi, Kanazawa-ku, Yokohama-shi, Kanagawa 236-0058 JAPAN		

14b	Typewritten Full Name of Sole or First Inventor	Osamu		KATO
		Given Name	Middle Name	Family Name
15b	Inventor's Signature	Osamu		Kato
16b	Date of Signature	March	3	2002
		Month	Day	Year
17b	Residence	Yokosuka-shi	Kanagawa	JAPAN
		City	State or Province	Country
18b	Citizenship	JAPAN		
19b	Post Office Address *(Insert complete mailing address, including country)*	5-45-G302, Shonantakatori, Yokosuka-shi, Kanagawa 237-0066 JAPAN		

14c	Typewritten Full Name of Sole or First Inventor	Junichi		AIZAWA
		Given Name	Middle Name	Family Name
15c	Inventor's Signature	Junichi		Aizawa
16c	Date of Signature	March	3	2002
		Month	Day	Year
17c	Residence	Yokohama-shi	Kanagawa	JAPAN
		City	State or Province	Country
18c	Citizenship	JAPAN		
19c	Post Office Address *(Insert complete mailing address, including country)*	9-20,Sakaigihoncho, Hodogaya-ku, Yokohama-shi Kanagawa 240-0033 JAPAN		

14d	Typewritten Full Name of Sole or First Inventor			
		Given Name	Middle Name	Family Name
15d	Inventor's Signature			
16d	Date of Signature			
		Month	Day	Year
17d	Residence			
		City	State or Province	Country
18d	Citizenship			
19d	Post Office Address *(Insert complete mailing address, including country)*			

*Note to Inventor: Please sign name on line 15 exactly as it appears in line 14 and insert the actual date of signing on line 16. If there are more than four inventors, please add a copy of this page for identification and signatures for the additional inventors.

1033 U.S. PTO
10321623
121802

PATENT NUMBER and ISSUE DATE

U.S. UTILITY Patent Application

APPL NUM	FILING DATE	CLASS	SUBCLASS	GAU	EXAMINER
10321623	12/18/2002	455	452.000	2683	D. Le

**APPLICANTS: Kenichi Miyoshi; Osamu Kato; Junichi Aizawa;

**CONTINUING DATA VERIFIED:

This application is a CON of 10/089,605 04/01/2002 Duc Le

** FOREIGN APPLICATIONS VERIFIED:

JAPAN 2000-234420 08/02/2000

JAPAN 2000-285405 09/20/2000

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PG-PUB	DO NOT PUBLISH ☐	RESCIND ☐

Foreign priority claimed ☐ yes ☐ no
35 USC 119 conditions met ☐ yes ☐ no
Verified and Acknowledged Examiners's intials

ATTORNEY DOCKET NO
L9289.02149B

TITLE : Communication terminal apparatus, base station apparatus, and radio communication method

U.S.DEPT. OF COMM./PAT.& TM-PTO-436L(Rev. 12-94)

NOTICE OF ALLOWANCE MAILED

Assistant Examiner

CLAIMS ALLOWED

Total Claims | Print Claim for O.G

ISSUE FEE

Amount Due | Date Paid

Primary Examiner

DRAWING

Sheets Drwg. | Figs.Drwg. | Print Fig.

Application Examiner

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PREPARED FOR ISSUE

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(Attached in pocket on right inside flap)

SEARCH

Class	Sub.	Date	Exmr.
455	522	4/7/04	DCL
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	68		
	67.11		
	561		
370	347		
	335		
	336		

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES

(List databases searched. Attach search strategy inside.)

	Date	Exmr.
Vo Nguyen 455	4/7/04	DCL
EAST Search	4/8/04	DCL

BEST AVAILABLE COPY

ISSUE SLIP STAPLE AREA (for additional cross-references)

ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
INTERNATIONAL CLASSIFICATION									
/									
/									
/									
/									
/									

∧ Continued on Issue Slip Inside File Jacket

INDEX OF CLAIMS

✓ .... Rejected
= .... Allowed
– (Through numeral) ... Canceled
+ .... Restricted
N .... Non-elected
I .... Interference
A .... Appeal
O .... Objected

Claim Final	Claim Original	Date 4/14/04	Date	Date	Date	Date	Date	Date	Date	Date
	1	✓								
	2	✓								
	3	✓								
	4	O								
	5	O								
	6	O								
	7	O								
	8	✓								
	9	✓								
	10	✓								
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Claim Final	Claim Original	Date	Date	Date	Date	Date	Date	Date	Date	Date
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Claim Final	Claim Original	Date	Date	Date	Date	Date	Date	Date	Date	Date
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If more than 150 claims or 9 actions staple additional sheet here

Express Mail Label No.

j1033 U.S. PTO 10/321623 121802

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)
(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
L9289.02149B

Total Pages in this Submission

j1033 U.S. PTO
121802

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

and invented by:

Kenichi MIYOSHI
Osamu KATO
Junichi AIZAWA

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☒ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: 10/089,605

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: ______

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: ______

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 68 pages and including the following:
   - a. ☒ Descriptive Title of the Invention
   - b. ☐ Cross References to Related Applications *(if applicable)*
   - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   - d. ☐ Reference to Sequence Listing, a Table, or a Computer Program Listing Appendix
   - e. ☒ Background of the Invention
   - f. ☒ Brief Summary of the Invention
   - g. ☒ Brief Description of the Drawings *(if filed)*
   - h. ☒ Detailed Description
   - i. ☒ Claim(s) as Classified Below
   - j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL (Large Entity) (Only for new nonprovisional applications under 37 CFR 1.53(b))	Docket No. L9289.02149B
	Total Pages in this Submission

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   a. ☒ Formal Number of Sheets 17
   b. ☐ Informal Number of Sheets ______
4. ☒ Oath or Declaration
   a. ☐ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☒ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☒ With Power of Attorney ☐ Without Power of Attorney
   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☒ Incorporation By Reference *(usable if Box 4b is checked)*
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ CD ROM or CD-R in duplicate, large table or Computer Program (Appendix)
7. ☐ Application Data Sheet (See 37 CFR 1.76)
8. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Computer Readable Form (CRF)
   b. ☐ Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper
   c. ☐ Statement(s) Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

9. ☐ Assignment Papers *(cover sheet & document(s))*
10. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
11. ☐ English Translation Document *(if applicable)*
12. ☒ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
13. ☒ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. ☐ Certificate of Mailing
    ☐ First Class ☐ Express Mail *(Specify Label No.)*: ______

UTILITY PATENT APPLICATION TRANSMITTAL (Large Entity) *(Only for new nonprovisional applications under 37 CFR 1.53(b))*	Docket No. L9289.02149B Total Pages in this Submission

Accompanying Application Parts (Continued)

17. ☒ Additional Enclosures *(please identify below):*

Confirmation Claim for Priority

Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

18. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
L9289.02149B
Total Pages in this Submission

Fee Calculation and Transmittal

CLAIMS AS FILED					
For	**#Filed**	**#Allowed**	**#Extra**	**Rate**	**Fee**
Total Claims	20	- 20 =	0	x $18.00	$0.00
Indep. Claims	2	- 3 =	0	x $84.00	$0.00
Multiple Dependent Claims (check if applicable) ☐					$0.00
				BASIC FEE	$740.00
OTHER FEE ***(specify purpose)*** ______					$0.00
				TOTAL FILING FEE	$740.00

☒ A check in the amount of **$740.00** to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **19-4375** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

James E. Ledbetter

Signature

Dated: **December 18, 2002**

James E. Ledbetter, Esq.
Registration No. 28,732
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L Street, N.W., Suite 850
Washington, DC 20036
Tel: 202-785-0100
Fax: 202-408-5200

cc:

The Official Dating Stamp of the Patent and Trademark Office Hereon is acknowledgment of the filing of:

Continuation Application: Cert./True Copy of Appln. as originally filed (61 pgs. Spec., 20 Claims, Abstract, Decl. (3 pages), 17 sheets of drwgs. (Figs. 1- 17); Preliminary Amendment; IDS with PTO-1449; and Confirmation Claim for Priority.

Description of paper: New Utility Patent Transmittal (in dup.) w/check no. 19236 for $740.00

Name of Applicant(s): Kenichi MIYOSHI, et al.

Serial No.: Continuation Application of S.N. 10/089,605 filed April 1, 2002

Atty. File No.: L9289.02149B Sender's Initials: JEL/ejw

J1033 U.S. PTO
10/321623
12/18/02

1/2/03

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STEVENS, DAVIS, MILLER & MOSHER, LLP
P.O. Box 34387
Washington, DC 20043-4387

aap 12/19/02

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121802

UTILITY PATENT APPLICATION TRANSMITTAL
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(Only for new nonprovisional applications under 37 CFR 1.53(b))

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UTILITY PATENT APPLICATION TRANSMITTAL **(Large Entity)** *(Only for new nonprovisional applications under 37 CFR 1.53(b))*	Docket No. **L9289.02149B**
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Application Elements (Continued)

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UTILITY PATENT APPLICATION TRANSMITTAL
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Docket No.
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Accompanying Application Parts (Continued)

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Signature

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STEVENS, DAVIS, MILLER & MOSHER, LLP
P.O. Box 34387
Washington, DC 20043-4387

12/19/02

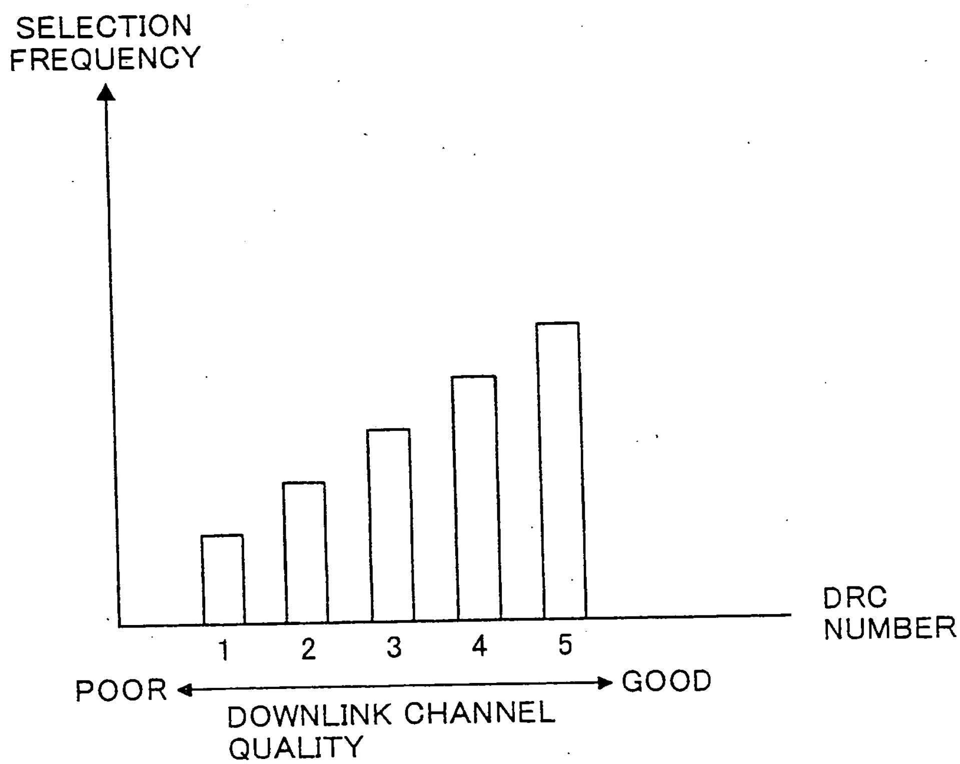
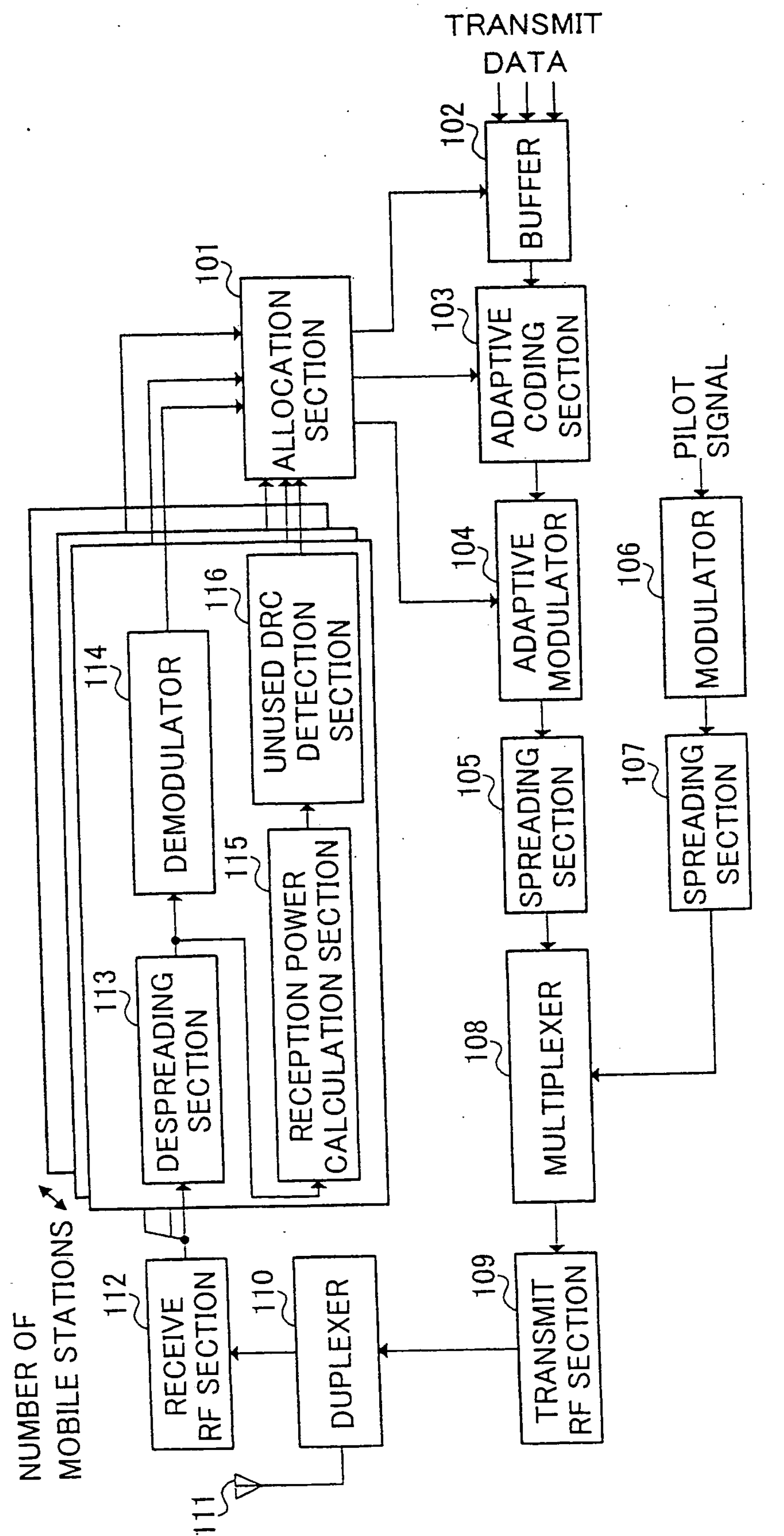

SELECTION
FREQUENCY
DRC
NUMBER
1
2
3
4
5
POOR
GOOD
DOWNLINK CHANNEL
QUALITY

FIG.1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101
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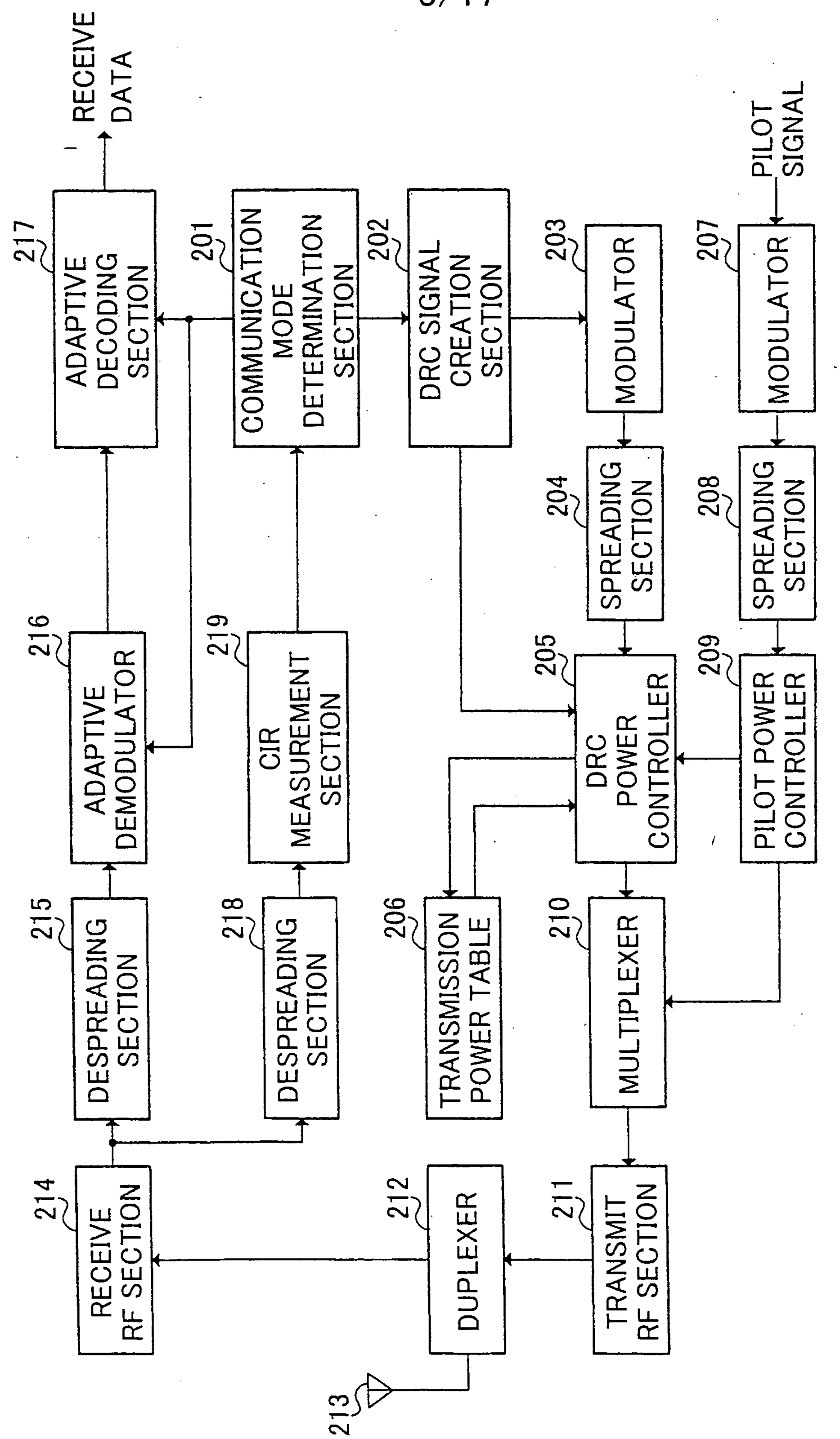
103
ADAPTIVE CODING SECTION
104
ADAPTIVE MODULATOR
PILOT SIGNAL
106
MODULATOR
105
SPREADING SECTION
107
SPREADING SECTION
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
NUMBER OF MOBILE STATIONS
113
DESPREADING SECTION
114
DEMODULATOR
115
RECEPTION POWER CALCULATION SECTION
116
UNUSED DRC DETECTION SECTION

FIG.2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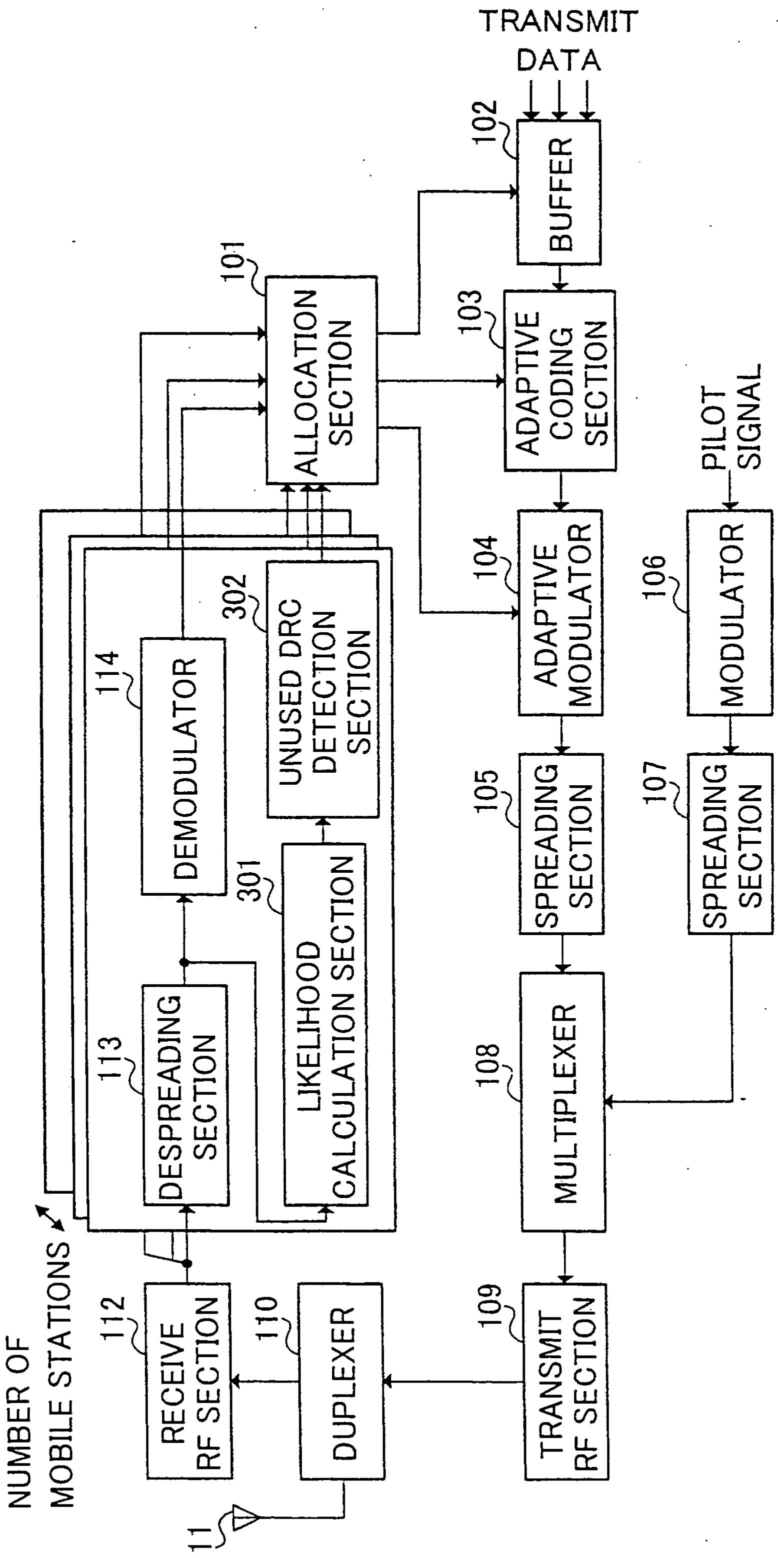
201 COMMUNICATION MODE DETERMINATION SECTION
202 DRC SIGNAL CREATION SECTION
203 MODULATOR
207 MODULATOR
PILOT SIGNAL
204 SPREADING SECTION
208 SPREADING SECTION
216 ADAPTIVE DEMODULATOR
219 CIR MEASUREMENT SECTION
205 DRC POWER CONTROLLER
209 PILOT POWER CONTROLLER
215 DESPREADING SECTION
218 DESPREADING SECTION
206 TRANSMISSION POWER TABLE
210 MULTIPLEXER
214 RECEIVE RF SECTION
212 DUPLEXER
211 TRANSMIT RF SECTION
213

FIG.3

DRC NUMBER	TRANSMISSION POWER (RATIO TO PILOT SIGNAL TRANSMISSION POWER)
1	−2dB
2	−1dB
3	0dB
4	+1dB
5	+2dB

FIG.4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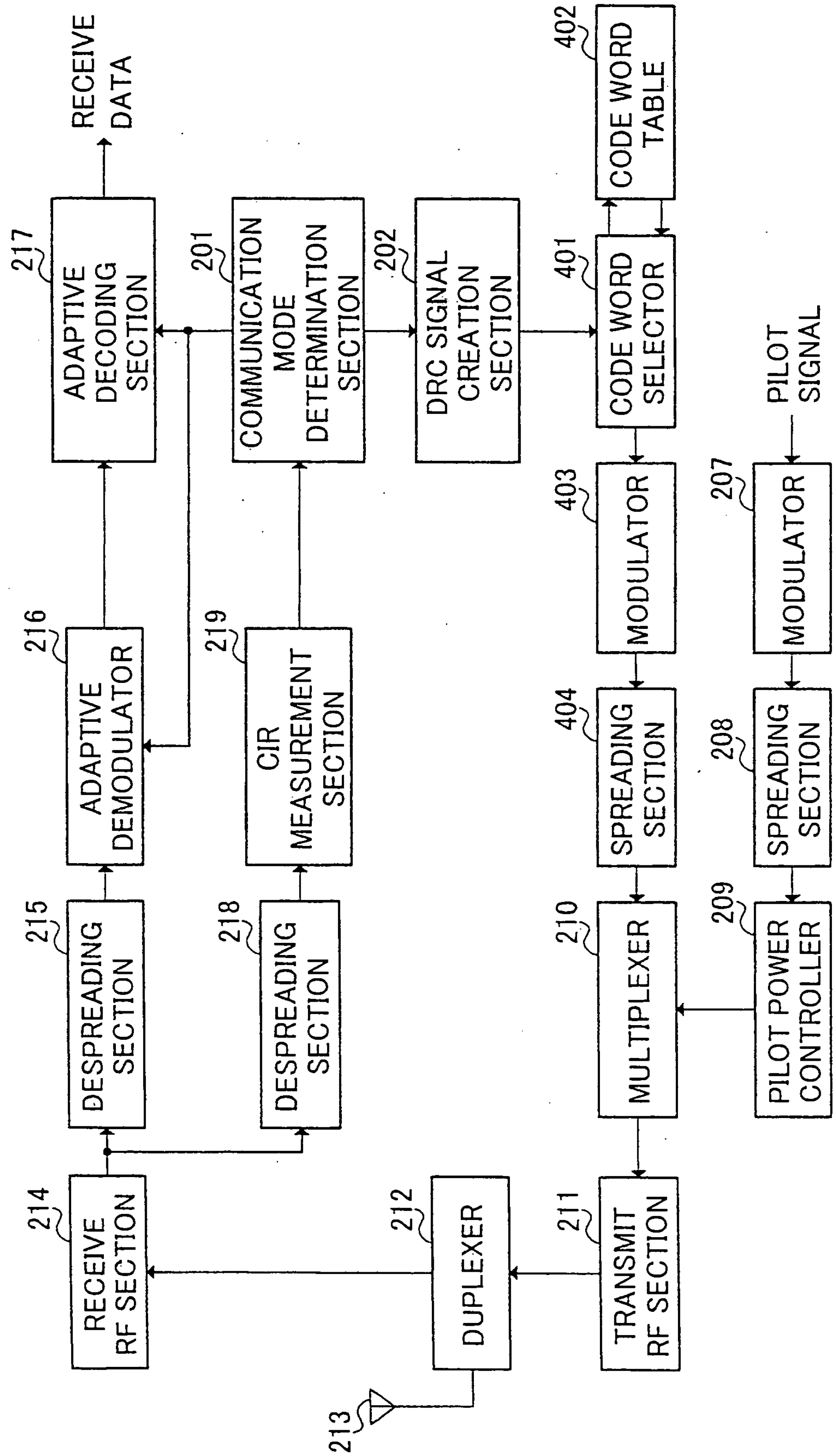
BUFFER
101
ALLOCATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
104
ADAPTIVE MODULATOR
106
MODULATOR
302
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
105
SPREADING SECTION
107
SPREADING SECTION
301
LIKELIHOOD CALCULATION SECTION
113
DESPREADING SECTION
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

FIG.5

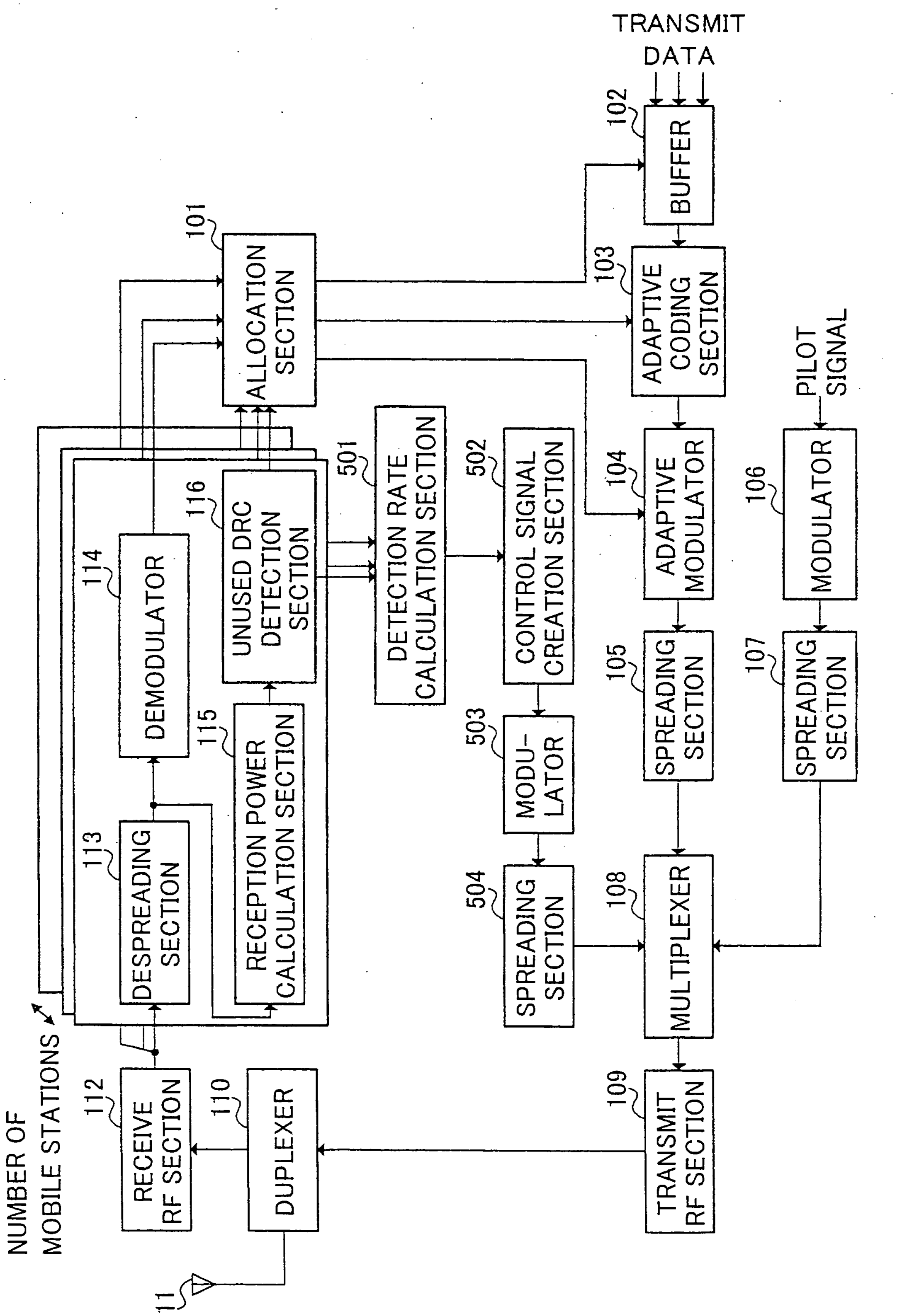


RECEIVE DATA
217
ADAPTIVE DECODING SECTION
201
COMMUNICATION MODE DETERMINATION SECTION
202
DRC SIGNAL CREATION SECTION
401
CODE WORD SELECTOR
402
CODE WORD TABLE
PILOT SIGNAL
403
MODULATOR
207
MODULATOR
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
404
SPREADING SECTION
208
SPREADING SECTION
215
DESPREADING SECTION
218
DESPREADING SECTION
210
MULTIPLEXER
209
PILOT POWER CONTROLLER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

FIG.6

DRC NUMBER	CODE WORD	CODE WORD MINIMUM DISTANCE
1	000000000	1
2	000000001	1
3	000000110	2
4	000111000	3
5	111111111	6

FIG.7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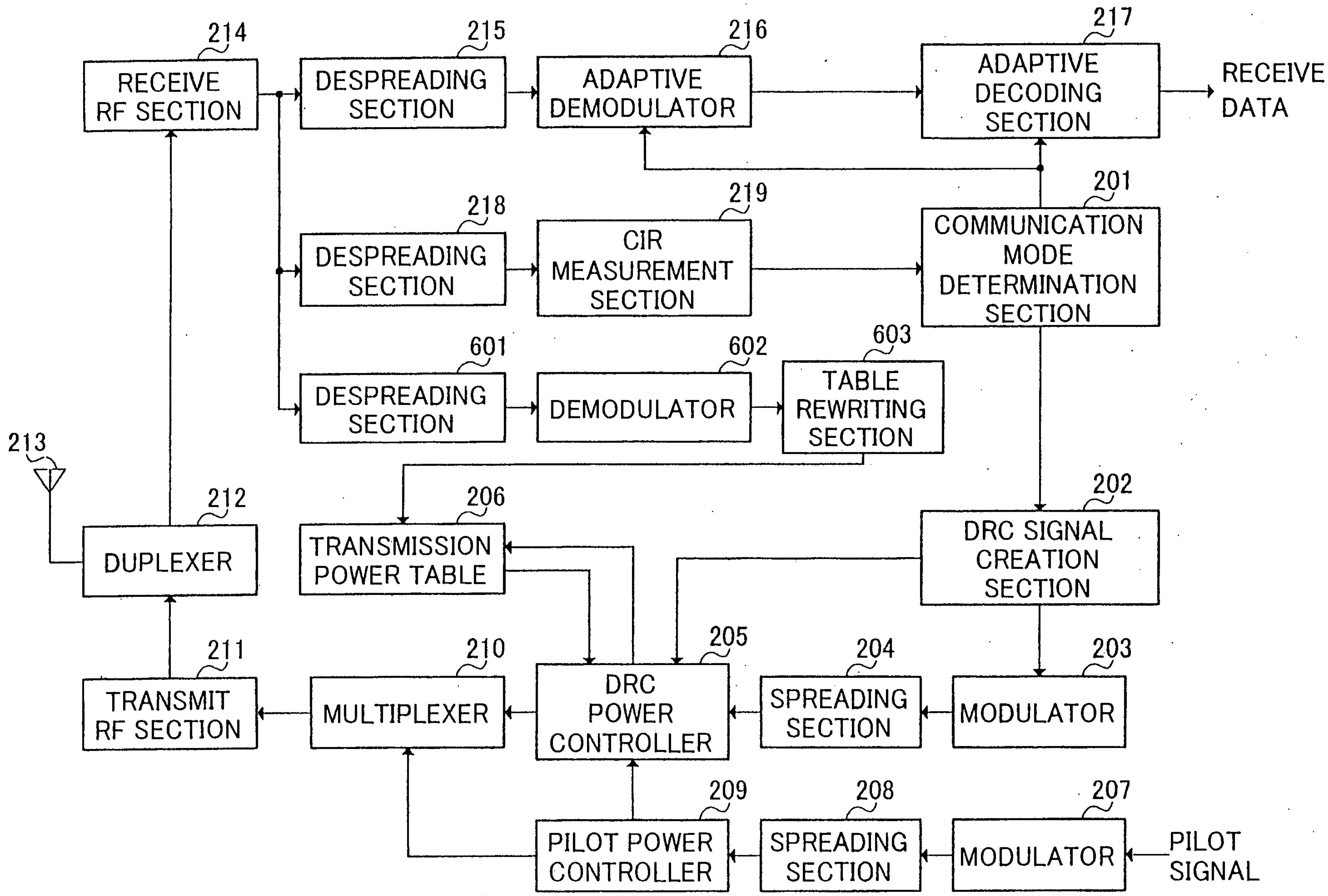
BUFFER
103
ADAPTIVE CODING SECTION
101
ALLOCATION SECTION
PILOT SIGNAL
501
DETECTION RATE CALCULATION SECTION
502
CONTROL SIGNAL CREATION SECTION
104
ADAPTIVE MODULATOR
106
MODULATOR
116
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
115
RECEPTION POWER CALCULATION SECTION
113
DESPREADING SECTION
503
MODU-LATOR
105
SPREADING SECTION
107
SPREADING SECTION
504
SPREADING SECTION
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

FIG.8



214
RECEIVE RF SECTION
215
DESPREADING SECTION
216
ADAPTIVE DEMODULATOR
217
ADAPTIVE DECODING SECTION
RECEIVE DATA
218
DESPREADING SECTION
219
CIR MEASUREMENT SECTION
201
COMMUNICATION MODE DETERMINATION SECTION
601
DESPREADING SECTION
602
DEMODULATOR
603
TABLE REWRITING SECTION
213
212
DUPLEXER
206
TRANSMISSION POWER TABLE
202
DRC SIGNAL CREATION SECTION
211
TRANSMIT RF SECTION
210
MULTIPLEXER
205
DRC POWER CONTROLLER
204
SPREADING SECTION
203
MODULATOR
209
PILOT POWER CONTROLLER
208
SPREADING SECTION
207
MODULATOR
PILOT SIGNAL

FIG.9

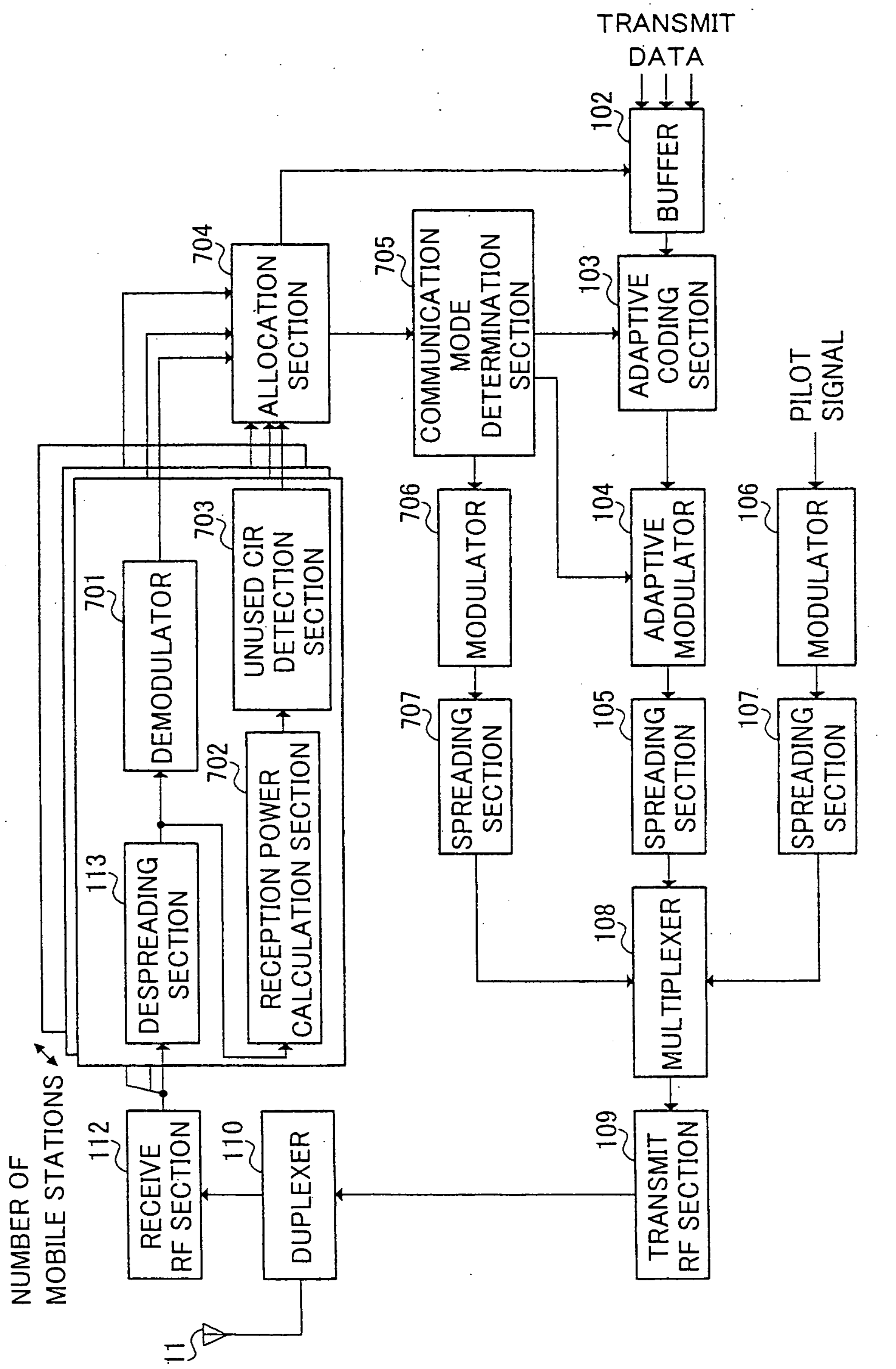
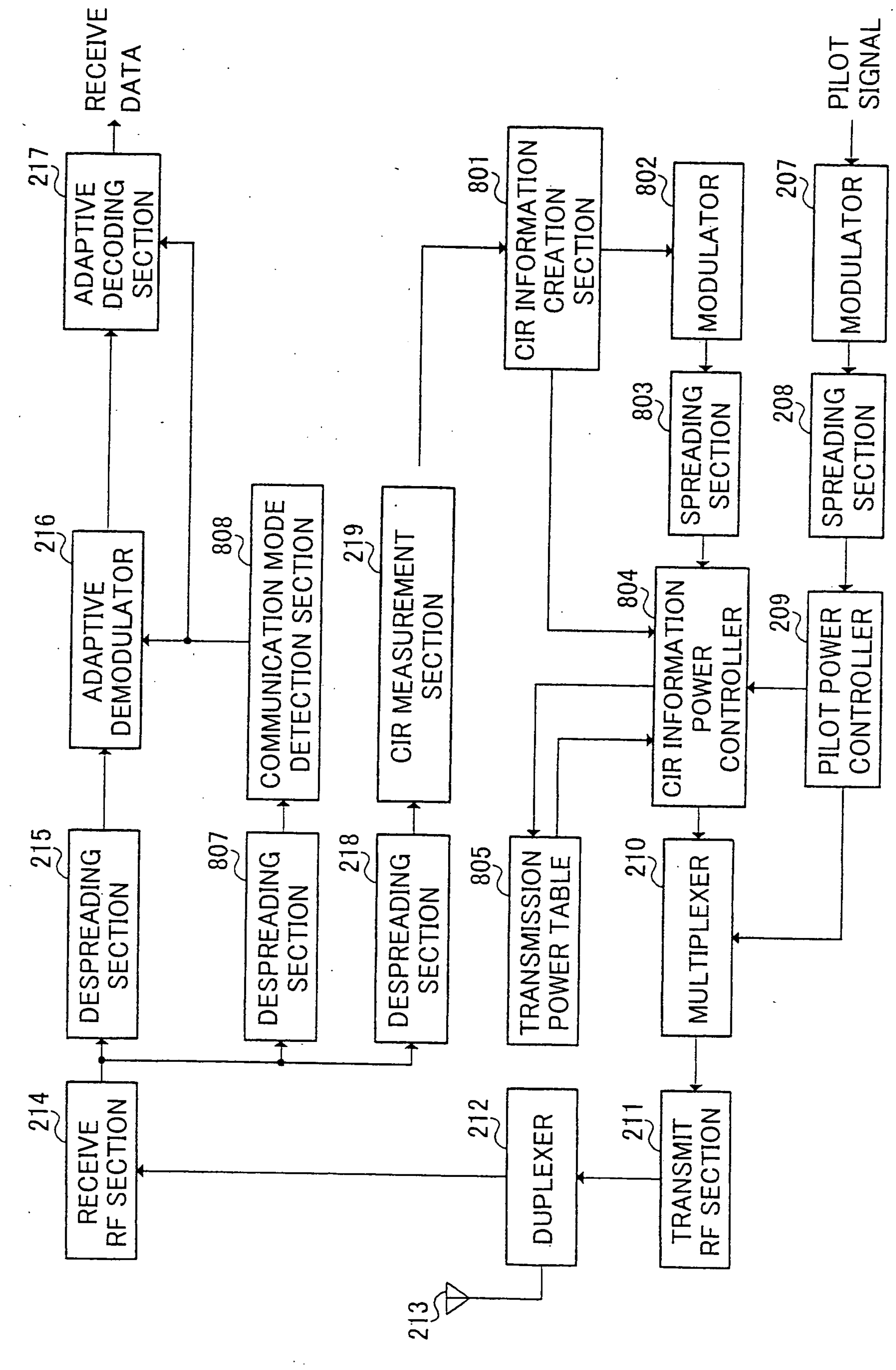

TRANSMIT DATA
102
BUFFER
103
ADAPTIVE CODING SECTION
104
ADAPTIVE MODULATOR
105
SPREADING SECTION
PILOT SIGNAL
106
MODULATOR
107
SPREADING SECTION
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
113
DESPREADING SECTION
701
DEMODULATOR
702
RECEPTION POWER CALCULATION SECTION
703
UNUSED CIR DETECTION SECTION
704
ALLOCATION SECTION
705
COMMUNICATION MODE DETERMINATION SECTION
706
MODULATOR
707
SPREADING SECTION
NUMBER OF MOBILE STATIONS

FIG.10



RECEIVE DATA
217
ADAPTIVE DECODING SECTION
216
ADAPTIVE DEMODULATOR
215
DESPREADING SECTION
214
RECEIVE RF SECTION
213
808
COMMUNICATION MODE DETECTION SECTION
807
DESPREADING SECTION
219
CIR MEASUREMENT SECTION
218
DESPREADING SECTION
801
CIR INFORMATION CREATION SECTION
805
TRANSMISSION POWER TABLE
212
DUPLEXER
802
MODULATOR
803
SPREADING SECTION
804
CIR INFORMATION POWER CONTROLLER
210
MULTIPLEXER
211
TRANSMIT RF SECTION
PILOT SIGNAL
207
MODULATOR
208
SPREADING SECTION
209
PILOT POWER CONTROLLER

FIG.11

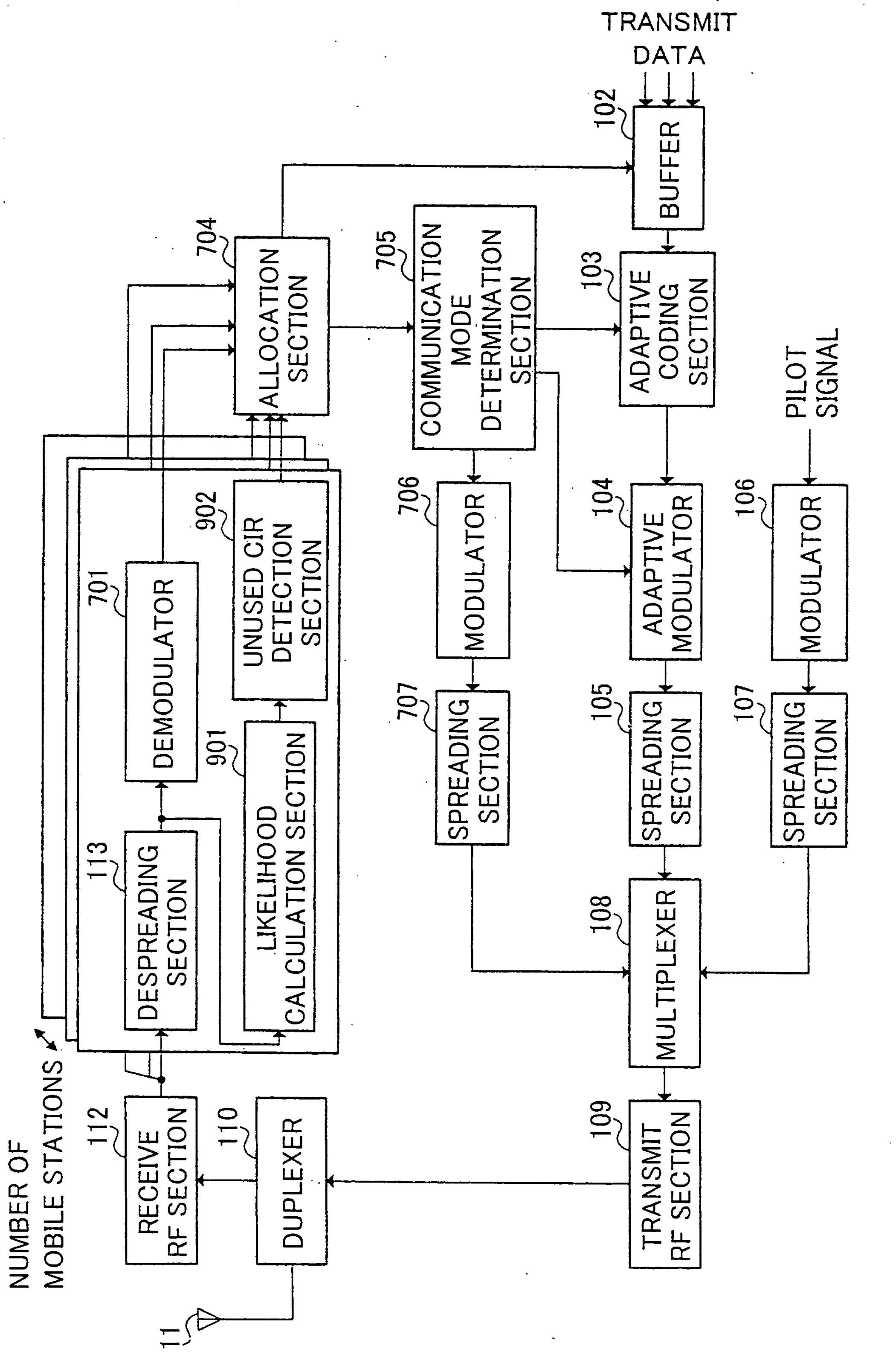

TRANSMIT DATA
102
BUFFER
704
ALLOCATION SECTION
705
COMMUNICATION MODE DETERMINATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
902
UNUSED CIR DETECTION SECTION
701
DEMODULATOR
706
MODULATOR
104
ADAPTIVE MODULATOR
106
MODULATOR
901
LIKELIHOOD CALCULATION SECTION
113
DESPREADING SECTION
707
SPREADING SECTION
105
SPREADING SECTION
107
SPREADING SECTION
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

FIG.12

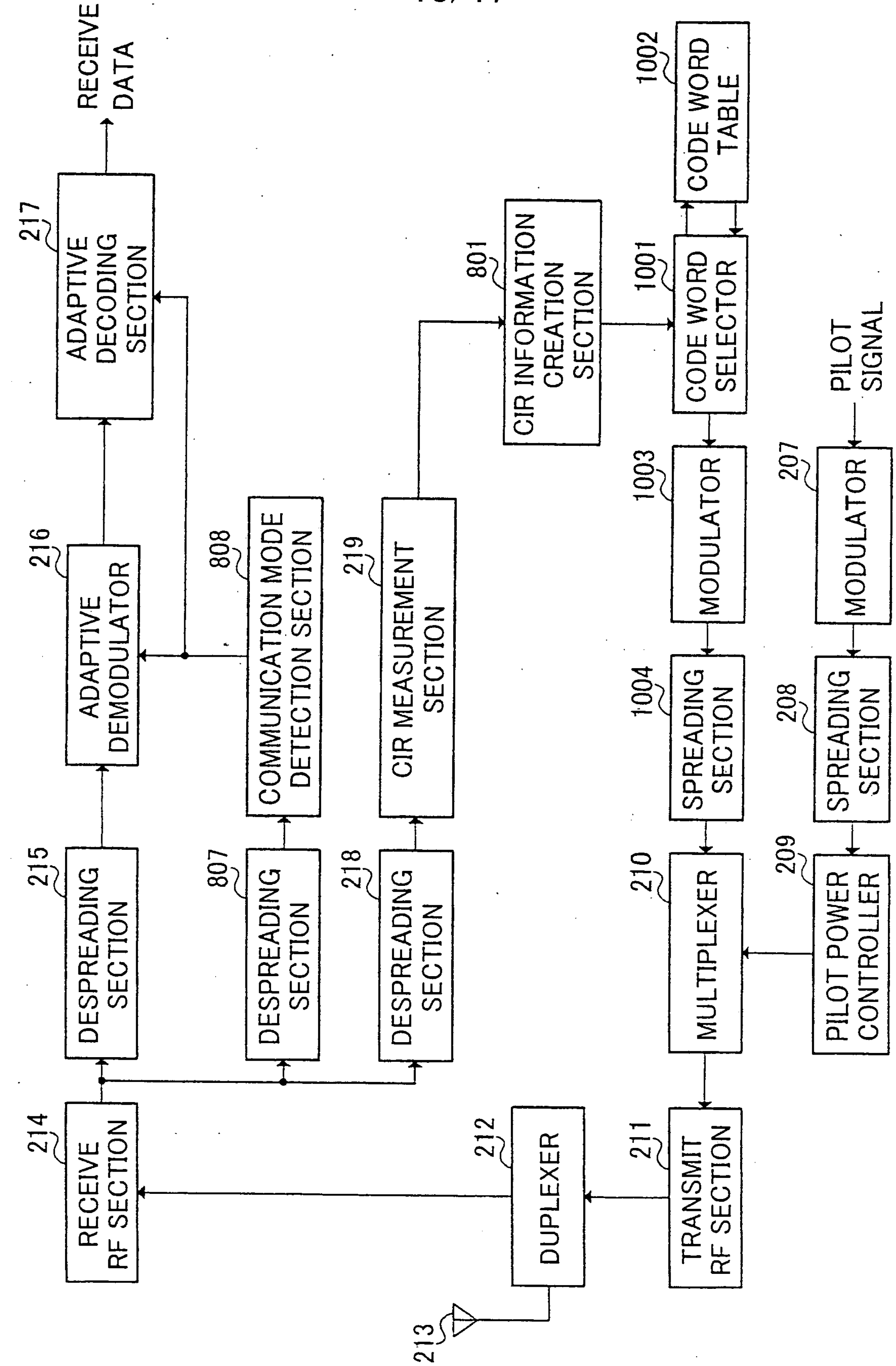

RECEIVE DATA
217
ADAPTIVE DECODING SECTION
216
ADAPTIVE DEMODULATOR
215
DESPREADING SECTION
214
RECEIVE RF SECTION
808
COMMUNICATION MODE DETECTION SECTION
807
DESPREADING SECTION
219
CIR MEASUREMENT SECTION
218
DESPREADING SECTION
801
CIR INFORMATION CREATION SECTION
212
DUPLEXER
213
1002
CODE WORD TABLE
1001
CODE WORD SELECTOR
1003
MODULATOR
1004
SPREADING SECTION
210
MULTIPLEXER
211
TRANSMIT RF SECTION
PILOT SIGNAL
207
MODULATOR
208
SPREADING SECTION
209
PILOT POWER CONTROLLER

FIG.13

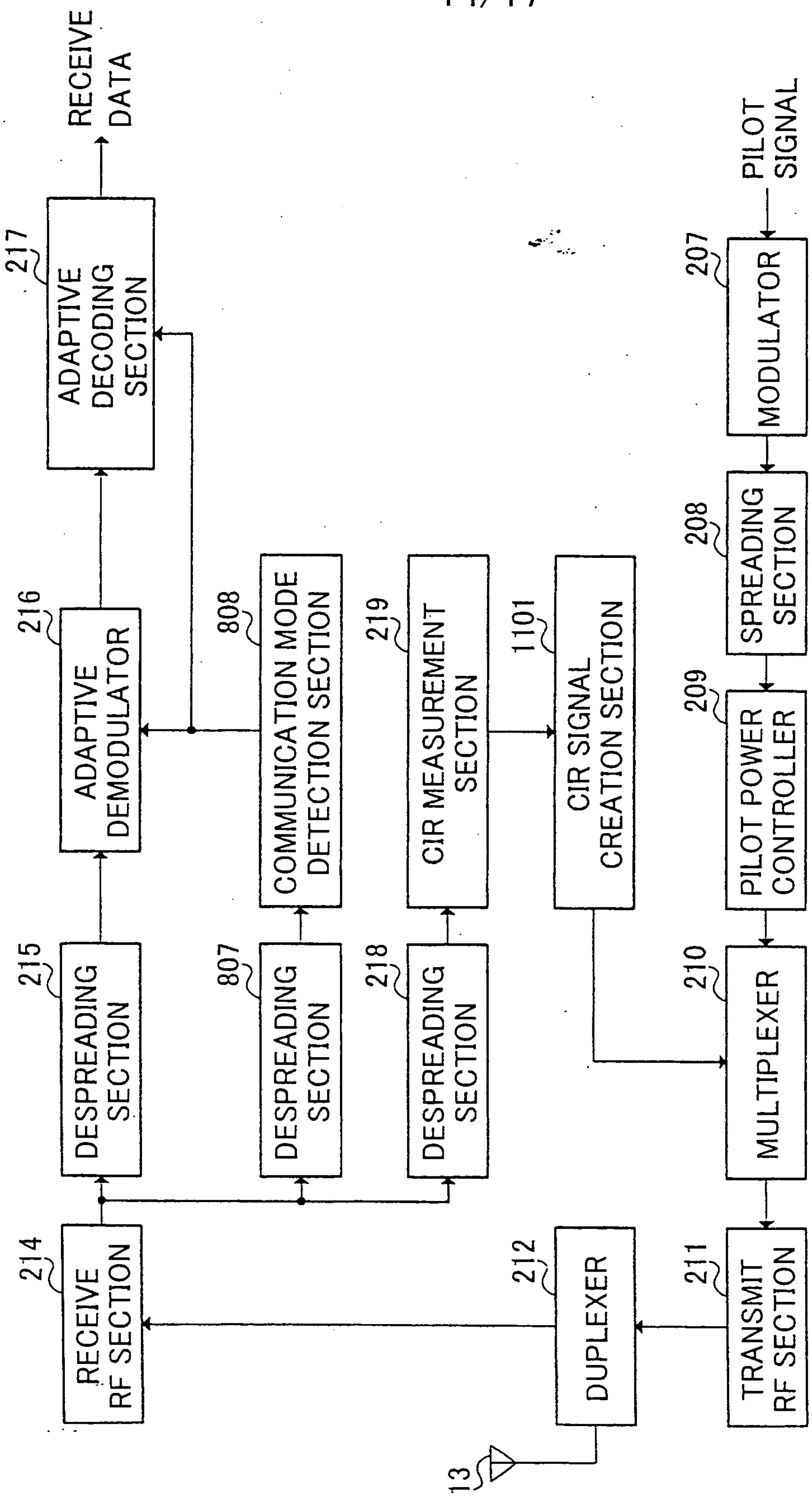

RECEIVE DATA
217
ADAPTIVE DECODING SECTION
216
ADAPTIVE DEMODULATOR
215
DESPREADING SECTION
214
RECEIVE RF SECTION
808
COMMUNICATION MODE DETECTION SECTION
807
DESPREADING SECTION
219
CIR MEASUREMENT SECTION
218
DESPREADING SECTION
1101
CIR SIGNAL CREATION SECTION
212
DUPLEXER
213
PILOT SIGNAL
207
MODULATOR
208
SPREADING SECTION
209
PILOT POWER CONTROLLER
210
MULTIPLEXER
211
TRANSMIT RF SECTION

FIG.14

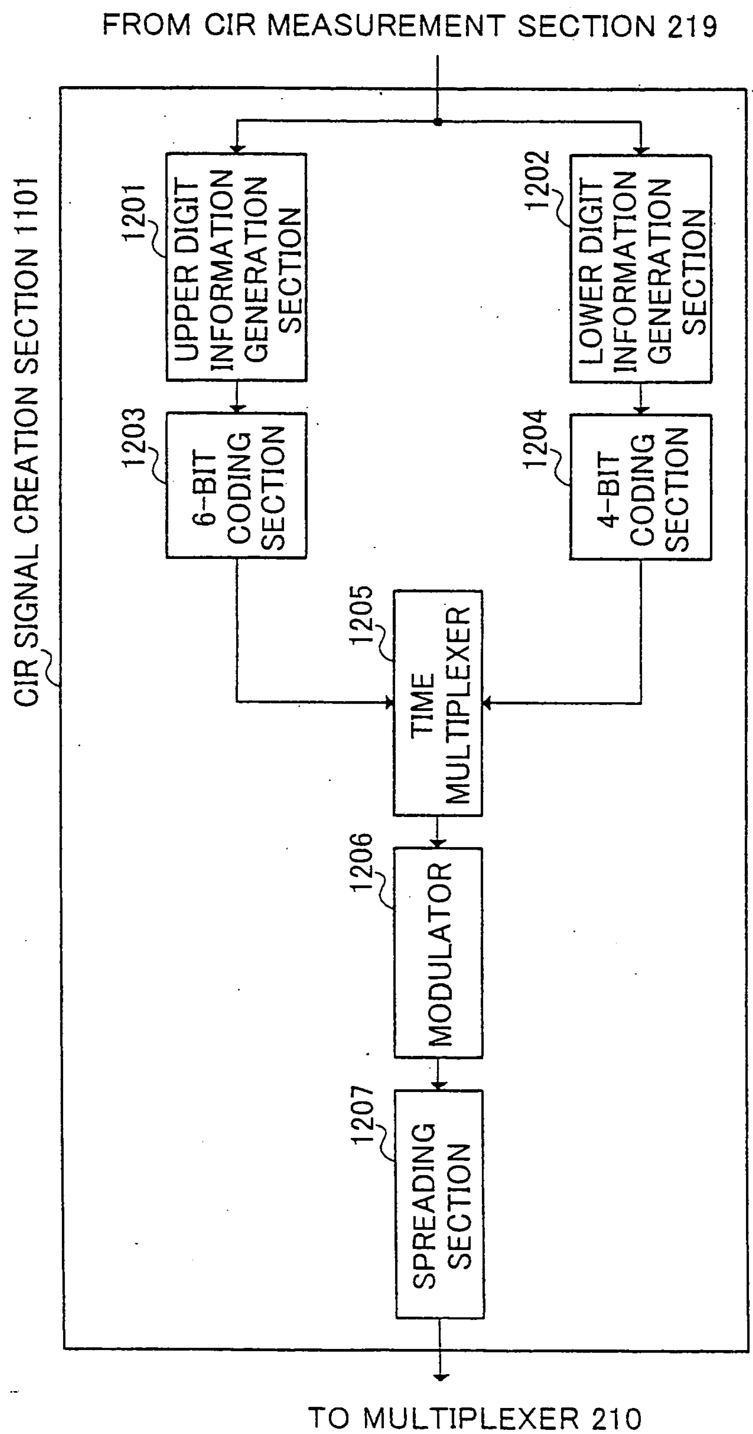

FROM CIR MEASUREMENT SECTION 219
CIR SIGNAL CREATION SECTION 1101
1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1203
6-BIT CODING SECTION
1204
4-BIT CODING SECTION
1205
TIME MULTIPLEXER
1206
MODULATOR
1207
SPREADING SECTION
TO MULTIPLEXER 210

FIG.15

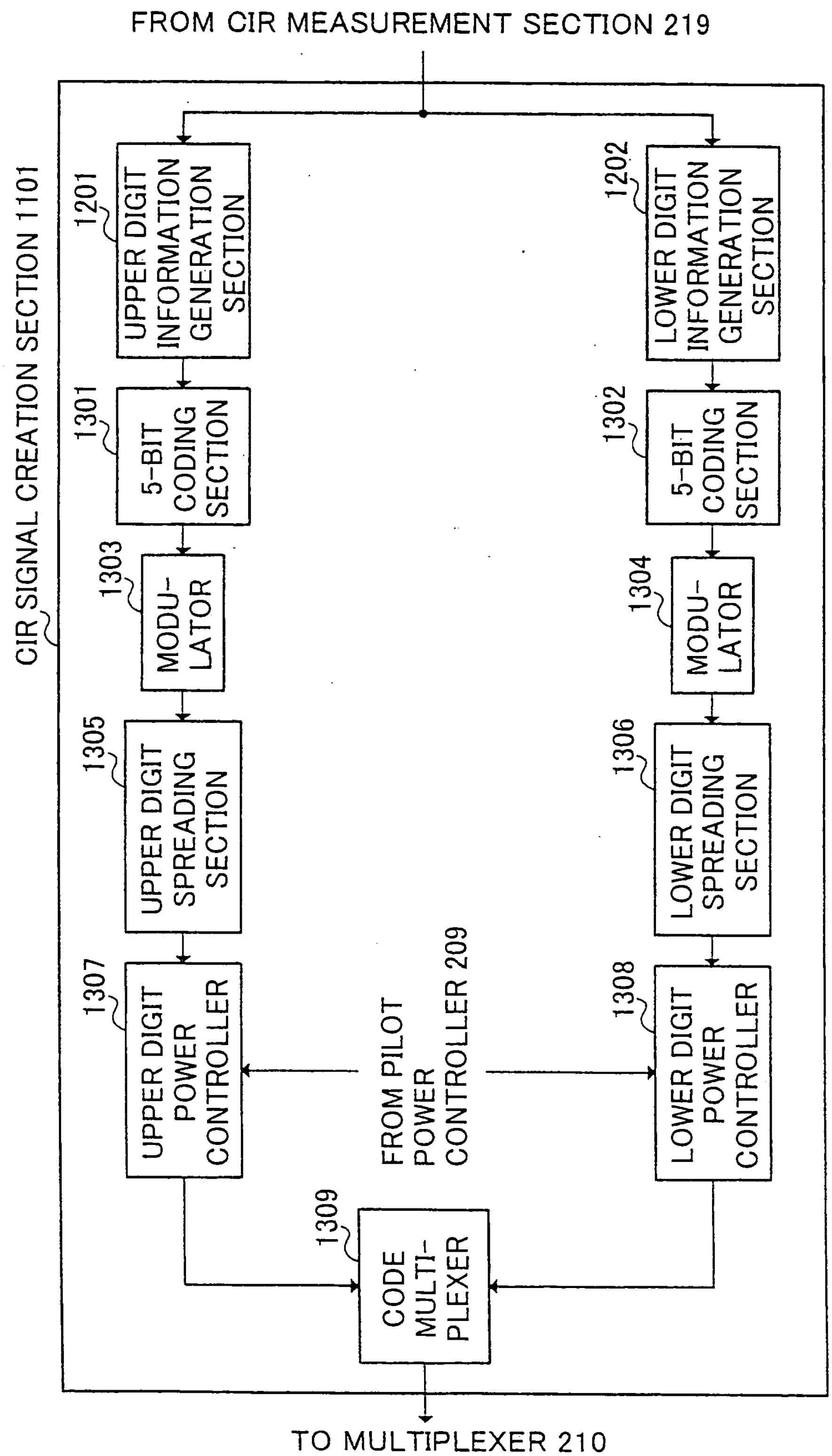

FROM CIR MEASUREMENT SECTION 219
CIR SIGNAL CREATION SECTION 1101
1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1301
5-BIT CODING SECTION
1302
5-BIT CODING SECTION
1303
MODU-LATOR
1304
MODU-LATOR
1305
UPPER DIGIT SPREADING SECTION
1306
LOWER DIGIT SPREADING SECTION
1307
UPPER DIGIT POWER CONTROLLER
1308
LOWER DIGIT POWER CONTROLLER
FROM PILOT POWER CONTROLLER 209
1309
CODE MULTI-PLEXER
TO MULTIPLEXER 210

FIG.16

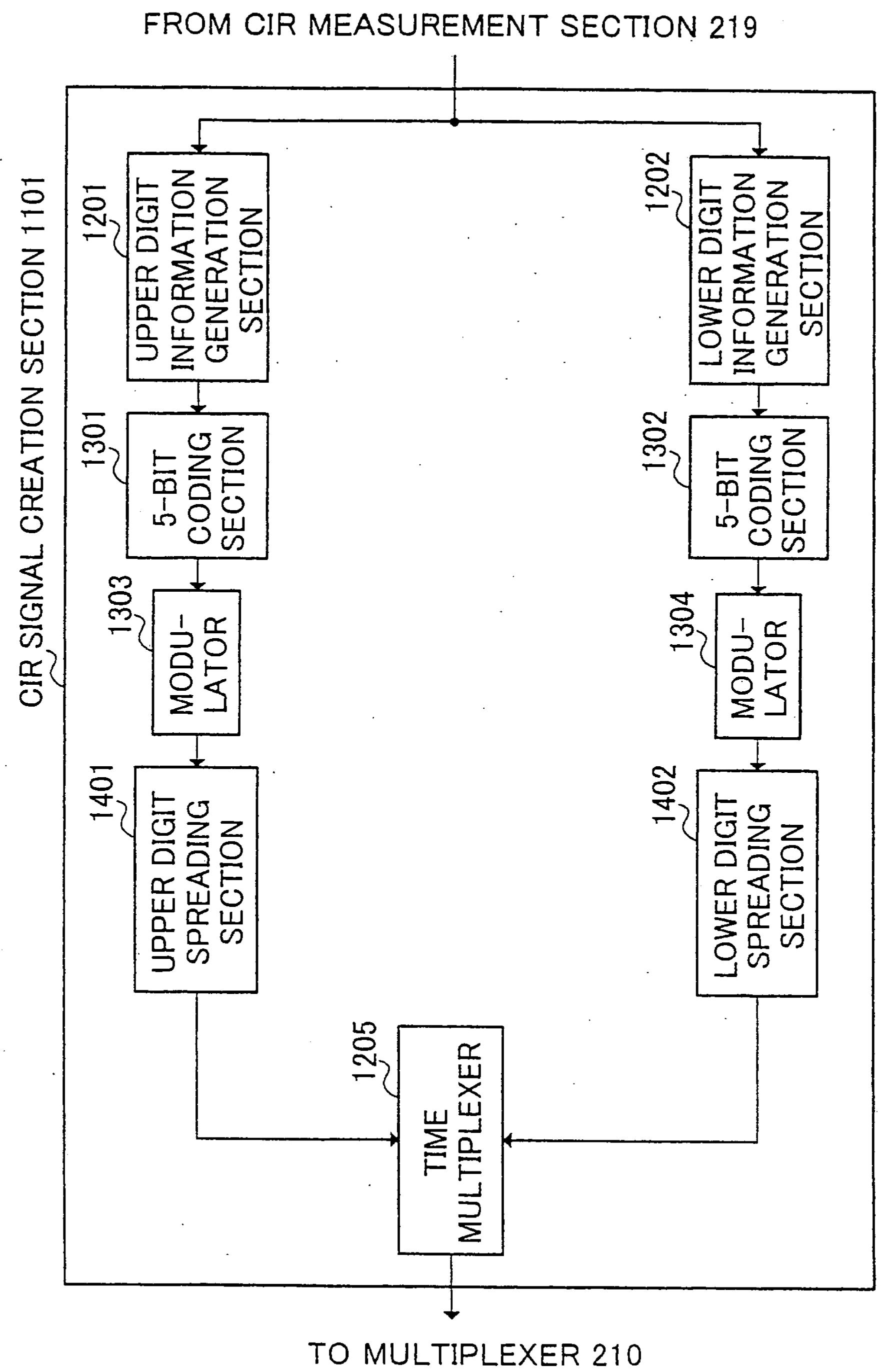

FROM CIR MEASUREMENT SECTION 219
CIR SIGNAL CREATION SECTION 1101
1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1301
5-BIT CODING SECTION
1302
5-BIT CODING SECTION
1303
MODU-LATOR
1304
MODU-LATOR
1401
UPPER DIGIT SPREADING SECTION
1402
LOWER DIGIT SPREADING SECTION
1205
TIME MULTIPLEXER
TO MULTIPLEXER 210

FIG.17

DESCRIPTION

COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

Technical Field

The present invention relates to a communication terminal apparatus, base station apparatus, and radio communication method to be used in a cellular communication system.

Background Art

In a cellular communication system, one base station performs radio communication with a plurality of communication terminals simultaneously, and therefore, as demand has increased in recent years, so has the need for higher transmission efficiency.

One technology that has been proposed for increasing the transmission efficiency of a downlink from a base station to a communication terminal is HDR (High Data Rate). HDR is a communication method whereby a base station performs scheduling for allocating communication resources to communication terminals by time division, and also sets a transmission rate for each communication terminal according to the downlink channel quality.

The operations by which a base station and communication terminals perform radio communication with HDR are described below. First, the base station transmits a pilot signal to each communication terminal. Each communication terminal estimates the downlink channel quality using a CIR (desired carrier to interference ratio) based on the pilot signal, etc., and finds a transmission rate at which communication is possible. Then, based on the transmission rate at which communication is possible, each communication terminal selects a communication mode, which is a combination of packet length, coding method, and modulation method, and transmits a data rate control (hereinafter referred to as "DRC") signal indicating the communication mode to the base station.

The type of modulation method that can be used in each system is predetermined as BPSK, QPSK, 16QAM, 64QAM, and so forth. Also, the type of coding that can be used in each system is predetermined as 1/2 turbo code, 1/3 turbo code, 3/4 turbo code, and so forth. Further, a plurality of transmission rates that can be used in each system are predetermined according to a combination of packet length, modulation method, and coding method. Each communication terminal selects a combination whereby communication can be performed most efficiently with the current downlink channel quality, and transmits a DRC signal indicating the selected communication mode to the base station. Generally, DRC signals are represented by numbers from 1 to N, with a higher number indicating a proportionally better downlink channel quality.

Based on the DRC signal transmitted from each communication terminal, the base station sets a transmission rate for each communication terminal, and sends a signal to each communication terminal via a control channel indicating communication resource allocation to each communication terminal. Generally, taking improvement of system transmission efficiency into consideration, communication resources are allocated with priority to the communication terminal that has the best downlink channel quality—that is to say, the communication terminal that transmits the highest-numbered DRC signal.

The base station then transmits data only to the relevant communication terminal in its allocated time. For example, if time t1 has been allocated to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

In this way, data transmission efficiency has conventionally been increased for the overall system by setting a transmission rate for each communication terminal according to channel quality by means of HDR, and performing communication resource allocation with priority to a communication terminal with a high transmission rate at which communication is possible.

However, if the communication mode determined by a communication terminal is received erroneously by the base station due to deterioration of the channel conditions on the uplink from the communication terminal to the base station, or the like, the base station will transmit data using that erroneous mode. As the determined communication mode and the communication mode of data transmitted to the communication terminal are different, the communication terminal cannot demodulate or decode the data.

Also, when a base station such as that described above has allocated time t1 to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

Due to the above, a problem arises in that, if the communication mode determined by a communication terminal is received erroneously by the base station, there will be an interval during which time-divided communication resources are not used, and downlink throughput falls.

Disclosure of Invention

It is an object of the present invention to provide a communication terminal apparatus, base station apparatus, and radio communication method that make it possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

In order to achieve the above-described object, in the present invention, with respect to information, among information indicative of downlink channel quality, which has a possibility of decreasing the downlink throughput when the information is received erroneously in a base station, a communication terminal provides such information with less susceptibility to errors in the propagation path to transmit. It is thereby possible to prevent the downlink throughput from decreasing.

Brief Description of Drawings

FIG.1 is a graph illustrating DRC signal selection frequency in a base station;

FIG.2 is a block diagram showing a configuration of a base station according to Embodiment 1 of the present invention;

FIG.3 is a block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention;

FIG.4 is a drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention;

FIG.5 is a block diagram showing another configuration of a base station according to Embodiment 1 of the present invention;

FIG.6 is a block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention;

FIG.7 is a drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention;

FIG.8 is a block diagram showing the configuration of a base station according to Embodiment 3 of the present invention;

FIG.9 is a block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention;

FIG.10 is a block diagram showing a configuration of a base station according to Embodiment 4 of the present invention;

FIG.11 is a block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention;

FIG.12 is a block diagram showing another configuration of a base station according to Embodiment 4 of the present invention;

FIG.13 is a block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention;

FIG.14 is a block diagram showing the configuration of a communication terminal according to Embodiment 6 of the present invention;

FIG.15 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 6 of the present invention;

FIG.16 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 7 of the present invention; and

FIG.17 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 8 of the present invention.

Best Mode for Carrying out the Invention

With reference now to the accompanying drawings, embodiments of the present invention will be explained in detail below.

(Embodiment 1)

As stated above, a base station allocates communication resources with priority to the communication terminal with the best downlink channel quality. In other words, a base station selects the highest-numbered DRC signal, and allocates communication resources with priority to the communication terminal that transmitted that selected DRC signal. Thus, DRC signal selection frequency is as shown in FIG.1. FIG.1 is a graph illustrating DRC signal selection frequency in a base station. In this figure, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better channel quality.

As shown in FIG.1, the higher the number of a DRC signal, the greater is the frequency of its selection by the base station. That is to say, the better the downlink channel quality of a communication terminal, the higher is the frequency with which communication resources are allocated to that communication terminal. This kind of relationship arises from the fact that there are many communication terminals, and there is an increased probability of there being a communication terminal with good downlink channel quality.

Thus, the selection frequency of each DRC signal differs according to channel quality. That is to say, since a DRC signal indicating that downlink channel quality is good tends to be selected with greater frequency, there is a high probability that downlink throughput will fall if a DRC signal indicating that downlink channel quality is good is received erroneously. Also, since a DRC signal indicating that downlink channel quality is poor tends to be selected with lower frequency, there is little effect of producing a fall in downlink throughput if a DRC signal indicating that downlink channel quality is poor is received erroneously.

Thus, a communication terminal according to Embodiment 1 of the present invention transmits at proportionally higher transmission power a DRC signal indicating that downlink channel quality is good. Also, a base station according to Embodiment 1 of the present invention excludes DRC signals with reception power lower than a predetermined threshold value in performing communication resource allocation.

FIG.2 is a block diagram showing a configuration of a base station according to Embodiment 1 of the present invention.

In FIG.2, an allocation section 101 determines communication resource allocation to each communication terminal based on DRC signals excluding DRC signals detected by unused DRC detection sections 116 described later herein from among DRC signals extracted by demodulators 114 described later herein. Then, based on the determined communication resource allocation, the allocation section 101 notifies a buffer 102 for output of downlink transmit data, indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104.

The buffer 102 holds downlink transmit data, and outputs downlink transmit data for a predetermined communication terminal to the adaptive coding section 103 in accordance with the directions of the allocation section 101. The adaptive coding section 103 codes the output signal from the buffer 102 in accordance with the directions of the allocation section 101, and outputs the resulting signal to the adaptive modulator 104. The adaptive modulator 104 modulates the output signal from the adaptive coding section 103 in accordance with the directions of the allocation section 101, and outputs the resulting signal to a spreading section 105. Spreading section 105 spreads the output signal from the adaptive modulator 104, and outputs the resulting signal to a multiplexer 108.

A modulator 106 modulates a pilot signal and outputs it to a spreading section 107. Spreading section 107 spreads the output signal from the modulator 106, and outputs the resulting signal to the multiplexer 108.

The multiplexer 108 performs time multiplexing of the spread pilot signal with the spread downlink transmit data at predetermined intervals, and outputs the resulting signal to a transmit RF section 109. The transmit RF section 109 converts the frequency of the output signal from the multiplexer 108 to radio frequency, and outputs the resulting signal to a duplexer 110.

The duplexer 110 transmits the output signal from the transmit RF section 109 as a radio signal from an antenna 111 to a communication terminal. Moreover, the duplexer 110 outputs the signals transmitted from each communication terminal and received by antenna 111 to receive RF section 112.

A receive RF section 112 converts the frequency of a radio frequency signal output from the duplexer 110 to baseband, and outputs the resulting signal to a despreading section 113. The despreading section 113 despreads the baseband signal using the spreading code used to spread the DRC signal, and outputs the resulting signal to the demodulator 114 and a reception power calculation section 115.

The demodulator 114 demodulates the output signal from the despreading section 113 and extracts the DRC signal, and outputs this signal to the allocation section 101.

The reception power calculation section 115 measures the reception power of the despread DRC signal, which is output to the unused DRC detection section 116. In the unused DRC detection section 116 is set a predetermined threshold value, as described later herein, and a DRC signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 101.

A despreading section 113, demodulator 114, reception power calculation section 115, and unused DRC detection section 116 are provided for each communication terminal. From each demodulator 114 a DRC signal for the corresponding communication terminal is output, and from each unused DRC detection section 116 a detection result for the corresponding communication terminal is output.

FIG.3 is a block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention. In FIG.3, a communication mode determination section 201 determines a communication mode indicating a combination of modulation method and coding method based on a CIR measured by a CIR measurement section 219 described later herein, and outputs the result to a DRC signal creation section 202. The communication mode determination section 201 also indicates the downlink receive data demodulation method to an adaptive demodulator 216, and indicates the downlink receive data decoding method to an adaptive decoding section 217, based on the determined communication mode.

The DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode output from the communication mode determination section 201, and outputs this DRC signal to a modulator 203 and DRC power controller 205.

Modulator 203 modulates the DRC signal and outputs the resulting signal to a spreading section 204. spreading section 204 spreads the output signal from modulator 203 and outputs the resulting signal to the DRC power controller 205. The DRC power controller 205 refers to a transmission power table 206 that shows the correspondence between DRC numbers and transmission power, controls the DRC signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209 described later herein, and outputs the DRC signal that has undergone transmission power control to a multiplexer 210. The actual method of controlling DRC signal transmission power will be described later herein.

A modulator 207 modulates the pilot signal and outputs the resulting signal to a spreading section 208. Spreading section 208 spreads the output signal from modulator 207 and outputs the resulting signal to the pilot power controller 209. The pilot power controller 209 controls the transmission power of the pilot signal, and outputs the pilot signal that has undergone transmission power control to the multiplexer 210. The pilot power controller 209 also outputs the pilot signal transmission power to the DRC power controller 205.

The multiplexer 210 performs time multiplexing of the DRC signal that has undergone transmission power control and the pilot signal that has undergone transmission power control at predetermined intervals, and outputs the resulting signal to a transmit RF section 211. The transmit RF section 211 converts the frequency of the output signal from the multiplexer 210 to radio frequency, and outputs the resulting signal to a duplexer 212.

The duplexer 212 transmits the output signal from the transmit RF section 211 as a radio signal from an antenna 213 to the base station. Also, a signal transmitted as a radio signal by the base station and received as a radio signal by the antenna 213 is output by the duplexer 212 to a receive RF section 214.

The receive RF section 214 converts the frequency of the radio frequency signal output from the duplexer 212 to baseband, and outputs the resulting signal to a despreading section 215 and a despreading section 218.

Despreading section 215 despreads the data component of the baseband signal and outputs the resulting signal to the adaptive demodulator 216. The adaptive demodulator 216 demodulates the output signal from despreading section 215 in accordance with the directions of the communication mode determination section 201, and outputs the resulting signal to the adaptive decoding section 217. The adaptive decoding section 217 decodes the output signal from the adaptive demodulator 216 in accordance with the directions of the communication mode determination section 201, and obtains receive data.

Despreading section 218 despreads the pilot signal component of the baseband signal and outputs the resulting signal to a CIR measurement section 219. The CIR measurement section 219 measures the CIR of the pilot signal output from despreading section 218, and outputs the result to the communication mode determination section 201.

Next, the procedure for transmission/reception of signals between the base station shown in FIG.2 and the communication terminal shown in FIG.3 will be described.

First, at the start of communication, a pilot signal is modulated by the modulator 106 in the base station, is spread by spreading section 107, and is output to the multiplexer 108. Only the spread pilot signal is output from the multiplexer 108 to the transmit RF section 109. The spread pilot signal is frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

A radio signal of only the pilot signal component transmitted as a radio signal from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to baseband by the receive RF section 214. The pilot signal component of the baseband signal is despread by despreading section 218, and output to the CIR measurement section 219.

Next, in the CIR measurement section 219, the CIR of the pilot signal output from despreading section 218 is measured, and based on the CIR, the communication mode is determined by the communication mode determination section 201. Then a DRC signal with a number corresponding to the communication mode is created by the DRC signal creation section 202.

The DRC signal is modulated by modulator 203, spread by spreading section 204, and output to the DRC power controller 205. In the DRC power controller 205, the DRC signal transmission power is controlled based on the transmission power of the pilot signal output from the pilot power controller 209, and the ratios of pilot signal transmission power to DRC signal transmission power set beforehand in the transmission power table 206.

The contents set in the transmission power table 206 will be described below. FIG.4 is a drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention.

The transmission power table 206 shows the correspondence between DRC numbers and DRC signal transmission power, set so that the higher the DRC number, the higher is the transmission power. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the transmission power table 206, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power.

As explained above, the frequency of selection by the base station tends to be proportional to the downlink channel quality indicated by a DRC signal, and therefore in this embodiment, transmission power is higher, and susceptibility to errors lower, the better the downlink channel quality indicated by a DRC signal. As a result, the probability of a DRC signal that indicates that downlink channel quality is good being received erroneously can be made lower than the probability of a DRC signal that indicates that downlink channel quality is poor being received erroneously. In other words, the probability of a DRC signal with a high frequency of selection by the base station being received erroneously can be made lower than the probability of a DRC signal with a low frequency of selection by the base station being received erroneously.

The DRC signal transmission power values set in the transmission power table 206 are expressed as a ratio to the pilot signal transmission power. Here, as shown in FIG.4, the settings are arranged so that DRC number 3 in the middle of DRC numbers 1 to 5 is taken as a reference, and DRC signals indicating a lower number than DRC number 3 are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a higher number than DRC number 3 are transmitted at higher transmission power than the pilot signal transmission power. That is to say, the settings are arranged so that DRC signals indicating a poorer channel quality than a predetermined channel quality (here, the channel quality corresponding to a DRC signal with DRC number 3) are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a better channel quality than the predetermined channel quality are transmitted at higher transmission power than the pilot signal transmission power.

Thus, with this embodiment, by setting DRC signals for which transmission power is increased and DRC signals for which transmission power is decreased in comparison with conventional DRC signal transmission power (here, that is, pilot signal transmission power), and making the total of DRC signal transmission power increases and decreases ±0 dB, it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors while keeping average DRC signal transmission power constant compared with a conventional system. That is to say, it is possible to proportionally reduce susceptibility to errors of DRC signals indicating that downlink channel quality is good without reducing uplink capacity compared with a conventional system.

Also, since, in this way, DRC signals indicating that downlink channel quality is poor (DRC signals with DRC numbers 1 and 2 in FIG.4) are transmitted at lower transmission power than in a conventional system, it is possible to reduce power consumption in a communication terminal that is located far from the base station and for which there is a high probability of transmitting a DRC signal indicating that downlink channel quality is poor. That is to say, in the case of a communication terminal that transmits a DRC signal indicating that downlink channel quality is poor, whereas the DRC signal was previously transmitted at transmission power that was high to begin with, according to this embodiment the DRC signal transmission power can be made lower than that high transmission power, enabling communication terminal power consumption to be greatly reduced.

As the frequency of selection by a base station is low to begin with for a DRC signal indicating that downlink channel quality is poor, there is almost no effect of producing a fall in throughput due to transmitting a DRC signal indicating that downlink channel quality is poor at lower transmission power than previously in this way.

Also, with this embodiment, DRC signals indicating that uplink channel quality is good (DRC signals with DRC numbers 4 and 5 in FIG.4) are transmitted at higher transmission power than in a conventional system.

However, there is a high possibility of a DRC signal indicating that uplink channel quality is good being transmitted from a communication terminal located comparatively near the base station. Also, due to pilot signal transmission power control that is performed constantly on an uplink, the transmission power of a pilot signal transmitted from a communication terminal located comparatively near the base station (that is, the conventional DRC signal transmission power) is low to begin with. Therefore, in the case of a communication terminal that transmits a DRC signal indicating that uplink channel quality is good, DRC signal transmission power remains low and power consumption remains low even though the previously originally low DRC signal transmission power increases, and so there is almost no effect on power consumption.

In the DRC power controller 205, the DRC signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 206. Then, in the DRC power controller 205, the transmission power of the DRC signal output from spreading section 204 is adjusted to this obtained transmission power, and a DRC signal that has been subjected to transmission power control is output to the multiplexer 210. To give a specific example, if the number of the DRC signal output from the DRC signal creation section 202 to the DRC power controller

205 is 5, the transmission power of the DRC signal output from spreading section 204 is adjusted to a transmission power 2 dB lower than the transmission power of the pilot signal output from the pilot power controller 209.

The DRC signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by the transmit RF section 211, and transmitted to the base station as a radio signal from the antenna 213 via the duplexer 212.

The radio signal transmitted from the communication terminal is received by the antenna 111 of the base station, and input to the receive RF section 112 via the duplexer 110. The signal input to the receive RF section 112 is frequency-converted to baseband, despread by the despreading section 113 using the spreading code used to spread the DRC signal, and output to the demodulator 114 and reception power calculation section 115.

In the demodulator 114 the output signal from the despreading section 113 is demodulated, and the DRC signal is extracted and output to the allocation section 101.

Here, since a DRC signal indicating that downlink channel quality is poor is transmitted by a communication terminal at lower transmission power than in a conventional system, the probability of a DRC signal indicating that downlink channel quality is poor being received erroneously by the base station is increased. Also, as stated above, if communication resource allocation is performed based on an erroneously received DRC signal, downlink throughput will fall.

Thus, in the reception power calculation section 115, the reception power of the despread DRC signal is measured, and is output to the unused DRC detection section 116. The lowest reception power at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest (a DRC signal with DRC number 1 in FIG.4) has been set beforehand in the unused DRC detection section 116 as a threshold value. Then, in the unused DRC detection section 116, a DRC signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 101. A DRC signal detected by the unused DRC detection section 116 is a DRC signal that is not used by the allocation section 101 in determining communication resource allocation.

In the allocation section 101, communication resource allocation to each communication terminal is determined based on the DRC signals remaining after DRC signals detected by the unused DRC detection section 116 have been excluded from the DRC signals extracted by the demodulator 114.

Thus, in a base station according to this embodiment, a DRC signal of reception power lower than the lowest reception power at which a DRC signal indicating that downlink channel quality is poorest is not received erroneously is excluded. That is to say, in a base station according to this embodiment, a notification signal susceptible to errors is excluded in determining downlink communication resource allocation. Therefore, according to a base station of this embodiment, even though a DRC signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on an erroneous DRC signal.

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

A base station according to this embodiment may also be configured as shown in FIG.5. FIG.5 is a block diagram showing another configuration of a base station according to Embodiment 1 of the present invention. That is to say, a base station may be configured in such a way that the reception power calculation section 115 and unused DRC detection section 116 shown in FIG.2 are replaced by a likelihood calculation section 301 and unused DRC detection section 302. In the following description, parts identical to those in FIG.2 are assigned the same reference numerals as in FIG.2 and their detailed explanations are omitted.

In FIG.5, the likelihood calculation section 301 calculates a likelihood that indicates the probable degree of certainty of a DRC signal, and outputs the calculation result to the unused DRC detection section 302. The lowest likelihood at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest has been set beforehand in the unused DRC detection section 302 as a threshold value. Then, in the unused DRC detection section 302, a DRC signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 101.

In this way the same kind of effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG.5.

(Embodiment 2)

In a communication terminal according to Embodiment 2 of the present invention, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted.

FIG.6 is a block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 203, spreading section 204, DRC power controller 205, and transmission power table 206 shown in FIG.3 are replaced by a code word selector 401, code word table 402, modulator 403, and spreading section 404. In the following description, parts identical to those in FIG.3 are assigned the same reference numerals as in FIG.3 and their detailed explanations are omitted.

The code word selector 401 refers to the code word table 402, converts a DRC signal created by the DRC signal creation section 202 to a predetermined code word, and outputs the code word to modulator 403. Modulator 403 modulates the code word and outputs it to spreading section 404. Spreading section 404 spreads the output signal from modulator 403 and outputs the resulting signal to a multiplexer 210.

Next, the operation of a communication terminal according to this embodiment will be described.

First, the contents set in the code word table 402 will be described. FIG.7 is a drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention.

The code word table 402 shows the correspondence between DRC numbers and code words after DRC signal conversion, set so that the higher the DRC number, the larger is the code word minimum distance of the code word to which the DRC signal is converted. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the code word table 402, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which the DRC signal is converted.

Here, "code word distance" is the number of bits that differ between code words, and "code word minimum distance" is the minimum number of bits by which a particular code word differs with respect to all other code words. To be specific, the code word for a DRC signal with DRC number 5 is "111111111", and this code word "111111111" differs by a minimum of 6 bits when compared with any of the code words corresponding to DRC signals with DRC numbers 1 to 4. Therefore, the code word minimum distance of the code word for a DRC signal with DRC number 5 is 6. Similarly, the code word minimum distance of the code word for a DRC signal with DRC number 4 is 3.

Thus, the code word for a DRC signal with DRC number 5 is less likely to be mistaken for another code word than the code word for a DRC signal with DRC number 4. That is to say, the larger code word minimum distance of a code word, the less likely it is to be mistaken for another code word.

In the code word selector 401, a DRC signal output from the DRC signal creation section 202 is converted to a code word set in the code word table 402, and output to modulator 403. To give a specific example, if the DRC signal output from the DRC signal creation section 202 is a number 5 DRC signal, it is converted to code word "111111111".

Following conversion, the code word is modulated by modulator 403 and spread by spreading section 404. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

Also, according to this embodiment, it is possible to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high without increasing DRC signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal without increasing communication terminal power consumption.

Moreover, according to this embodiment, it is possible to change the degree of insusceptibility to errors of code words corresponding to DRC signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

(Embodiment 3)

A base station according to Embodiment 3 of the present invention transmits to a communication terminal a control signal for table rewriting based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined, and a communication terminal according to Embodiment 3 of the present invention rewrites the contents of a transmission power table or code word table based on a control signal transmitted from the base station.

FIG.8 is a block diagram showing the configuration of a base station according to Embodiment 3 of the present invention. As shown in this figure, a base station according to this embodiment is configured by further providing the configuration shown in FIG.2 with a detection rate calculation section 501, control signal creation section 502, modulator 503, and spreading section 504. In the following description, parts identical to those in FIG.2 are assigned the same reference numerals as in FIG.2 and their detailed explanations are omitted.

In FIG.8, the detection rate calculation section 501 calculates the rate of detection by the unused DRC detection section 116 and outputs the result to the control signal creation section 502. That is to say, the detection rate calculation section 501 calculates the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined. Based on the detection rate, the control signal creation section 502 creates a control signal for table rewriting (hereinafter referred to as "table rewrite signal"), which is output to modulator 503. Modulator 503 modulates the table rewrite signal and outputs it to spreading section 504. Spreading section 504 spreads the output signal from modulator 503 and outputs the resulting signal to the multiplexer 108.

FIG.9 is a block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured by further providing the configuration shown in FIG.3 with a despreading section 601, demodulator 602, and table rewriting section 603. In the following description, parts identical to those in FIG.3 are assigned the same reference numerals as in FIG.3 and their detailed explanations are omitted.

In FIG.9, despreading section 601 despreads a baseband signal using the spreading code used to spread the table rewrite signal, and outputs the resulting signal to the demodulator 602. The demodulator 602 demodulates the output signal from despreading section 601 and extracts the table rewrite signal, which is output to the table rewriting section 603. The table rewriting section 603 rewrites the contents of the transmission power table in accordance with the table rewrite signal.

Next, the procedure for transmission/reception of signals between the base station shown in FIG.8 and the communication terminal shown in FIG.9 will be described.

First, in the detection rate calculation section 501 of the base station, the detection rate of the unused DRC detection section 116 is calculated and is output to the control signal creation section 502. The detection rate can be calculated, for example, from the number of detections in a predetermined time.

A predetermined threshold value for the detection rate has been set in the control signal creation section 502, and this threshold value is compared with the detection rate calculated by the detection rate calculation section 501. If the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be increased is created, and is output to modulator 503. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all DRC signal transmission power values to be increased simultaneously from their current values.

The table rewrite signal is modulated by modulator 503, spread by spreading section 504, and output to the multiplexer 108. The spread table rewrite signal is multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

The radio signal transmitted from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to baseband by the receive RF section 214. The baseband signal is despread by despreading section 601 and demodulated by the demodulator 602, and the table rewrite signal is extracted. The extracted table rewrite signal is output to the table rewriting section 603.

The contents of the transmission power table 206 are then rewritten by the table rewriting section 603 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 increases all the transmission power values set in the transmission power table 206.

In the above description, the configuration is such that the table rewriting section 603 rewrites the contents of the transmission power table 206, but this embodiment may also be applied to a communication terminal according to Embodiment 2, and a configuration may be used whereby the table rewriting section 603 rewrites the contents of the code word table 402 shown in FIG.6.

In this case, if the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, the control signal creation section 502 of a base station according to this embodiment creates a table rewrite signal ordering all code word minimum distances set in the code word table 402 to be increased. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all code word minimum distances of code words corresponding to DRC signals to be increased simultaneously from their current values. Then the table rewriting section 603 rewrites the contents of the code word table 402 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 rewrites the code words set in the code word table 402 with code words all of whose code word minimum distances are larger than at present.

Thus, according to this embodiment, the contents of the transmission power table or code word table are rewritten based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined. In other words, in this embodiment, transmission power table or code word table contents are rewritten adaptively in accordance with variations in the communication environment. That is to say, according to this embodiment, when the communication environment deteriorates and the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined reaches or exceeds a predetermined threshold value, the transmission power of each DRC signal is increased, or the code word minimum distance of the code word corresponding to each DRC signal is increased, thereby enabling the DRC signal error occurrence rate to be held down even when the communication environment deteriorates.

In this embodiment, the predetermined detection rate threshold value is decided upon considering appropriately the environment in which the communication system is used.

Moreover, with this embodiment, it is also possible to further set a second predetermined threshold value in the control signal creation section 502 to create a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be decreased when the detection rate calculated by the detection rate calculation section 501 falls below this second threshold value. By this means, it is possible to reduce DRC signal transmission power when DRC signal reception quality becomes excessive, thereby enabling communication terminal power consumption to be decreased.

Furthermore, in this embodiment, table rewriting is performed based on the rate of detection by the unused DRC detection section 116, but it is also possible to rewrite a table based on the distribution of DRC signals used in determining communication resource allocation from among DRC signals transmitted from mobile stations, so that that distribution is optimized. In this case, the base station shown in FIG.8 is configured with the detection rate calculation section replaced by a used DRC distribution determination section, which determines the distribution of DRC signals used in communication resource allocation determination based on DRC signals output from the demodulator 114 and detection results output from the unused DRC detection section 116, and outputs a signal indicating that distribution to the control signal creation section 502. The control signal creation section 502 then creates a table rewrite signal based on the signal indicating the distribution output from the used DRC distribution determination section.

(Embodiment 4)

A communication terminal according to Embodiment 4 of the present invention transmits at higher transmission power in proportion to CIR information that indicates that downlink channel quality is good. A base station according to Embodiment 4 of the present invention excludes CIR information for which the reception power is lower than a predetermined threshold value in performing communication resource allocation.

In above-described Embodiment 1, a communication terminal determines the communication mode based on the CIR and transmits a DRC signal corresponding to that determined communication mode to the base station at predetermined transmission power, and the base station determines communication resource allocation to each communication terminal based on the DRC signals. DRC signal can be represented with far fewer bits than other information indicating downlink channel quality (such as a downlink CIR, for example), and therefore use of a DRC signal has the advantage of enabling the downlink channel utilization efficiency to be increased. On the other hand, since a communication terminal must be provided with a table for communication mode determination, a table for DRC signal creation, and so forth to determine the communication mode and create a DRC signal, there are the disadvantages of increased communication terminal power consumption and apparatus size.

Thus, in this embodiment, a communication terminal transmits CIR information to the base station at predetermined transmission power, and the base station determines the communication mode based on the CIR information and then determines communication resource allocation to each communication terminal. As a result, although there is the disadvantage of a slight decrease in the uplink channel utilization efficiency, the fact that communication terminals do not have to determine the communication mode and create a DRC signal, and do not need to be provided with a communication mode determination table, DRC signal creation table, and so forth, offers the major advantage of enabling communication terminal power consumption and apparatus size to be reduced. Also, in this embodiment, it is possible for CIR information for a plurality of terminals to be compared in the base station, and the correct communication mode to be determined with certainty, making this embodiment particularly useful in cases such as those where it is not possible for the communication mode to be determined simply from the CIR in each communication terminal.

A base station according to this embodiment and a communication terminal according to this embodiment will be described below. FIG.10 is a block diagram showing a configuration of a base station according to Embodiment 4 of the present invention. In the following description, parts identical to those in FIG.2 are assigned the same reference numerals as in FIG.2 and their detailed explanations are omitted.

In FIG.10, a demodulator 701 demodulates the output signal from a despreading section 113, and extracts a signal that contains CIR information (hereinafter referred to as "CIR signal"), which is output to an allocation section 704.

A reception power calculation section 702 measures the reception power of the despread CIR signal, which is output to an unused CIR detection section 703. In the unused CIR detection section 703 is set a predetermined threshold value in the same way as in Embodiment 1, and a CIR signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 704.

A despreading section 113, demodulator 701, reception power calculation section 702, and unused CIR detection section 703 are provided for each communication terminal. From each demodulator 701 a CIR signal for the corresponding communication terminal is output, and from each unused CIR detection section 703 a detection result for the corresponding communication terminal is output.

The allocation section 704 determines communication resource allocation to each communication terminal based on CIR information indicated by CIR signals excluding CIR signals detected by the unused CIR detection sections 703 from among the CIR signals extracted by the demodulators 701. Then, based on the determined communication resource allocation, the allocation section 704 notifies a buffer 102 for output of downlink transmit data, and outputs the CIR information to a communication mode determination section 705.

Based on the CIR information output from the allocation section 704, the communication mode determination section 705 determines the communication mode, which indicates a combination of modulation method and coding method, and outputs a signal indicating this communication mode to a modulator 706. In addition, based on the determined communication mode, the communication mode determination section 705 indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104. Modulator 706 modulates the signal indicating the communication mode and outputs it to a spreading section 707. Spreading section 707 spreads the output signal from modulator 706 and outputs the resulting signal to a multiplexer 108.

FIG.11 is a block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention. In the following description, parts identical to those in FIG.3 are assigned the same reference numerals as in FIG.3 and their detailed explanations are omitted.

In FIG.11, a CIR information creation section 801 creates a CIR signal indicating a CIR measured by a CIR measurement section 219, and outputs it to a modulator 802 and CIR information power controller 804. Modulator 802 modulates the CIR signal and outputs it to a spreading section 803. Spreading section 803 spreads the output signal from modulator 802 and outputs the spread signal to the CIR information power controller 804. The CIR information power controller 804 refers to a transmission power table 805 that shows the correspondence between CIR level and transmission power, and controls the CIR signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209, and outputs the CIR signal that has undergone transmission power control to a multiplexer 210.

A despreading section 807 despreads the baseband signal using the spreading code used to spread the signal indicating the communication mode, and outputs the despread signal to a communication mode detection section 808. The communication mode detection section 808 demodulates the output signal from despreading section 807 and detects the communication mode. Then, based on the detected communication mode, the communication mode detection section 808 indicates the downlink receive data demodulation method to an adaptive demodulator 216 and indicates the downlink receive data decoding method to an adaptive decoding section 217.

Next, the procedure for transmission/reception of signals between the base station shown in FIG.10 and the communication terminal shown in FIG.11 will be described.

First, in the communication terminal shown in FIG.11, the CIR of the pilot signal output from despreading section 218 is measured by the CIR measurement section 219, and a CIR signal is created by the CIR information creation section 801.

The CIR signal is modulated by modulator 802, spread by spreading section 803, and output to the CIR information power controller 804. In the transmission power table 805, the correspondence between CIR level and CIR signal transmission power is shown in the same way as in Embodiment 1, set so that the CIR signal transmission power increases in proportion to the level of the CIR. That is to say, in the settings in transmission power table 805, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power. Also, as in Embodiment 1, the CIR signal transmission power values set in the transmission power table 805 are expressed as a ratio to the pilot signal transmission power.

In the CIR information power controller 804, the CIR signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 805. Then, in the CIR information power controller 804, the transmission power of the CIR signal output from spreading section 803 is adjusted to this obtained transmission power, and a CIR signal that has been subjected to transmission power control is output to the multiplexer 210.

The CIR signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

In the base station shown in FIG.10, the output signal from the despreading section 113 is demodulated by demodulator 701, and the demodulated CIR signal is extracted and output to the allocation section 704. In the reception power calculation section 702, the reception power of the despread CIR signal is measured, and is output to the unused CIR detection section 703. The lowest reception power at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 703 as a threshold value, as in Embodiment 1. Then, in the unused CIR detection section 703, a CIR signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 704. A CIR signal detected by the unused CIR detection section 703 is a

CIR signal that is not used by the allocation section 704 in determining communication resource allocation.

In the allocation section 704, communication resource allocation to each communication terminal is determined based on the CIR shown by CIR signals remaining after CIR signals detected by the unused CIR detection section 703 have been excluded from the CIR signals extracted by the demodulator 701, and CIR information is output to the communication mode determination section 705.

In the communication mode determination section 705, the communication mode is determined based on CIR information output from the allocation section 704, and a signal indicating this communication mode is output to modulator 706. The signal indicating the communication mode is modulated by modulator 706, spread by spreading section 707, multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to the communication terminal as a radio signal from an antenna 111 via a duplexer 110.

In the communication terminal shown in FIG.11, a baseband signal is despread by despreading section 807, and the despread signal is output to the communication mode detection section 808. In the communication mode detection section 808, the output signal from despreading section 807 is demodulated and the communication mode is detected, and based on the detected communication mode, the downlink receive data demodulation method is indicated to the adaptive demodulator 216 and the downlink receive data decoding method is indicated to the adaptive decoding section 217.

Thus, according to this embodiment, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

Also, according to this embodiment, as in Embodiment 1, a CRI signal of reception power lower than the lowest reception power at which a CIR signal indicating that downlink channel quality is poorest is not received erroneously is excluded, and therefore, even though a CIR signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on erroneous CIR information.

A base station according to this embodiment may also be configured as shown in FIG.12. FIG.12 is a block diagram showing another configuration of a base station according to Embodiment 4 of the present invention. That is to say, a base station may be configured in such a way that the reception power calculation section 702 and unused CIR detection section 703 shown in FIG.10 are replaced by a likelihood calculation section 901 and unused CIR detection section 902. In the following description, parts identical to those in FIG.10 are assigned the same reference numerals as in FIG.10 and their detailed explanations are omitted.

In FIG.12, the likelihood calculation section 901 calculates a likelihood that indicates the probable degree of certainty of a CRI signal, and outputs the calculation result to the unused CIR detection section 902. The lowest likelihood at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 902 as a threshold value. Then, in the unused CIR detection section 902, a CIR signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 704.

In this way the same effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG.12.

(Embodiment 5)

In a communication terminal according to Embodiment 5 of the present invention, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted.

FIG.13 is a block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 802, spreading section 803, CIR information power controller 804, and transmission power table 805 shown in FIG.11 are replaced by a code word selector 1001, code word table 1002, modulator 1003, and spreading section 1004. In the following description, parts identical to those in FIG.11 are assigned the same reference numerals as in FIG.11 and their detailed explanations are omitted.

The code word selector 1001 refers to the code word table 1002, converts a CIR signal created by the CIR information creation section 801 to a predetermined code word, and outputs it to modulator 1003. Modulator 1003 modulates the code word and outputs it to spreading section 1004. Spreading section 1004 spreads the output signal from modulator 1003 and outputs the resulting signal to a multiplexer 210.

Next, the operation of a communication terminal according to this embodiment will be described.

In the same way as in above-described Embodiment 2, the code word table 1002 shows the correspondence between CIR level and code words after CIR signal conversion, set so that the higher the CIR level, the larger is the code word minimum distance of the code word to which the CIR signal is converted. That is to say, in the settings in the code word table 1002, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which the CIR signal is converted.

In the code word selector 1001, a CIR signal output from the CIR information creation section 801 is converted to a code word set in the code word table 1002, and output to modulator 1003. Following conversion, the code word is modulated by modulator 1003 and spread by spreading section 1004. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

Thus, according to this embodiment, as in Embodiment 2, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

Also, according to this embodiment, as in Embodiment 2, it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high without increasing CIR signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information without increasing communication terminal power consumption.

Moreover, according to this embodiment, as in Embodiment 2, it is possible to change the degree of insusceptibility to errors of code words corresponding to CIR signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

(Embodiment 6)

A communication terminal according to Embodiments 6 to 8 of the present invention transmits with less susceptibility to errors in the propagation path in proportion to information for which the amount of change is large within CIR information. In other words, a communication terminal according to Embodiments 6 to 8 of the present invention transmits with less susceptibility to errors in the propagation path in proportion to information that indicates a broad value within CIR information.

The meaning of "information for which the amount of change is large" and "information that indicates a broad value" here can be illustrated by a specific example. If a CIR value is indicated by a value with a decimal fraction (such as 8.7 dB), then the above-mentioned information refers to the integer part (here, "8"). In this case, since the amount of change per unit of the integer part is 1 dB, while the amount of change per unit of the fractional part is 0.1 dB, the integer part is "information for which the amount of change is large". Therefore, if an integer part is received erroneously by a base station, the degree of error is large compared with the case where a fractional part is received erroneously, and the probability of an erroneous communication mode being determined is higher—that is to say, the probability of downlink throughput falling is higher.

Also, CIR information is normally converted to a code word with a limited number of bits before being transmitted to a base station, and there are also limits on the transmission power and spreading code spreading factor that can be used in transmitting CIR information. There are thus limits to making CIR information overall insusceptible to errors, and it is difficult to do so.

Thus, in Embodiments 6 to 8 of the present invention, within the above-described limitations on transmission of CIR information, transmission is performed with insusceptibility to errors in the propagation path made proportional to "information for which the amount of change is large" within the above limitations so that, at least "information for which the amount of change is large" (that is, "information that indicates a broad value") of CIR information is received correctly.

A communication terminal according to Embodiment 6 of the present invention is described below. A communication terminal according to Embodiment 6 of the present invention performs conversion to, and transmits, a code word with a code length proportional to the value of the upper digit in a CIR value.

FIG.14 is a block diagram showing the configuration of a communication terminal according to Embodiment 6 of the present invention. In the following description, parts identical to those in FIG.11 are assigned the same reference numerals as in FIG.11 and their detailed explanations are omitted.

In FIG.14, a CIR signal creation section 1101 converts a CIR value measured by a CIR measurement section 219 to a code word and creates a CIR signal, and outputs the created CIR signal to a multiplexer 210. At this time, the CIR signal creation section 1101 creates a CIR signal by performing conversion to a code word with a code length proportional to the value of the upper digit in the CIR value.

Next, the configuration of the CIR signal creation section 1101 will be described. FIG.15 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 6 of the present invention.

In FIG.15, an upper digit information generation section 1201 outputs the value of the upper digit in the CIR value output from the CIR measurement section 219 to a 6-bit coding section 1203. A lower digit information generation section 1202 outputs the value of the lower digit in the CIR value output from the CIR measurement section 219 to a 4-bit coding section 1204. To give a specific example, if the CIR value output from the CIR measurement section 219 is 8.7 dB, the upper digit information generation section 1201 outputs the value of the integer part, "8", to the 6-bit coding section 1203, and the lower digit information generation section 1202 outputs the value of the fractional part, "7", to the 4-bit coding section 1204.

The 6-bit coding section 1203 converts the value output from the upper digit information generation section 1201 (here, "8") to a 6-bit code word, and outputs the 6-bit code word to a time multiplexer 1205. The 4-bit coding section 1204 converts the value output from the lower digit information generation section 1202 (here, "7") to a 4-bit code word, and outputs the 4-bit code word to the time multiplexer 1205. It is herein assumed that the number of bits that can be used to indicate a CIR value is ten.

The time multiplexer 1205, by storing the 6-bit code word in the first half of a slot and storing the 4-bit code word in the following latter half of the slot, performs time multiplexing of the code word for the integer part of the CIR value (that is, the code word corresponding to the value of the upper digit) and the code word for the fractional part of the CIR value (that is, the code word corresponding to the value of the lower digit). The time multiplexer 1205 then outputs the time-multiplexed 10-bit code word to a modulator 1206 as a CIR signal. It is herein assumed that one slot is composed of 10 bits, with the integer part of a CIR value represented by the preceding 6 bits and the fractional part of a CIR value represented by the succeeding 4 bits.

The modulator 1206 modulates the CIR signal and outputs it to the spreading section 1207. The spreading section 1207 spreads the output signal from the modulator 1206 and outputs the resulting signal to the multiplexer 210.

Next, the operation of a communication terminal with the above configuration will be described.

In the 6-bit coding section 1203, the value of the upper digit in the CIR value (here, "8") is converted to a 6-bit code word, and the value of the lower digit in the CIR value (here, "7") is converted to a 4-bit code word.

As the number of different code words that can be represented by 6 bits is 2^6, and the number of different code words that can be represented by 4 bits is 2^4, the code word minimum distance between code words can be made larger for code words represented by 6 bits. Therefore, a code word represented by 6 bits is less susceptible to being mistaken for another code word than a code word represented by 4 bits. That is to say, in this embodiment, the value of the upper digit of a CIR value is less susceptible to errors.

Thus, with a communication terminal according to this embodiment, within the limitation of 10 bits available to indicate a CIR value, by performing conversion to a code word of a code length proportional to the value of the upper digit in a CIR value, it is possible to perform transmission with insusceptibility to errors made proportional to the value of the upper digit for which the amount of change is large. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

In this embodiment, a case has been described where the upper digit value is converted to a 6-bit code word and the lower digit value is converted to a 4-bit code word. However, as long as the number of bits of the code word corresponding to the upper digit value is greater than the number of bits of the code word corresponding to the lower digit value, there are no particular limitations on these numbers of bits.

(Embodiment 7)

A communication terminal according to Embodiment 7 of the present invention transmits with transmission power increased in proportion to the value of the upper digit in a CIR value.

A communication terminal according to this embodiment differs from a communication terminal according to Embodiment 6 only in the internal configuration of the CIR signal creation section 1101, and therefore only the CIR signal creation section 1101 will be described in the following description.

FIG.16 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 7 of the present invention. In the following description, parts identical to those in FIG.15 are assigned the same reference numerals as in FIG.15 and their detailed explanations are omitted.

The CIR signal creation section 1101 shown in FIG.16 converts a CIR value measured by a CIR measurement section 219 to a code word, and then creates a CIR signal, increasing transmission power in proportion to the value of the upper digit.

In FIG.16, a 5-bit coding section 1301 converts the value output from an upper digit information generation section 1201 to a 5-bit code word and outputs the 5-bit code word to a modulator 1303, and a 5-bit coding section 1302 converts the value output from a lower digit information generation section 1202 to a 5-bit code word and outputs the 5-bit code word to a modulator 1304. Thus, in this embodiment, both the upper digit value and the lower digit value are converted to 5-bit code words, and therefore there is no difference between them in insusceptibility to errors from a code word standpoint.

Modulator 1303 modulates the code word output from 5-bit coding section 1301, and outputs it to an upper digit spreading section 1305. Modulator 1304 modulates the code word output from 5-bit coding section 1302, and outputs it to a lower digit spreading section 1306.

The upper digit spreading section 1305 spreads the output signal from modulator 1303, and outputs the spread signal to an upper digit power controller 1307. The lower digit spreading section 1306 spreads the output signal from modulator 1304, and outputs the spread signal to a lower digit power controller 1308. At this time, the upper digit spreading section 1305 and lower digit spreading section 1306 perform their respective spreading processing using different spreading codes of the same spreading factor. That is to say, the upper digit value of the CIR value and the lower digit value of the CIR value are spread using different spreading codes that have the same spreading factor.

Based on the transmission power of a pilot signal output from a pilot power controller 209, the upper digit power controller 1307 controls the transmission power of the signal indicating the upper digit value of the CIR value, and outputs the signal that has undergone transmission power control to a code multiplexer 1309. Similarly, based on the transmission power of the pilot signal output from the pilot power controller 209, the lower digit power controller 1308 controls the transmission power of the signal indicating the lower digit value of the CIR value, and outputs the signal that has undergone transmission power control to the code multiplexer 1309. The actual transmission power control method will be described later herein.

The code multiplexer 1309 multiplexes the signal indicating the upper digit value of the CIR value and the signal indicating the lower digit value of the CIR value in the same time slot. That is to say, the code multiplexer 1309 performs code multiplexing of the signal indicating the upper digit value and the signal indicating the lower digit value.

Next, the operation of a communication terminal with the above configuration will be described.

In the upper digit power controller 1307, a signal indicating the upper digit value of a CIR value is adjusted to a transmission power whose only predetermined value is higher than the pilot signal transmission power. In the lower digit power controller 1308, a signal indicating the lower digit value of the CIR value is adjusted to a transmission power whose only predetermined value is lower than the pilot signal transmission power. That is to say, the transmission power is increased in proportion to the value of the upper digit in the CIR value.

Thus, a communication terminal according to this embodiment can transmit with insusceptibility to errors made proportional to the upper digit value for which the amount of change is large by transmitting with transmission power increased in proportion to the upper digit value of a CIR value. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

Also, in this embodiment, by increasing transmission power of the upper digit value compared with conventional CIR signal transmission power (here, the pilot signal transmission power), and decreasing transmission power of the lower digit value by the amount by which it is increased for the upper digit value, giving a total transmission power increase/decrease value of ±0 dB, the overall CIR signal transmission power is kept the same as conventional CIR signal transmission power. Thus, according to this embodiment, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value while keeping CIR signal transmission power the same as in a conventional system. That is to say, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value without reducing uplink capacity compared with a conventional system.

(Embodiment 8)

A communication terminal according to Embodiment 8 of the present invention transmits with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit in a CIR value.

A communication terminal according to this embodiment differs from a communication terminal according to Embodiment 6 or 7 only in the internal configuration of the CIR signal creation section 1101, and therefore only the CIR signal creation section 1101 will be described in the following description.

FIG.17 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 8 of the present invention. In the following description, parts identical to those in FIG.15 or FIG.16 are assigned the same reference numerals as in FIG.15 or FIG.16 and their detailed explanations are omitted.

The CIR signal creation section 1101 shown in FIG.17 converts a CIR value measured by a CIR measurement section 219 to a code word, and then creates a CIR signal, with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit.

In FIG.17, an upper digit spreading section 1401 spreads the output signal from modulator 1303 and outputs the resulting signal to a time multiplexer 1205, and a lower digit spreading section 1402 spreads the output signal from modulator 1304 and outputs the spread signal to the time multiplexer 1205. At this time, the upper digit spreading section 1401 performs spreading processing with a spreading code of the same kind as used by the lower digit spreading section 1402 and with a higher spreading factor than that of the lower digit spreading section 1402. That is to say, the upper digit value of the CIR value is spread with a higher spreading factor than the lower digit value. As a result, insusceptibility to errors in the propagation path is proportional to the upper digit value.

Thus, a communication terminal according to this embodiment can transmit with insusceptibility to errors made proportional to the upper digit value for which the amount of change is large by transmitting with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit in a CIR value. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

Also, in this embodiment, the spreading factor for the upper digit value is increased compared with a conventional CIR signal spreading factor, and the spreading factor for the lower digit value is decreased by the amount by which it is increased for the upper digit value. By this means, the amount of data sent in one slot is kept the same as for a conventional CIR signal. Thus, according to this embodiment, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value without reducing the amount of data sent in one slot.

It is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 1 and a communication terminal according to above-described Embodiment 2. Moreover, it is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 4 and a communication terminal according to above-described Embodiment 5. Furthermore, it is also possible to implement the present invention by combining the respective communication terminals according to above-described Embodiments 6 to 8. In addition, it is also possible for the transmission power table provided in a communication terminal according to above-described Embodiment 4 and the code word table provided in a communication terminal according to above-described Embodiment 5 to be rewritten as appropriate based on a control signal from the base station, in the same way as in above-described Embodiment 3.

Also, in above-described Embodiments 1 to 8, a case has been described where a pilot signal is time-multiplexed, but above-described Embodiments 1 to 8 are not limited to this, and can also be applied to a case where a pilot signal is code-multiplexed.

Moreover, in above-described Embodiments 1 to 8, a CIR has been used as a value that indicates pilot signal reception quality, but this is not a limitation, and any value may be used as long as it is a value that indicates reception quality.

Furthermore, in above-described Embodiments 1 to 5, the predetermined threshold value set in the unused DRC detection section or the unused CIR detection section is assumed to be a fixed value, but a configuration may also be used whereby the threshold value is varied adaptively in accordance with the DRC signal error rate or CIR signal error rate.

In addition, in above-described Embodiments 6 to 8, either time multiplexing or code multiplexing may be used when multiplexing code words.

Also, in above-described Embodiments 6 to 8, an example has been given in which a CIR value is represented by one integer-part digit and one fractional-part digit. However, this is not a limitation, and above-described Embodiments 6 to 8 may all be implemented for CIR values represented by a plurality of digits.

Moreover, in above-described Embodiments 6 to 8, the value of the upper digit of a CIR value has been described as "information for which the amount of change is large". However, "information for which the amount of change is large" does not necessarily correspond to the size of a digit. For example, if a method is used whereby a CIR value is represented by an integer by first indicating a broad value of 0 db, 2 dB, 4 dB, 6 dB … changing by 2 dB at a time, and adding information indicating the presence or absence of an increment of 1 dB for that broad value, a value changing by 2 dB at a time is "information for which the amount of change is large". With this method, to represent a CIR value of 7 dB, for example, CIR information that includes information indicating 6 dB and information indicating that there is an increment of 1 dB is transmitted to the base station. At this time, the communication terminal apparatus transmits the information indicating 6 dB with greater insusceptibility to errors than the information indicating that there is an increment of 1 dB, in the same way as in above-described Embodiments 6 to 8.

As described above, according to the present invention it is possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

This application is based on Japanese Patent Application No.2000-234420 filed on August 2, 2000, and Japanese Patent Application No.2000-285405 filed on September 20, 2000, entire content of which is expressly incorporated by reference herein.

CLAIMS

1. A communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

Sub a1

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates channel quality;

wherein said transmitter transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

2. The communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

3. The communication terminal apparatus according to claim 2, wherein said transmitter transmits with transmission power increased in proportion to a notification signal that indicates that channel quality is good.

4. The communication terminal apparatus according to claim 3, further comprising a controller that controls transmission power of a pilot signal;

wherein said transmitter transmits with a notification signal that indicates channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

Sub a1

5. The communication terminal apparatus according to claim 3, further comprising:

a table that indicates a correspondence between a notification signal and transmission power; and

a rewriting device that rewrites contents of said table in accordance with a control signal from a base station apparatus;

wherein said transmitter adjusts a notification signal to predetermined transmission power based on said table.

6. The communication terminal apparatus according to claim 2, wherein said transmitter transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that channel quality is good.

7. The communication terminal apparatus according to claim 6, further comprising:

a table that indicates a correspondence between a notification signal and a code word; and

a rewriting device that rewrites contents of said table in accordance with a control signal from a base station apparatus;

wherein said transmitter converts a notification signal to a predetermined code word based on said table.

8. The communication terminal apparatus according to claim 2, further comprising a determination device that determines a communication mode indicated by a combination of modulation method and coding method based on channel quality;

Sub A1

wherein said transmitter makes a notification signal a signal that indicates a communication mode.

9. The communication terminal apparatus according to claim 2, wherein:

said measurement device measures pilot signal reception quality; and

said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value.

10. The communication terminal apparatus according to claim 1, wherein:

said measurement device measures pilot signal reception quality; and

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality value.

11. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

12. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

Sub C1

13. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

14. A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurement device that measures reception power of a notification signal;

a detector that detects a notification signal whose reception power is less than a predetermined threshold value; and

a determination device that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

15. The base station apparatus according to claim 14,

further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

16. A base station apparatus comprising:

Sub a1

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurement device that measures likelihood of a notification signal;

a detector that detects a notification signal whose likelihood is less than a predetermined threshold value; and

a determination device that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

17. The base station apparatus according to claim 16, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

18. A radio communication method, wherein:

a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and

Sub a1

said base station determines downlink communication resource allocation in accordance with a notification signal.

19. The radio communication method according to claim 18, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

20. The radio communication method according to claim 18, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a reception quality value.

ABSTRACT

A communication mode determination section 201 determines the communication mode based on the CIR measured by a CIR measurement section 219; a DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode; and a DRC power controller 205 refers to a transmission power table 206 showing the correspondence between DRC numbers and transmission power, and, based on the transmission power of the pilot signal output from a pilot power controller 209, increases transmission power in proportion as the DRC signal indicates that downlink channel quality is good.

ICATION FOR UNITED STATES P/
Declaration for Patent Application

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on

the invention entitled: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHO

the specification of which 2 (file no ______________)

(check at least one) 3 [x] is attached hereto
4 [ ] was filed on ________ as (5) U.S. Application Serial No.________
6 [ ] and was amended ________________ (if applicable)

Use this portion only if you are entering the U.S. National phase based on a PCT International Application designating the U.S.		
7 [x]	was filed as PCT international application	
8	Number PCT/JP01/06654	
9	on 2/August/2001	
	and was amended under PCT Article(s) 19 and/or 34	
10	on ________________ (if applicable).	
11	priority date claimed in PCT International Application	

JAPAN	2000-234420	2/August/2000
(Country)	(Number)	(Day/Month/Year Filed)
JAPAN	2000-285405	20/September/2000
(Country)	(Number)	(Day/Month/Year Filed)
(Country)	(Number)	(Day/Month/Year Filed)

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended, by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application (s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date earlier than that of the application(s) on which priority is claimed.

12a Prior (Foreign) Application(s) any Priority Claims Under 35 U.S.C. 119 — Priority Claimed

(Country)	(Number)	(Day/Month/Year Filed)	[ ] Yes	[ ] No
(Country)	(Number)	(Day/Month/Year Filed)	[ ] Yes	[ ] No

Priority Claim(s) from U.S. Provisional Application(s) – I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

12b

Application No.	Day/Month/Year Filed	Application No.	Day/Month/Year Filed

Do not use this portion to identify a PCT application if the parent application is the U.S. National phase of the PCT application	I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between filing date of the prior application and the national or PCT international filing date of this application. 13 (U.S. Application Number) (U.S. Filing Date) Status (patented, pending, abandoned)

I hereby appoint the following attorneys of the firm of Stevens, Davis, Miller & Mosher, L.L.P. as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office:

James E. Ledbetter, Reg. No. 28732; Thomas P. Pavelko, Reg. No. 31689; and Anthony P. Venturino, Reg. No. 31674.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO STEVENS, DAVIS, MILLER & MOSHER, L.L.P., 1615 L Street, N.W., Suite 850, Washington, D.C. 20036, TELEPHONE (202) 408-5100, FACSIMILE (202) 408-5200.

See page 2 for signature lines

other side for instructions for completing this form

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line 1 Insert the same title as is used on t... specification and in the assignment.

line 2 Is optional but is provided so that you can use it to identify more readily an application prior to the time that the Patent Office application serial number is assigned. We suggest that the specification, drawings and declaration always bear a file number since it can help to get the papers together in case they become inadvertently separated. In instances where the specification is filed without a signed declaration form (under 37 CFR §1.53) a file number on a later-received separate form will assist us in associating it with the correct case.

line 3 Check this box if the specification, claims and drawing (if any) are attached to this declaration form, e.g., when filing a new patent application.

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line 6 Is used in conjunction with line 5 but only when there have been one or more amendments to the specification or claims. Line 6 is also used when the Examiner requires a new declaration because claims inserted by amendment cover subject matter not originally claimed (37 CFR §1.67).

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line 12a Is used in the following instances:

(i) If a single priority is being claimed from a foreign application you need to list only the first-filed application; you do not need to list other countries if all applications were filed within one year of the U.S. filing.

(ii) If multiple priorities are being claimed, from a plurality of applications filed in one or more countries, you must list the first filed application for each aspect of the invention. Example: if aspect A of the invention was disclosed in an application filed 11 months earlier in country X and aspect B was disclosed 9 months earlier in an application filed in country Y, then the applications in <u>both</u> countries X and Y must be identified. Only the <u>first</u> application for each aspect of the invention needs to be identified <u>provided</u> all applications on that aspect were filed within one year prior to the U.S. filing.

(iii) If a <u>non-priority</u> application is being filed you must list <u>all</u> applications in all countries where corresponding foreign applications were filed <u>more than one year</u> prior to the U.S. filing. This is so the Examiner can check to see if any of those applications were published or patented early enough to be prior art against the U.S. application.

(iv) If there are more than two applications to be listed we suggest that you type in on this form only "See attached Schedule A" and then list all of the previous applications on an attached sheet.

line 12b Is used to claim priority under 35 USC §119(e) based on a provisional application filed within one year of the filing of the instant application. More than one provisional application may be identified provided neither was filed more than one year earlier.

line 13 This block is used only in instances where there is a previously filed <u>U.S.</u> non-provisional application which was copending at the time the present application was (or is being) filed. that previous application could be a U.S. non-provisional application or the National Phase of a PCT allocation. In such a case the present application may be entitled to the priority of the previous application's U.S. filing date (and consequently the foreign priority thereof) provided the present application is identified as a continuing application (continuation, divisional or continuation-in-part) of the earlier (parent) application. If the foregoing is applicable, please fill in one line for each such prior application.

line 14 Type the inventor's proper legal name in the order specified, e.g., "John B. JONES" or "J. Bob JONES" if the inventor so prefers. It is <u>not</u> acceptable to use only initials such as "J. B. JONES."

line 15 The inventor's "signature" may be his (or her) usual manner of signing but it is preferable that the inventor simply write his (or her) name in his (or her) own cursive handwriting in the same order as on line 14, e.g., given name, middle initial and Family name.

line 16 Insert the <u>actual</u> date of signature.

line 17 Insert simply the city and state or country, e.g., "Paris, France", of the inventor's <u>residence</u>, not citizenship. No street address or postal code is required on this line.

line 18 Insert the inventor's citizenship. The statement of citizenship (or subject of) is a statutory requirement (35 USC §115). Simply the name of the country of citizenship, e.g., "Japan" is sufficient.

line 19 Insert the inventor's mailing address. The purpose of requiring the post office address is to enable the Patent Office to communicate directly with the inventor if desired, such as in the case of death of the U.S. attorney. It should be the address where the inventor customarily receives his (or her) mail and should include the postal code. If applicable it can be the inventor's business address or address at place of employment.

Applicants are reminded that the U.S. Patent and Trademark Office has very strict requirements as to proper execution of an application. The applicant should make sure that he reviews the declaration, prior to signing to make sure the declaration properly identifies the application and all relevant information; and should review the specification and claims (including drawings, if any) before signing the declaration. Failure to do so will require the filing of a supplemental declaration --- 37 CFR §1.67(c).

Any handwritten changes to the specification, claims or drawings must be in ink personally by all of the inventors <u>prior to</u> signing the declaration and the adjacent left margin must be initialed and dated by all of the inventors, e.g., "JBJ 6-9-91".

Please let us know if there are any questions regarding proper completion of this form. Thank you.

An assignment, a separate document requiring separate signature and dating may be enclosed. Please look for it and sign and date it in the same manner as in lines 15 and 16 above.

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.

I hereby declare that all statements made herein [illegible] knowledge are true and that all statements made on [illegible]n and belief are believed to be true; and further that these statements were made with the knowledge that [illegible]ul false statements and the like so made are punishable [illegible] or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

PAGE 2 OF U.S.A. DECLARATION FORM

14a	Typewritten Full Name of Sole or First Inventor	Kenichi		MIYOSHI
		Given Name	Middle Name	Family Name
15a	Inventor's Signature	Kenichi		Miyoshi
16a	Date of Signature	March	3	2002
		Month	Day	Year
17a	Residence	Yokohama-shi	Kanagawa	JAPAN
		City	State or Province	Country
18a	Citizenship	JAPAN		
19a	Post Office Address *(Insert complete mailing address, including country)*	11-4-1305, Nokendaihigashi, Kanazawa-ku, Yokohama-shi, Kanagawa 236-0058 JAPAN		

14b	Typewritten Full Name of Sole or First Inventor	Osamu		KATO
		Given Name	Middle Name	Family Name
15b	Inventor's Signature	Osamu		Kato
16b	Date of Signature	March	3	2002
		Month	Day	Year
17b	Residence	Yokosuka-shi	Kanagawa	JAPAN
		City	State or Province	Country
18b	Citizenship	JAPAN		
19b	Post Office Address *(Insert complete mailing address, including country)*	5-45-G302, Shonantakatori, Yokosuka-shi, Kanagawa 237-0066 JAPAN		

14c	Typewritten Full Name of Sole or First Inventor	Junichi		AIZAWA
		Given Name	Middle Name	Family Name
15c	Inventor's Signature	Junichi		Aizawa
16c	Date of Signature	March	3	2002
		Month	Day	Year
17c	Residence	Yokohama-shi	Kanagawa	JAPAN
		City	State or Province	Country
18c	Citizenship	JAPAN		
19c	Post Office Address *(Insert complete mailing address, including country)*	9-20,Sakaigihoncho, Hodogaya-ku, Yokohama-shi Kanagawa 240-0033 JAPAN		

14d	Typewritten Full Name of Sole or First Inventor			
		Given Name	Middle Name	Family Name
15d	Inventor's Signature			
16d	Date of Signature			
		Month	Day	Year
17d	Residence			
		City	State or Province	Country
18d	Citizenship			
19d	Post Office Address *(Insert complete mailing address, including country)*			

*Note to Inventor: Please sign name on line 15 exactly as it appears in line 14 and insert the actual date of signing on line 16. If there are more than four inventors, please add a copy of this page for identification and signatures for the additional inventors.

PATENT APPLICATION SERIAL NO. ____________________

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

12/19/2002 STEUMEL1 00000040 10321623
01 FC:1001 740.00 OP

Repln. Ref: 04/22/2003 SDIRETA1 0013430800
DA#:194378 Name/Number:10321500
FC: 9204 $740.00 CR

Adjustment date: 04/22/2003 SDIRETA1
12/19/2002 STEUMEL1 00000040 10321623
01 FC:1001 -740.00 OP

Adjustment date: 03/17/2004 TLUU11
10/30/2003 TLUU11 00000007 10321500
01 FC:1999 -740.00 OP

03/17/2004 TLUU11 00000007 10321623
01 FC:1001 740.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2001 — 481-697/59173

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al.

Appln. No.: New Continuation Application of 10/089,605 filed April 1, 2002

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.56

Assistant Commissioner of Patents
Washington, D. C. 20231

Sir:

Pursuant to 37 C.F.R. §1.56, applicants hereby call to the attention of the Patent and Trademark Office the references listed on the attached List of References. All of these references are of record in the parent application; copies need not be submitted (see 37 CFR §1.98(d)). This list of references is being provided to ensure listing of these references on a patent to issue in this application in accordance with the following paragraph of MPEP 609:

> "A citation on form PTO-1449 and considered by the Examiner...will be printed on the patent."

Applicants present these references so that the Patent and Trademark Office may, in the first instance, determine any relevancy thereof to the presently claimed invention; see Beckman Instruments, Inc. v. Chemtronics, Inc., 439 F.2d 1369, 1380, 165 USPQ 355, 364 (5th Cir., 1970). Also see Patent Office Rules 104 and 106.

Applicants respectfully request that these references be expressly considered during the prosecution of this application and made of record herein and appear among the "References Cited" on any patent to issue herefrom.

Respectfully submitted,

Date: December 18, 2002

James E. Ledbetter
Registration No. 28,732

JEL/ejw
ATTORNEY DOCKET NO. L9289.02149B

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Washington, DC 20043-4387
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#4A
[handwritten initials]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application

Inventors: Kenichi MIYOSHI, et al.

Appln. No.: New Continuation Application of 10/089,605 filed April 1, 2002

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Please amend the above-captioned application as follows:

IN THE SPECIFICATION

Please insert the following paragraph at page 1, between lines 4 and 5:

--This is a continuation of application number 10/089,605 filed April 1, 2002.--

IN THE CLAIMS

Please amend claims 1-20 to read as follows (Exhibit I contains a marked up version):

a1

1. (Amended) A communication terminal apparatus used in a communication system in which communication resources are allocated

to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising:

a measurer that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates said downlink channel quality;

wherein said notification signal includes information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

a1

2. (Amended) The communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good.

3. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits with transmission power increased in proportion to a notification signal that indicates that said downlink channel quality is good.

4. (Amended) The communication terminal apparatus according to claim 3, further comprising a controller that controls transmission power of a pilot signal,

wherein said transmitter transmits with a notification signal that indicates said downlink channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates said downlink channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

a1

5. (Amended) The communication terminal apparatus according to claim 3, further comprising:

a table that indicates a correspondence between a notification signal and transmission power; and

a rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus,

wherein said transmitter adjusts a notification signal to predetermined transmission power based on said table.

6. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits after performing conversion to a code word with a size of a code word minimum

distance proportional to a notification signal that indicates that said downlink channel quality is good.

7. (Amended) The communication terminal apparatus according to claim 6, further comprising:

a table that indicates a correspondence between a notification signal and a code word; and

a rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus,

a1

wherein said transmitter converts a notification signal to a predetermined code word based on said table.

8. (Amended) The communication terminal apparatus according to claim 2, further comprising a determiner that determines a communication mode indicated by a combination of modulation method and coding method based on channel quality,

wherein said transmitter makes a notification signal a signal that indicates a communication mode.

9. (Amended) The communication terminal apparatus according to claim 2, wherein:

said measurer measures pilot signal reception quality; and said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value.

10. (Amended) The communication terminal apparatus according to claim 1, wherein:

said measurer measures pilot signal reception quality; and

al

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality value.

11. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

12. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

13. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

14. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a1

a measurer that measures reception power of a notification signal;

a detector that detects a notification signal whose reception power is less than a predetermined threshold value; and

a determiner that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

15. The base station apparatus according to claim 14, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

16. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurer that measures likelihood of a notification signal;

a detector that detects a notification signal whose likelihood is less than a predetermined threshold value; and

a1

a determiner that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

17. The base station apparatus according to claim 16, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

18. (Amended) A radio communication method, wherein:

a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of said downlink channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and

a1

said base station determines downlink communication resource allocation in accordance with a notification signal.

19. (Amended) The radio communication method according to claim 18, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good.

20. The radio communication method according to claim 18, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to

a1 information for which an amount of change is large within information used to indicate a reception quality value.

REMARKS

This application is directed to original claims 1-20 which are amended for clarity. The amendments are considered to be non-narrowing and no estoppel should be deemed to attach thereto.

Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

Date: December 16, 2002

James E. Ledbetter
Registration No. 28,732

JEL/spp

ATTORNEY DOCKET NO. L9289.02149B

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<u>Exhibit I</u>

1. (Amended) A communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising:

a [measuring device] <u>measurer</u> that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates <u>said downlink</u> channel quality;

wherein said [transmitter transmits a] notification signal [having] <u>includes</u> information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

2. (Amended) The communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that <u>said downlink</u> channel quality is good.

3. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits with transmission power increased in proportion to a notification signal that indicates that said downlink channel quality is good.

4. (Amended) The communication terminal apparatus according to claim 3, further comprising a controller that controls transmission power of a pilot signal [;],

wherein said transmitter transmits with a notification signal that indicates said downlink channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates said downlink channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

5. (Amended) The communication terminal apparatus according to claim 3, further comprising:

a table that indicates a correspondence between a notification signal and transmission power; and a [rewriting device] rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus[;],

wherein said transmitter adjusts a notification signal to predetermined transmission power based on said table.

6. (Amended) The communication terminal apparatus according to claim 2, wherein said transmitter transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that said downlink channel quality is good.

7. (Amended) The communication terminal apparatus according to claim 6, further comprising:

a table that indicates a correspondence between a notification signal and a code word; and

a [rewriting device] rewriter that rewrites contents of said table in accordance with a control signal from a base station apparatus[;],

wherein said transmitter converts a notification signal to a predetermined code word based on said table.

8. (Amended) The communication terminal apparatus according to claim 2, further comprising a [determination device] <u>determiner</u> that determines a communication mode indicated by a combination of modulation method and coding method based on channel quality[;]<u>,</u>

wherein said transmitter makes a notification signal a signal that indicates a communication mode.

9. (Amended) The communication terminal apparatus according to claim 2, wherein:

said [measurement device] <u>measurer</u> measures pilot signal reception quality; and

said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value.

10. (Amended) The communication terminal apparatus according to claim 1, wherein:

said [measurement device] <u>measurer</u> measures pilot signal reception quality; and

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality value.

11. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

12. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

13. The communication terminal apparatus according to claim 10, wherein said transmitter transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

14. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a [measurement device] <u>measurer</u> that measures reception power of a notification signal;

a detector that detects a notification signal whose reception power is less than a predetermined threshold value; and

a [determination device] <u>determiner</u> that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

15. The base station apparatus according to claim 14, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

16. (Amended) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a [measurement device] <u>measurer</u> that measures likelihood of a notification signal;

a detector that detects a notification signal whose likelihood is less than a predetermined threshold value; and a [determination device] <u>determiner</u> that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

17. The base station apparatus according to claim 16, further comprising:

a calculator that calculates a rate of detection by said detector; and

a transmitter that transmits a control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

18. (Amended) A radio communication method, wherein:

a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of <u>said downlink</u> channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and said base station determines downlink communication resource allocation in accordance with a notification signal.

19. (Amended) The radio communication method according to claim 18, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that <u>said downlink</u> channel quality is good.

20. The radio communication method according to claim 18, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a reception quality value.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Inventors: Kenichi MIYOSHI, et al.

Appln. No.: New Continuation Application of 10/089,605 filed April 1, 2002

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

CONFIRMATION CLAIM FOR PRIORITY

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

The benefit of the filing date of the following foreign application filed in the following foreign country and priority provided in the 35 USC §119 have been claimed for the above-identified application:

JAPANESE PATENT APPLICATION NO. 2000-234420
FILED August 2, 2000

JAPANESE PATENT APPLICATION NO. 2000-285405
FILED September 20, 2000.

The International Bureau received the priority document within the time limit in parent application serial no. 10/089,605 filed April 1, 2002.

It is requested that the file of this application be marked to indicate that the requirements of 35 USC §119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of these papers.

Respectfully submitted,

Date: December 18, 2002

James E. Ledbetter
Registration No. 28,732

JEL/ejw
ATTORNEY DOCKET NO. L9289.02149B
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Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

10321623.021203 0360

OIPE JC73
FEB 12 2003
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE #3

In re the Application of

Inventors: Kenichi MIYOSHI, et al.

Application No.: 10/321,500

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

In response to the Notice to File Corrected Application Papers dated February 6, 2003, submitted herewith are substitute Figures 2, 5 and 16 in compliance with 37 CFR 1.84 and 37CFR 1.121.

Respectfully submitted,

Date: February 12, 2003

James E. Ledbetter
Registration No. 28,732

JEL/ejw

Attorney Docket No. L9289.02149A
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WASHINGTON, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

#3

UNITED STATES PATENT AND TRADEMARK OFFICE

OIPE JC73 FEB 12 2003 PATENT & TRADEMARK OFFICE

Commissioner for Patents
Washington, DC 20231
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APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B

CONFIRMATION NO. 5366

FORMALITIES LETTER

OC000000009487029

24257
STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

Date Mailed: 02/06/2003

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

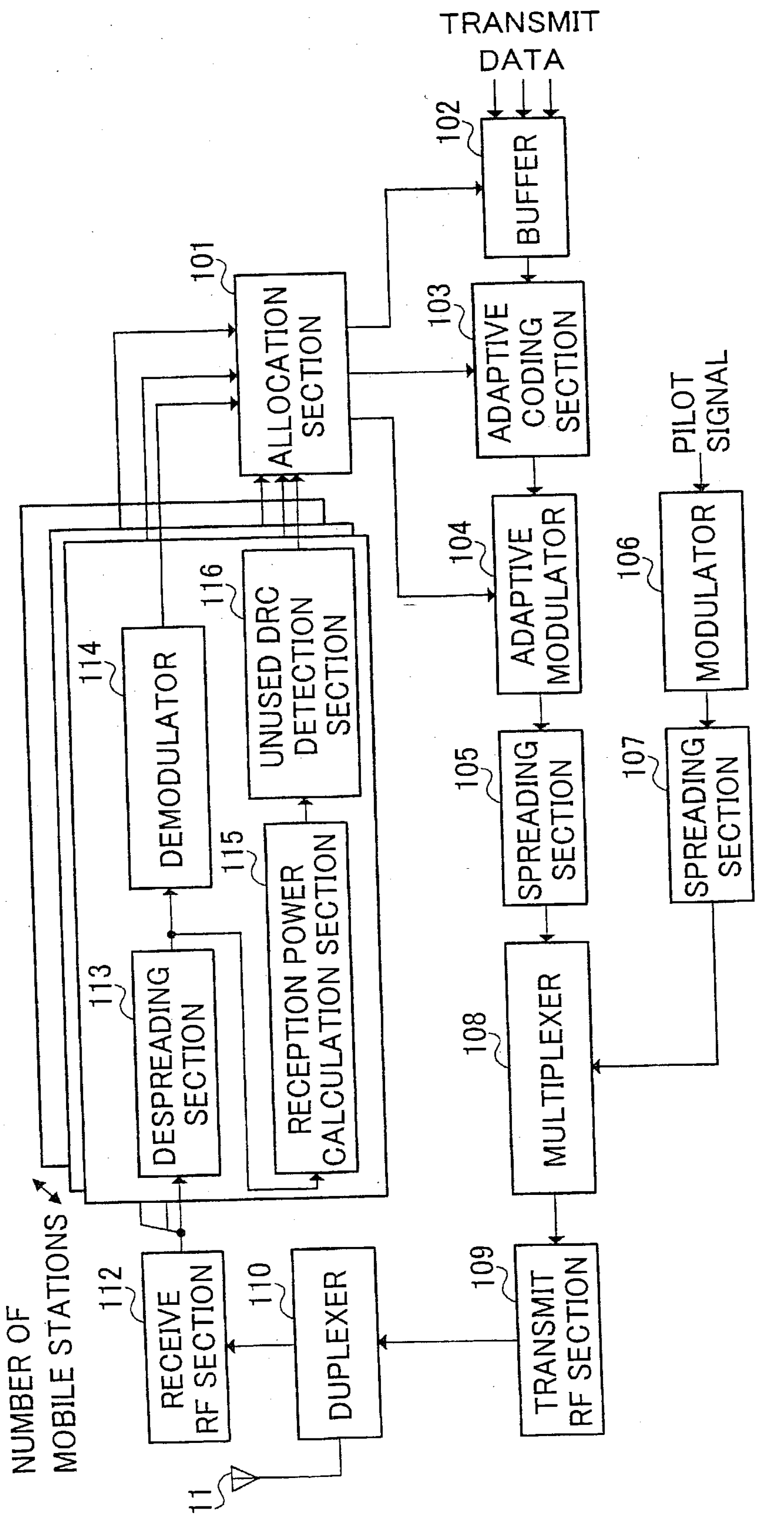
An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121 are required. The drawings submitted are not acceptable because:
  - The drawing sheets do not have the appropriate margin(s) (see 37 CFR 1.84(g)). Each sheet must include a top margin of at least 2.5 cm. (1 inch), a left side margin of at least 2.5 cm. (1 inch), a right side margin of at least 1.5 cm. (5/8 inch), and a bottom margin of at least 1.0 cm. (3/8 inch).See Figures(s) 2, 5, 16.

A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE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SPREADING SECTION
107
SPREADING SECTION
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
113
DESPREADING SECTION
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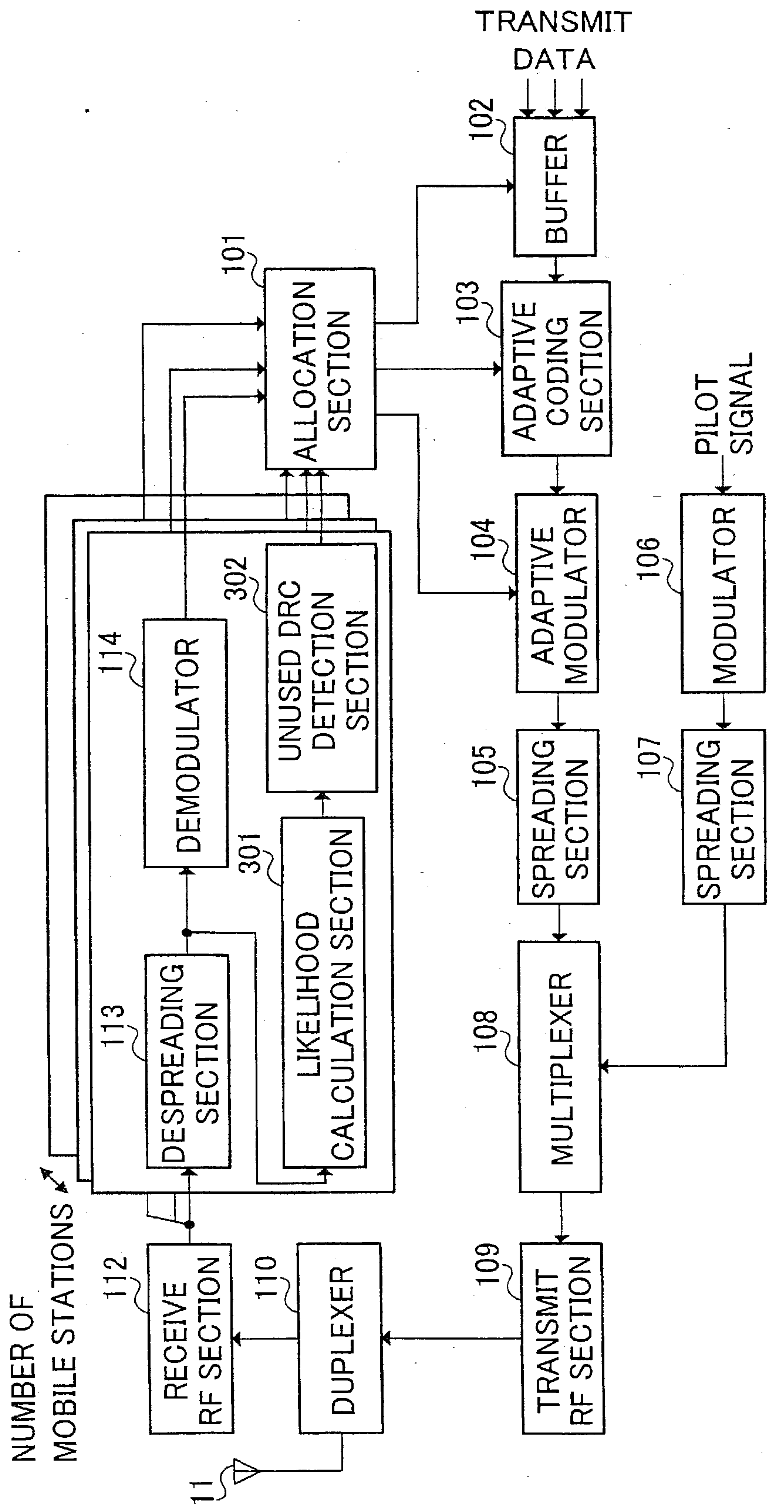
DEMODULATOR
115
RECEPTION POWER CALCULATION SECTION
116
UNUSED DRC DETECTION SECTION
NUMBER OF MOBILE STATIONS

FIG.2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SPREADING SECTION
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SPREADING SECTION
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MULTIPLEXER
109
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DUPLEXER
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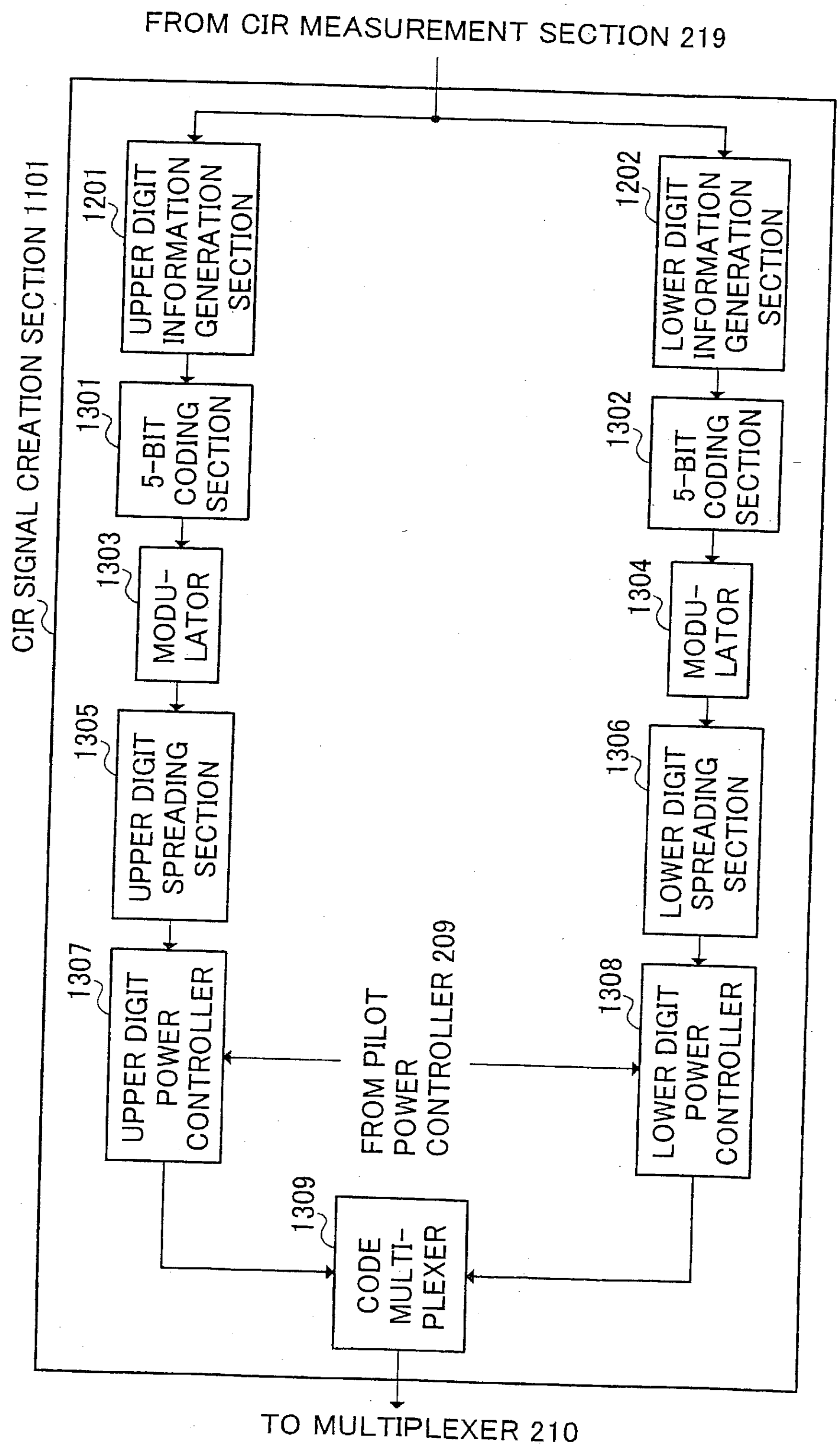
LIKELIHOOD CALCULATION SECTION
302
UNUSED DRC DETECTION SECTION
NUMBER OF MOBILE STATIONS

FIG.5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1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1301
5-BIT CODING SECTION
1302
5-BIT CODING SECTION
1303
MODU-LATOR
1304
MODU-LATOR
1305
UPPER DIGIT SPREADING SECTION
1306
LOWER DIGIT SPREADING SECTION
1307
UPPER DIGIT POWER CONTROLLER
1308
LOWER DIGIT POWER CONTROLLER
FROM PILOT POWER CONTROLLER 209
1309
CODE MULTI-PLEXER
TO MULTIPLEXER 210

FIG.16

L Number	Hits	Search Text	DB	Time stamp
1	11382	down-link downlink down adj link	USPAT; US-PGPUB	2004/04/08 16:24
2	664	(quality cir) near8 (down-link downlink down adj link)	USPAT; US-PGPUB	2004/04/08 16:24
3	12773	up-link uplink up adj link	USPAT; US-PGPUB	2004/04/08 16:24
4	1613	(power) near8 (up-link uplink up adj link)	USPAT; US-PGPUB	2004/04/08 16:25
5	101	((quality cir) near8 (down-link downlink down adj link)) same ((power) near8 (up-link uplink up adj link))	USPAT; US-PGPUB	2004/04/08 16:25
6	53826	455/$.ccls.	USPAT; US-PGPUB	2004/04/08 16:25
7	80	(((quality cir) near8 (down-link downlink down adj link)) same ((power) near8 (up-link uplink up adj link))) and 455/$.ccls.	USPAT; US-PGPUB	2004/04/08 16:32
8	1739	455/69.ccls. 455/522.ccls.	USPAT; US-PGPUB	2004/04/08 16:33
9	1370	edward near2 urban.xp.	USPAT; US-PGPUB	2004/04/08 16:33
10	74	(455/69.ccls. 455/522.ccls.) and (edward near2 urban.xp.)	USPAT; US-PGPUB	2004/04/08 16:34
11	126	((quality cir) near8 (down-link downlink down adj link)) and (455/69.ccls. 455/522.ccls.)	USPAT; US-PGPUB	2004/04/08 16:34

Sr

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 04/22/2004

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 04/22/2004 2

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	10/321,623	MIYOSHI ET AL.
	Examiner	Art Unit
	DANH C LE	2683

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 December 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,8-10,14,16 and 18-20* is/are rejected.

7)☒ Claim(s) *4-7,11-13,15 and 17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 10/089,605.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 3.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. **Claims 1-3, 8-10, 14, 16, 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tong (US 2001/0038630) in view of Juntti (US 5,564,074).**

As to claim 1, Tong teaches a communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality (figure 1 and paragraph 37-38), said communication terminal apparatus comprising:

a measurer device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates said downlink channel quality;

wherein said transmitter transmits a notification signal includes information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality.

Tong fails to teach channel quality having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus. Juntti teaches channel quality having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus (col.4, line

57-col.5, line 6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Juntti into the system of Tong in order to maximized the service level.

As to claim 2, the combination of Tong and Juntti teaches the communication terminal apparatus according to claim 1, wherein said transmitter transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that said downlink channel quality is good (Juntti, col.4, line 57-col.5, line 6).

As to claim 3, the combination of Tong and Juntti teaches varying transmission power base on the increasing the transmission quality. The combination of Tong and Juntti fails to teach increasing the transmission power when the channel quality is good as claimed. However, the above claimed limitation would not render the claim patentable over the applied references because its merely depends on how one would like to vary the transmission power based on channel quality. In addition, channel quality would be further improved if the transmission power is increased. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of increasing the transmission power in proportion to a notification signal into the system of Tong and Juntti in order to maximized the service level and avoid the reception error.

As to claim 8, the combination of Tong and Juntti teaches the communication terminal apparatus according to claim 2, further comprising a determiner that determines communication mode indicated by combination of modulation method and coding method based channel quality;

wherein said transmitter makes a notification signal a signal that indicates a communication mode (Tong, paragraph 85, 86).

As to claim 9, the combination of Tong and Juntti teaches the communication terminal apparatus according to claim 2, wherein:

said measurer device measures pilot signal reception quality; and

said transmitter makes a notification signal a signal that indicates a pilot signal reception quality value (Tong, paragraph 85, 86).

As to claim 10, the combination of Tong and Juntti teaches the communication terminal apparatus according claim 1, wherein :

said measurer device measures pilot signal reception quality; and

said transmitter transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate a pilot signal reception quality signal (Juntti, col.4, line 57-col.5, line 6).

As to claim 14, the combination of Tong and Juntti teaches a base station apparatus (paragraph 37, 64, 80-82) comprising:

a receiver that receives a notification signal transmitted from the communication terminal apparatus according to claim 1;

a measurer device that measures reception power of a notification signal;

a detector that detects a notification signal whose a predetermined threshold reception power is less than value; and determiner device that determines downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality notification signals.

As to claim 16, the combination of Tong and Juntti teaches a base station apparatus (paragraph 37, 64, 80-82) comprising:

a receiver that receives notification signal transmitted from the communication terminal apparatus

according to claim 1:

a measurer device that measures likelihood a notification signal;

a detector that detects a notification signal whose likelihood is less than a predeteçmined threshold value; and

determiner device that determines downlink communication resource a notification signal excluding detected notification signal from a received plurality of notification signals.

As to claim 18, the claim is a method claim of claim 1; therefore, the claim is interpreted and rejected as set as in claim 1.

As to claim 19, the claim is a method claim of claim 2; therefore, the claim is interpreted and rejected as set as in claim 2.

As to claim 20, the claim is a method claim of claim 3; therefore, the claim is interpreted and rejected as set as in claim 3.

Allowable Subject Matter

Claims 4-7, 11-13, 15, 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

As to claim 4, the teaching of prior arts either alone or in combination fails to teach the transmitter transmits with a notification signal that indicates said downlink channel quality better than a predetermined channel quality set to higher transmission power than pilot signal transmission power, and a notification signal that indicates said downlink channel quality poorer than a predetermined channel quality set to lower transmission power than pilot signal transmission power.

As to claim 5, the teaching of prior arts either alone or in combination fails to teach the table that indicates a correspondence between a notification signal and transmission power, rewriting device that rewrites contents of said table in accordance with control signal from a base station apparatus, wherein said signal to predetermined transmission power based on said table transmitter adjusts notification signal that indicates that channel quality is good.

As to claim 6, the teaching of prior arts either alone or in combination fails to teach the transmitter transmits after performing conversion to a code word with size of code word minimum distance proportional to a notification signal that indicates that said downlink channel quality is good.

As to claim 7, the teaching of prior arts either alone or in combination fails to teach the table that indicates a correspondence between a notification signal and a code word, a rewriting device that table accordance with a station apparatus, wherein said transmitter converts a notification signal to a predetermined code word based on said table.

As to claim 11, the teaching of prior arts either alone or in combination fails to teach the notification signal converted to a code word whose code length is proportional to a value of an upper digit.

As to claim 12, the teaching of prior arts either alone or in combination fails to teach the transmitter transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

As to claim 13, the teaching of prior arts either alone or in combination fails to teach the transmitter transmits notification signal spread with a spreading code whose spreading factor higher in proportion to a value of an upper digit.

As to claims 15 and 17, the teaching of prior arts either alone or in combination fails to teach the a calculator that calculates by said detector, a transmitter that transmits a rate of detection control signal instructing a communication terminal apparatus to rewrite said table based on a result of comparison of a rate of detection and a predetermined threshold value.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A. Nakano et al (US RE37,870) teaches the CDMA/TDD radio communication system.

B. Lee et al (US 2001/0050900) teaches the communication system and method of transmitting data therein.

C. Luschi et al (US 2003/0043778) teaches the wireless communication network, a user terminal therefore, a base station therefor and a method of telecommunication.

D. Sumasu et al (US 2002/0155861) teaches the base station apparatus, communication terminal apparatus, and communication method.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C LE whose telephone number is 703-306-0542. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

danh

Danh C.Le

WILLIAM TROST
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO. L9289.02149B	CONT. APPN. OF SERIAL NO. 10/089,605
APPLICANT Kenichi MIYOSHI et al.	
FILING DATE December 18, 2002	GROUP 2684

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER								DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER								DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DCL		2000	0	4	9	6	6	3		02/2000	JAPAN			Abstract	
DCL		11	3	3	1	0	5	7		11/1999	JAPAN			Abstract	

DCL		**OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)**
		"HDR Reverse Link Proposal", E. Esteves, et al., *Qualcomm Inc.*, pgs. 1-10.
		International Search Report dated November 13, 2001.

EXAMINER [signature]	DATE CONSIDERED 4/7/04

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

Notice of References Cited	Application/Control No. 10/321,623	Applicant(s)/Patent Under Reexamination MIYOSHI ET AL.	
	Examiner DANH C LE	Art Unit 2683	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,564,074	10-1996	Juntti, Juhani	455/67.11
	B	US-2001/0038630	11-2001	Tong et al.	370/395
	C	US-RE37,870	10-2002	Nakano et al.	370/342
	D	US-2001/0050900	12-2001	Lee et al.	370/232
	E	US-2003/0043778	03-2003	Luschi et al.	370/349
	F	US-2002/0155861	10-2002	Sumasu et al.	455/561
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
tes in MM-YYYY format are publication dates. Classifications may be US or foreign.

#5
fd
6/15/04

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al.

Appln. No.: 10/321,623

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

Pursuant to Rules 56 and 99, Applicants hereby call the attention of the Patent Office to the documents listed on the attached Form PTO 1449. These references were cited in a Supplementary European Search Report dated March 5, 2004 (copy attached). US 980 corresponds to WO 325.

Applicants present this art so that the Patent Office may, in the first instance, determine any relevancy thereof to the presently claimed invention, see Beckman Instruments, Inc. v. Chemtronics, Inc., 439 F.2d 1369, 1380, 165 USPQ 355, 364 (5th Cir. 1970). Also see Patent Office Rules 104 and 106. Applicants respectfully request that this art be expressly considered during the prosecution of this application and made of record herein and appear among the "References Cited" on any patent to issue herefrom.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: June 7, 2004

JEL/mat

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FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
L9289.02149B	10/321,623
APPLICANT: Kenichi MIYOSHI, et al.	
FILING DATE: December 18, 2002	GROUP: 2683

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER								DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		6	6	0	3	9	8	0		08/2003	Kitagawa			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER								DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	NO
		0	9	8	6	2	8	2		03/2000	Europe				
		0	9	8	6	1	9	2		03/2000	Europe				
		0	0	1	3	3	2	5		03/2000	WO			Abstract	
		0	8	0	2	6	3	8		10/1997	Europe				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

European Search Report dated March 5, 2004

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

2683

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al. Art Unit: 2683

Appln. No.: 10/321,623

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

NOTICE OF CO-PENDING RELATED APPLICATION PURSUANT TO 37 CFR §1.56 MPEP 2001.06(b)

Assistant Commissioner of Patents
Washington, D. C. 20231

Sir:

Pursuant to 37 CFR §1.56 and MPEP 2001.06(b), the applicants hereby call to the attention of the Patent and Trademark Office the following application which may be deemed to be a co-pending related application to the present application:

(1) 10/321,500

It is requested that the prior art references from each application be reviewed by the examiner and made of record in each of the other applications. To assist the examiner, submitted herewith is an Information Disclosure Statement directed to making the art currently of record in each of the above-listed cases also of record in the present application.

Respectfully submitted,

Date: June 7, 2004

James E. Ledbetter
Registration No. 28,732

JEL/att

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application

Inventors: Kenichi MIYOSHI, et al. Art Unit: 2683

Appln. No.: 10/321,623

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

CERTIFICATION UNDER 37 CFR §1.97(e)(1)

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

In fulfillment of 37 CFR 1.97(c)(1) and 1.97(e)(1), it is hereby certified that each item of information contained in the attached Information Disclosure Statement was first cited in any communication (see the attached copy of a Foreign Search Report dated March 5, 2004) from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

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(19) Europäisches Patentamt
European Patent Office
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(11) EP 0 986 282 A1

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published in accordance with Art. 158(3) EPC

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(87) International publication number:
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Best Available Copy

(54) RADIO COMMUNICATION DEVICE AND METHOD OF CONTROLLING TRANSMISSION RATE

(57) The communication terminal apparatus measures reception quality and reports the measurement result to the base station apparatus, and the base station apparatus switches the transmission rate based on the reported result of the reception quality. In this way, the transmission rate is switched starting at the point in time at which the reception quality of the communication terminal apparatus deteriorates. Furthermore, the transmission rate is switched so that the amount of interference with others is within the allowable range according to the channel condition between the communication terminal apparatus and base station apparatus.

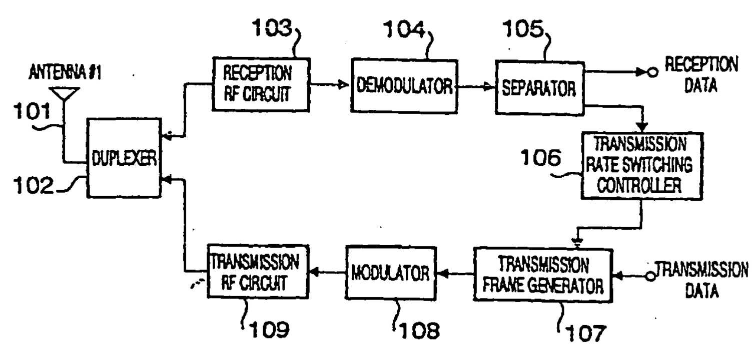


FIG. 1

EP 0 986 282 A1

Description

Technical Field

[0001] The present invention relates to a radio communication apparatus with a variable transmission rate and a transmission rate control method.

Background Art

[0002] A conventional radio communication apparatus is explained using a document "Performance of SIR-Based Transmit Power Control using Outer Loop in the forward Link of DS-CDMA (TECHNICAL REPORT OF IEICE AP96-148, EMCJ96-83, RCS96-162, MW96-188 (1997-02)." This document describes a transmission power control method in CDMA. The following is an explanation of this description.

[0003] In transmission power control, measurement of SIR indicating the reception quality and increment/decrement of transmission power are performed at every slot cycle (0.625 ms). In this case, if the measured SIR is greater than the target SIR a command to reduce transmission power is sent to the base station (transmission side) and if the measured values is smaller than the target SIR a command to increase transmission power is sent to the base station. The base station increments or decrements transmission power according to this command.

[0004] Furthermore, the base station controls the outer loop taking into account the fact that the target SIR to acquire the required quality (FER: Frame Error Rate) varies depending on the environment of a mobile station. To be more specific, FER is measured from decoded data. This FER is compared with the target FER in every several frames and if the measured value is greater, the target SIR is increased and if the measured value is smaller, the target SIR is reduced.

[0005] The prior art performs transmission power control not only by sending a transmission power control command to the transmitting side based on the SIR measured by the mobile station but also by changing the target SIR through outer loop control.

[0006] However, the prior art has the following problem. That is, the target SIR increases depending on the environment and transmission rate of the mobile station and the reception SIR sometimes decreases due to fading, etc. In such a case, the mobile station instructs the base station to increase transmission power to make the reception SIR come closer to the target SIR, considerably increasing transmission power of the base station to the mobile station, which is likely to increase interference with other mobile stations to an intolerable degree.

Disclosure of Invention

[0007] It is an objective of the present invention to provide a radio communication apparatus and transmission rate control method capable of controlling transmission power of a base station directed to a mobile station appropriately without being affected by the environment of the mobile station or transmission rate.

[0008] This objective is achieved by a radio communication apparatus and transmission rate control method that switch the transmission rate of a transmission signal based on reception quality information from the other end of communication, or according to the environment of the other end of communication and transmit the signals at the switched transmission rate.

Brief Description of Drawings

[0009]

FIG.1 is a block diagram showing a configuration of a base station apparatus according to Embodiment 1 of the present invention;

FIG.2 is a block diagram showing a configuration of a communication terminal apparatus that carries out a radio communication with the base station apparatus according to the embodiment above;

FIG.3 is a block diagram to explain a desired signal reception power measurement method in the communication terminal apparatus above;

FIG.4 is a block diagram to explain a method of measuring signal-to-interference plus noise ratio in the communication terminal apparatus above;

FIG.5 is a diagram to explain a method of signal-to-interference plus noise ratio in the communication terminal apparatus above;

FIG.6 is a data frame configuration diagram used in a communication by the base station apparatus of the present invention;

FIG.7 is another data frame configuration diagram used in a communication by the base station apparatus of the present invention;

FIG.8 is a sequence diagram between the base station apparatus and communication terminal apparatus of the present invention;

FIG.9 is another sequence diagram between the base station apparatus and communication terminal apparatus of the present invention;

FIG.10 is another sequence diagram between the base station apparatus and communication terminal apparatus of the present invention;

FIG.11 is another sequence diagram between the base station apparatus and communication terminal apparatus of the present invention;

FIG.12 is a flow chart to explain a transmission rate switching method in the base station apparatus according to the embodiment above;

FIG.13 is another flow chart to explain a transmission rate switching method in the base station apparatus according to the embodiment above;

FIG.14 is another flow chart to explain a transmission rate switching method in the base station apparatus according to the embodiment above;

FIG.15 is another flow chart to explain a transmission rate switching method in the base station apparatus according to the embodiment above;

FIG.16 is a block diagram showing a configuration of a base station apparatus according to Embodiment 2 of the present invention;

FIG.17 is a block diagram showing a configuration of a communication terminal apparatus that carries out a radio communication with the base station apparatus according to the embodiment above;

FIG.18 is a block diagram to explain a method of measuring desired signal reception power in the communication terminal apparatus above;

FIG.19 is a block diagram to explain a method of measuring signal-to-interference plus noise ratio in the communication terminal apparatus above;

FIG.20 is a flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.21 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.22 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.23 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.24 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.25 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.26 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.27 is another flow chart to explain a method of switching the transmission rate in the base station apparatus according to the embodiment above;

FIG.28 is a diagram to explain transmission rate control between layers in the base station apparatus of the present invention; and

FIG.29 is a flow chart to explain transmission rate control between layers in the base station apparatus of the present invention.

Best Mode for Carrying out the Invention

[0010] With reference now to the attached drawings, the embodiments of the present invention are explained in detail below.

(Embodiment 1)

[0011] FIG.1 is a block diagram showing a configuration of a base station apparatus according to Embodiment 1 of the present invention. In this base station apparatus, a signal received from antenna 101 is sent to reception RF circuit 103 via duplexer 102 to use a same antenna for both transmission and reception. At reception RF circuit 103, the reception signal is amplified and converted to an intermediate frequency or a baseband frequency.

[0012] The frequency-converted signal is demodulated by demodulator 104. The demodulation result is sent to separator 105, where it is separated into reception data and a signal for transmission rate switching control.

[0013] Transmission rate switching controller 106 sends a transmission rate switching signal to transmission frame generator 107 based on the received control signal. The operation of the transmission rate switching control circuit will be explained later.

[0014] Regarding transmission, the transmission data are modulated by modulator 108 and sent to transmission RF circuit 109. Transmission RF circuit 109 converts the frequency of the transmission data and then amplifies it. This transmission signal is sent from antenna 101 via duplexer 102.

[0015] FIG.2 is a block diagram showing a configuration of a communication terminal apparatus that carries out a radio communication with the base station apparatus according to Embodiment 1 of the present invention.

[0016] A signal received from antenna 201 is sent to reception RF circuit 203 via duplexer 202 to use a same antenna for both transmission and reception, where it is amplified and converted to an intermediate frequency or a baseband frequency. The frequency-converted signal is demodulated by demodulator 204. At the same time, the output signal of the reception RF circuit is sent to reception quality measurement circuit 205, where the reception quality is measured.

[0017] This reception quality includes, for example, received signal strength, desired signal reception power, signal to interference ratio (SIR), Signal-to-Interference plus Noise Ratio (hereinafter abbreviated as "SINR"). The received signal strength is obtained by measuring the power of reception RF. The use of the received signal strength makes the circuit configuration simplest and allows the use in an environment free of interference signals.

[0018] The reception power of a desired signal is measured by multiplying the reception signal by a known signal. In this case, if an interference signal exists, using the received signal strength alone would end up reporting the reception power of the desired signal and the interference signal, and this would mean that the reception power of a desired signal required by the terminal might not always be reported. Therefore, in order to measure and report the reception power of the desired signal required by the terminal, it is desirable to use SINR as the reception quality which is the most reliable information as an index to determine an error rate characteristic.

[0019] A measurement circuit for the desired signal reception power is shown in FIG.3. This circuit extracts the known pattern component of the reception signal; complex conjugate circuit 302 carries out a complex conjugate operation on the known pattern held by the base station; complex multiplication circuit 301 carries out a complex multiplication on the known pattern component of the reception signal and the known pattern subjected to the complex conjugate operation and calculates the position of the desired reception signal on the complex plane (position of the black circle in FIG.5); and power measurement circuit 303 measures the power from this calculation result.

[0020] On the other hand, an SINR measurement circuit is shown in FIG.4. This circuit extracts the known pattern component of the reception signal; complex conjugate circuit 402 carries out a complex conjugate operation on the known pattern held by the base station; complex multiplication circuit 401 carries out a complex multiplication on the known pattern component of the reception signal and the known pattern subjected to the complex conjugate operation and calculates the position of the desired reception signal on the complex plane (position of the black circle in FIG.5); and the power is measured from this calculation result. Furthermore, interference signal + noise power measurement circuit 404 measures interference signal power + noise power from a mean value of vector sum of squares between the position of each reception signal (position of the white circle in FIG.5) and position of the desired reception signal (position of the black circle in FIG.5). Furthermore, desired power measurement circuit 403 measures the desired power from the calculation result above. Then, ratio calculation circuit 405 calculates the ratio between the output of interference signal + noise power measurement circuit 404 and the output of desired power measurement circuit 403. SINR is calculated from this.

[0021] The reception quality measurement result calculated in this way is sent to multiplexing circuit 206. Multiplexing circuit 206 assigns the transmission data and reception quality measurement result to a transmission slot. Modulation circuit 207 modulates such transmission data and transmission RF circuit 208 converts the frequency and amplifies. This transmission signal is sent from antenna 201 via duplexer 202.

[0022] Here, how the transmission rate switching information is reported from the communication terminal apparatus to the base station apparatus is explained. There are two types of reporting; reporting all the time and reporting on an as-needed basis. Since the first method performs reporting all the time, it can switch the transmission rate with high precision but the amount of communication increases.

[0023] In the case of voice communications, voice information (message) is often transmitted multiplexed with control information in one slot as shown in FIG.6. Therefore, reporting all the time is possible in voice communications or low-speed data communications.

[0024] In the latter method, only a small amount of communication is required because reporting is performed only when required. It is desirable to use this method for packet communications to realize high-speed data communications. In packet communications, intermittent information is sent in a short time. Thus, as shown in FIG.7(a) and FIG.7(b), control information is not multiplexed in a slot but a flag indicating whether it is a message or control information is used. FIG.7(a) shows a case where a flag is set to indicate a message. FIG.7(b) shows a case where a flag is set to indicate control information.

[0025] Then, the timing for switching the transmission rate is explained. There are four methods of timing for switching the transmission rate as shown below:

[0026] The first method is explained using FIG.8. While the transmission terminal apparatus is measuring the reception quality, there are moments the reception quality deteriorates drastically. In a mobile communication environment, in the case of non-line-of-sight (non-LOS) communication called "shadowing", for example, the received signal strength decreases drastically by 10 dB or more. While monitoring such a situation, reporting is made when the reception quality deteriorates drastically. Upon reception of this reception quality report, the base station apparatus switches the transmission rate. When the reception quality improves, which is measured on the communication terminal side periodically or by a demand from the base station, the base station apparatus switches the transmission rate to the original transmission rate . The timing at which the reception quality deteriorates or improves drastically can be detected by performing threshold judgment on the reception quality such as reception field density, for example.

[0027] Then, the second method is explained using FIG.9. The base station apparatus measures the reception quality. If the reception quality deteriorates drastically, this can be determined as non-LOS communication called "shadowing." Shadowing is determined by the position of the antenna of the communication terminal apparatus and the antenna of the base station apparatus and not affected by differences in the carrier frequency. Therefore, in such a case, it is possible that the reception quality will also deteriorate drastically in the communication terminal apparatus. Thus, the base station apparatus sends a request for reporting the reception quality to the communication terminal apparatus. The communication terminal apparatus measures the reception quality and reports it to the base station apparatus. The base station apparatus performs transmission rate switching control according to the reported reception quality. When the reception quality improves, which is measured on the communication terminal side periodically or by a request from the base, the base station apparatus switches the transmission rate to the original transmission rate. The timing at which the reception quality deteriorates or improves drastically can be detected by performing threshold judgment on the reception quality, for example, received signal strength.

[0028] Then, the third method is explained using FIG.10. If there is an error in the message received, the communication terminal apparatus issues a retransmission request. The base station apparatus sends a request for reporting the reception quality to the communication terminal apparatus when the communication terminal apparatus issues a retransmission request. The communication terminal apparatus measures the reception quality and reports it to the base station apparatus. The base station apparatus performs transmission rate switching control according to the reported reception quality. For example, if the reported reception quality measured by the communication terminal apparatus is lower than a predetermined value, the base station apparatus switches the transmission rate. When the reception quality improves, which is measured on the communication terminal side periodically or by a demand from the base station, the base station apparatus switches the transmission rate to the original transmission rate. The timing at which the reception quality deteriorates or improves drastically can be detected by performing threshold judgment on the reception quality, for example, received signal strength.

[0029] Then, the fourth method is explained using FIG.11. The base station apparatus monitors the transmission power of itself. The base station apparatus controls the transmission power based on a transmission power control signal sent from the communication terminal apparatus, and if the quality of transmission from the base station apparatus to the communication terminal apparatus deteriorates, the communication terminal apparatus requests an increase of transmission power. If this request is judged to be excessive transmission power taking into account the amount of interference with others, the base station apparatus performs transmission rate switching control. Judgment of excessive transmission power can be performed by threshold judgment, for example. Moreover, if a predetermined allowable amount of transmission power has been secured, then the base station apparatus switches the transmission rate to the original transmission rate. This predetermined allowable amount of transmission power is determined appropriately according to the amount of transmission rate controlled. For example, if the transmission rate is reduced to 1/2, the transmission rate is switched when at least an allowable amount of 3 dB has been secured.

[0030] By the way, combining some of the 4 methods above can eliminate delays in switching the transmission rate and perform delicate control.

[0031] Thus, the reception quality measurement result of the downlink signal transmitted from the base station apparatus shown in FIG.1 is measured by the communication terminal apparatus in FIG.2 and reported to the base station on the uplink. The base station switches the transmission rate based on the reception quality measured and received on the uplink by the transmission terminal apparatus.

[0032] Here, the operation of the transmission rate switching control circuit is explained in detail. FIG.12 is a flow chart of the transmission rate switching control circuit. In ST11, the base station apparatus compares the reception quality measurement result reported from the communication terminal apparatus with threshold 1. Here, a case when SIR is used as the reception quality is explained, but the same applies when the received signal strength, desired signal reception power or SINR is used. This threshold 1 is set according to the transmission rate, but in a CDMA communication system, it is set according to the spreading factor or the number of multiplexing codes.

[0033] If the reception quality measurement result (SIR) is greater than threshold 1, the same transmission rate is used. If SIR is smaller than threshold 1, the channel condition is determined to be bad and the transmission rate is changed to a 1/2 transmission rate (ST12).

[0034] Moreover, as shown in FIG.13, the base station apparatus compares the reception quality measurement result reported from the communication terminal apparatus with threshold 1 (ST21) and if SIR is greater than threshold 1, the same transmission rate is used. If SIR is smaller than threshold 1, the transmission rate is switched to such a transmission rate that SIR is greater than threshold 1 (ST22). In CDMA, the spreading factor is switched. Thus, SIR exceeds threshold 1 and more accurate control can be performed on varying reception quality. This makes it possible to improve the reception quality of the other end of communication even if the condition of the communication path with the other end of communication deteriorates drastically and reduce the amount of interference with others because the target reception quality is reduced and transmission power is reduced. Therefore, it is possible to enhance the effect of switching the transmission rate.

[0035] Moreover, as shown in FIG.14, the base station apparatus compares the reception quality measurement result reported from the communication terminal apparatus with threshold 2 (ST31) and if SIR is smaller than threshold 2, the same transmission rate is used and if SIR is greater than threshold 2, the channel condition is determined to be good and the transmission rate is switched to a double transmission rate (1/2 spreading factor)(ST32). Here, threshold 2 corresponds to a double transmission rate and is set greater than threshold 1. Thus, while the channel condition is good, the transmission rate is increased to transmit as much data as possible. That is, if the condition of the communication path with the other end of communication is good, faster transmission is possible while maintaining the reception quality of the other end of communication.

However, since the transmission power does not increase, interference with others does not increase.

[0036] Moreover, as shown in FIG.15, threshold n is set (ST41) and the base station apparatus compares the reception quality measurement result reported from the communication terminal apparatus with threshold n (ST42). If SIR is smaller than threshold n, threshold n is switched to threshold n+1 corresponding to the next fastest transmission rate (ST43). If SIR is greater than threshold n, the nth fastest transmission rate (spreading factor) is set (ST44). That is, the transmission rate is switched to such a transmission rate that SIR is set to a value between threshold n and threshold n+1 corresponding to the two transmission rates. Threshold n corresponds to the nth fastest transmission rate and is greater than threshold n+1. In this case, the fastest transmission is possible on condition that the reception quality be satisfied. This allows more accurate control over the transmission rate according to the channel condition.

[0037] Using such a method, it is possible to switch the transmission rate of the base station according to the reception quality of the communication terminal apparatus. This not only avoids the reception quality of the other end of communication from continuing to be bad but also reduces transmission power because the target reception quality reduces, which reduces interference with others. Therefore, it is possible to control the transmission power of the base station to the communication terminal apparatus appropriately without being affected by the environment of the communication terminal apparatus and transmission speed.

(Embodiment 2)

[0038] FIG.16 is a block diagram showing a configuration of a base station apparatus according to Embodiment 2 of the present invention.

[0039] In this bass station apparatus, a signal received from antenna 101 is sent to reception RF circuit 103 via duplexer 102 to use a same antenna for both transmission and reception. At reception RF circuit 103, the reception signal is amplified and converted to an intermediate frequency or a baseband frequency.

[0040] The frequency-converted signal is demodulated by demodulator 104. The demodulation result is sent to separation circuit 105, where it is separated into reception data and transmission power control signal.

[0041] Transmission rate switching control circuit 106 sends a transmission rate switching signal to transmission frame generator 107 based on the transmission power control signal. The operation of the transmission rate switching control circuit will be explained later.

[0042] Regarding transmission, the transmission data are modulated by modulation circuit 108 and sent to transmission RF circuit 109. Transmission RF circuit 109 converts the frequency of the transmission data. This transmission signal is sent from antenna 101 via duplexer 102.

[0043] FIG.17 is a block diagram showing a configuration of a communication terminal apparatus that carries out a radio communication with the base station apparatus according to Embodiment 2 of the present invention.

[0044] A signal received from antenna 201 is sent to reception RF circuit 203 via duplexer 202 to use a same antenna for both transmission and reception, where it is amplified and converted to an intermediate frequency or a baseband frequency. The frequency-converted signal is demodulated by demodulator 204. At the same time, the output signal of the reception RF circuit is sent to transmission power control value calculation circuit 205, where the transmission power control signal is determined.

[0045] This transmission power control signal includes, for example, received signal strength, desired signal reception power, signal to interference ratio (SIR), and signal-to-interference plus noise ratio. Moreover, concerning the amount of information sent as a transmission power signal, there are cases with 2 pieces of information on whether to increase/decrease the transmission power, 3 pieces of information on whether to increase/maintain/decrease the transmission power or 4 or more pieces of information with more detailed setting of the amount of control than the above cases.

[0046] First, the case where the control information consists of 2 pieces of information is explained. If the received signal strength is based, the power of reception RF is measured. If the measured power is greater than a threshold, a control signal is generated so that the transmission power from the base station is reduced and if the measured power is smaller than the threshold, the control signal is created so that the transmission power from the base station is increased. Such a method based on the received signal strength has the simplest circuit configuration. Furthermore, this method can be used in an environment where there is no interference signal.

[0047] If the desired signal reception power is based, the reception signal is measured by multiplying the reception signal by a known signal. If an interference signal exists, using the received signal strength alone would not mean that the reception power of the desired signal and that of the interference signal have been reported. Therefore, it is necessary to measure and report the reception power of the desired signal required by the communication terminal apparatus. Thus, it is desirable to use SINR as the reception quality, which is the most reliable information as an index to determine error rate characteristics.

[0048] The desired signal reception power measurement circuit is shown in FIG.18. This circuit extracts the known pattern component of the reception signal; complex conjugate circuit 302 carries out a complex conjugate operation on the known pattern held by the base station; complex multiplication circuit 301 carries out a complex multiplication and calculates the position of the desired reception signal on the complex plane (position of the black circle in FIG.5); and power measurement circuit 303 measures the power based on this calculation result. If the power measured by comparison circuit 1801 is greater than threshold 3, a control signal is generated so that the transmission power from the base station is reduced and if the measured power is smaller than threshold 3, the control signal is generated so that the transmission power from the base station is increased.

[0049] On the other hand, an SINR measurement circuit is shown in FIG.19. This circuit extracts the known pattern component of the reception signal; complex conjugate circuit 402 carries out a complex conjugate operation on the known pattern held by the base station; complex multiplication circuit 401 carries out a complex multiplication and calculates the position of the desired reception signal on the complex plane (position of the black circle in FIG.5); and the power is measured based on this calculation result. Furthermore, interference signal + noise power measurement circuit 404 measures interference signal power + noise power from a mean value of vector sum of squares between the position of each reception signal (position of the white circle in FIG.5) and position of the desired reception signal (position of the black circle in FIG.5). Furthermore, desired power measurement circuit 403 measures desired power. Then, ratio calculation circuit 405 calculates the ratio between the output of interference signal power + noise power measurement circuit 404 and the output of desired power measurement circuit 403. If the power ratio measured by comparison circuit 1901 is greater than threshold 3, a control signal is generated so that the transmission power from the base station is reduced and if the measured power ratio is smaller than threshold 3, a control signal is generated so that the transmission power from the base station is increased.

[0050] Then, the case where the control information has 3 pieces of information is explained. In the case of 3 pieces of information, threshold 3 and threshold 4 which is greater than threshold 3, are used as thresholds. If the power ratio measured is smaller than threshold 3, a control signal is generated so that the transmission power from the base station is increased. If the measured power ratio is greater than threshold 3 and smaller than threshold 4, a control signal is generated so that the transmission power from the base station is retained. If the measured power ratio is greater than threshold 4, a control signal is generated so that the transmission power from the base station is reduced.

[0051] Moreover, if the control information has 4 or more pieces of information, the number of thresholds is set to (number of control information pieces - 1) to determine control information divided into smaller pieces through threshold judgment based on comparison among a plurality of thresholds.

[0052] The transmission power control information calculated in this way is sent to multiplexing circuit 206. Multiplexing circuit 206 assigns the transmission data and transmission power control information to a transmission slot. Modulation circuit 207 modulates such transmission data and transmission RF circuit 208 converts the frequency and amplifies the transmission data. This transmission signal is sent from antenna 201 via duplexer 202.

[0053] Thus, the transmission power control signal based on the reception quality of the downlink signal transmitted from the base station apparatus shown in FIG.16 is generated by the communication terminal apparatus shown in FIG.17 and reported to the base station apparatus on the uplink. The base station apparatus switches the transmission rate based on the transmission power control signal measured by the communication terminal apparatus received on the uplink.

[0054] Here, the operation of the transmission rate switching control circuit is explained in detail. FIG.20 is a flow chart showing transmission rate switching control. The base station apparatus estimates the reception quality by accumulating the transmission power control information reported from the communication terminal apparatus (ST51) and compares it with threshold 1 (ST52). This threshold 1 is set according to the transmission rate but in the CDMA communication system, it is set according to the spreading factor or the number of multiplexing codes.

[0055] If reception quality estimated value (SIR estimated value) is greater than threshold 1, the channel condition is determined to be good and the same transmission rate is used. If the SIR estimated value is smaller than threshold 1, the channel condition is determined to be bad and the transmission rate is switched to a 1/2 transmission rate (×2 spreading factor)(ST53).

[0056] Thus, the transmission rate is switched based on the channel estimation result, making it possible to reduce interference with others. Furthermore, the use of the transmission power control bit for channel estimation can reduce the amount of information to be sent from the other end of communication without the need for special control information about transmission rate control.

[0057] Furthermore, as shown in FIG.21, the base station apparatus estimates the reception quality by accumulating the transmission power control information reported from the communication terminal apparatus (ST61) and compares it with threshold 1 (ST62). If the SIR estimated value is greater than threshold 1, the channel condition is determined to be good and the same transmission rate is used. If the SIR estimated value is smaller then threshold 1, the channel condition is determined to be bad and SIR may be changed to such a transmission rate that SIR is greater than threshold 1 (ST63). This allows more accurate control over varying reception quality. That is, it is possible not only to improve the reception quality of the other end of communication even if the channel condition with the other end of communication deteriorates drastically but also to reduce the transmission power because the target reception quality reduces, also reducing interference with others. Therefore, it is possible to enhance the effect of transmission rate switching.

[0058] As shown in FIG.22, the base station apparatus estimates the reception quality by accumulating the transmission power control information reported from the communication terminal apparatus (ST71) and compares it with threshold 2 (ST72). If the SIR estimated value is smaller than threshold 2, the channel condition is determined to be bad and the same transmission rate is used. If the SIR estimated value is greater than threshold 2, the channel condition is determined to be good and the transmission rate may be switched to a double transmission rate (1/2 spreading factor) (ST73). Threshold 2 corresponds to a double transmission rate and is greater than threshold 1.

[0059] In this way, while the channel condition is good, the transmission rate is increased to transmit as much data as possible. That is, if the channel condition with the other end of communication is good, faster transmission is possible while maintaining the reception quality of the other end of communication. By the way, since transmission power is not increased, interference with others does not increase.

[0060] As shown in FIG.23, the base station apparatus estimates (ST82) the reception quality by accumulating the transmission power control information reported from the communication terminal apparatus by setting threshold n (ST81) and compares it with threshold n (ST84). If the SIR estimated value is smaller than threshold n, threshold n is changed to threshold n+1, which corresponds to the next fastest transmission rate (ST83). If the SIR estimated value is greater than threshold n, the nth fastest transmission rate (spreading factor) is set (ST85). That is, a transmission rate is selected so that the SIR estimated value is between threshold n and threshold n+1 corresponding to two transmission rates. Threshold n corresponds to the nth fastest transmission rate and is greater than threshold n+1. In this case, the fastest transmission is possible on condition that the reception quality be satisfied. This allows more accurate control of transmission rate according to the channel condition.

[0061] Furthermore, the operation of another transmission rate switching control circuit is explained. As shown in FIG.24, for example, the base station apparatus determines the required transmission power based on the transmission power control information reported from the communication terminal apparatus. This transmission power is compared with threshold 4 (ST91).

[0062] This threshold 4 is determined according to the amount of interference with others generated by increasing the limit value or transmission power of the transmitter. Threshold 4 is also set according to the transmission rate, but in the CDMA communication system it is set according to the spreading factor or the number of multiplexing codes. That is, if transmission is performed with ×16 spreading or ×256 spreading, there is a ×16 difference in terms of spreading factor and so the threshold of transmission power at ×16 spreading is 16 times the threshold of transmission power at ×256 spreading. The same applies to the number of multiplexing codes.

[0063] If the transmission power is smaller than threshold 4, the same transmission rate is used. If the transmission power is greater than threshold 4, interference with others is determined to be great and the transmission rate is switched to a 1/2 transmission rate (×2 spreading factor) (ST92). This allows the optimal or fastest transmission on condition that interference with others be within the allowable range.

[0064] Furthermore, as shown in FIG.25, the base station apparatus determines the required transmission power based on the transmission power control information reported from the communication terminal apparatus. This transmission power is compared with threshold 4 (ST101) and if the transmission power is smaller than threshold 4, the same transmission rate is used and if the transmission power is greater than threshold 4, interference with others is determined to be great and a transmission rate (spreading factor) is selected so that the transmission power is smaller than threshold 4 (ST102). This can prevent an excessive amount of interference from generating.

[0065] Furthermore, as shown in FIG.26, the base station apparatus determines the required transmission power based on the transmission power control information reported from the communication terminal apparatus. This transmission power is compared with threshold 5 (ST111) and if the transmission power is greater than threshold 5, the same transmission rate is used and if the transmission power is smaller than threshold 5, interference with others is determined to be small and the transmission rate may be switched to a double transmission rate (1/2 spreading factor) (ST112). Here, threshold 5 corresponds to a double transmission rate and is smaller than threshold 4.

[0066] Furthermore, as shown in FIG.27, threshold n is set (ST121) and the base station apparatus compares the transmission power based on the transmission power control information reported from the communication terminal apparatus with threshold n (ST123). If the transmission power is greater than threshold n, threshold n is changed to threshold n+1, which corresponds to the next fastest transmission rate (ST122). If the transmission power is smaller than threshold n, the nth fastest transmission rate (spreading factor) is set (ST124). That is, a transmission rate is selected so that the transmission power is a value between threshold n and threshold n+1 corresponding to two transmission rates. Threshold n corresponds to the nth fastest transmission rate and is smaller than threshold n+1. In this case, the fastest transmission is possible on condition that the amount of interference with others be controlled within a certain range.

[0067] Furthermore, the base station sets transmission power in various ways; transmitting with the transmission power prior to switching every time the transmission rate is switched, transmitting with the transmission power prior to switching reduced by a certain value and transmitting with the transmission power prior to switching increased by a certain value.

[0068] The first method is valid to reliably improve the communication quality for the terminal. In the configuration of the present embodiment, a transmission power control signal input to transmission rate switching control circuit 106 can be sent to transmission RF circuit 109. Transmission RF circuit 109 controls increase/decrease of the transmission power based on the transmission power control signal.

[0069] The second method is a method of setting transmission power by subtracting a certain value from the transmission power when switching the transmission rate. This is because the transmission power possibly reaches a great value when the channel is improved for the terminal, generating great interference with other terminals. In this configuration of the embodiment, the transmission power control signal input to transmission rate switching control circuit 106 can be changed to such a control signal that the transmission power is reduced by a certain value when switching the transmission rate. Transmission RF circuit 109 controls increase/decrease of the transmission power based on the transmission power control signal. In this case, the transmission power control accumulated value also needs to be reduced by a certain value.

[0070] The third method is a method of increasing the transmission power within the allowable range of interference with others and is valid to improve the communication quality. In the configuration of this embodiment, the transmission power control signal input to transmission rate switching control circuit 106 can be changed to such a control signal that the transmission power is increased by a certain value when the transmission rate is switched. In this case, the transmission power control accumulated value also needs to be increased by a certain value.

[0071] For a certain value to decrease, in the CDMA system for example, transmission with power reduced by 3dB allows one additional communication terminal apparatus communicating with a similar spreading factor.

[0072] Furthermore, together with the transmission power control information, the reception quality information can also be reported from the communication terminal apparatus using the method explained in Embodiment 1. The method of reporting from the communication terminal apparatus to the base station apparatus and its timing are the same as those in Embodiment 1.

[0073] Transmission rate switching control is normally performed based on the accumulated value of transmission power control information and if the reception quality on the communication terminal apparatus side deteriorates drastically, the reception quality information is reported from the communication terminal apparatus to the base station apparatus and the base station apparatus performs transmission rate switching control.

[0074] Furthermore, the base station apparatus sends a request for measurement of the reception quality to the communication terminal apparatus at the timing at which the communication terminal apparatus generates a request for resend of ARQ control information, etc., and the communication terminal apparatus measures the reception quality and reports it to the base station apparatus. The base station apparatus performs transmission rate switching based on the reception quality reported.

[0075] Then, the control between layers in the transmission rate control method described in Embodiments 1 and 2 above is explained. FIG.28 is a diagram to explain how the transmission rate is controlled between layers.

[0076] In this control, as shown in FIG.28, allowable transmission power (Pallow) set in a radio resource control (RRC) layer of layer 3 is sent to layer 1 (physical layer). In layer 1, average transmission power is compared with allowable transmission power (Pallow). Then, a message (MPHY-STATUS) such as "Allowable transmission power has been reached" or "Allowable transmission power has been exceeded" or "Average transmission power is X dB below allowable transmission power" is indicated from layer 1 to the medium access control (MAC) layer of layer 2. The allowable transmission power is appropriately set by the radio resource control layer (layer 3) according to the system load such as the traffic condition.

[0077] Here, the message "Allowable transmission power has been reached" or "Allowable transmission power has been exceeded" indicates that the channel condition is determined to be bad and it is necessary to lower the transmission rate. On the other hand, the message "Average transmission power is X dB below allowable transmission power" indicates that the channel condition is recovered and the transmission rate can be increased.

[0078] Details of control are explained using FIG.29. Here, a case with the downlink is explained. First, the radio resource control layer monitors the downlink traffic condition and determines the initial transmission rate on the downlink through negotiation between the radio resource control layer (layer 3) and medium access control layer (layer 2). Then, a communication is started.

[0079] During a communication, in ST131, at least one frame of average transmission power (Pave) is monitored in layer 1. The transmission rate is controlled according to this channel condition.

[0080] First, this average transmission power (Pave) is compared with allowable transmission power (Pallow) and the difference between these two (D = Pallow - Pave) is obtained. Then, in ST132, it is determined whether average transmission power (Pave) exceeds allowable transmission power (Pallow) or not. If average transmission power (Pave) exceeds allowable transmission power (Pallow), a message "Allowable transmission power has been reached" or "Allowable transmission power has been exceeded" is indicated in ST133.

[0081] According to this message, the transmission rate is lowered in medium access control layer (layer 2) and total (average) transmission power is reduced in layer 1. This reduces interference with other communication terminals.

[0082] If average transmission power (Pave) does not exceed allowable transmission power (Pallow), it is determined whether the difference is at least a predetermined value (Pstep) in ST134. This Pstep is a power step corresponding to the difference between the changed transmission rate and original transmission rate when the transmission rate is lowered.

[0083] If difference (D) between average transmission power (Pave) and allowable transmission power (Pallow) is smaller than predetermined value (Pstep), the same transmission rate is used. If difference (D) between average transmission power (Pave) and allowable transmission power (Pallow) is greater than predetermined value (Pstep), layer 1 indicates a message "Average transmission power is X dB below allowable transmission power" in ST135. Then, according to this message, medium access control layer (layer 2) increases the transmission rate and layer 1 increases the total transmission power within the range of XdB. This makes it possible to immediately send the transmission signal that has been buffered due to the lowered transmission rate.

[0084] In FIG.29, it is only determined whether the transmission rate is "increased" or "maintained" or "lowered," but judgment is not limited to this; it is also possible to freely set a command to make the transmission rate variable beyond this limitation.

[0085] Then, a case where the aforementioned transmission rate control is actually performed is explained. According to the existing method of changing the transmission rate, the downlink is designated for burst transmission and the uplink is designated for continuous transmission. Therefore, the transmission rate is changed according to this. That is, transmission power itself is not changed on the downlink, and, for example, transmission is performed only in the first half of a frame, and on the uplink, transmission power is lowered and transmission is performed through rate matching without perforating the frame. The medium access control layer (layer 2) selects the transmission rate among a rate set specified by the radio resource control layer (layer 3). At this time, the physical layer (layer 1) creates and adds a word indicating the current transmission rate as instructed by the medium access control layer (layer 2).

[0086] Furthermore, when each base station performs the transmission rate control above separately, negotiation is required when diversity handover takes place. For example, a method by which all base stations select a specific transmission rate through negotiation in the upper layer and another method by which no transmission rate control is performed during diversity handover are possible examples of this.

[0087] The explanation above describes the case where the parameter monitored in layer 1 is transmission power, but FER, SIR or interference power can also be used as the parameter monitored in layer 1.

[0088] The explanation above describes the case where the transmission rate control shown in FIG.29 is performed on the downlink, but the transmission rate control shown in FIG.29 can also be applied to the uplink.

[0089] Transmission rate control on the downlink is used to reduce interference with others but transmission rate control on the uplink is not only used to reduce interference with others but also used to achieve power saving or when there are hardware restrictions.

[0090] Embodiments 1 and 2 above describe the apparatus shown in FIG.1 and FIG.16 as the base station apparatus and the apparatus shown in FIG.2 and FIG.17 as the communication terminal apparatus, but the present invention is also applicable to the case where the apparatus shown in FIG.1 and FIG.16 is the communication terminal apparatus and the apparatus shown in FIG.2 and FIG.17 is the base station apparatus.

[0091] Furthermore, Embodiments 1 and 2 describe the case with a transmission rate set to ×2 or 1/2, but in the present invention, the transmission rate can also be set to other magnifications according to various conditions.

[0092] As explained above, in the radio communication apparatus and transmission rate control method of the present invention, the base station can switch the transmission rate of the base station based on a transmission power control signal of the base station that the terminal has determined by measuring the reception quality. This allows appropriate control by the base station over transmission power to the mobile station without being affected by the environment of the mobile station or transmission speed.

[0093] This application is based on the Japanese Patent Application No.HEI 10-107300, entire content of which is expressly incorporated by reference herein.

Industrial Applicability

[0094] The present invention is applicable to a base station apparatus and communication terminal apparatus in a digital radio communication system.

Claims

1. A radio communication apparatus comprising:

   transmission rate switching means for switching a transmission rate of a transmission signal based on reception quality information from the other end of communication; and
   transmission means for transmitting a transmission signal at the switched transmission rate.

2. The radio communication apparatus according to claim 1, wherein the transmission rate switching means selects a 1/2 transmission rate when the reception quality measurement result of the reception quality information is smaller than a first threshold.

3. The radio communication apparatus according to claim 1, wherein the transmission rate switching means selects a transmission rate at which the reception quality measurement result becomes greater than the first threshold when the reception quality measurement result of the reception quality information is smaller than the first threshold.

4. The radio communication apparatus according to claim 3, wherein the transmission rate switching means selects a double transmission rate when the reception quality measurement result is greater than a second threshold which is greater than said first threshold.

5. The radio communication apparatus according to claim 1, wherein the transmission rate switching means selects a transmission rate that meets the reception quality of the reception quality measurement result in the reception quality information and at the same time allows the fastest transmission.

6. A radio communication apparatus comprising:

   reception quality estimation means for estimating the reception quality of the other end of communication based on transmission power control information of said other end of communication;
   transmission rate switching means for switching the transmission rate of a transmission signal based on this reception quality estimation result; and
   transmission means for transmitting the transmission signal at the switched transmission rate.

7. The radio communication apparatus according to claim 6, wherein the reception quality estimation means estimates the reception quality by accumulating the transmission power control information and the transmission rate switching means selects a 1/2 transmission rate when the reception quality estimation result is smaller than a threshold.

8. The radio communication apparatus according to claim 6, wherein the reception quality estimation means estimates the reception quality by accumulating the transmission power control information and the transmission rate switching means selects a transmission rate at which the reception quality becomes greater than the first threshold when the reception quality estimation result is smaller than the first threshold.

9. The radio communication apparatus according to claim 8, wherein the reception quality estimation means estimates the reception quality by accumulating the transmission power control signal and the transmission rate switching means selects a double transmission rate when the reception quality estimation result is greater than a second threshold which is greater than the first threshold.

10. The radio communication apparatus according to claim 6, wherein the reception quality estimation means estimates the reception quality by accumulating the transmission power control signal and the transmission rate switching means selects a transmission rate that meets the reception quality of the reception quality estimation result and at the same time allows the fastest transmission.

11. A radio communication apparatus comprising:

    transmission rate switching means for switching a transmission rate of a transmission signal based on transmission power control information from the other end of communication; and
    transmission means for transmitting the transmission signal at the switched transmission rate.

12. The radio communication apparatus according to claim 11, wherein the transmission rate switching means selects a 1/2 transmission rate when the transmission power in the transmission power control information is greater than a threshold.

13. The radio communication apparatus according to claim 11, wherein the transmission rate switching means selects a transmission rate at which the transmission power becomes smaller than a first threshold when the transmission power in the transmission power control information is greater than the first threshold.

14. The radio communication apparatus according to claim 13, wherein the transmission rate switching means selects a double transmission rate when the transmission power is smaller than a second threshold which is smaller than said first threshold.

15. The radio communication apparatus according to claim 11, wherein the transmission rate switching means switches the transmission rate so that the transmission power in the transmission power control information is within a predetermined range.

16. The radio communication apparatus according to claim 2, wherein the threshold is set according to the transmission rate in communication.

17. The radio communication apparatus according to claim 2, using a CDMA communication system and setting a threshold according to the spreading factor.

18. The radio communication apparatus according to claim 2, using a CDMA communication system and setting a threshold according to the number of multiplexing codes.

19. A radio communication system comprising:

a first radio communication apparatus comprising reception quality measuring means for measuring reception quality and transmission means for transmitting information including this reception quality; and
a second radio communication apparatus comprising transmission rate switching means for switching a transmission rate based on said reception quality.

20. The radio communication system according to claim 19, wherein the second radio communication apparatus comprises transmission power control means for controlling the transmission power of the first radio communication apparatus based on the reception quality measurement result.

21. The radio communication system according to claim 20, wherein the first radio communication apparatus comprises reception quality estimation means for estimating the reception quality of said other end of communication based on the transmission power control information from the second radio communication apparatus.

22. The radio communication system according to claim 19, wherein the first radio communication apparatus transmits information to the second radio communication apparatus all the time.

23. The radio communication system according to claim 19, wherein the first radio communication apparatus transmits information to the second radio communication apparatus only when required.

24. The radio communication system according to claim 23, wherein the second radio communication apparatus switches the transmission rate when the reception quality measured by the first radio communication apparatus deteriorates.

25. The radio communication system according to claim 23, wherein, when the reception quality of the second radio communication apparatus deteriorates, the second radio communication apparatus requests the first radio communication apparatus to send information including the reception quality.

26. The radio communication system according to claim 23, wherein the first radio communication apparatus requests the second radio communication apparatus to resend the information including the reception quality when the reception signal contains an error and the second radio communication apparatus, upon reception of the resend request, requests the first radio communication apparatus to send the information including the reception quality.

27. The radio communication system according to claim 19, wherein the transmission rate switching means switches the transmission rate when the transmission rate switching means receives a report that the transmission power is excessive from the second radio communication apparatus.

28. A transmission rate control method comprising the steps of:

comparing allowable transmission power set in a first layer with average transmission power obtained in a second layer, which is lower than said first layer;
indicating a change or no change in a transmission rate in said second layer according to said comparison result; and
changing the transmission rate in a third layer which is higher than said second layer and lower than said first layer according to a change or no change in said transmission rate.

29. The transmission rate control method according to claim 28, wherein said first layer is instructed to lower the transmission rate when said average transmission power is greater than said allowable transmission power.

30. The transmission rate control method according to claim 28, wherein said first layer is instructed to increase the transmission rate when said average transmission power is smaller than said allowable transmission power by a predetermined amount or more.

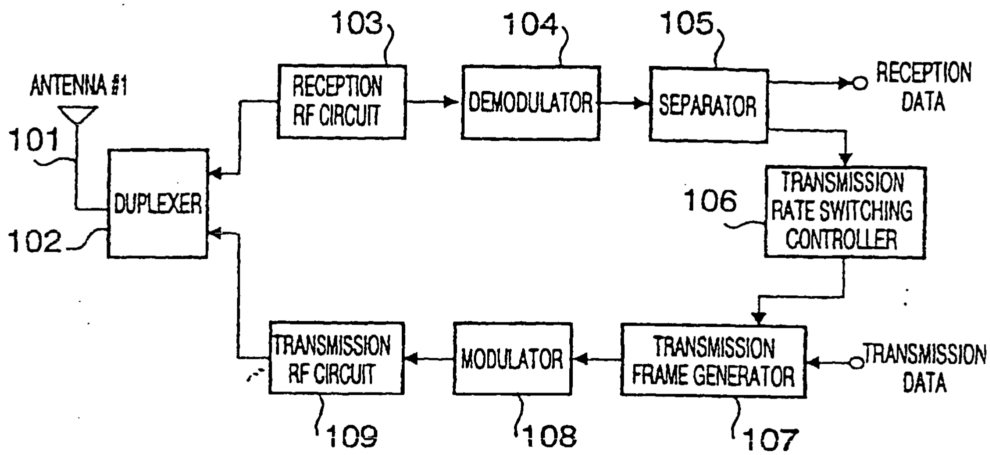

103
104
105
ANTENNA #1
RECEPTION RF CIRCUIT
DEMODULATOR
SEPARATOR
RECEPTION DATA
101
DUPLEXER
102
106
TRANSMISSION RATE SWITCHING CONTROLLER
TRANSMISSION RF CIRCUIT
MODULATOR
TRANSMISSION FRAME GENERATOR
TRANSMISSION DATA
109
108
107

FIG. 1

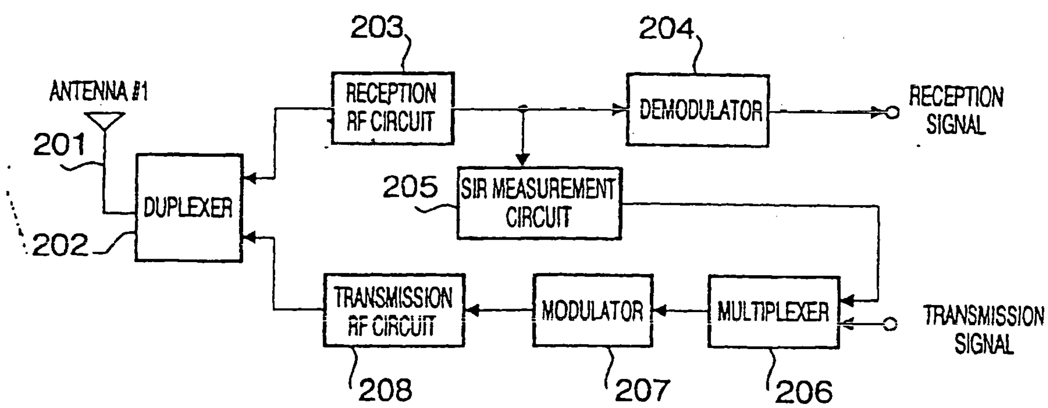

203
204
ANTENNA #1
RECEPTION RF CIRCUIT
DEMODULATOR
RECEPTION SIGNAL
201
DUPLEXER
202
205
SIR MEASUREMENT CIRCUIT
TRANSMISSION RF CIRCUIT
MODULATOR
MULTIPLEXER
TRANSMISSION SIGNAL
208
207
206

FIG. 2

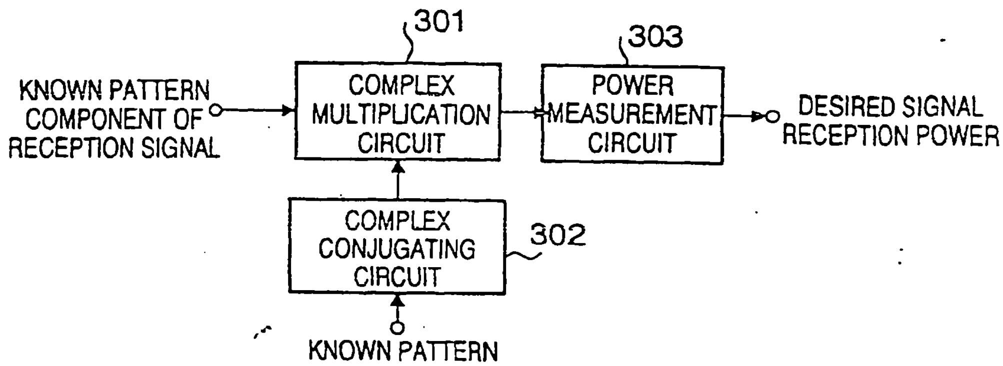

301
303
KNOWN PATTERN COMPONENT OF RECEPTION SIGNAL
COMPLEX MULTIPLICATION CIRCUIT
POWER MEASUREMENT CIRCUIT
DESIRED SIGNAL RECEPTION POWER
COMPLEX CONJUGATING CIRCUIT
302
KNOWN PATTERN

FIG. 3

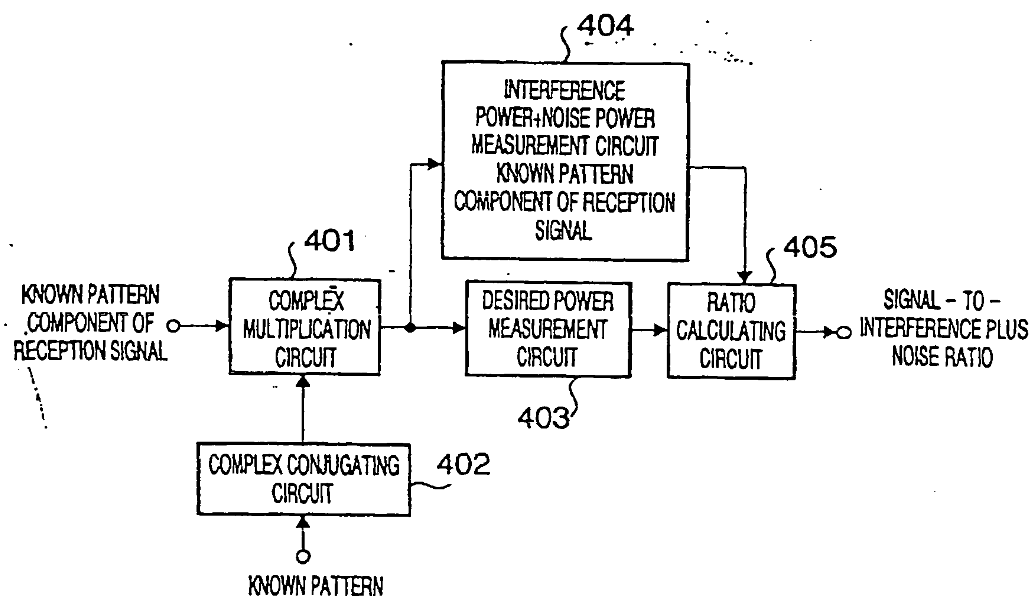

404
INTERFERENCE POWER+NOISE POWER MEASUREMENT CIRCUIT KNOWN PATTERN COMPONENT OF RECEPTION SIGNAL
401
405
KNOWN PATTERN COMPONENT OF RECEPTION SIGNAL
COMPLEX MULTIPLICATION CIRCUIT
DESIRED POWER MEASUREMENT CIRCUIT
RATIO CALCULATING CIRCUIT
SIGNAL - TO - INTERFERENCE PLUS NOISE RATIO
403
COMPLEX CONJUGATING CIRCUIT
402
KNOWN PATTERN

FIG. 4

FIG. 5

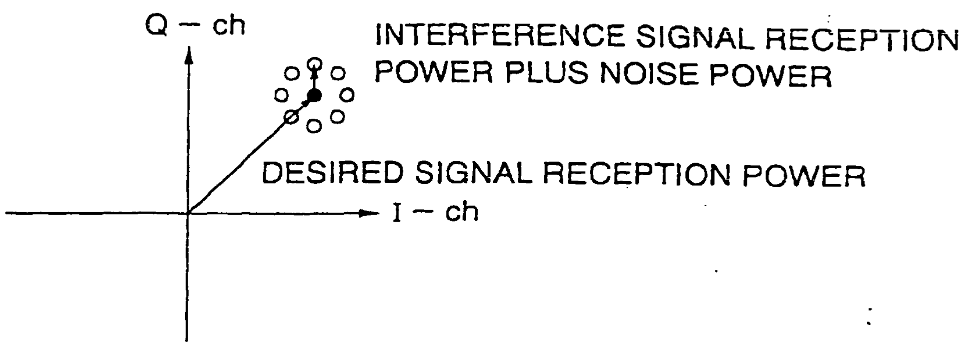
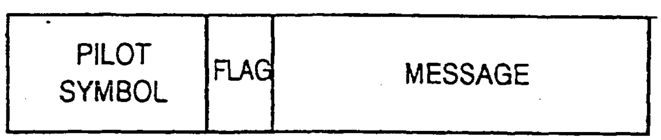
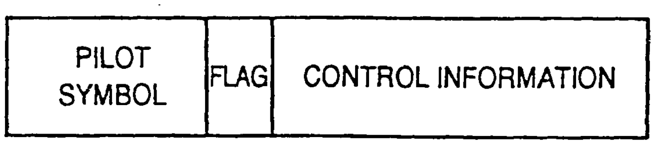


FIG. 6

FIG. 7

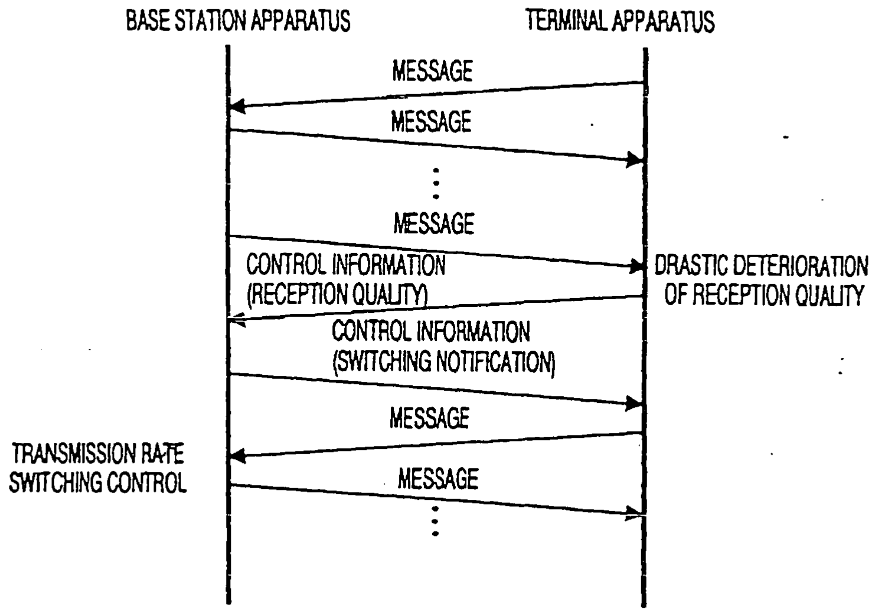


(a) WHEN FLAG = MESSAGE



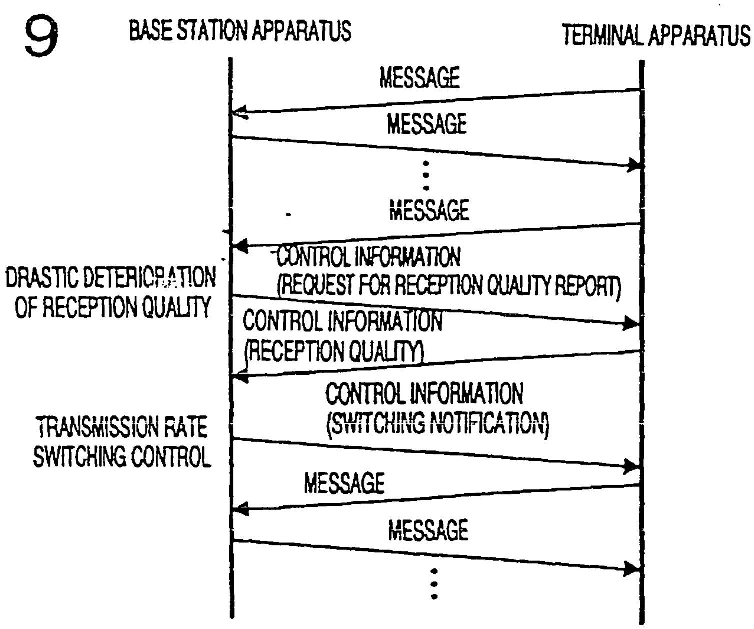
(b) WHEN FLAG = CONTROL INFORMATION

FIG. 8



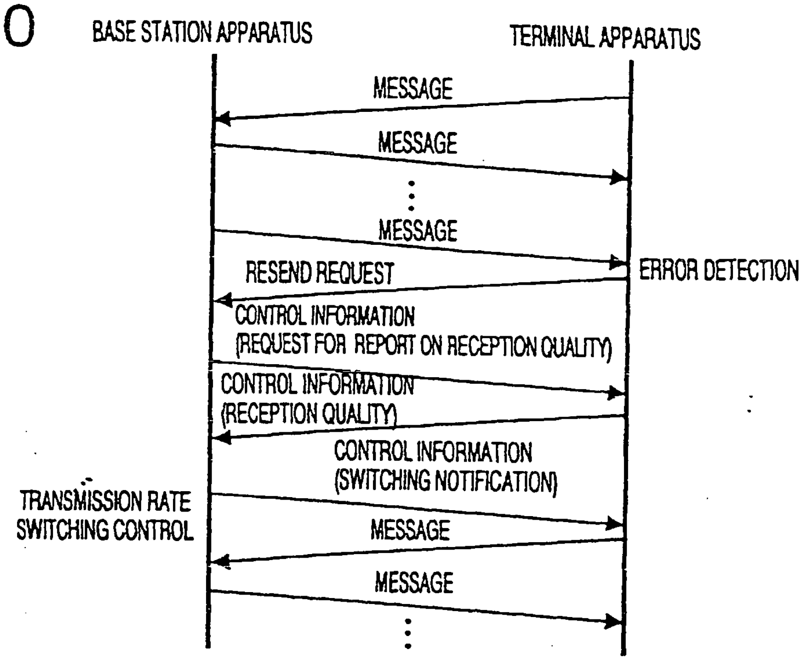
WHEN TERMINAL APPARATUS STARTS TO REPORT UPON RECEPTION OF RECEPTION QUALITY MEASUREMENT RESULT

FIG. 9



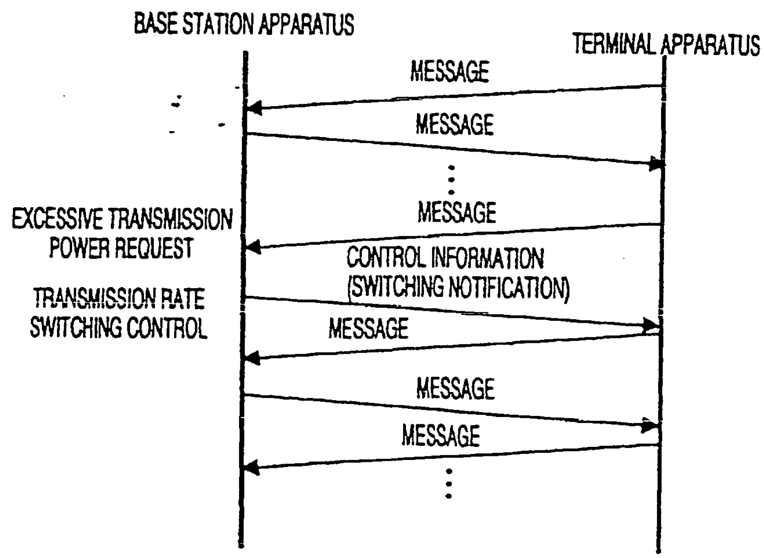
WHEN BASE STATION APPARATUS STARTS TO REQUEST FOR REPORT ON RECEPTION QUALITY TO TERMINAL UPON RECEPTION OF RECEPTION QUALITY MEASUREMENT RESULT

FIG. 10



WHEN BASE STATION APPARATUS STARTS TO REQUEST FOR REPORT ON RECEPTION QUALITY TO TERMINAL UPON RECEPTION OF RESEND REQUEST FROM TERMINAL

FIG. 11



WHEN BASE STATION APPARATUS STARTS TRANSMISSION RATE SWITCHING CONTROL BASED ON OWN TRANSMISSION POWER

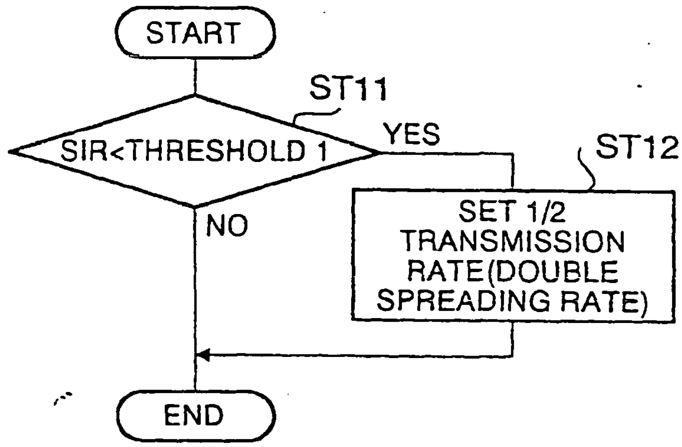

START
ST11
SIR<THRESHOLD 1
YES
ST12
SET 1/2 TRANSMISSION RATE(DOUBLE SPREADING RATE)
NO
END

FIG. 12

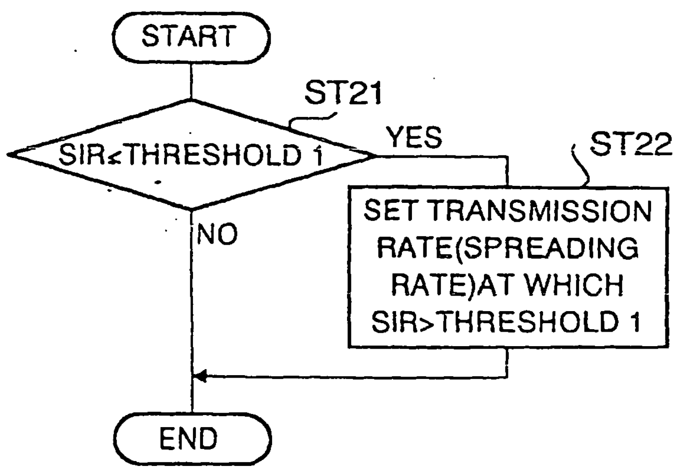

START
ST21
SIR≤THRESHOLD 1
YES
ST22
SET TRANSMISSION RATE(SPREADING RATE)AT WHICH SIR>THRESHOLD 1
NO
END

FIG. 13

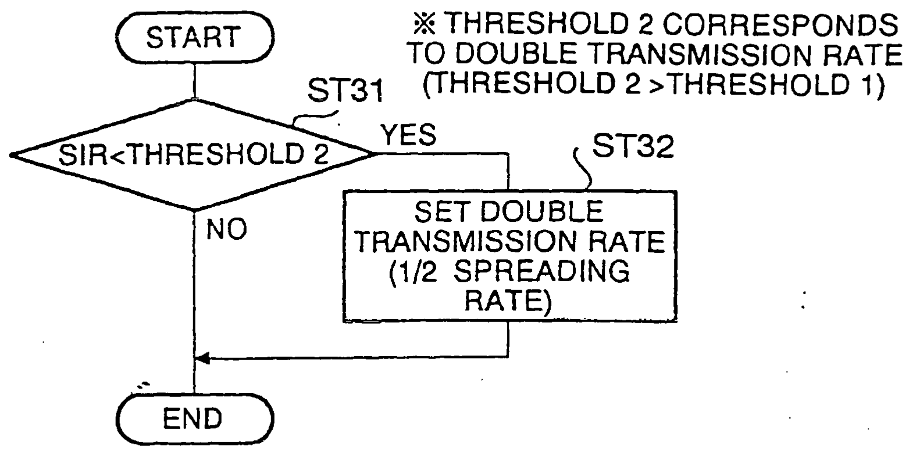

START
※ THRESHOLD 2 CORRESPONDS TO DOUBLE TRANSMISSION RATE (THRESHOLD 2 >THRESHOLD 1)
ST31
SIR<THRESHOLD 2
YES
ST32
SET DOUBLE TRANSMISSION RATE (1/2 SPREADING RATE)
NO
END

FIG. 14

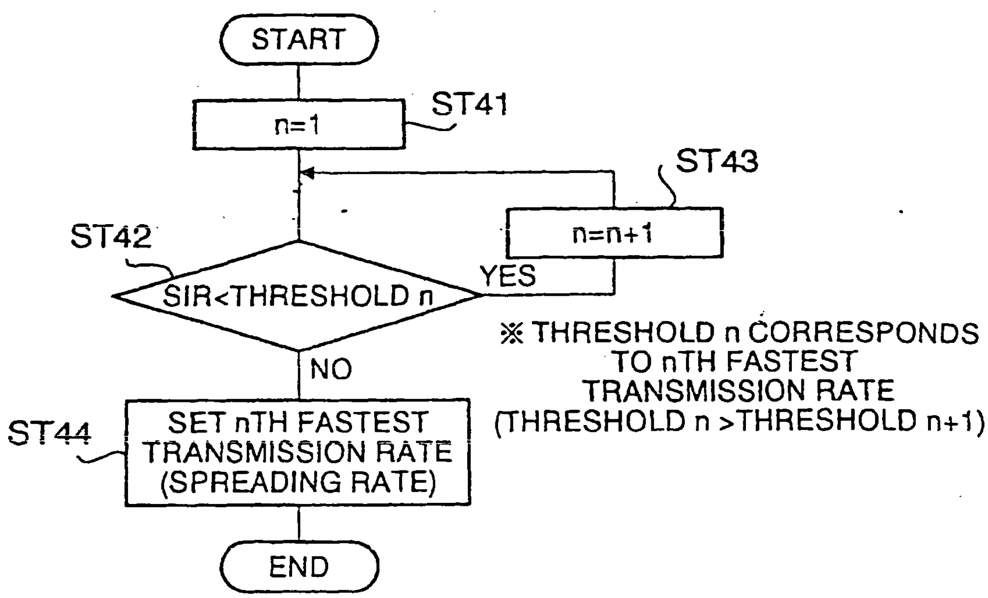

START
n=1
ST41
ST43
n=n+1
ST42
SIR<THRESHOLD n
YES
※ THRESHOLD n CORRESPONDS TO nTH FASTEST TRANSMISSION RATE (THRESHOLD n >THRESHOLD n+1)
NO
ST44
SET nTH FASTEST TRANSMISSION RATE (SPREADING RATE)
END

FIG. 15

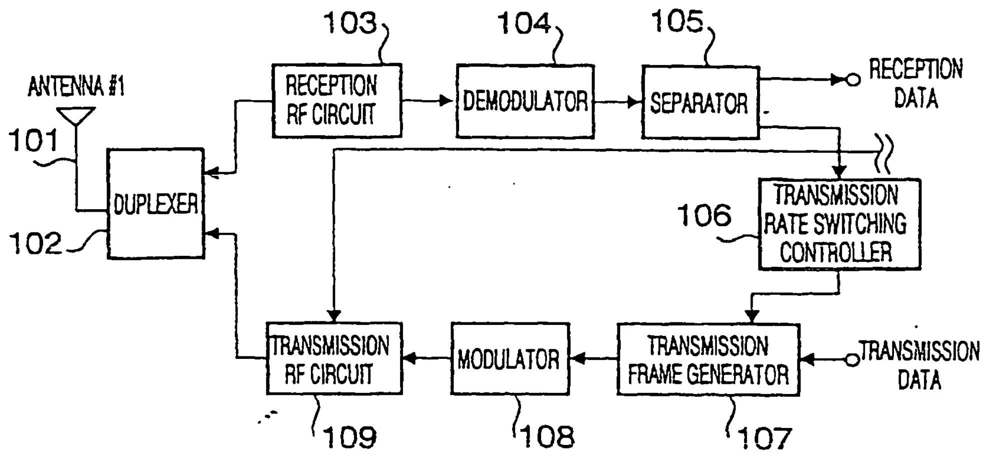

103
104
105
ANTENNA #1
RECEPTION RF CIRCUIT
DEMODULATOR
SEPARATOR
RECEPTION DATA
101
DUPLEXER
102
106
TRANSMISSION RATE SWITCHING CONTROLLER
TRANSMISSION RF CIRCUIT
MODULATOR
TRANSMISSION FRAME GENERATOR
TRANSMISSION DATA
109
108
107

FIG. 16

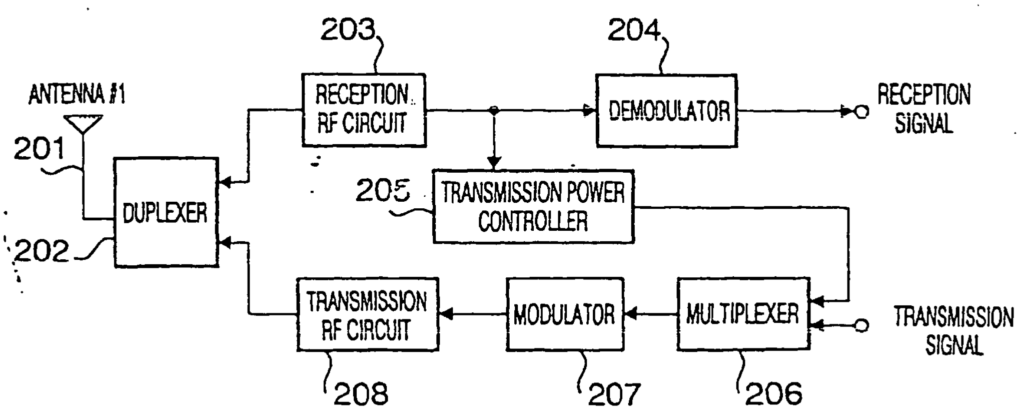

203
204
ANTENNA #1
RECEPTION RF CIRCUIT
DEMODULATOR
RECEPTION SIGNAL
201
DUPLEXER
202
205
TRANSMISSION POWER CONTROLLER
TRANSMISSION RF CIRCUIT
MODULATOR
MULTIPLEXER
TRANSMISSION SIGNAL
208
207
206

FIG. 17

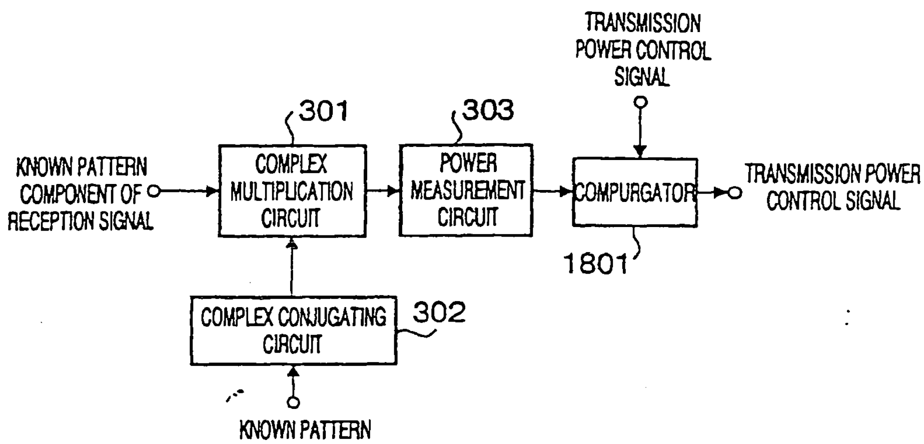

TRANSMISSION POWER CONTROL SIGNAL
301
303
KNOWN PATTERN COMPONENT OF RECEPTION SIGNAL
COMPLEX MULTIPLICATION CIRCUIT
POWER MEASUREMENT CIRCUIT
COMPURGATOR
TRANSMISSION POWER CONTROL SIGNAL
1801
COMPLEX CONJUGATING CIRCUIT
302
KNOWN PATTERN

FIG. 18

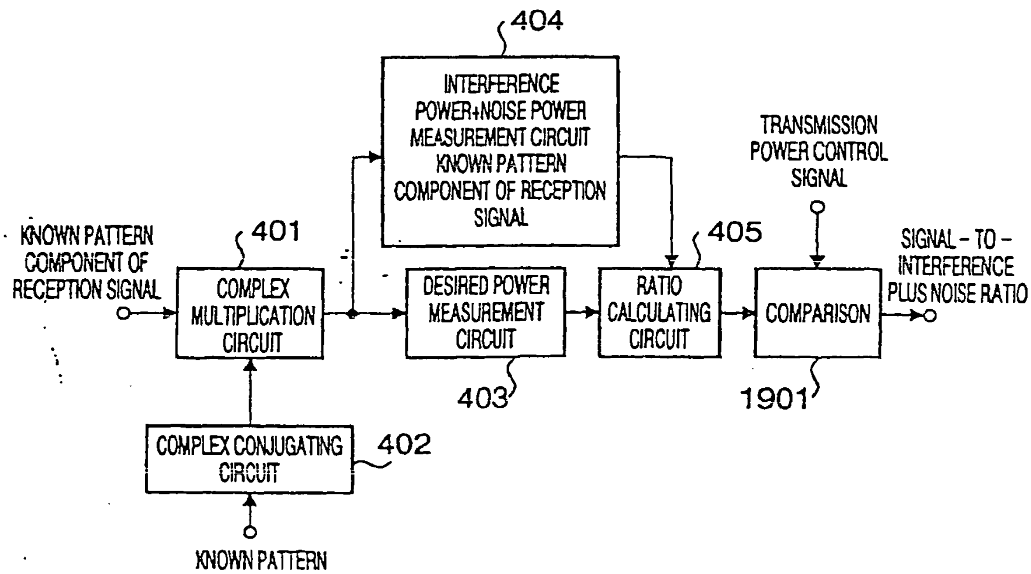

404
INTERFERENCE POWER+NOISE POWER MEASUREMENT CIRCUIT KNOWN PATTERN COMPONENT OF RECEPTION SIGNAL
TRANSMISSION POWER CONTROL SIGNAL
KNOWN PATTERN COMPONENT OF RECEPTION SIGNAL
401
405
SIGNAL - TO - INTERFERENCE PLUS NOISE RATIO
COMPLEX MULTIPLICATION CIRCUIT
DESIRED POWER MEASUREMENT CIRCUIT
RATIO CALCULATING CIRCUIT
COMPARISON
403
1901
COMPLEX CONJUGATING CIRCUIT
402
KNOWN PATTERN

FIG. 19

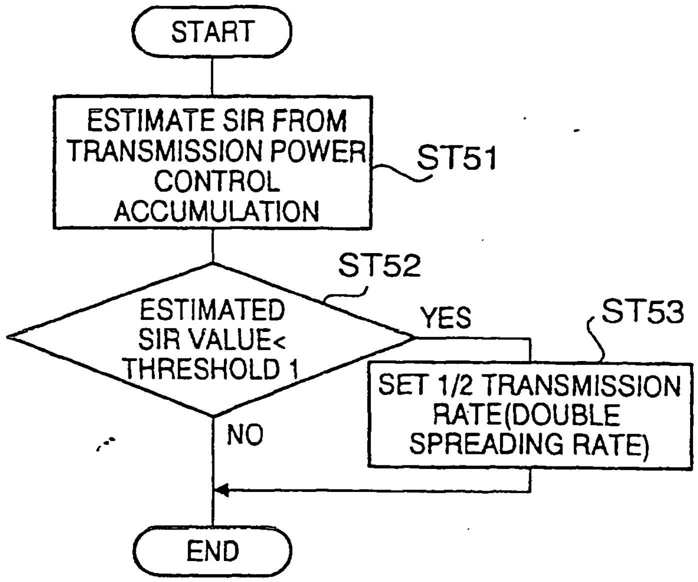

START
ESTIMATE SIR FROM TRANSMISSION POWER CONTROL ACCUMULATION
ST51
ST52
ESTIMATED SIR VALUE< THRESHOLD 1
YES
ST53
SET 1/2 TRANSMISSION RATE(DOUBLE SPREADING RATE)
NO
END

FIG. 20

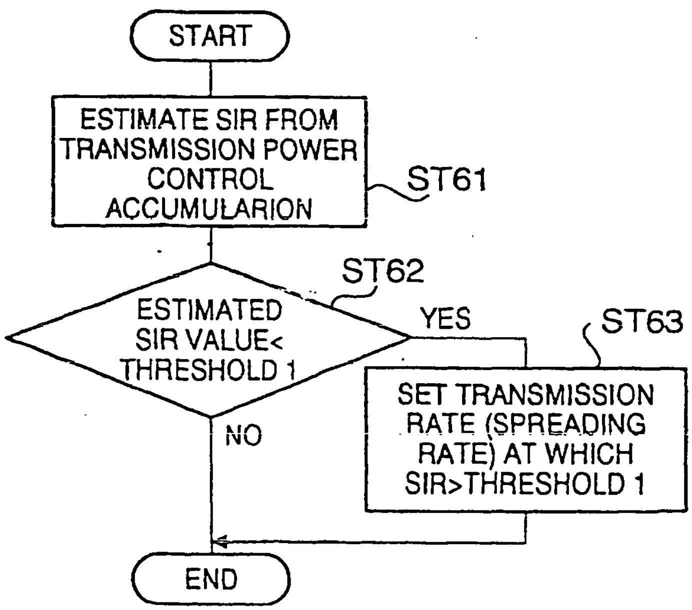

START
ESTIMATE SIR FROM TRANSMISSION POWER CONTROL ACCUMULARION
ST61
ST62
ESTIMATED SIR VALUE< THRESHOLD 1
YES
ST63
SET TRANSMISSION RATE (SPREADING RATE) AT WHICH SIR>THRESHOLD 1
NO
END

FIG. 21

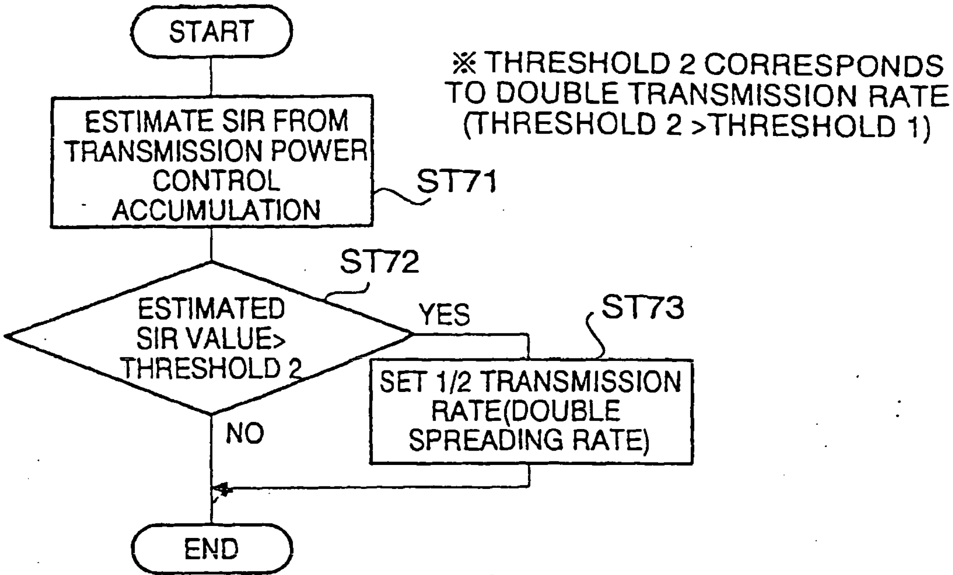

START
ESTIMATE SIR FROM TRANSMISSION POWER CONTROL ACCUMULATION
ST71
ST72
ESTIMATED SIR VALUE> THRESHOLD 2
YES
ST73
SET 1/2 TRANSMISSION RATE(DOUBLE SPREADING RATE)
NO
END
※ THRESHOLD 2 CORRESPONDS TO DOUBLE TRANSMISSION RATE (THRESHOLD 2 >THRESHOLD 1)

FIG. 22

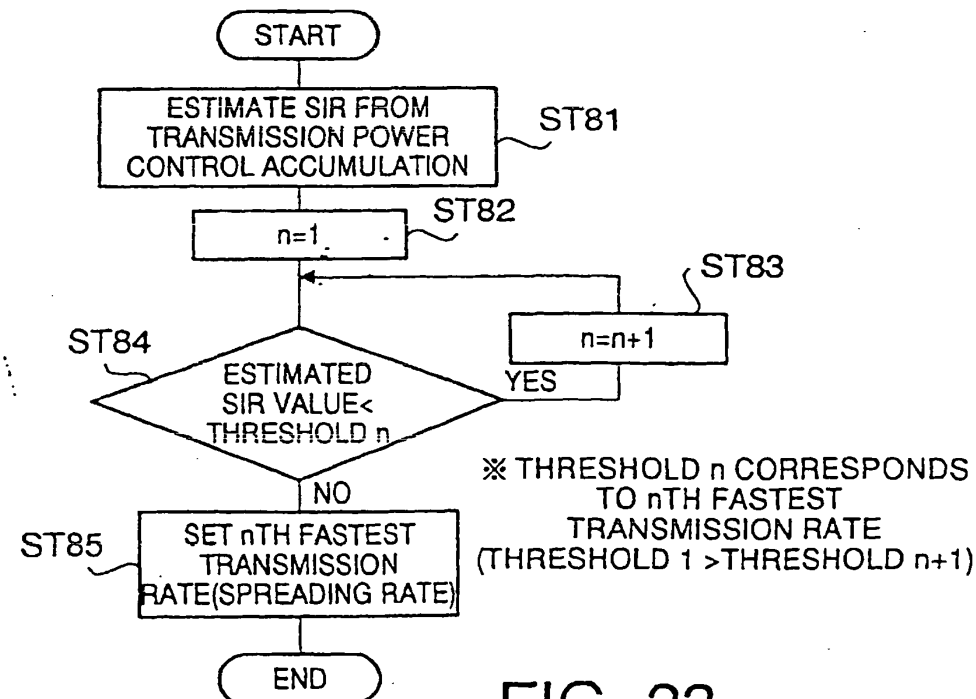

START
ESTIMATE SIR FROM TRANSMISSION POWER CONTROL ACCUMULATION
ST81
n=1
ST82
ST83
n=n+1
ST84
ESTIMATED SIR VALUE< THRESHOLD n
YES
NO
※ THRESHOLD n CORRESPONDS TO nTH FASTEST TRANSMISSION RATE (THRESHOLD 1 >THRESHOLD n+1)
ST85
SET nTH FASTEST TRANSMISSION RATE(SPREADING RATE)
END

FIG. 23

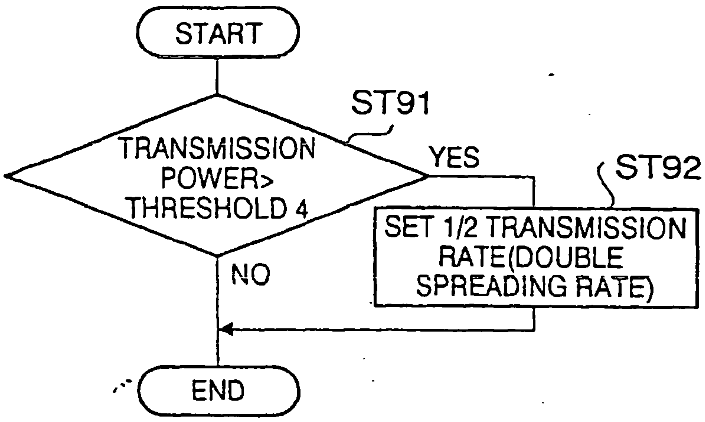

START
ST91
TRANSMISSION POWER> THRESHOLD 4
YES
NO
ST92
SET 1/2 TRANSMISSION RATE(DOUBLE SPREADING RATE)
END

FIG. 24

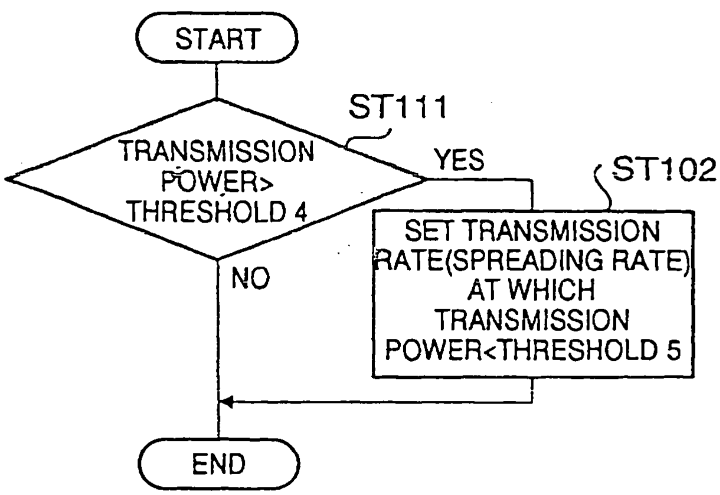

START
ST111
TRANSMISSION POWER> THRESHOLD 4
YES
NO
ST102
SET TRANSMISSION RATE(SPREADING RATE) AT WHICH TRANSMISSION POWER<THRESHOLD 5
END

FIG. 25

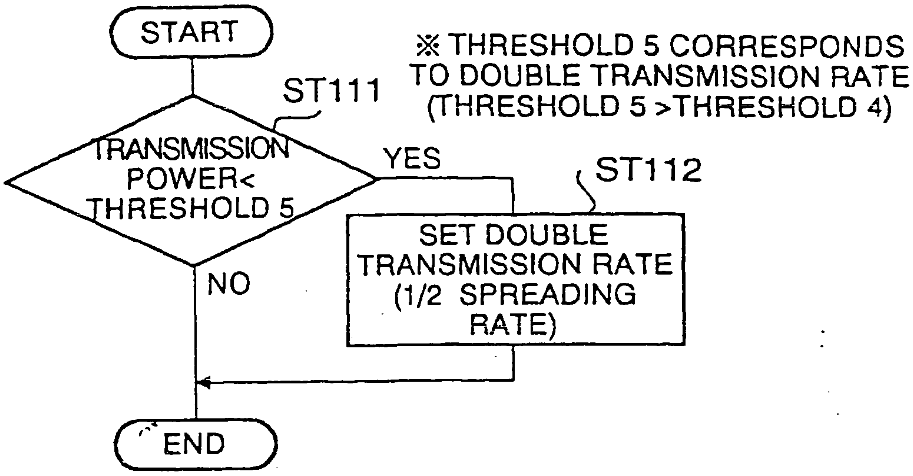

START
ST111
TRANSMISSION POWER< THRESHOLD 5
YES
NO
ST112
SET DOUBLE TRANSMISSION RATE (1/2 SPREADING RATE)
END
※ THRESHOLD 5 CORRESPONDS TO DOUBLE TRANSMISSION RATE (THRESHOLD 5 >THRESHOLD 4)

FIG. 26

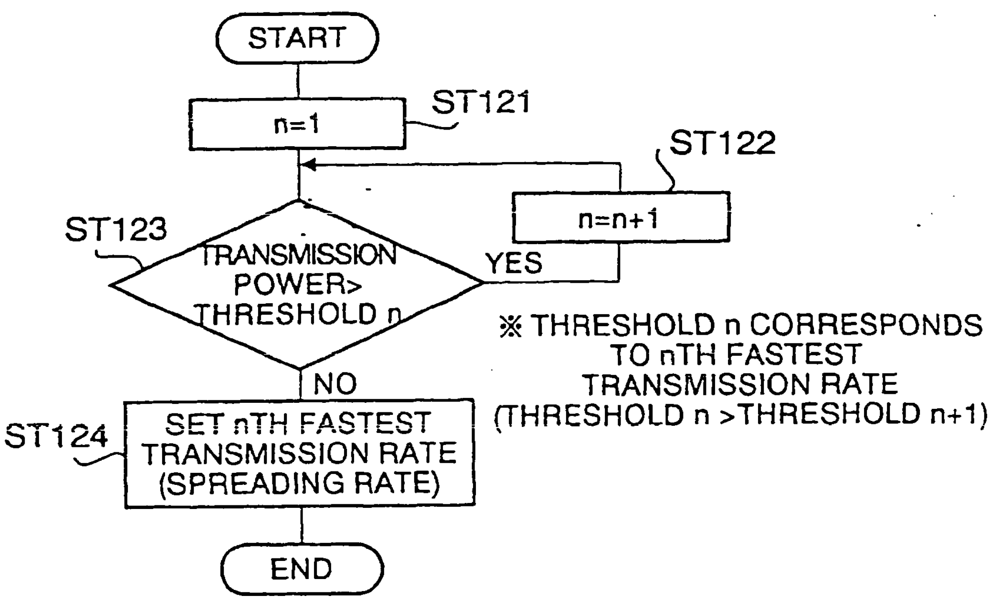

START
ST121
n=1
ST122
n=n+1
ST123
TRANSMISSION POWER> THRESHOLD n
YES
NO
ST124
SET nTH FASTEST TRANSMISSION RATE (SPREADING RATE)
END
※ THRESHOLD n CORRESPONDS TO nTH FASTEST TRANSMISSION RATE (THRESHOLD n >THRESHOLD n+1)

FIG. 27

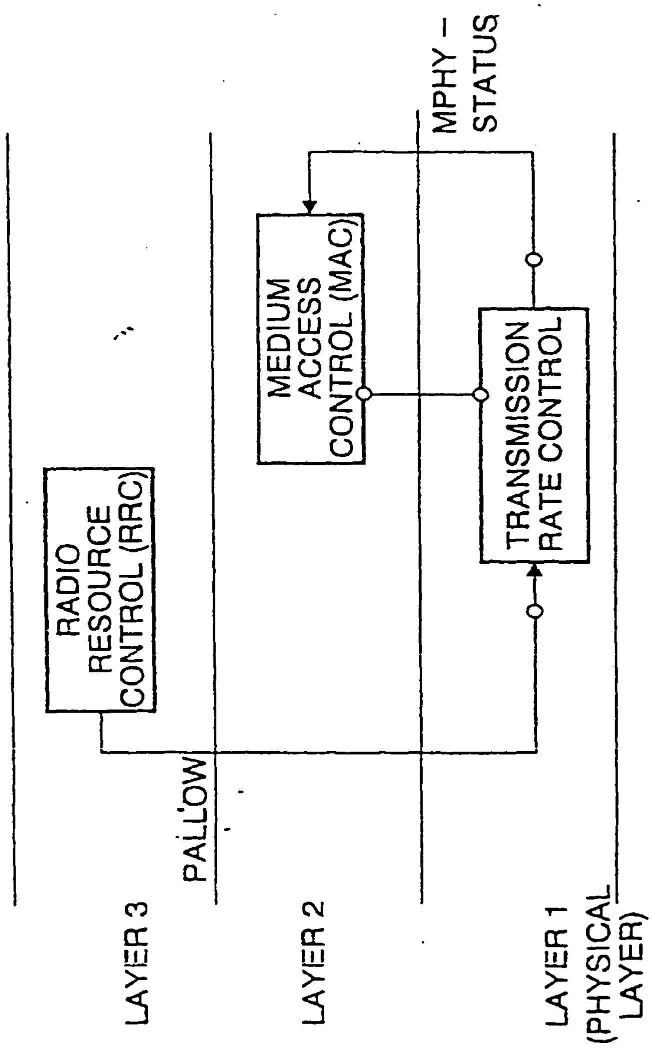

MPHY –
STATUS
RADIO
RESOURCE
CONTROL (RRC)
MEDIUM
ACCESS
CONTROL (MAC)
TRANSMISSION
RATE CONTROL
PALLOW
LAYER 3
LAYER 2
LAYER 1
(PHYSICAL
LAYER)

FIG. 28

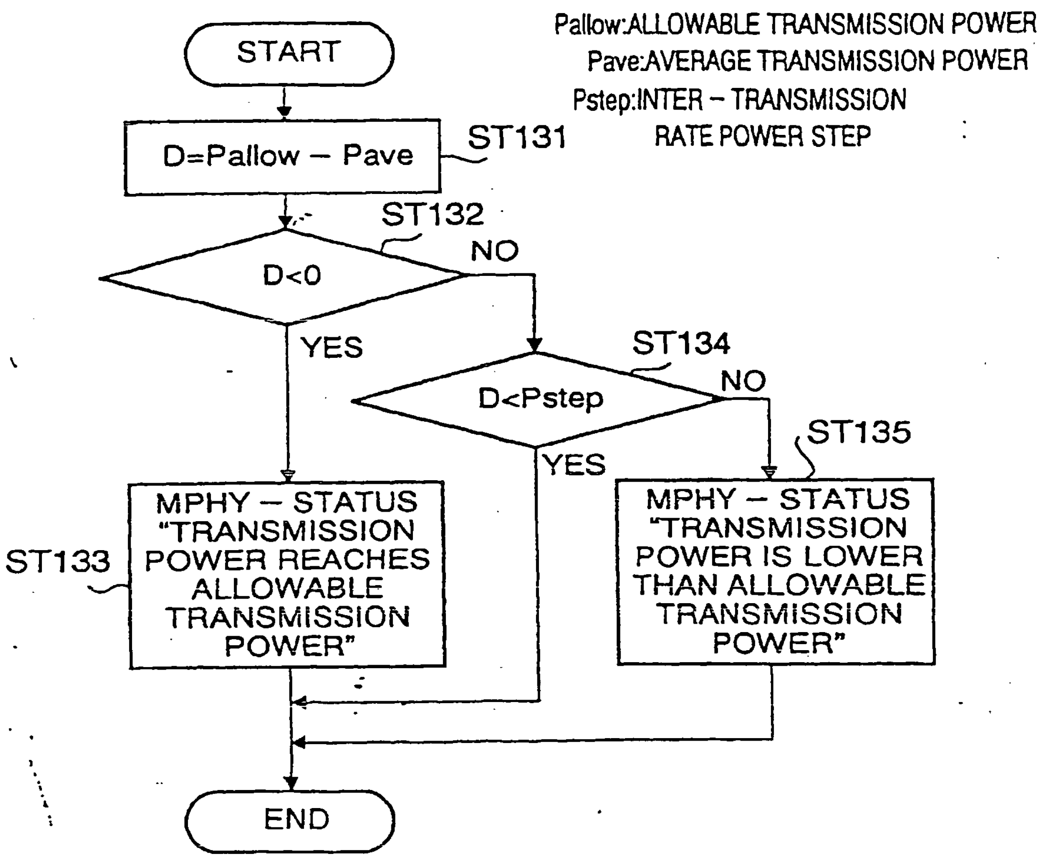

Pallow:ALLOWABLE TRANSMISSION POWER
Pave:AVERAGE TRANSMISSION POWER
Pstep:INTER – TRANSMISSION RATE POWER STEP
START
D=Pallow – Pave
ST131
ST132
D<0
NO
YES
ST134
D<Pstep
NO
YES
ST135
ST133
MPHY – STATUS "TRANSMISSION POWER REACHES ALLOWABLE TRANSMISSION POWER"
MPHY – STATUS "TRANSMISSION POWER IS LOWER THAN ALLOWABLE TRANSMISSION POWER"
END

FIG. 29

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/02077

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl⁶ H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl⁶ H04Q7/00-7/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-1999
Kokai Jitsuyo Shinan Koho 1971-1999 Jitsuyo Shinan Toroku Koho 1996-1999

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP, 07-143572, A (CSELT-CENTRO STUDI E LABORATORI TELECOMUNICAZIONI SOCIETA PER AZIONI), 2 June, 1995 (02. 06. 95) & EP, 627827, A	1-5, 16-18 6-15
X Y	JP, 09-506231, A (Qualcomm,Inc.), 17 June, 1997 (17. 06. 97) & WO, 9604718 & EP, 721704, A	1-5, 16-30 6-15
X	JP, 10-075209, A (Lucent Technologies Inc.), 17 March, 1998 (17. 03. 98) & CA, 2204057, A	1-5
Y	JP, 08-340308, A (NTT Data Communications Systems Corp.), 24 December, 1996 (24. 12. 96) (Family: none)	6-15
Y	JP, 09-046290, A (NEC Engineering K.K.), 14 February, 1997 (14. 02. 97) & US, 5825761, A	6-15

[x] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search 13 July, 1999 (13. 07. 99)	Date of mailing of the international search report 27 July, 1999 (27. 07. 99)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/02077

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 09-312649, A (NEC Corp.), 2 December, 1997 (02. 12. 97) (Family: none)	6-15
Y	JP, 10-502778, A (Qualcomm,Inc.), 10 March, 1998 (10. 03. 98) & WO, 9602097, A & US, 5603096, A	19-30

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

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(19) Europäisches Patentamt
European Patent Office
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(11) EP 0 986 192 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
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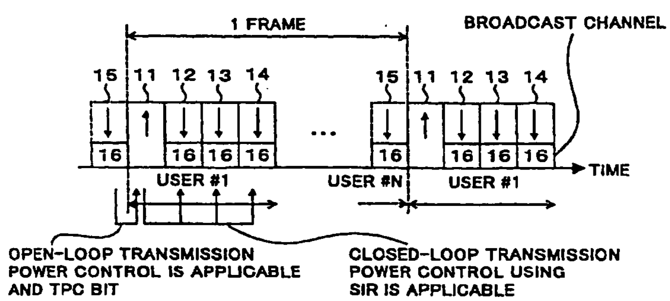
(54) Mobile station communication apparatus, base station communication apparatus and radio communication method for transmission power control

(57) A mobile station apparatus performs a communication in a CDMA/TDD system with TDMA structure with a base station apparatus using a subframe having a plurality of slots, and monitors a broadcast channel signal. The mobile station apparatus further measures a quality of the broadcast channel signal received immediately before transmitting a traffic channel signal in reverse link, and based on the measurement result, controls transmission power in reverse link.

FIG.4



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a mobile station communication apparatus, a base station communication apparatus and a radio communication method which are used in digital radio communication.

Description of the Related Art

[0002] In digital radio communications, as circuit-switching systems for a plurality of mobile station apparatuses to concurrently communicate in the same frequency band, multiple access communication systems have been applied, examples of which are Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). In the use of TDMA techniques, multiple access communications are performed by transmitting and receiving assigned slots to which information signals are divided. In the use of CDMA techniques, multiple access communications are performed using spread spectrum communications in which information signals are spread over a broad frequency band to transmit, as compared to original frequency band, using a Direct Spreading (DS) system. In the use of DS techniques, information signals are multiplied by a spreading code.

[0003] On the other hand, in radio communications, duplex systems such as Frequency Division Duplex (FDD) system and Time Division Duplex system have been applied conventionally for the purpose of improving communication efficiencies. For example, in the TDD system which is also called Ping-Pong system, communications are performed by dividing transmission time and reception time in the same radio frequency band.

[0004] In the case of the TDD system, since the same frequency band is used for transmission and reception, fading variations of transmitted signals and received signals are the same (frequency correlation characteristic of fading variations is 1). In addition, when transmission and reception are switched shortly enough, since fading variations of transmitted signals and received signals are almost the same (time correlation characteristic of fading variations is high), it is possible to perform in a mobile station apparatus transmission power control using a received power level (hereinafter, also referred to as received level) from a base station apparatus , which is called open-loop power control. Further, in the case where a base station apparatus has a plurality of antennas, the base station may apply transmission diversity in which optimal antennas are selected corresponding to the received level at each antenna. In this case, the mobile station apparatus does not need to perform space diversity, thereby enabling the mobile station apparatus to be miniaturized.

[0005] In specific applications, the multiple access communication system such as TDMA and CDMA and the communication system such as FDD and TDD are combined. In particular, a CDMA/TDD system is considered to be used widely in future, because this system is capable of efficiently increasing the number of system users.

[0006] As transmission power control in this CDMA/TDD system, open-loop power control may be used. When reverse and forward link communications are performed by the open-loop power control, a reference for controlling one link is changed by controlling another link. In other words, the transmission power control is affected by a variation of received signal level due to, for example, fading, and therefore resulting in the inconvenience that the transmission power control is often unstable.

[0007] Therefore, with respect to the CDMA/TDD system, as disclosed in Japanese Patent Application H7-221700, there has been proposed the method in which a base station apparatus transmits a pilot signal of which power level is known as constant, and based on the pilot signal, a mobile station apparatus performs transmission power control with higher accuracy.

[0008] In addition, the introduction of TDMA structure to the communication method in the above-mentioned CDMA/TDD system has been proposed in order to decrease interference in the system. Further, in such a communication method of CDMA/TDD system with TDMA structure, there has been proposed the use of control channel called broadcast channel or perch channel (hereinafter referred to as broadcast channel) including transmission power control information and other information. In this case, a pilot channel signal which is transmitted in known constant power is not present, and an interval of reverse link slot and forward link slot is sometimes long depending on a subframe configuration due to TDMA structure. Therefore, it is not possible to apply the transmission power control disclosed in the above-mentioned application directly, thus remaining the problem that transmission power control and base station transmission diversity are not performed properly. Such a problem is actualized in a system applying asymmetry transmission system in which the number of forward link slots and that of reverse link slots are different. This problem is explained specifically below.

[0009] FIG.1A and FIG.1B are frame structure diagrams in the case where each user performs asymmetry transmission using four slots of one reverse slot and three forward slots in the CDMA/TDD system with TDMA structure. FIG. 1A illustrates a frame structure composed of one reverse slot (S1) and three forward slots (S2 to S4) in this order. FIG.1B illustrates a frame structure composed of three forward slots (S1 to S3) and one reverse slot (S4) in this order.

[0010] In the case of the frame structure as illustrated in FIG.1A, since forward slot S2 is present next to reverse slot S1, base station transmission diversity and transmission power control are effectively performed using a received level of reverse link signal. However, in the CDMA/TDD system with TDMA structure, since the base station apparatus communicates with a plurality of users assigning slots in one frame, an interval of forward link S4 and following reverse link S1 becomes long. In other words, a delay corresponding to a plurality of slots occurs until next transmission after measuring a received level of forward link signal to reflect in the next transmission, and therefore, the performance deteriorates largely when fading varies rapidly, and accuracy of open-loop power control in the mobile station is lowered.

[0011] On the other hand, in the case of the frame structure as illustrated in FIG. 1B, since forward slot S3 is present next to reverse link slot S4, open-loop power control is performed effectively using a received level of forward link signal. However, since an interval between reverse slot S4 and following forward slot S1 becomes long, base station transmission diversity and accuracy of transmission power control deteriorate.

SUMMARY OF THE INVENTION

[0012] An object of the present invention is to provide a mobile station communication apparatus, a base station communication apparatus and a radio communication method which do not lower performances of transmission power control and base station transmission diversity in a communication method of a CDMA/TDD system with TDMA structure in which communications are performed using a subframe, having a plurality of slots, as a unit.

[0013] In order to achieve the above-mentioned object, according to the present invention, in a CDMA/TDD system with TDMA structure communication system using a subframe having a plurality of slots, a mobile station measures a quality of a broadcast channel signal in forward link received immediately before transmitting a traffic channel signal in reverse link, and based on the measurement result, controls transmission power in reverse link. While, based on TPC information received from the mobile station apparatus or appropriately corrected reverse link signal, a base station apparatus performs transmission diversity and transmission power control in forward link.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The above and other objects and features of the invention will appear more fully hereinafter from a consideration of the following description taken in connection with the accompanying drawing wherein one example is illustrated by way of example, in which;

FIG.1A and 1B are frame configuration diagrams in a conventional CDMA/TDD system with TDMA structure;

FIG.2 is a block diagram illustrating a configuration of a mobile station apparatus in a communication system using a radio communication apparatus according to an embodiment of the present invention;

FIG.3 is a block diagram illustrating a configuration of a base station apparatus according to the above embodiment;

FIG.4 is a frame configuration diagram used in the communication system according to the above embodiment; and

FIG.5 is a block diagram illustrating a configuration of another base station apparatus according to the above embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Communication apparatuses according to an embodiment of the present invention will be described in the following with reference to accompanying drawings.

[0016] FIG.2 is a block diagram illustrating a configuration of a mobile station apparatus in a communication system using a radio communication apparatus according to the embodiment of the present invention. This mobile station apparatus is principally composed of one or a plurality of antennas 101, receiver 100, transmitter 105 and transmission/reception slot control section 110.

[0017] Receiver 100 has traffic channel CDMA demodulator 102, broadcast channel CDMA demodulator 103, and SIR(Signal Interference Ratio) measuring section 104. Transmitter 105 has forward link TPC bit generating section 106, slot construction section 107, CDMA modulator 108, and transmission power control section 109. Transmission/reception slot control section 110 controls receiver 100, transmitter 105 and transmission/reception slots.

[0018] FIG.3 is a block diagram illustrating a configuration of a base station apparatus in a communication system using the radio communication apparatus according to the embodiment of the present invention. This base station apparatus is principally composed of antenna 201, receiver 200, transmitter 204, and transmission/reception slots control section 208.

[0019] Receiver 200 has CDMA demodulator 202 and forward link TPC bit demodulation section 203. Transmitter 204 has traffic channel CDMA modulator 205, broadcast channel CDMA modulator 206 (common to all users), and transmission power control section 207. Transmission/reception slot control section 208 controls receiver 200, transmitter 204 and transmission/reception slots.

[0020] Operations in the communication system with the mobile station and base station each having the above-described configuration will be described next.

[0021] A received signal received at antenna 101 at a mobile station apparatus side is adjusted at transmission/reception slot control section 110, and input to traffic channel CDMA demodulator 102 and broadcast channel CDMA demodulator 103. Traffic channel CDMA demodulator 102 demodulates received data. Broadcast channel CDMA demodulator 103 demodulates forward link transmission power control information and reverse link interference power information which are inserted to a broadcast channel, while outputs the demodulated signal to SIR measuring section 104. Based on the input signal, SIR measuring section 104 measures a reception quality to recognize channel condition. SIR measuring section 104 further outputs the measurement result to forward link TPC bit generating section 106 and transmission power control section 109 in the transmitter. This SIR measurement result is used for forward link closed-loop transmission power control at forward link TPC bit generating section 106, while used for reverse link open-loop transmission power control at transmission power control section 109. In other words, based on the input SIR measurement result, forward link TPC bit generating section 106 generates forward link TPC bit to be transmitted to the base station apparatus so as to output to slot construction section 107. Further, based on the SIR measurement result, transmission power control section 109 performs transmission power control.

[0022] Slot construction section 107 sequentially constructs slots of reverse link transmission data, while inserts a TPC bit input from forward link TPC bit generating section 106 to a specific slot. The transmission data subjected to such a slot construction is modulated at CDMA modulator 108, and transmitted in transmission power control section 109 at the power corresponding to the measurement result input from SIR measuring section 104.

[0023] On the other hand, a received signal received at antenna 201 at a base station apparatus side is adjusted at transmission/reception slot control section 208, and input to CDMA demodulator 202 to demodulate received data. Forward link TPC bit demodulation section 203 demodulates forward link TPC bit inserted to the received signal to output to transmission power control section 207.

[0024] Forward link transmission data is demodulated at traffic channel CDMA modulator 205, and transmitted at transmission power control section 207 at transmission power level determined by the received forward link TPC bit. Broadcast channel CDMA modulator 206 concurrently modulates data to be transmitted in a broadcast channel. The broadcast channel is a channel used commonly to all users in the same frequency band as in a traffic channel and with different spreading code from that of the traffic channel. The data subjected to the CDMA modulation is transmitted from antenna 201. In addition, broadcast channel signals are transmitted at almost constant power and not subjected to transmission power control.

[0025] With respect to transmission power control performed in the communication system configured as descried above, a detailed description is given below using a frame configuration diagram illustrated in FIG.4. FIG.4 illustrates an example of an asymmetry transmission system in which one frame has four subframes each having four slots of one reverse slot and three forward slots. In this system, communications are performed according to the CDMA/TDD system, each subframe is assigned for a different user and all frames are divided using subframes according to the TDMA structure.

[0026] In forward link, the base station apparatus transmits broadcast channel signal 16 to all users. This broadcast channel signal includes forward link transmission power information and reverse link interference power information, so that the mobile station apparatus receives these information to use a measurement of SIR in forward link.

[0027] As illustrated in FIG.4, broadcast channel signal 16 is provided at all forward slots over the entire of one frame. In the case of user #1, broadcast channel signal 16 is also transmitted in forward link slot 15 which is present before assigned four slots 11, 12, 13 and 14. The mobile station apparatus dose not monitor SIR of the traffic channel signal, but measures SIR of broadcast channel signal 16 at slot 15 positioning immediately before reverse link 11, so that the mobile station recognizes immediately previous channel conditions. Further, as the measurement methods, a received power level of the broadcast channel signal may be measured instead of SIR. The SIR measurement or received power level measurement may be performed also using the traffic channel signal. The mobile station apparatus performs the transmission power control for signals in reverse link slot 11 corresponding to the measurement result, while inserting the TPC bit to reverse link slot 11 in order to be used for closed-loop transmission power control using SIR for forward link in the base station apparatus.

[0028] Thus, in the case where an interval of a forward link slot and a following reverse link slot becomes long in the TDMA structure, the mobile station apparatus is capable of performing transmission power control with high accuracy by monitoring a broadcast channel signal at an appropriate timing, and the base station apparatus is capable of performing transmission power control and base station transmission diversity with high accuracy. Further, since the mobile station apparatus has a CDMA demodulator for despreading a signal of control channel (broadcast channel), the mobile station apparatus is capable of monitoring the signal of control channel (broadcast channel) more assuredly.

[0029] On the other hand, the base station apparatus performs closed-loop transmission power control in forward link slots 12, 13 and 14 by demodulating the TPC bit transmitted in reverse link slot 11.

[0030] Thus, it is possible to combine open-loop transmission power control in reverse link and closed-loop transmission power control in forward link to achieve the transmission power control. Therefore, it is possible to perform transmission power control appropriate enough for both reverse link and forward link even in the case where fading varies rapidly, thereby enabling transmission power control accuracy to be further improved.

[0031] A broadcast channel signal is transmitted in forward link from the base station apparatus. However, it is not necessary to transmit the broadcast channel signal in all slots in forward link. When the broadcast channel signal is transmitted at least in a slot immediately before a reverse link slot, it is possible to provide sufficient transmission power control to the mobile station apparatus of the present invention.

[0032] In addition, it is possible to insert information, such as forward link transmission power information and reverse link interference power information, to the broadcast channel signal. Therefore, the use of the broadcast channel signal enables the mobile station apparatus to combine the open-loop power control by measuring a power level of a received signal as previously described and closed-loop power control. For example, a base station apparatus inserts information indicative of transmission power of broadcast channel signal to the broadcast channel signal. A mobile station apparatus acquires the forward link power information using the broadcast channel signal, and obtains a difference between a base station transmitted broadcast channel power level and an actually transmitted power level, thus enabling the mobile station to estimate channel conditions with high accuracy. Such processing may be combined with the closed-loop power control which uses, for example, TPC information received from the base station.

[0033] Specifically, the transmission power of a mobile station apparatus (Tms) in the case of performing such a control is obtained using, for example, an equation as follows:

$$Tms=(Pbts+Ptpc)+(Tbts-Rms)$$

where Pbts is target received power in a base station apparatus, Ptpc is corrected power corresponding to TPC bit of closed-loop power control from the base station apparatus, Tbts is (estimated) transmission power of base station apparatus transmitted broadcast channel signal, and Rms is received power of broadcast channel signal in the mobile station apparatus.

[0034] In other words, the mobile station apparatus performs the closed-loop power control in reverse link using the target received power in the base station apparatus (Pbts) and the corrected power based on the TPC bit obtained in forward link (Ptpc), while obtains a difference between estimated transmission power of base station transmitted broadcast channel signal (Tbts) and received power of the broadcast channel signal so as to add to the transmission power.

[0035] Information on the estimated transmission power of base station transmitted broadcast channel signal (Tbts) is inserted to forward link from the base station, and the broadcast channel signal is transmitted at least in a forward link slot positioning immediately before a transmission slot in reverse link. In other words, the base station apparatus is controlled to transmit the broadcast channel signal to which transmission power information is inserted at such a timing.

[0036] Since the mobile station thus performs transmission power control by combining the open-loop power control and the closed-loop power control, the accuracy of the transmission power control is further improved.

[0037] In addition, this embodiment describes about an example of a system where asymmetry transmission is performed using one reverse slot and three forward slots. However, it may be possible to design the assignment of slots for forward link and reverse link flexibility depending on a system. For example, it may be possible to assign first to fourth slots respectively to reverse link, forward link, reverse link and forward link, or to reverse link, reverse link, forward link and forward link.

[0038] When the transmission diversity in a base station apparatus is considered, it is preferable to assign at least a head slot of each subframe to reverse link and further at least a final slot of each subframe to forward link. This is because the base station apparatus needs a reverse link slot signal from a user assigned to the subframe before transmitting a forward link slot to the user in order to perform transmission diversity in forward link. Since the assignment is performed in such a manner that the head slot of each subframe is always used in reverse link and the final slot of each subframe is always used in forward link, the mobile station apparatus can monitor a broadcast channel signal in a forward link slot immediately before a reverse link slot, and the base station apparatus can perform the transmission diversity using received signals from the mobile station apparatus assuredly.

[0039] The base station apparatus for performing such transmission diversity is explained using FIG.5. FIG.5 is a schematic block diagram illustrating an example of a configuration of a base station apparatus in a communication system using multiple access communication apparatuses.

[0040] This base station apparatus is principally composed of a plurality of antennas, such as, 401 and 402, receiver 400, transmitter 405 and transmission/reception slot controlling section 409.

[0041] Receiver 400 has CDMA demodulator 403, and antenna received power comparator 404. Transmitter 405 has traffic channel CDMA modulator 406 and broadcast channel CDMA demodulator 408, which is common to all users, and antenna selection control section 407. Transmission/reception slot control section 409 adjusts transmission slots and received slots respectively for transmitter 400 and receiver 405.

[0042] Signals received at antenna 401 and antenna 402 are input to CDMA demodulator 403 to demodulate data, and also input to antenna received power comparator 404, provided in parallel to CDMA demodulator 403, to monitor. Antenna received power comparator 404 outputs an antenna control signal to antenna selection control section 407 so that an antenna under the best channel condition is selected.

[0043] Transmission data is modulated at traffic channel CDMA modulator 406, input to antenna selection control section 407, and transmitted from antennas 401 and 402. Corresponding to the antenna selection control signal input from antenna received power comparator 404, transmission power for each antenna is controlled, and thereby the selection between transmission antennas for respective users is controlled. The comparison of received power at each antenna is performed by measuring received level of the traffic channel signal in reverse slot 11 illustrated in FIG.4. to compare. The measurement result is reflected in the transmission of traffic channel signals in slots 12, 13 and 14. While, a broadcast channel signal is modulated in broadcast channel CDMA modulator 408 and transmitted from the antenna in the same way as traffic channel signal. However, the antenna selection control is not performed for the broadcast channel signal.

[0044] In addition, there has been proposed a system applying a CDMA/TDD system in Joint-Detection system. In this system, open-loop transmission power control is performed in forward link based on a reverse signal received in a base station apparatus. In the transmission power control of the present invention, it is possible to perform open-loop transmission power control in reverse link using the broadcast channel signal, and also perform open-loop transmission power control in forward link using the reverse link traffic channel signal subjected to the transmission power control. Therefore, the present invention is applicable to the system applying CDMA/TDD system in Joint-Detection system.

[0045] In addition, system designs and modifications are facilitated by that the assignment in a subframe is fixed in such a manner that the head slot is assigned for reverse slot and the final slot is assigned for forward slot, and that a broadcast channel signal is transmitted only in the final slot for forward link. In other words, since it is enough for the base station apparatus to transmit a broadcast channel signal only in a specific slot, it is possible to change a slot assignment of each subframe easily, thereby enabling the system to be designed flexibly.

[0046] For example, according to the present invention, it is possible to correspond to both a system in which symmetry transmission is performed and another system in which asymmetry transmission is performed by fixing a slot for a broadcast channel signal and changing the assignment for forward slots and reverse slots. Further, it is possible to apply the present invention to a public network system with high generality in which frame configurations are standardized. Furthermore, according to the present invention, it is possible to easily correspond to a system in which a slot assignment is different for every subframe or in which each mobile station is controlled to belong to a specific base station.

[0047] As described above, according to the mobile station communication apparatus, base station communication apparatus, and radio communication method of the present invention, it is possible in the CDMA/TDD system with TDMA structure to perform base station transmission diversity and transmission power control with high accuracy, and to follow propagation path variations of both forward link and reverse link even when fading varies rapidly, thereby resulting in improved communication qualities.

[0048] The present invention is not limited to the above described embodiments, and various variations and modifications may be possible without departing from the scope of the present invention.

[0049] This application is based on the Japanese Patent Applications No.HEI10-027711 filed on January 26, 1998 and No.HEI10-252991 filed on September 7, 1998, entire contents of which are expressly incorporated by reference herein.

Claims

1. A mobile station communication apparatus comprising:

    communication control means(110) for performing a communication in a CDMA/TDD system with a TDMA structure with a base station communication apparatus using a subframe having a plurality of slots;
    received quality measurement means(104) for measuring a quality of a broadcast channel signal in forward link which is received immediately before transmitting a traffic channel signal in reverse link; and reverse link transmission power control means(109) for
    controlling transmission power in reverse link based on the measurement result in said received quality measurement means.

2. A mobile station communication apparatus comprising:

    communication control means(110) for performing a communication in a CDMA/TDD system with a TDMA structure with a base station communication apparatus using a subframe having a plurality of slots;
    CDMA demodulation means(102,103) for receiving both a traffic channel signal and a broadcast channel signal transmitted from the

base station communication apparatus in forward link to respectively despread with different spreading codes;

received quality measurement means(104) for measuring a quality of the broadcast channel signal in forward link which is received immediately before transmitting a reverse link signal, after said CDMA demodulation means demodulates said broadcast channel signal;

reverse link transmission power control means(109) for controlling transmission power in reverse link based on the measurement result in said received quality measurement means.

3. The mobile station communication apparatus according to claim 1, wherein said communication control means(110) uses a first slot in forward link and a final slot in reverse link in a subframe.

4. The mobile station communication apparatus according to claim 1, wherein said apparatus further comprises forward link TPC bit generating means(106) for generating a TPC bit, which is used in transmission power control in the base station communication apparatus , based on the measurement result in said received quality measurement means.

5. A base station communication apparatus comprising:

communication control means(208) for performing a communication in a CDMA/TDD system with a TDMA structure with a mobile station communication apparatus using a subframe having a plurality of slots;

broadcast channel signal transmission means(206) for transmitting a broadcast channel signal, common to all users, in forward link;

reception means(202) for receiving in reverse link a signal subjected to transmission power control based on a received quality of said broadcast channel signal; and

transmission power control means(207) for controlling transmission power of transmission data in forward link.

6. The base station communication apparatus according to claim 5, wherein said communication control means(208) uses a first slot in forward link and a final slot in reverse link in a subframe.

7. The base station communication apparatus according to claim 5, wherein said broadcast channel signal transmission means(206) transmits a broadcast channel signal only in a specific slot in forward link.

8. The base station communication apparatus according to claim 5, wherein said transmission power control means(207) acquires TPC information, which is generated in the mobile station communication apparatus based on the received quality of said broadcast channel signal, from a traffic channel signal in reverse link, and based on the acquired TPC information, controls transmission power in forward link.

9. The base station communication apparatus according to claim 5, wherein said transmission power control means(207) controls transmission power in forward link based on a quality of a signal received in said reception means.

10. A radio communication method in which a base station communication apparatus and a mobile station communication apparatus each comprises communication control means for performing a communication in a CDMA/TDD system with a TDMA structure mutually using a subframe having a plurality of slots, said method comprising the steps of:

transmitting in said base station communication apparatus data using a traffic channel, while transmitting a broadcast channel signal common to all users using a broadcast channel;

measuring in said mobile station communication apparatus a quality of said broadcast channel signal which is received in forward link immediately before transmitting a reverse link signal, after said broadcast channel signal is CDMA demodulated, and based on the measurement result, performing transmission power control, while inserting a TPC bit to a traffic channel signal to transmit in forward link; and

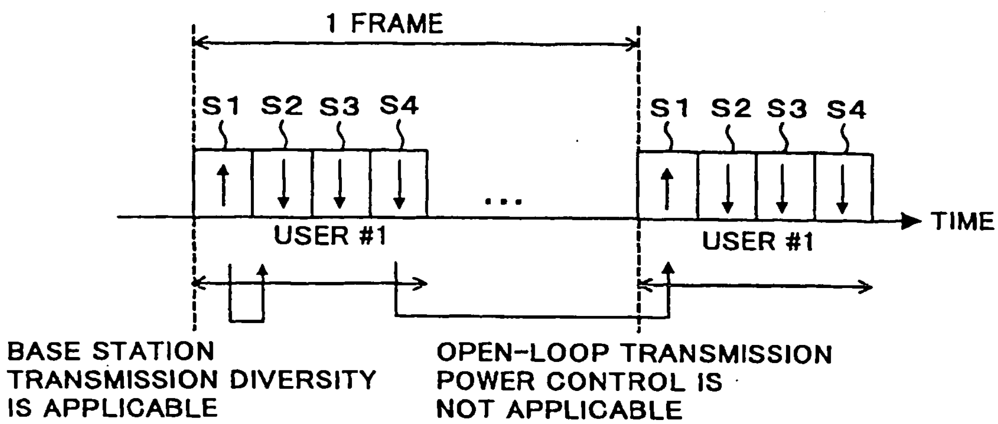
performing, in said base station communication apparatus which receives said traffic channel signal, transmission power control based on the acquired TPC bit.

11. A radio communication method comprising the steps:

providing both a base station communication apparatus and a mobile station communication apparatus with communication control means for performing a communication in a CDMA/TDD system with a TDMA structure mutually using a subframe having a plurality of slots;

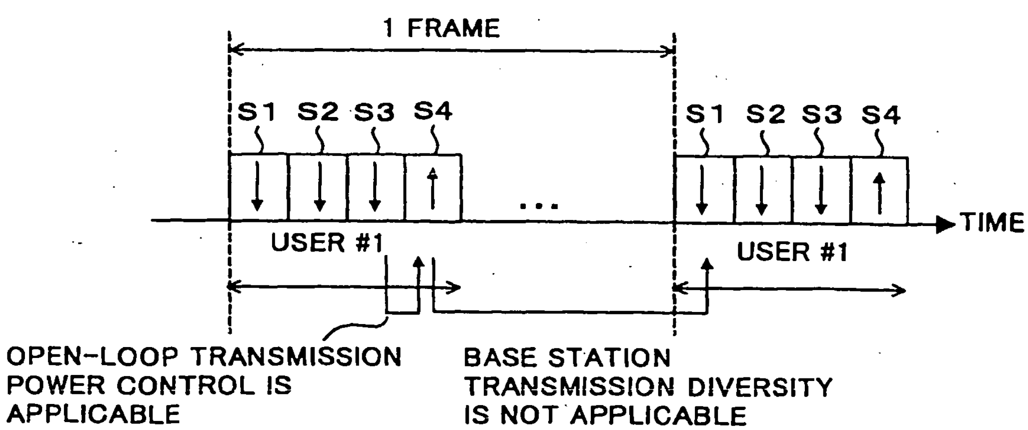
performing in said mobile station communication apparatus open loop power control based on a received quality of a broadcast channel signal received immediately before transmitting a reverse link signal, while generating a forward link TPC bit based on the received quality of said broadcast channel signal; and

performing in said base station communication apparatus closed loop power control based on the received TPC bit.



PRIOR ART

FIG.1A



PRIOR ART

FIG.1B

FIG.2

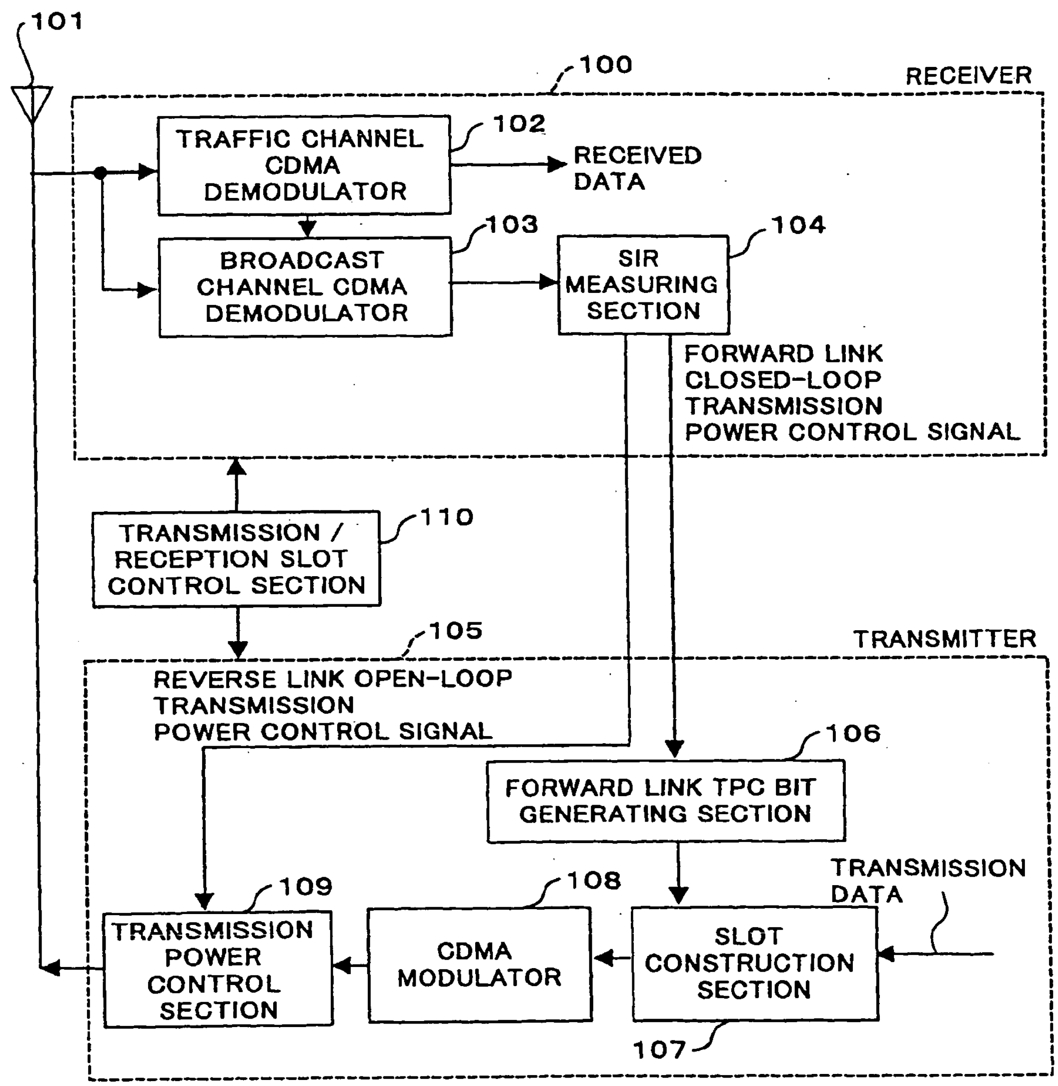

101
100
RECEIVER
TRAFFIC CHANNEL CDMA DEMODULATOR
102
RECEIVED DATA
103
104
BROADCAST CHANNEL CDMA DEMODULATOR
SIR MEASURING SECTION
FORWARD LINK CLOSED-LOOP TRANSMISSION POWER CONTROL SIGNAL
TRANSMISSION / RECEPTION SLOT CONTROL SECTION
110
105
TRANSMITTER
REVERSE LINK OPEN-LOOP TRANSMISSION POWER CONTROL SIGNAL
106
FORWARD LINK TPC BIT GENERATING SECTION
TRANSMISSION DATA
109
108
TRANSMISSION POWER CONTROL SECTION
CDMA MODULATOR
SLOT CONSTRUCTION SECTION
107

FIG.3

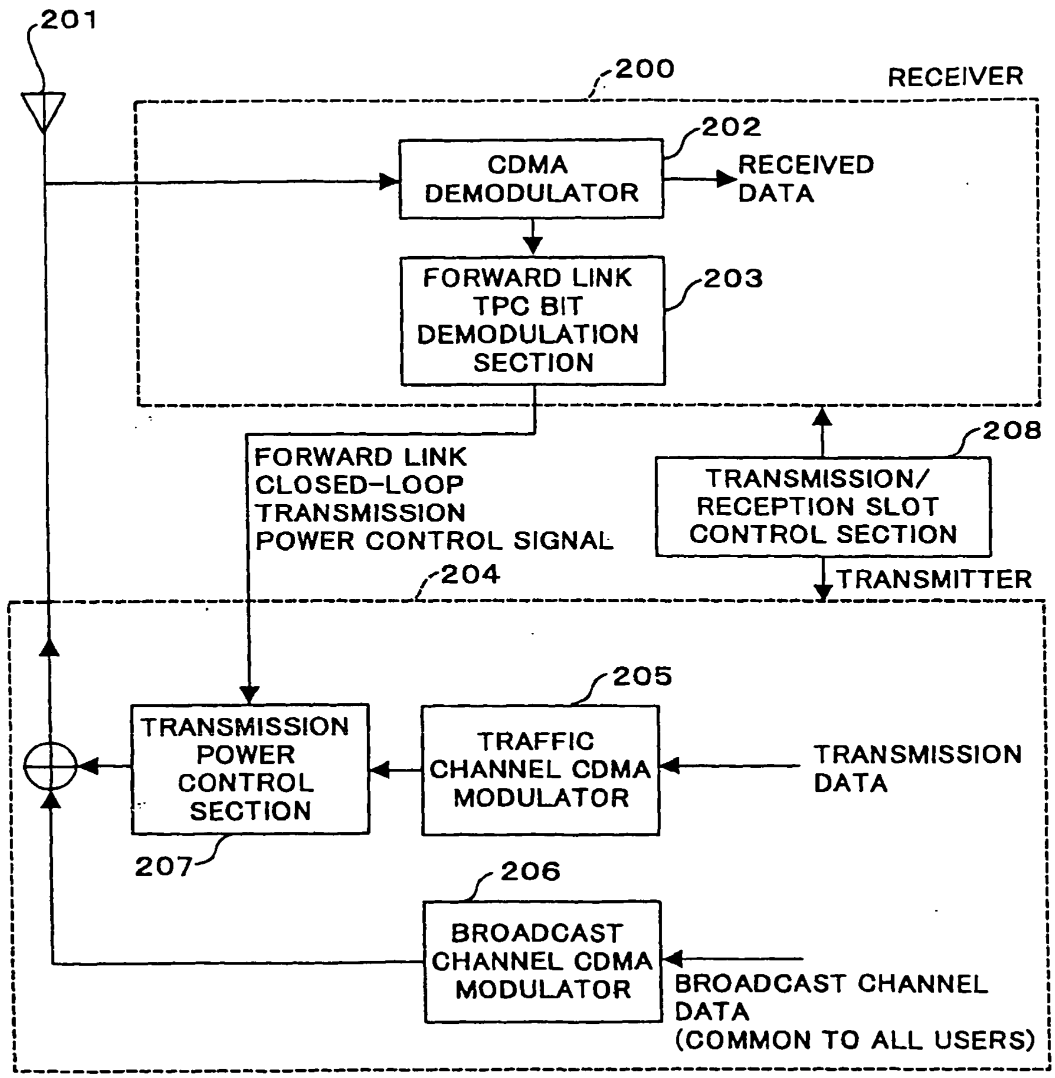

201
200
RECEIVER
202
CDMA DEMODULATOR
RECEIVED DATA
FORWARD LINK TPC BIT DEMODULATION SECTION
203
FORWARD LINK CLOSED-LOOP TRANSMISSION POWER CONTROL SIGNAL
208
TRANSMISSION/ RECEPTION SLOT CONTROL SECTION
204
TRANSMITTER
205
TRANSMISSION POWER CONTROL SECTION
TRAFFIC CHANNEL CDMA MODULATOR
TRANSMISSION DATA
207
206
BROADCAST CHANNEL CDMA MODULATOR
BROADCAST CHANNEL DATA (COMMON TO ALL USERS)

FIG.4

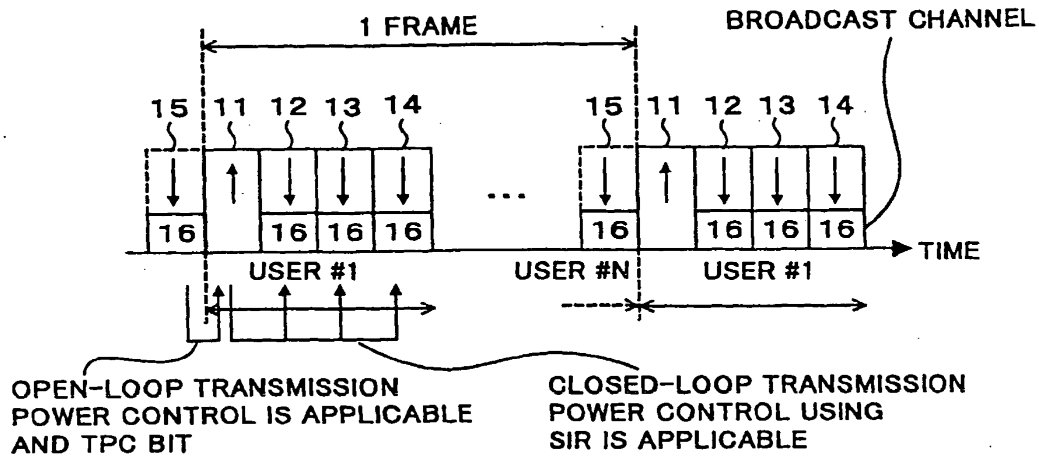
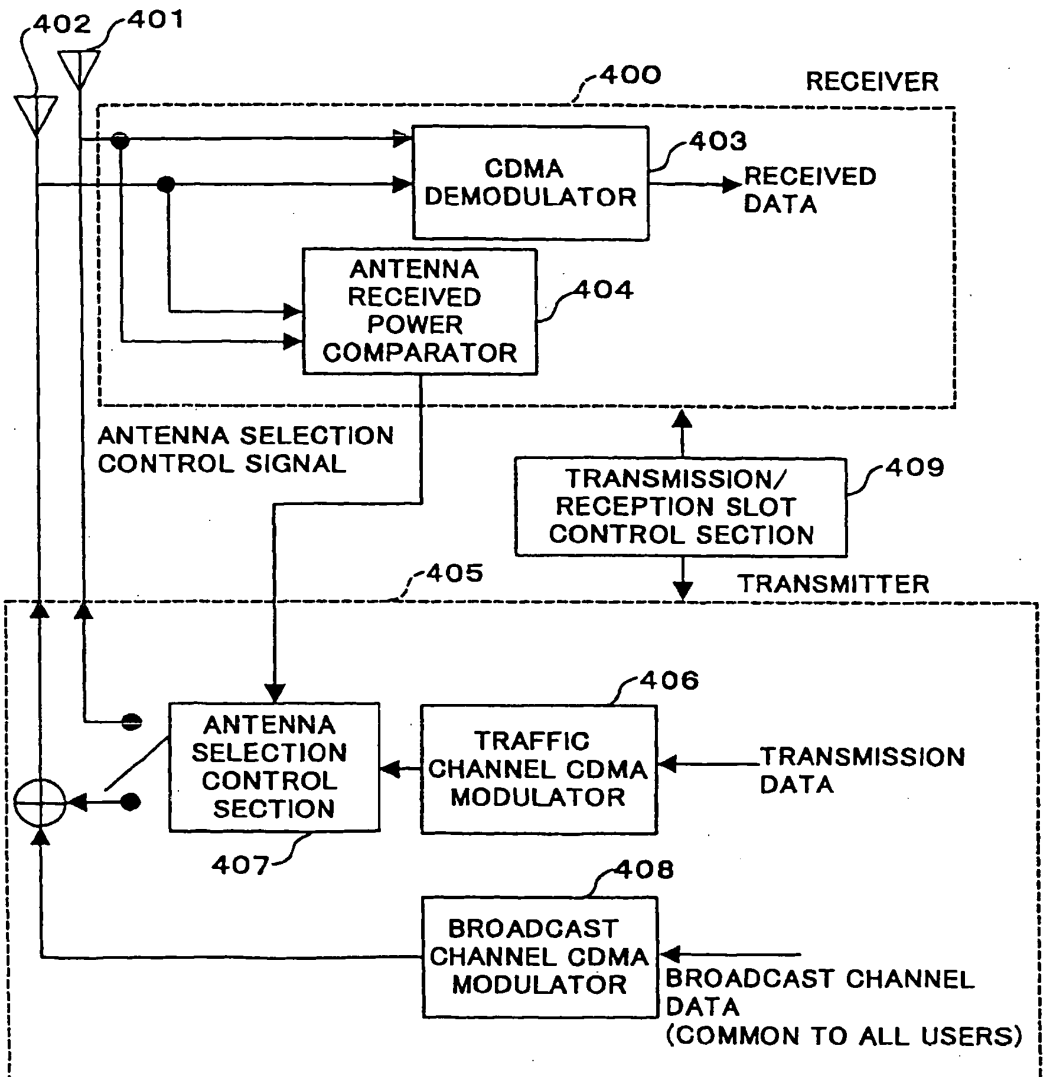

1 FRAME
BROADCAST CHANNEL
15
11
12
13
14
16
USER #1
USER #N
TIME
OPEN-LOOP TRANSMISSION POWER CONTROL IS APPLICABLE AND TPC BIT
CLOSED-LOOP TRANSMISSION POWER CONTROL USING SIR IS APPLICABLE

FIG.5


402
401
400
RECEIVER
CDMA DEMODULATOR
403
RECEIVED DATA
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404
ANTENNA SELECTION CONTROL SIGNAL
TRANSMISSION/ RECEPTION SLOT CONTROL SECTION
409
405
TRANSMITTER
406
ANTENNA SELECTION CONTROL SECTION
TRAFFIC CHANNEL CDMA MODULATOR
TRANSMISSION DATA
407
408
BROADCAST CHANNEL CDMA MODULATOR
BROADCAST CHANNEL DATA (COMMON TO ALL USERS)

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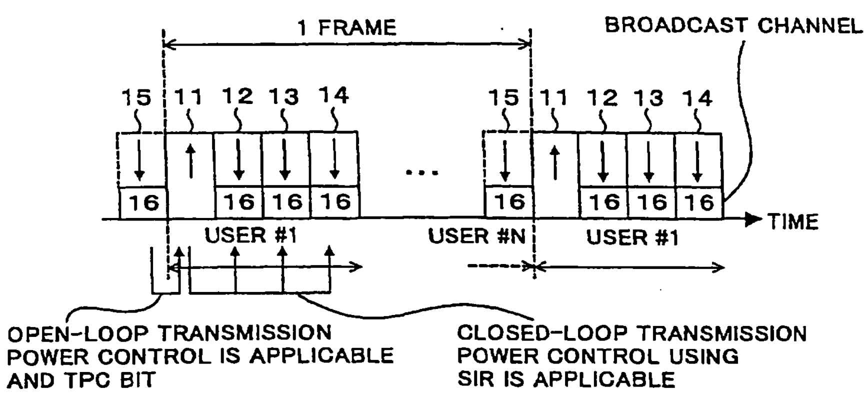
(54) **Mobile station communication apparatus, base station communication apparatus and radio communication method for transmission power control**

(57) A mobile station apparatus performs a communication in a CDMA/TDD system with TDMA structure with a base station apparatus using a subframe having a plurality of slots, and monitors a broadcast channel signal. The mobile station apparatus further measures a quality of the broadcast channel signal received immediately before transmitting a traffic channel signal in reverse link, and based on the measurement result, controls transmission power in reverse link.

FIG.4



EP 0 986 192 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 11 4627

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	MIYA K ET AL: "WIDEBAND CDMA SYSTEMS IN TDD-MODE OPERATION FOR IMT-2000" IEICE TRANSACTIONS ON COMMUNICATIONS, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, JP, vol. E81-B, no. 7, 1 July 1998 (1998-07-01), pages 1317-1325, XP000790163 ISSN: 0916-8516 * page 1317, right-hand column, line 1 - line 20 * * paragraph [03.6]; figures 5,10,13 * ---	1-11	H04B7/005
X	WO 98 34356 A (QUALCOMM INC) 6 August 1998 (1998-08-06) * page 4, line 25 - page 9, line 3; figures 2,3 * ---	1-11	
X,D	EP 0 668 664 A (MATSUSHITA ELECTRIC IND CO LTD) 23 August 1995 (1995-08-23) * claim 1; figure 2 * ---	1,2	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	26 August 2003	Burghardt, G

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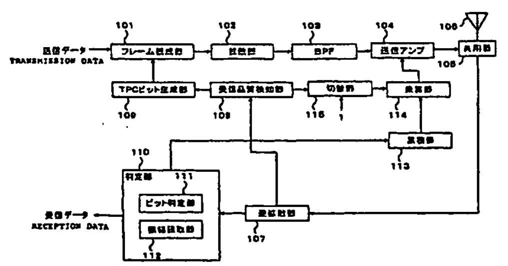
添付公開書類
国際調査報告書

(54)Title: **TRANSMITTER-RECEIVER, AND METHOD FOR CONTROLLING TRANSMISSION POWER OF THE SAME**

(54)発明の名称　送受信装置及びその送信電力制御方法



101 ... FRAME CREATING SECTION
102 ... SPECTRUM-SPREADING SECTION
104 ... TRANSMISSION AMPLIFIER
105 ... COMMON DEVICE
107 ... SPECTRUM-DISPREADING SECTION
108 ... RECEPTION QUALITY MEASURING SECTION
109 ... TPC BIT GENERATING SECTION
110 ... JUDGING SECTION
111 ... BIT JUDGING SECTION
112 ... AMPLITUDE READING SECTION
113 ... CUMULATING SECTION
114 ... MULTIPLYING SECTION
115 ... SWITCHING SECTION

(57) Abstract

A reception quality measurement section (108) measures the reception quality, a bit judging section (111) judges whether the TPC bit is 0 or 1, an amplitude reading section (112) reads the ratio of the amplitude of the signal other than the TPC bit to that of the TPC, a cumulating section (113) judges the change and changed amount of the transmission power on the assumption that the code of the TPC bit is a change of the transmission power and that the amplitude ratio is the changed amount of transmission power and gives a transmission amplifier (104) an instruction, and a multiplying section (114) multiplies the amplitude of the signal other than the TPC bit by a correction value corresponding to the reception quality and determines the amplitude of the TPC bit.

(57)要約

受信品質検知部１０８が受信品質を検知し、ビット判定部１１１がＴＰＣビットが０か１か判定し、振幅読取部１１２がＴＰＣビット以外の信号の振幅とＴＰＣビットの振幅との割合を読み取り、累積部１１３がＴＰＣビットの符号を送信電力の増減、振幅割合は送信電力の増減量として送信電力の増減及び増減量を判定し、送信アンプ１０４に指示し、乗算部１１４がＴＰＣビット以外の信号の振幅に受信品質に応じた補正値を掛け、ＴＰＣビットの振幅を定める。

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YU	ユーゴースラビア
ZA	南アフリカ共和国
ZW	ジンバブエ

明　細　書

送受信装置及びその送信電力制御方法

技術分野

本発明は、ＣＤＭＡ方式を用いた移動体通信の送受信装置及びその送信電力制御方法に関する。

背景技術

従来の移動体通信の送受信装置及びその送信電力制御方法について図２０を用いて説明する。図１は、従来の送受信装置の概略構成を示す要部ブロック図である。

フレーム構成部１は、送信データとＴＰＣビットを多重させる。拡散部２は、多重化データを拡散変調し、ＢＰＦ３は、拡散変調された信号のうち不要な信号を除去する。送信アンプ４は、不要な信号を除去された送信信号を増幅する。共用器５は、アンテナ６への入出力信号を制御する。アンテナ６は、増幅された送信信号を放射する。

アンテナ６は送信された信号を受信する。逆拡散部７は受信信号を復調する。この時、受信品質検知部８は、逆拡散部７の行った逆拡散の結果から信号成分と雑音成分の比（Signal Interference Ratio：以下、ＳＩＲという）を計算することで受信品質を検知する。

ＴＰＣビット生成部９は、受信品質検知部８の検知結果を受け取り、受信品質が所望品質以下であれば送信電力を上げ、所望品質以上であれば他のユーザへの干渉を低減させるために送信電力を下げるように相手局に伝えるＴＰＣビットを生成する。例えば、所望品質以下であれば１を、所望品質以上であれば０をＴＰＣビットとする。生成されたＴＰＣビットはフレーム構成部１に送られ、送信データと共に多重化される。

判定部１０は、復調後の受信信号の中から受信データを得ると同時に相手局が生成し送信してきたＴＰＣビットを抽出し、ＴＰＣビットが0か１かを判定する。累積部１１は、判定部１０の判定結果を受け取り、その結果に対応して送信アンプ４に送信電力の増減を指示する。例えば、判定結果が０の時は相手局からの指示が送信電力を下げることであると判断して現在の増幅量を１ｄＢ下げ、判定結果が１の時は相手局からの指示が送信電力を上げることであると判断して現在の増幅量を１ｄＢ上げる、というように予め定めておく。

このように従来の送受信装置及び送信電力制御方法は、基地局及び移動局双方の送受信装置で受信信号中のＴＰＣビットに基づいて送信電力制御を行うことによって、適切な送信電力を保つようにする。

しかしながら、従来の送受信装置及びその送信電力制御方法においては、送信電力制御時の増減量、すなわち受信した１ビットから成るＴＰＣビットに基づいて増減させる送信電力の幅が予め設定した一定値（上記例では±１ｄＢ）であるため、この一定値が大きく設定されていると、振幅の変化が小さい状況（低速フェージング時）において適切に制御できず安定性を欠くこととなり、この一定値が小さく設定されていると、振幅の変化が大きい状況（高速フェージング時）での追随性が悪くなるという問題がある。

振幅の変化が大きい状況としては、例えばコンプレストモード（Compressed Mode）使用時が考えられる。コンプレストモード等の休止区間を設けるシステムにおいては、休止区間中に制御送信電力値と目標値である所要送信電力値に大きな差が生じる。

また、上記例ではＴＰＣビットが１ビットであるために二値、すなわち「増加」又は「減少」、しか送受信できない。したがって、１スロット内のＴＰＣビットへの割当を増やすことによって送受信できる情報量を増やし、送信電力の増減だけでなく増減量を細かく制御することも考えられる。しかし、１スロットのビット数は決まっているため、ＴＰＣビットに用いるビット数

を増やすと、データの伝送効率が低下するという問題がある。

さらに、上記例では、送信電力が適正で現在の値を維持したい場合でも、制御が増加か減少に限られるため、一定値を保つことができず、適正値を挟んで細かい周期で増加・減少を繰り返すことになる。

発明の開示

本発明の目的は、データ伝送効率を落とさずに、高速フェージング時及びコンプレストモード適用時の追随性と低速フェージング時の安定性とを兼ね備える送受信装置及びその送信電力制御方法を提供することである。

本発明の送受信装置及びその送信電力制御方法は、ＴＰＣビットの振幅を他の送信信号とは別に設定できるようにする。特に、ＴＰＣビットの符号のみならず振幅をもパラメータとすることで、符号が増減を示し、振幅が増減量を示すようにし、１ビットから成るＴＰＣビットで送信電力の単なる一定量の増減制御のみならず任意の増減量で増減させる制御を伝達する。

図面の簡単な説明

図１は、従来の送受信装置の概略構成を示すブロック図；

図２は、本発明の実施の形態１に係る送受信装置の概略構成を示す要部ブロック図；

図３は、本発明の実施の形態１に係る受信品質検知部の概略構成を示す要部ブロック図；

図４は、本発明の実施の形態２に係るリミタを乗算部と送信アンプの間に設けた送受信装置の概略構成を示す要部ブロック図；

図５は、本発明の実施の形態２に係るリミタを受信品質検知部と切替部の間に設けた送受信装置の概略構成を示す要部ブロック図；

図６は、本発明の実施の形態２に係るリミタを累積部と乗算部の間に設けた送受信装置の概略構成を示す要部ブロック図；

図７は、本発明の実施の形態２に係るリミタを判定部と累積部の間に設けた送受信装置の概略構成を示す要部ブロック図；

図８は、本発明の実施の形態３に係る送受信装置の概略構成を示す要部ブロック図；

図９Ａ及び図９Ｂは、コンプレストモードを説明するための送信タイミング図；

図１０Ａ及び図１０Ｂは、コンプレストモードを説明するためのスロットを示す図；

図１１は、本発明の実施の形態３における送信電力制御を説明するための回線品質の変動を示す図；

図１２は、本発明の実施の形態３における送信電力制御を説明するための回線品質の変動を示す図；

図１３は、本発明の実施の形態４に係る送受信装置の概略構成を示す要部ブロック図；

図１４Ａは、従来の制御送信電力及びＳＩＲの変動を示すグラフ；

図１４Ｂは、本発明の実施の形態４における送信電力制御を説明するための制御送信電力及びＳＩＲの変動を示すグラフ；

図１５は、本発明の実施の形態５に係る送受信装置の概略構成を示す要部ブロック図；

図１６は、本発明の実施の形態５における送信電力制御を説明するための制御送信電力及びＳＩＲの変動を示すグラフ；

図１７は、本発明の実施の形態６に係る送受信装置の概略構成を示す要部ブロック図；

図１８は、本発明の実施の形態６における送信電力制御を説明するための制御送信電力及びＳＩＲの変動を示すグラフ；

図１９は、本発明の実施の形態７に係る送受信装置の概略構成を示す要部ブロック図；並びに

図２０は、チップインターリーブを説明するためのフレームフォーマットの一例を示す模式図である。

発明を実施するための最良の形態

以下、本発明の実施の形態について、図面を参照して詳細に説明する。

（実施の形態１）

最初に図２を用いて本発明の実施の形態１に係る送受信装置及びその送信電力制御方法について図２及び図３を用いて説明する。図２は、本発明の実施の形態１に係る送受信装置の概略構成を示すブロック図である。

フレーム構成部１０１は送信データとＴＰＣビットを多重させる。拡散部１０２は多重化データを拡散・変調する。ＢＰＦ１０３は余分な信号を除去する。送信アンプ１０４は送信信号を増幅する。この送信信号は、共用器１０５を通って、アンテナ１０６から放射される。

アンテナ１０６は送信された信号を受信する。逆拡散部１０７が受信信号を復調する。この時、受信品質検知部１０８は逆拡散部１０７のＳＩＲから受信品質を検知する。受信品質検知部１０８の構成は後述する。ＴＰＣビット生成部１０９はこの受信品質を基にＴＰＣビットを生成し、フレーム構成部１０１へ伝達する。

判定部１１０は、ビット判定部１１１と振幅読取部１１２とを含む。判定部１１０は復調後の受信信号の中から受信データを得、出力する。ビット判定部１１１は受信信号中のＴＰＣビットを抽出し、ＴＰＣビットが0か1かを判定する。一方、振幅読取部１１２は、受信信号中のＴＰＣビット以外の信号の振幅とＴＰＣビットの振幅との割合を読み取る。

累積部１１３は、判定部１１０から受信信号のＴＰＣビットの符号と振幅値割合を得る。符号は送信電力の増加指示又は減少指示を表わし、振幅値割合は送信電力の増減量を表わす。累積部１１３は、これら２つの条件を組み合わせることによって、任意の増減量の送信電力増減を送信アンプ１０４に

指示する振幅制御値を得ることができる。

このようにＴＰＣビットの振幅を可変とし、符号のみならず振幅をもパラメータとすることによって、送信電力を単なる一定量の増減制御のみならず任意の増減量で増減するきめ細かい制御をすることができる。よって、振幅の変化が大きい高速フェージング時にも振幅の変化が小さい低速フェージング時にも対応することができる。

また、受信したＴＰＣビットの振幅が０であるならば、累積部１１３の出力である振幅制御値は±０となり、ＴＰＣビットの符号が示す増減指示が実質的に無意味となり、送信アンプ１０４に現状値維持という指示を送ることになる。

乗算部１１４は、送信信号中のＴＰＣビットを、他のビットと同じ累積部１１３が算出した振幅制御値による振幅ではなく、受信品質に基づいて可変な振幅で送信するように送信アンプ１０４に指示する機能を有する。すなわち、ＴＰＣビットの送信電力制御時のみ受信品質検知部１０８が検知した受信品質から算出した補正値を振幅制御値に掛けることによって、受信品質を加味することができる。

これにより、ＴＰＣビット以外の送信信号は通信相手局からの指示通りの振幅で送信し、ＴＰＣビットは受信品質が基準からどのくらい離れていたかの割合を基に通信相手局からの指示通りの振幅を変化させ、その変化によって基準からの隔たりの割合を示すことができる。

この補正値は、受信品質と所望品質との差に比例する。すなわち、受信品質が所望品質から大きく離れていれば大きく、差が小さければ１に近づく。よって、通信相手への送信電力制御要求増減量に比例した振幅を送信信号中のＴＰＣビットに持たせることができる。補正値の算出方法は後述する。

切替部１１５は、予め蓄積されている値「１」と受信品質検知部１０８からの受信品質を表わす数値とを切り替え、どちらか一方だけを乗算部１１４へ送る機能を有する。この切替部１１５の働きにより、ＴＰＣビット以外の

ビットの送信電力制御時には補正値を常に１に保ち、ＴＰＣビットの送信電力制御時だけ受信品質検知部１０８からの補正値を乗算部１１４へ送ることができる。

このようにして、一定の振幅である送信信号１スロット中のＴＰＣビットのみ振幅を可変とすることができ、通信相手の判定部が符号及び振幅を読み取れるようにすることができる。なお、ＴＰＣビットの振幅が小さい場合は誤りが多くなるが、これは送信電力制御量が小さいことを意味するため、影響は少なくて済む。

次いで図３を用いて受信品質検知部１０８の構成を詳述する。図３は、実施の形態１に係る受信品質検知部の概略構成を示す要部ブロック図である。

受信品質検知部１０８に入った逆拡散信号は、最初にＳＩＲ測定部２０１においてＳＩＲが測定される。減算部２０２は、測定された受信信号のＳＩＲ（以下、測定ＳＩＲという）から蓄積部２０３が保持する基準ＳＩＲを減算し、結果を正負判定部２０４へ送る。正負判定部２０４は、減算結果の正負を判定し、結果をＴＰＣビット生成部１０９へ伝える。これによってＴＰＣビット生成部１０９は０か１か、すなわち送信電力を上げる指示か下げる指示いずれを送信するかを判断しビットを生成することができる。

除算部２０５は、測定ＳＩＲと基準ＳＩＲの比を計算し、振幅変換部２０６へ送る。振幅変換部２０６は入力である除算結果を入力と出力が一対一対応の単調増加関数となるように変換し、出力を振幅制御補正値として切替部１１５を介して乗算部１１４へ送る。

このように測定ＳＩＲと基準ＳＩＲの比を計算することにより、信号とノイズの割合を測定・算出し、予め蓄積されている基準ＳＩＲと比較することで基準との差が判るため、受信信号の受信品質を検知することができる。

この振幅変換部２０６の行う変換方法として、例えば以下のような方法が一実施例として考えられる。

振幅変換部２０６への入力をＸ、出力をＹと置き、Ｙを以下のように定め

る。

Ｙ　＝　ＳＱＲＴ｛ＡＢＳ（１０＊Log_{10}Ｘ）｝

ここで、ＳＱＲＴ（Ｚ）はＺの平方根を返す関数であり、ＡＢＳ（Ｚ）はＺの絶対値を返す関数である。

乗算部１１４へ送られたＹは累積部１１３の出力である振幅制御値をＴＰＣビットの送信電力制御時のみ受信品質に合わせて補正する役割を果たすが、上記数式で定めたようにログと平方根を用いることによって、誤差に直接的に比例させるような補正よりも振幅の変動を小さく抑えることができる。すなわち、誤差Ｘが大きい時に補正値Ｙが必要以上に大きくなり過ぎるのを抑えることができるため、送信アンプ１０４への負荷を軽減することができる。

このように、従来１ビットのＴＰＣビットでは０か１かの二値情報しか送信できなかったのに対し、本実施の形態によれば、１スロット中のＴＰＣビットの送信時の振幅を可変とすることにより、振幅の値というパラメータが増え、同じ１ビットのままでより多くの情報を送ることができ、通信相手への送信電力増減要求のみならず、増減量要求をも１ビットのＴＰＣビットで送信できるため、データ伝送効率を落とさずに高速フェージング時の追随性と低速フェージング時の安定性とを向上させることができる。

すなわち、この方法では、受信信号中の１ビットから成るＴＰＣビットの符号によって送信電力を増加させるのか減少させるのかの指示を送ることができ、ＴＰＣビットの振幅によって送信電力をどの程度増加若しくは減少させるのかの指示を送ることができるため、データ伝送効率を下げることなく送信電力の増減及び増減量の情報を送ることができ、通信相手局は一定値の増減のみを行う送信電力制御に比べて高速フェージングにも低速フェージングにも対応できる送信電力制御がが可能となる。また、増減量を示す振幅を０にすることにより、ＴＰＣビットの符号が示す増減支持が実質的に無意味になり、一定値の増減のみを行う場合には不可能であった送信電力の現状値維持の指示を送ることができる。このように、通信相手局からの送信電力制

御要求を受信し、それに合わせて送信電力を変え、更に受信品質から算出した通信相手局への送信電力制御要求を送信することができるため、通信品質を良好に保つことができる。

（実施の形態２）

本実施の形態に係る送受信装置は、実施の形態１と同様の構成を有し、但しリミタを付加し、送信アンプに過剰な送信電力増加要求が行われることを防ぐものである。

リミタの配置場所としては、１）乗算部と送信アンプの間、２）受信品質検知部と切替部の間、３）累積部と乗算部の間、４）判定部と累積部の間、が考えられる。以下、１）から４）の各々の場合について図４から図７を用いて説明する。なお、実施の形態１と同様の構成には同一の符号を付し、詳しい説明は省略する。

リミタを１）乗算部と送信アンプの間に設けた場合の送受信装置の構成を図４に示す。図４では、乗算部１１４から送信アンプ１０４に送る送信電力の振幅制御値をリミタ３０１で制限することができる。したがって、移動局がフェージングの谷に位置するため通信品質が劣化し、結果として送信アンプ１０４に過剰な送信電力増加要求がなされる場合、リミタ３０１で振幅制御値を制限することによって敢えて品質劣化を許容し、過剰な送信電力にならないようにすることができる。

リミタを２）受信品質検知部と切替部の間に設けた場合の送受信装置の構成を図５に示す。図５では、受信品質検知部１０８から切替部１１５を介して乗算部１１４に送る振幅制御補正値をリミタ４０１で制限することができる。したがって、雑音や干渉によって受信品質検知部１０８の検知結果が乱れ、実際に必要な補正値よりも過剰な値が乗算部１１４へ出力されることを防ぎ、過剰な送信電力増加要求を回避することができる。

リミタを３）累積部と乗算部の間に設けた場合の送受信装置の構成を図５に示す。図６では、累積部１１３から乗算部１１４に送る振幅制御値をリミ

タ５０１で制限することができる。したがって、雑音や干渉によって累積部１１３が出力する振幅制御値が実際に必要な制御値よりも過剰な値が乗算部１１４へ出力されることを防ぎ、過剰な送信電力増加要求を回避することができる。また、この３）では乗算部１１４での補正前にリミタ５０１による制限を行うことから、受信した元々の振幅制御値が大きい場合、乗算部１１４での補正後に制御を行う１）の場合よりも正確な送信電力制御を行うことができる。

リミタを４）判定部と累積部の間に設けた場合の送受信装置の構成を図７に示す。図７では、振幅読取部１１２から累積部１１３に送る振幅値をリミタ６０１で制限することができる。したがって、雑音や干渉によって実際の振幅値よりも過剰な値が乗算部１１４へ出力されることを防ぎ、過剰な送信電力増加要求を回避することができる。

なお、上記リミタの配置１）から４）は、すべて同時に成り立つことができるものであるから、任意の組み合わせで用いることができる。

このように実施の形態２においては、送信アンプ１０４に過剰な負荷がかかることを防止することができ、装置安全性が向上する。

（実施の形態３）

本実施の形態では、コンプレストモード時に、ＴＰＣビットの符号及び振幅で送信電力の増減及び増減量を示すようにする場合について説明する。ここで、コンプレストモードとは、図９及び図１０に示すように、連続送信していたデータに対する拡散率を下げ、その代わりに拡散率を変えた部分のパワーを上げて送信して、送信時間を圧縮するモードをいう。コンプレストモードは、スロッテッドモード（Slotted Mode）と呼ばれる場合もある。

コンプレストモードでは、送信時間を圧縮することにより、空いた時間で他のキャリアをモニタすることができる。したがって、通信中に、伝送する情報量を下げずに、異キャリアの情報をモニタすることができる。この場合、通信及び異キャリアのモニタを１つの受信部で行うことができる。

例えば、図１０Ａに示すような通常のスロット８０１に対する拡散率がＣである場合に、コンプレストモードにおいては拡散率をＣ／２として、図１０Ｂに示すような圧縮スロット８０２を設ける。すなわち、コンプレストモードでは、図９Ａに示すような連続送信しているフレームａ，ｂについて、図９Ｂに示すように、フレームａの前半及びフレームｂの後半を圧縮スロット（例えば、拡散率がＣ／２、パワーが通常スロット８０１の２倍）とする。

このとき、送信がストップする期間（休止区間；ここでは例えば１０ｍｓ）が生じるので、この期間を用いて異キャリアをモニタする。すなわち、圧縮スロット８０２の期間では、周波数ｆ１で受信しており、送信がストップしている期間に周波数ｆ２をモニタする。

図８は、本発明の実施の形態３に係る送受信装置の概略構成を示す要部ブロック図である。なお、実施の形態１と同様の構成について同一の符号を付し、詳しい説明は省略する。また、送信側のコンプレストモードと受信側のコンプレストモードは、非同期（独立の事象）で考えるものとする。

図８に示す送受信装置では、コンプレストモードであるかどうかを認識するコンプレストモード制御部（受信側）７０２と、コンプレストモード時に送信電力制御のステップ幅を制御すると共に、コンプレストモードが解除されたときに、送信電力の増減及び増減量を示す送信電力制御ビットの符号及び振幅を用いて送信電力制御を行うコンプレストモード時ステップ幅制御器７０３と、コンプレストモードであることを指示するコンプレストモード制御部（送信側）７０１と、を有する。

なお、コンプレストモード制御部（受信側）７０２は、コンプレストモード時にコンプレストモード用の送信電力制御を行うと共に、コンプレストモード解除時に送信電力制御信号の符号及び振幅に基づいて送信電力制御を行うように、コンプレストモード時ステップ幅制御器７０３を制御する。

上記構成を有する送受信装置の動作について説明する。まず、送信側では、コンプレストモード制御部（送信側）７０１が、コンプレストモードの送信

を行うことを決定すると、その指示をフレーム構成部１０１、拡散部１０２、及び送信アンプ１０４にそれぞれ出す。

フレーム構成部１０１では、図９Ｂに示すように、圧縮スロット８０２のためのフレームフォーマットを行い、さらに拡散部１０２に対して、拡散率が通常スロット８０１の半分の拡散コードを指定して、圧縮スロット８０２を作成させる。さらに、送信アンプ１０４に出す指令にて、コンプレストモード中は送信を行わないようにする。

受信側では、コンプレストモード制御部（受信側）７０２がコンプレストモードであることを認識して決定すると、その間は送信電力制御ビットを受け取れないため、その指令をコンプレストモード時ステップ幅制御器７０３に与え、コンプレストモード中は特別な送信電力制御を行う。

この特別な送信電力制御とは、例えばコンプレストモード中は送信電力制御ビットとして０を出力して、コンプレストモードに入る前の値を変化させないようにしたりする制御、過去の変動から予測した変化を与える制御、送信電力を徐々に下げる制御などが考えられる。このコンプレストモード中における特別の送信電力制御については、特に制限はない。

コンプレストモード間は送信電力制御が適切に行われないので、コンプレストモード解除時には、送信電力制御誤差が通常の連続送信時よりより遙かに大きくなる。しかしながら、本実施の形態によれば、送信電力信号の符号及び振幅を用いて送信電力制御の増減及び増減量を制御するので、特に、送信電力制御ビットの振幅で送信電力制御のステップを可変にできるので、コンプレストモード解除後に、早急に送信電力制御誤差を補償することができ、他ユーザへの干渉の低減と、自らの送信信号の品質確保を行うことができる。

図１１及び図１２を用いて、本実施の形態における回線変動に対する送信電力制御の追従状態について説明する。図１１及び図１２における（ａ）の曲線は、回線品質の変動を示す。従来の送信電力制御方法においては、（ｂ）に示す送信側の送信電力制御及び（ｃ）に示す受信側の受信品質変動となる。

この場合、図１１の（ｃ）に示すように、コンプレストモード解除後の過剰品質に対して、適正な品質に戻るまでに長い期間を要し、図１２の（ｃ）に示すように、コンプレストモード解除後の品質が保証されない期間が長くなる。

一方、本実施の形態の送信電力制御方法によれば、（ｄ）に示す送信側の送信電力制御及び（ｅ）に示す受信側の受信品質変動となる。この送信電力制御方法は、実施の形態１及び２と同様であるので、具体的な説明は省略する。すなわち、送信側では、送信電力制御ビットの振幅で送信電力制御のステップを可変にできるので、コンプレストモード解除後の大きな送信電力制御誤差に対してダイナミックに誤差補償を行うことができ、所望品質に素早く収束させることができる。

このように、本実施の形態に係る送受信装置によれば、１ビットから成るＴＰＣビットの符号及び振幅をパラメータとして任意増減量の送信電力制御を行うので、コンプレストモードにおいて送信電力制御ができなかったために生じた大きな送信電力制御誤差を短時間に小さくする追従性を有することができ、回線品質の変動に迅速に対応することができる。

（実施の形態４）

本実施の形態に係る送受信装置は、実施の形態３と同様の構成を有し、但し休止区間に入る直前に送信電力制御より算出される振幅値よりも大きい送信振幅値で送信を行う期間を設けるものである。

以下、図１３及び図１４を用いて、本実施の形態に係る送受信装置について説明する。図１３は、本発明の実施の形態４に係る送受信装置の概略構成を示す要部ブロック図であり、図１４は、本発明の実施の形態４における送信電力制御を説明するための送信電力及びＳＩＲの変動を示すグラフである。なお、実施の形態３と同様の構成には同一の符号を付し、詳しい説明は省略する。

図１３において、休止区間前振幅設定部１２０１は、休止区間が始まる直

前のある一定期間、制御送信電力が、所要送信電力の大きさと無関係に、通常の制御時よりも大幅に大きくする指令を生成し、切替部１１５を介して乗算部１１４に伝達する。

コンプレストモードにおいては、休止区間の開始時期・終了時期は既知であるため、休止区間前振幅設定部１２０１及び切替部１１５は、コンプレストモード制御部（受信側）７０２から容易に休止区間開始時期を知ることができ、上記制御が可能となる。

次いで、図１４を用いて本実施の形態における送信電力制御について説明する。図１４Aは、従来の制御量が一定の送信電力制御を行った場合の制御送信電力及び測定ＳＩＲの変動を表わすグラフであり、図１４Bは、本実施の形態に係る送信電力制御を行った場合の制御送信電力及び測定ＳＩＲの変動を示すグラフである。

図１４Aに示すように、従来の送信電力制御では、休止区間の間に所要送信電力が増加し続けたとすると、休止区間が終了し送受信が再開された時点ではＳＩＲを大きく劣化している。この劣化をなるべく短時間に解消することを目的としたのが実施の形態３であった。

本実施の形態では、更に、休止区間に入る直前の一定期間、送信電力制御より算出される振幅値、すなわち所要送信電力値に近づけるための振幅値、よりも大きい送信振幅値で送信を行い、休止区間終了後の送受信再開時に制御送信電力が所要送信電力に大幅に満たないためにＳＩＲに落ち込みがあり制御送信電力が所要送信電力に追従するまでに受信品質の劣化がある場合においても，予め測定ＳＩＲが基準ＳＩＲを大きく上回る区間を作っておくことによって、全体として品質を維持することができる.

このように、本実施の形態によれば、休止区間に入る直前に送信電力制御により算出される振幅値よりも大きい送信振幅値で送信を行う期間を設けるため、休止区間終了後の測定ＳＩＲの落ち込みによる受信品質の劣化の影響を軽減することができる。

（実施の形態５）

本実施の形態に係る送受信装置は、実施の形態３と同様の構成を有し、但し休止区間終了直後には所要送信電力を超える送信電力で送信する区間を設けるものである。

以下、図１５及び図１６を用いて、本実施の形態に係る送受信装置について説明する。図１５は、本発明の実施の形態５に係る送受信装置の概略構成を示す要部ブロック図であり、図１６は、本発明の実施の形態５における送信電力制御を説明するための送信電力及びＳＩＲの変動を示すグラフである。なお、実施の形態３と同様の構成には同一の符号を付し、詳しい説明は省略する。

図１５において、余剰振幅設定部１４０１は、逆拡散部１０７から測定ＳＩＲを得、また、コンプレストモード制御部（受信側）７０２から休止区間の始期・終期タイミングを得、休止区間がある場合、休止区間後の所定期間に対して、制御送信電力が所要送信電力を満たしたあともさらに制御送信電力を増加させる制御を行うようにＴＰＣビットの符号と振幅の補正値を設定し、符号についてはＴＰＣビット生成部１０９に出力し、補正値については切替部１１５に出力する。ＴＰＣビット生成部１０９は余剰振幅設定部１４０１の出力をもとにＴＰＣビットを生成し、フレーム構成部１０１へ伝達する。

次いで、図１６を用いて、本実施の形態における電力制御について説明する。図１６は、本実施の形態に係る電力制御を行った場合の制御送信電力及び測定ＳＩＲの変動を示すグラフである。

図１６に示すように、本実施の形態では、休止区間終了後の所定期間、制御送信電力が所要送信電力を満たした後も更に送信電力を増加させるように送信電力制御を行う。また、その時の送信電力の増減量は可変である。

上記電力制御を行うことによって、図示するように、測定ＳＩＲが基準ＳＩＲを満たした後もさらに過剰に送信電力が修正されるため、、休止区間終

了後の送受信再開時に制御送信電力が所要送信電力に大幅に満たないためにＳＩＲに落ち込みがあり制御送信電力が所要送信電力に追従するまでに受信品質の劣化がある場合においても，全体として品質を維持することができる.

このように、本実施の形態によれば、休止区間終了後に所要送信電力を満たした後もさらに送信電力を過剰に修正にするため、休止区間終了後の受信側測定ＳＩＲの落ち込み分による受信品質の劣化の影響を軽減することができる。

（実施の形態６）

本実施の形態に係る送受信装置は、実施の形態３と同様の構成を有し、但し休止区間終了直後の送信電力値にオフセット値を加えるものである。

以下、図１７及び図１８を用いて、本実施の形態に係る送受信装置について説明する。図１７は、本発明の実施の形態６に係る送受信装置の概略構成を示す要部ブロック図であり、図１８は、本発明の実施の形態６における送信電力制御を説明するための制御送信電力及びＳＩＲの変動を示すグラフである。なお、実施の形態３と同様の構成には同一の符号を付し、詳しい説明は省略する。

図１７において、所要送信電力予測部１６０１は、コンプレストモード制御部（受信側）７０２から休止区間の始期・終期タイミングを得、休止区間がある場合、休止区間終了後に受信側で基準ＳＩＲを満たすために必要な送信電力を予測し、オフセット設定部１６０２に出力する。オフセット設定部１６０２は、予測結果を基づいて送信電力のオフセット値を設定し累積部１１３へ出力する。

次いで、図１８を用いて、本実施の形態における電力制御について説明する。図１８は、本実施の形態に係る電力制御を行った場合の制御送信電力及び測定ＳＩＲの変動を示すグラフである。

図１８に示すように、本実施の形態では、休止区間終了後、送受信再開時の最初の制御送信電力値を、休止区間開始直前の制御送信電力値に算出され

たオフセット値を加えた値とする。すなわち、オフセット値は、休止区間終了後送受信再開時の所要送信電力値を予測し、再開時の制御送信電力値が所要送信電力値に一致するように算出される。よって、送受信再開時の所要送信電力値と制御送信電力値との差を最小限にすることができ、測定ＳＩＲが落ち込んでいる期間を短縮化できる。

このように、本実施の形態によれば、休止区間終了後、送受信再開時の最初の制御送信電力値を、休止区間開始直前の制御送信電力値に算出されたオフセット値を加えた値とすることによって、送受信再開時の所要送信電力値と制御送信電力値との差を最小限にすることができ、測定ＳＩＲが落ち込んでいる期間を短縮化できるため、休止区間後の受信品質の劣化を軽減することができる。

なお、本実施の形態において、休止区間終了直後の所要送信電力を予測する方法は任意であるが、一例として、休止区間以前のＴＰＣビットの符号の個数又は増減量の和を基準とする方法が考えられる。

（実施の形態７）

本実施の形態に係る送受信装置は、実施の形態３と同様の構成を有し、但しチップインターリーブを行うものである。

以下、図１９及び図２０を用いて、本実施の形態に係る送受信装置について説明する。図１９は、本発明の実施の形態７に係る送受信装置の概略構成を示す要部ブロック図であり、図２０は、チップインターリーブを説明するためのフレームフォーマットの一例を示す模式図である。なお、実施の形態３と同様の構成には同一の符号を付し、詳しい説明は省略する。

図１９において、チップインターリーブ部１８０１は、拡散された送信信号の各チップをインターリーブを行い、チップデインターリーブ部１８０２は、受信信号を送信のチップインターリーブと逆の並び換えを行う。

次いで、図２０を用いて、チップインターリーブが行われた場合のフレームフォーマットについて説明する。図２０は、１スロット８シンボルで１６

倍拡散の場合の一例を示している。

図２０において、シンボル０は拡散されて１６チップになる。このとき、１６チップは連続した位置に置かれるのではなく、８チップ毎に配置される。これにより１つのシンボルについてのチップが複数のスロットに振り分けられた状態となっているので、１つのシンボルについてのチップが信号品質の良いスロットと悪いスロットに分散するため、受信側において各シンボルを一定のレベルの品質に保つことができる。よって、休止区間終了後の所要送信電力と制御送信電力とに差があり、信号品質の悪いスロットが生じた場合でも、そのスロットのシンボルの劣化分を信号品質の良いスロットのシンボルが補うため，信号品質を保つことができる。

このように、本実施の形態によれば、任意の増減量の送信電力制御を行うことによりコンプレストモードにおいて送信電力制御ができなかったために生じた大きな送信電力制御誤差を短時間に小さくする追従性を有することができ、更に、チップインターリーブを行うことによって各シンボルの受信品質を平均化するため、休止区間後の受信品質の劣化を軽減することができる。

なお、チップインターリーブの本発明への適用に際し、チップインターリーブ／チップデインターリーブの具体的は方法については任意であり、ここで挙げた数値に限定されるものではない。

なお、本発明は、上記実施の形態１～７に限定されず、種々変更して実施することが可能である。例えば、上記実施の形態１～７は、適宜組み合わせて実施することが可能である。

また、実施の形態４～７は、コンプレストモード使用下における送信電力制御であれば適用することができ、実施の形態１～３に示した任意増減量の送信電力制御とは独立して適用することも可能である。

さらに、本発明は、ハンドオーバ時の送信電力制御による干渉低減を目的としたＦＢＩ（Feed Back Information）ビットが用いられるシステムにおいても適用可能である。

以上説明したように、本発明によれば、ＴＰＣビットの符号及び振幅で送信電力の増減及び増減量を示すようにするので、データ伝送効率を落とさずに高速フェージング時及びコンプレストモード時の追随性と低速フェージング時の安定性とを向上させることができる。

本明細書は、１９９８年８月２８日出願の特願平１０－２４３７４３号、１９９９年３月１１日出願の特願平１１－０６５６８４号、及び１９９９年６月２４日出願の特願平１１－１７８９２６号に基づく。これらの内容はここに含めておく。

産業上の利用可能性

本発明は、ディジタル無線通信システムにおける移動局のような通信端末装置や基地局装置に適用することができる。

請求の範囲

１．受信信号の受信品質を検知する検知手段と、受信信号中のＴＰＣビットの符号及び振幅を読み取る読取手段と、送信信号にＴＰＣビットを多重させ且つ送信信号の振幅をビット毎に設定する制御手段と、送信信号を前記制御手段にて設定した振幅で送信する送信手段と、を具備する送受信装置。

２．前記検知手段は、受信信号のＳＩＲを測定する測定部と、基準となるＳＩＲを保持している蓄積部と、測定ＳＩＲと基準ＳＩＲとの差を求める差算出部と、測定ＳＩＲと基準ＳＩＲとの比を求める比算出部と、を有する請求項１記載の送受信装置。

３．前記制御手段は、ＴＰＣビットの符号を設定する符号設定部と、ＴＰＣビットの振幅を設定するＴＰＣビット振幅設定部と、送信信号中のＴＰＣビット以外のビットの振幅を設定する一般振幅設定部と、を有する請求項１記載の送受信装置。

４．前記符号設定部は前記差算出部の出力によって符号を設定し、前記ＴＰＣビット振幅設定部は前記比算出部の出力によって振幅を設定する請求項３記載の送受信装置。

５．前記読取手段は、ＴＰＣビットの符号を読み取る符号判定部と、ＴＰＣビット以外の信号の振幅とＴＰＣビットの振幅との割合を読み取る振幅読取部と、を有する請求項１記載の送受信装置。

６．前記一般振幅設定部は、前記振幅読取部の出力から増減量を求め、前記符号判定部の出力を基に前回送信時の振幅に前記増減量を加算又は減算した値をＴＰＣビット以外の信号の振幅として設定し、前記ＴＰＣビット振幅設定部はＴＰＣビットの振幅をＴＰＣビット以外の信号の振幅に前記比算出部の出力を乗算した値に設定する請求項１記載の送受信装置。

７．前記ＴＰＣビット振幅設定部の出力制限を行うリミタを具備する請求項３記載の送受信装置。

８．前記比算出部の出力制限を行うリミタを具備する請求項２記載の送受信

装置。

９．前記一般振幅設定部の出力制限を行うリミタを具備する請求項３記載の送受信装置。

１０．前記振幅読取部の出力制限を行うリミタを具備する請求項５記載の送受信装置。

１１．前記比算出部は、算出された比を単調増加関数に変換して出力する請求項２記載の送受信装置。

１２．前記比算出部は、算出された比をＬｏｇ及び平方根を用いた演算によって単調増加関数に変換して出力する請求項１１記載の送受信装置。

１３．信号に対する拡散率を減少させるコンプレストモードであるかどうかを認識する認識手段と、受信信号中の送信電力制御信号の符号及び振幅を読み取る読取手段と、前記コンプレストモード時にコンプレストモード用の送信電力制御を行うと共に、コンプレストモード解除時に前記送信電力制御信号の符号及び振幅に基づいて送信電力制御を行う送信電力制御手段と、を具備する送受信装置。

１４．前記送信電力制御手段は、コンプレストモード時に、休止区間前の所定期間における送信電力値を所定量又は所定割合増加させる休止区間前振幅制御部を有する請求項１３記載の送受信装置。

１５．前記送信電力制御手段は、コンプレストモード時に、休止区間後の所定期間の送信電力制御における目標値を所要送信電力値以上に設定する余剰振幅設定部を有する請求項１３記載の送受信装置。

１６．前記送信電力制御手段は、コンプレストモード時に、休止区間開始直前の送信電力値にオフセット値を加えた値を休止区間後送受信再開時の送信電力値とする休止区間後振幅設定部と、休止区間終了直後の所要送信電力値を予測し、この予測値と休止区間開始直前の送信電力値との差を前記オフセット値として設定するオフセット設定部と、を有する請求項１３記載の送受信装置。

１７．前記オフセット設定部は、休止区間以前のＴＰＣビットの符号の個数又は増減量を基準として予測値を決定する請求項１６記載の送受信装置。

１８．拡散された送信データに対してチップインターリーブ処理を行うチップインターリーブ手段と、受信データに対してチップ毎にデインターリーブ処理を行うチップデインターリーブ手段と、を具備する請求項１３記載の送受信装置。

１９．送受信装置を具備する通信端末装置であって、前記送受信装置は、受信信号の受信品質を検知する検知手段と、受信信号中のＴＰＣビットの符号及び振幅を読み取る読取手段と、送信信号にＴＰＣビットを多重させ且つ送信信号の振幅をビット毎に設定する制御手段と、送信信号を前記制御手段にて設定した振幅で送信する送信手段と、を具備する。

２０．送受信装置を具備する基地局装置であって、送受信装置は、受信信号の受信品質を検知する検知手段と、受信信号中のＴＰＣビットの符号及び振幅を読み取る読取手段と、送信信号にＴＰＣビットを多重させ且つ送信信号の振幅をビット毎に設定する制御手段と、送信信号を前記制御手段にて設定した振幅で送信する送信手段と、を具備する。

２１．受信信号の受信品質を検知する検知工程と、受信信号中のＴＰＣビットの符号及び振幅を読み取る読取工程と、送信信号にＴＰＣビットを多重させ且つ送信信号の振幅をビット毎に設定する制御工程と、送信信号を前記制御工程にて設定した振幅で送信する送信工程と、を具備する送信電力制御方法。

２２．前記検知工程は、受信信号のＳＩＲを測定し、予め蓄積している基準ＳＩＲとの差を求める差算出工程と、前記測定ＳＩＲと前記基準ＳＩＲとの比を求める比算出工程と、を有する請求項２１記載の送信電力制御方法。

２３．前記制御工程は、送信信号中のＴＰＣビットの符号を設定する符号設定工程と、送信信号中のＴＰＣビットの振幅を設定するＴＰＣビット振幅設定工程と、送信信号中のＴＰＣビット以外のビットの振幅を設定する一般振

幅設定工程と、を有する請求項２１記載の送信電力制御方法。

２４．前記符号設定工程は前記差算出工程の出力によって符号を設定し、前記ＴＰＣビット振幅設定工程は前記比算出工程の出力によって振幅を設定する請求項２３記載の送信電力制御方法。

２５．前記読取工程は、ＴＰＣビットの符号を読み取る符号判定工程と、ＴＰＣビット以外の信号の振幅とＴＰＣビットの振幅との割合を読み取る振幅読取工程と、を有する請求項２１記載の送信電力制御方法。

２６．前記一般振幅設定工程は、前記振幅読取工程の出力から増減量を求め、前記符号判定工程の出力を基に前回送信時の振幅に前記増減量を加算又は減算した値をＴＰＣビット以外の信号の振幅として設定し、前記ＴＰＣビット振幅設定工程はＴＰＣビットの振幅をＴＰＣビット以外の信号の振幅に前記比算出工程の出力を乗算した値に設定する請求項２３記載の送信電力制御方法。

２７．信号に対する拡散率を減少させるコンプレストモード時にコンプレストモード用の送信電力制御を行うと共に、コンプレストモード解除時に前記送信電力制御信号の符号及び振幅に基づいて送信電力制御を行う送信電力制御方法。

２８．コンプレストモード時に、休止区間前の所定期間における送信電力値を所定量又は所定割合増加させる請求項２７記載の送信電力制御方法。

２９．コンプレストモード時に、休止区間後の所定期間の送信電力制御における目標値を所要送信電力値以上に設定する請求項２７記載の送信電力制御方法。

３０．コンプレストモード時に、休止区間終了直後の所要送信電力値を予測し、この予測値と休止区間開始直前の送信電力値との差をオフセット値として、休止区間開始直前の送信電力値に前記オフセット値を加えた値を休止区間後送受信再開時の送信電力値とする請求項２７記載の送信電力制御方法。

３１．休止区間以前のＴＰＣビットの符号の個数又は増減量を基準として前

記予測値を決定する請求項３０記載の送信電力制御方法。

３２．拡散された送信データに対してチップインターリーブ処理を行い、受信データに対してチップ毎にデインターリーブ処理を行う請求項２７記載の送信電力制御方法。

図1

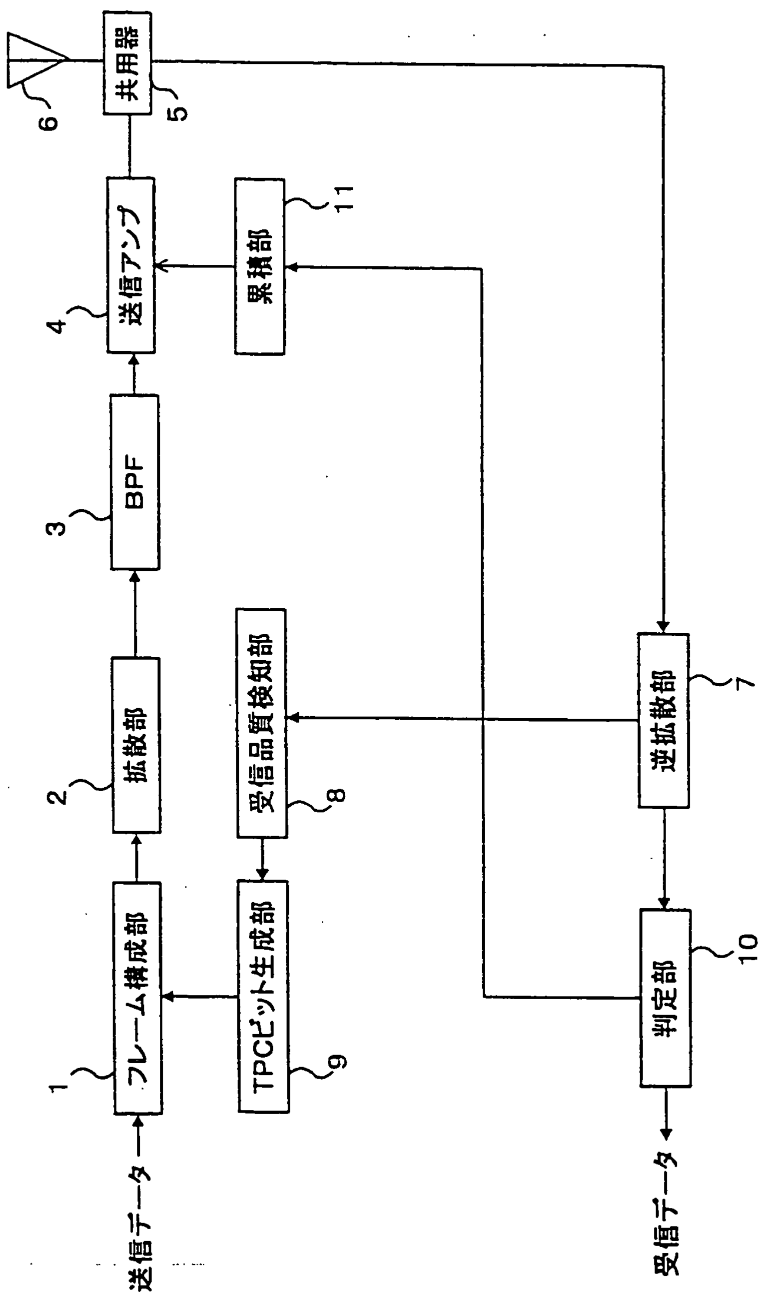

送信データ
フレーム構成部
1
拡散部
2
BPF
3
送信アンプ
4
共用器
5
6
TPCビット生成部
9
受信品質検知部
8
累積部
11
逆拡散部
7
判定部
10
受信データ

図2

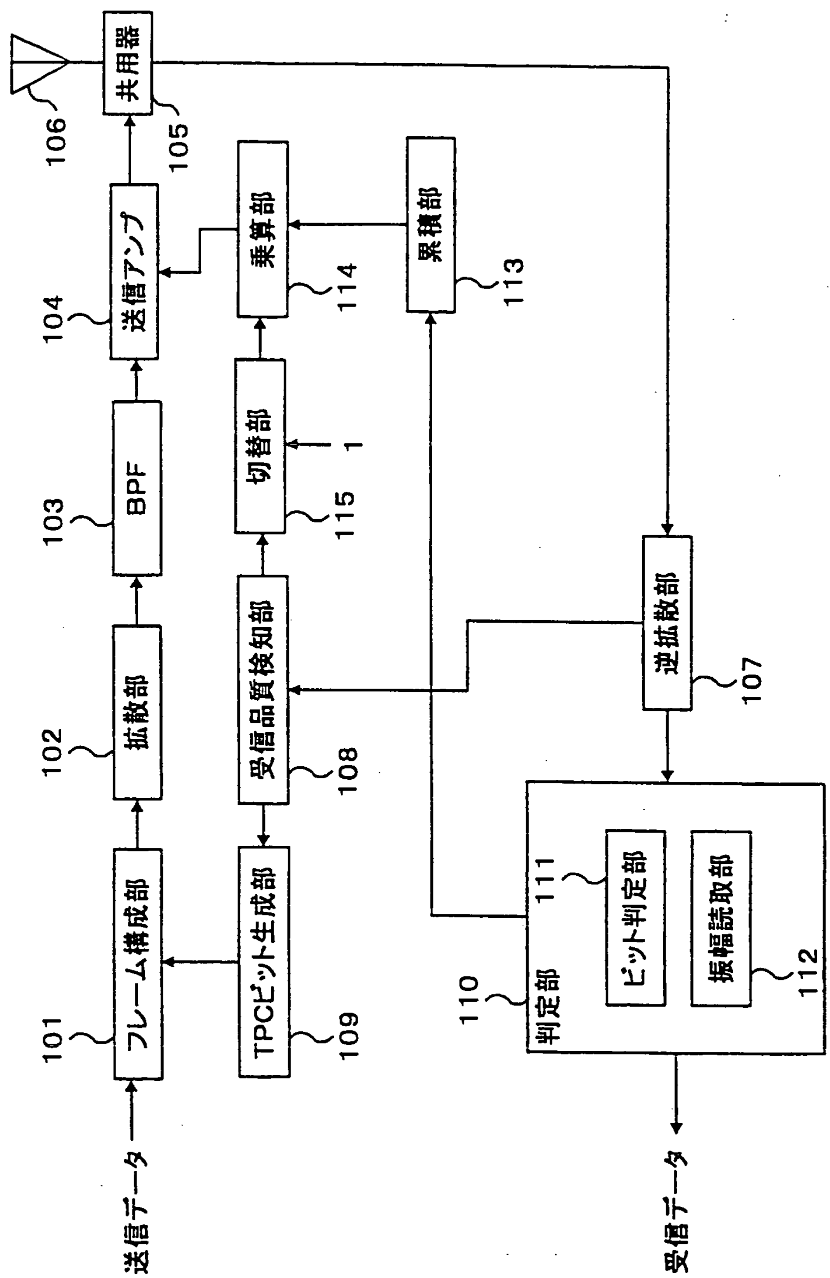

送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
共用器
105
106
TPCビット生成部
109
受信品質検知部
108
切替部
115
1
乗算部
114
累積部
113
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図3

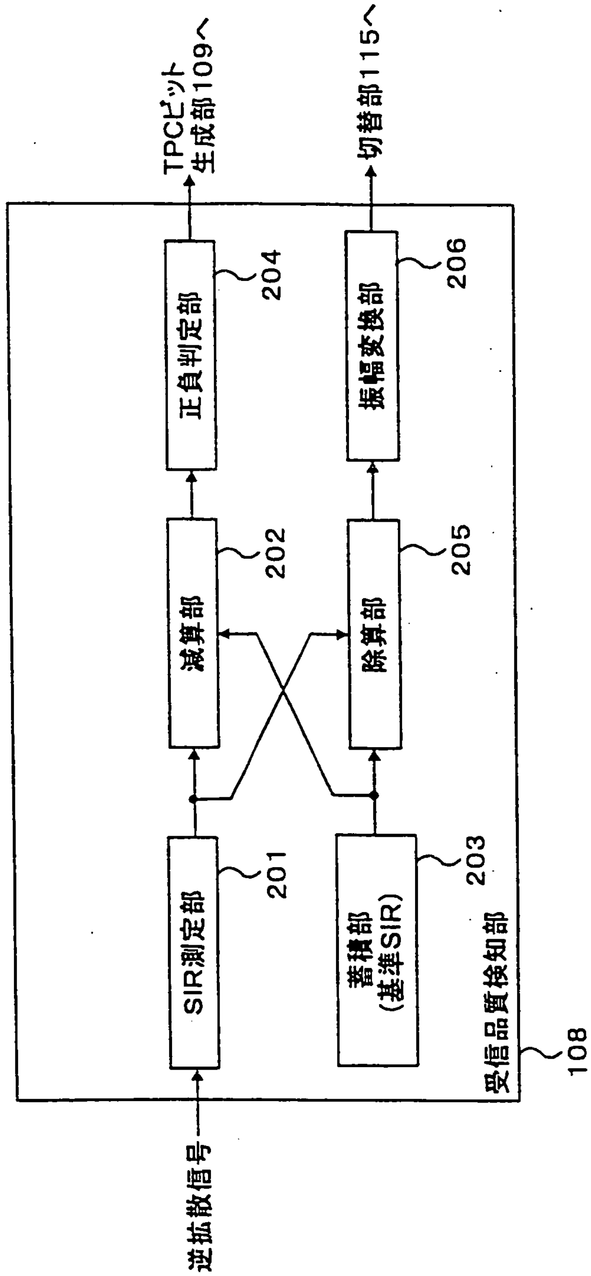
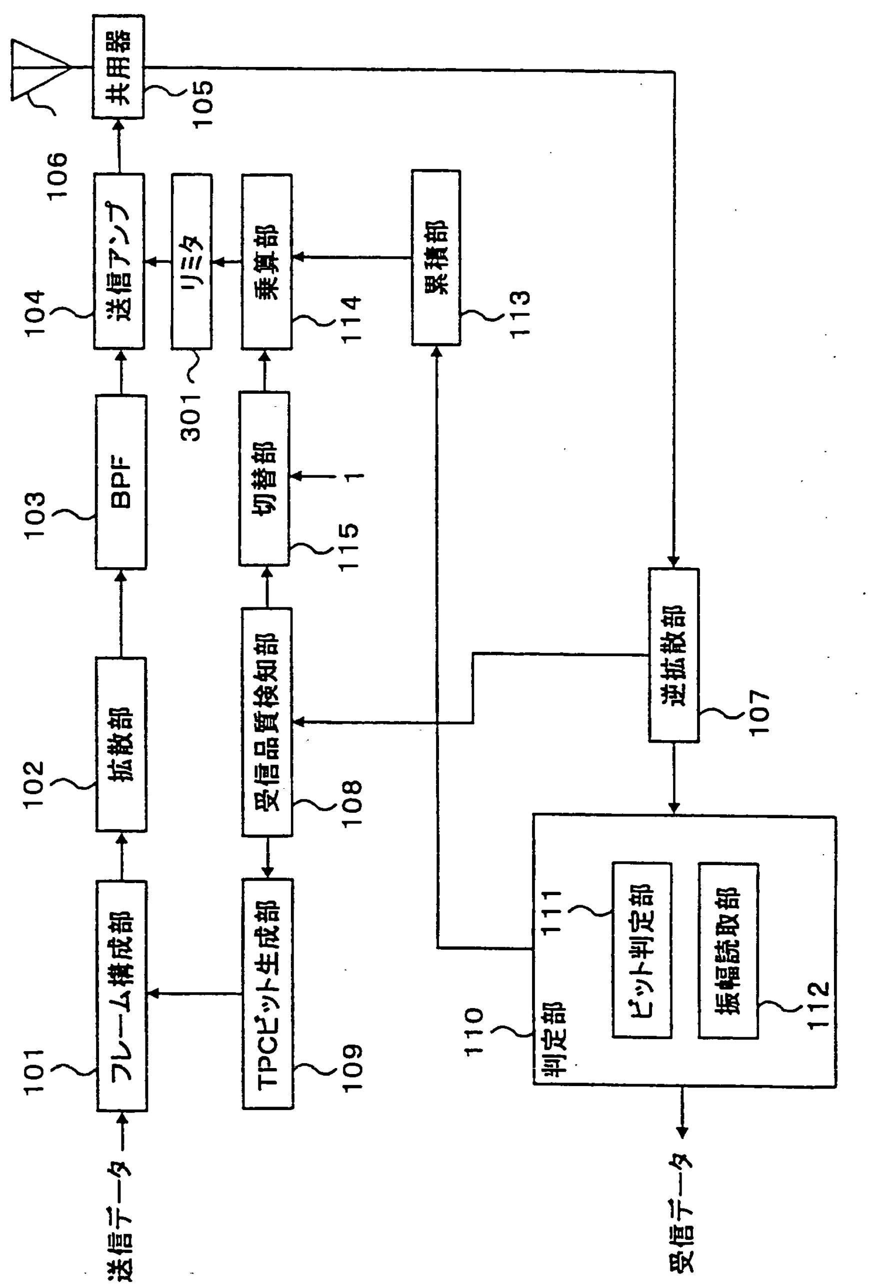

TPCビット生成部109へ
切替部115へ
正負判定部
204
振幅変換部
206
減算部
202
除算部
205
SIR測定部
201
蓄積部
(基準SIR)
203
受信品質検知部
108
逆拡散信号

図4



送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
106
共用器
105
TPCビット生成部
109
受信品質検知部
108
切替部
115
1
乗算部
114
リミタ
301
累積部
113
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図5

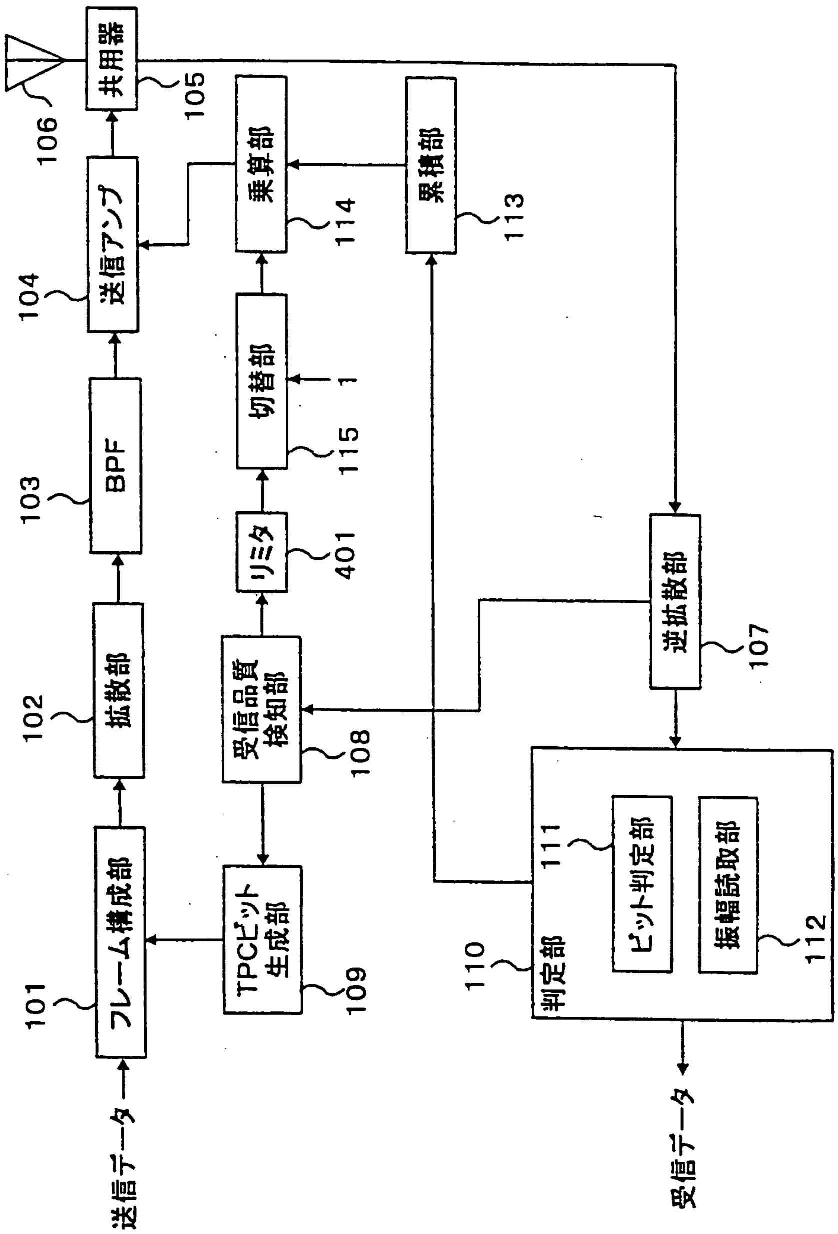

送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
共用器
105
106
TPCビット生成部
109
受信品質検知部
108
リミタ
401
切替部
115
1
乗算部
114
累積部
113
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図6

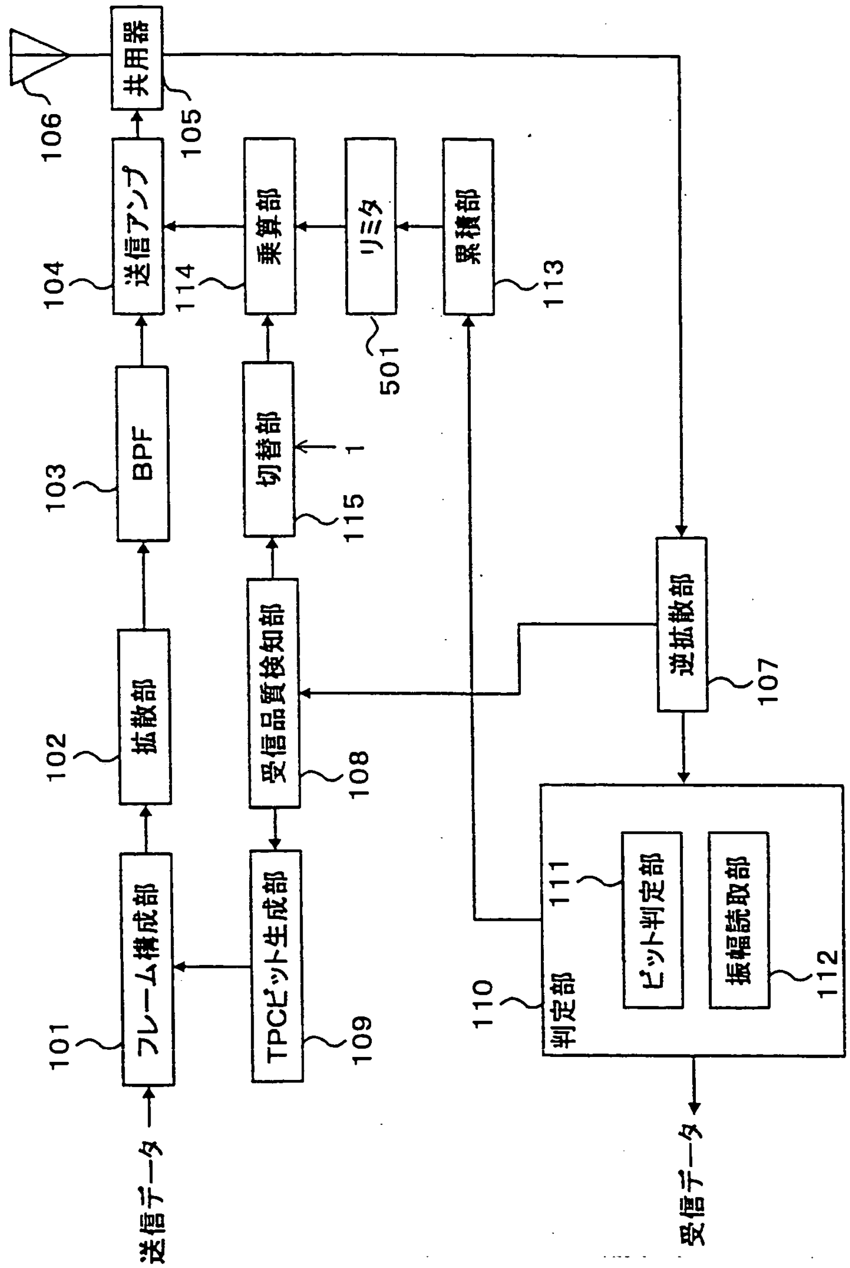

送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
共用器
105
106
TPCビット生成部
109
受信品質検知部
108
切替部
115
1
乗算部
114
リミタ
501
累積部
113
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図7

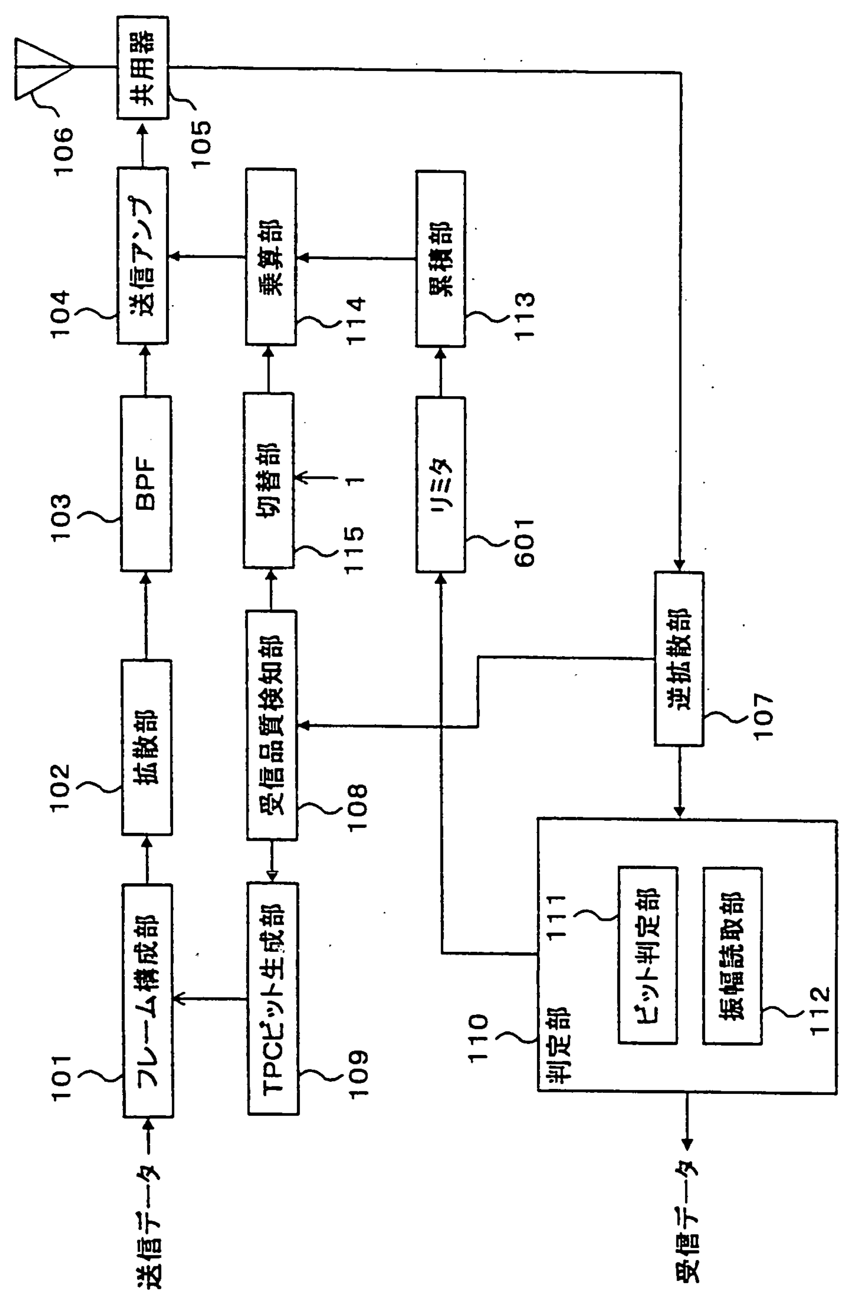
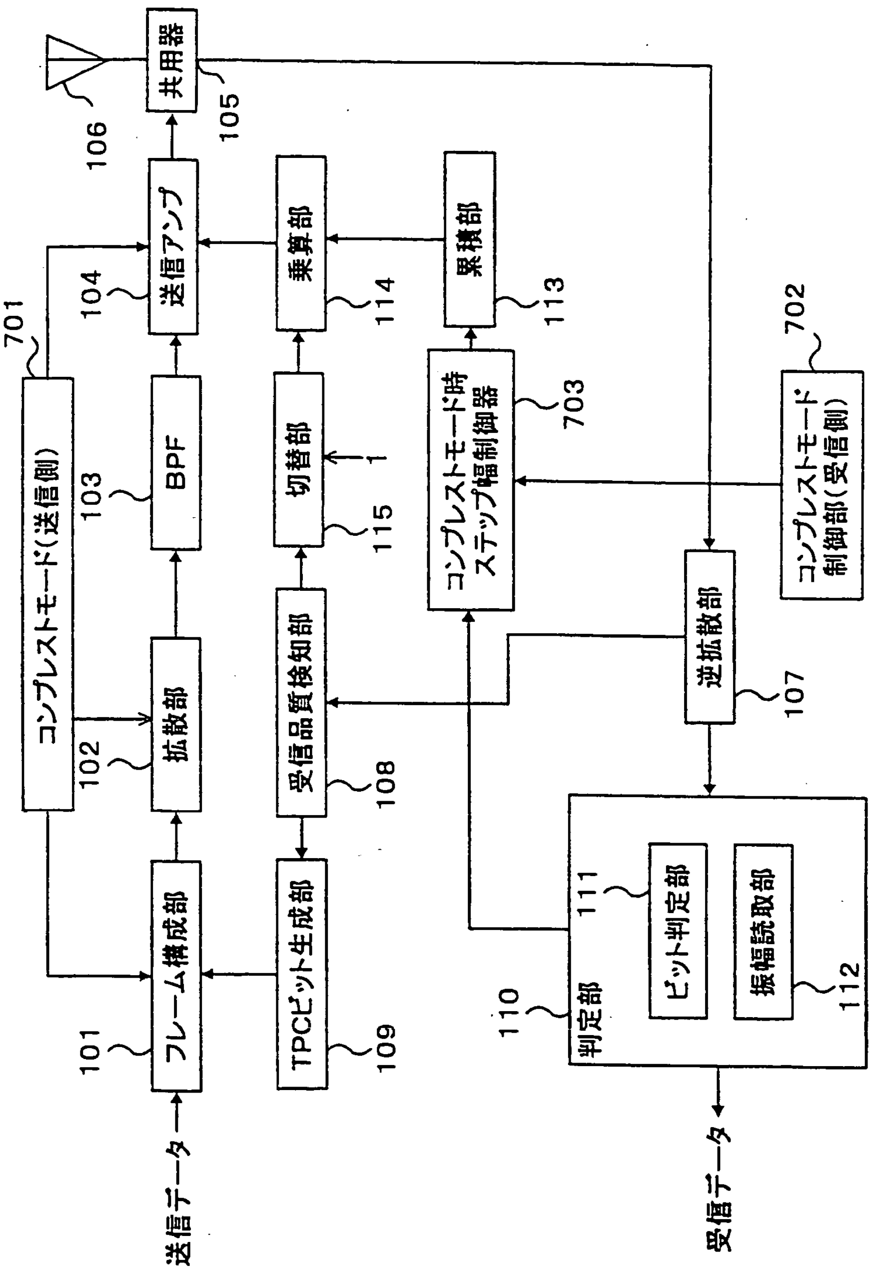

送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
共用器
105
106
TPCビット生成部
109
受信品質検知部
108
切替部
115
1
乗算部
114
リミタ
601
累積部
113
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図8


送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
共用器
105
106
コンプレストモード(送信側)
701
TPCビット生成部
109
受信品質検知部
108
切替部
115
1
乗算部
114
累積部
113
コンプレストモード時ステップ幅制御器
703
コンプレストモード制御部(受信側)
702
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

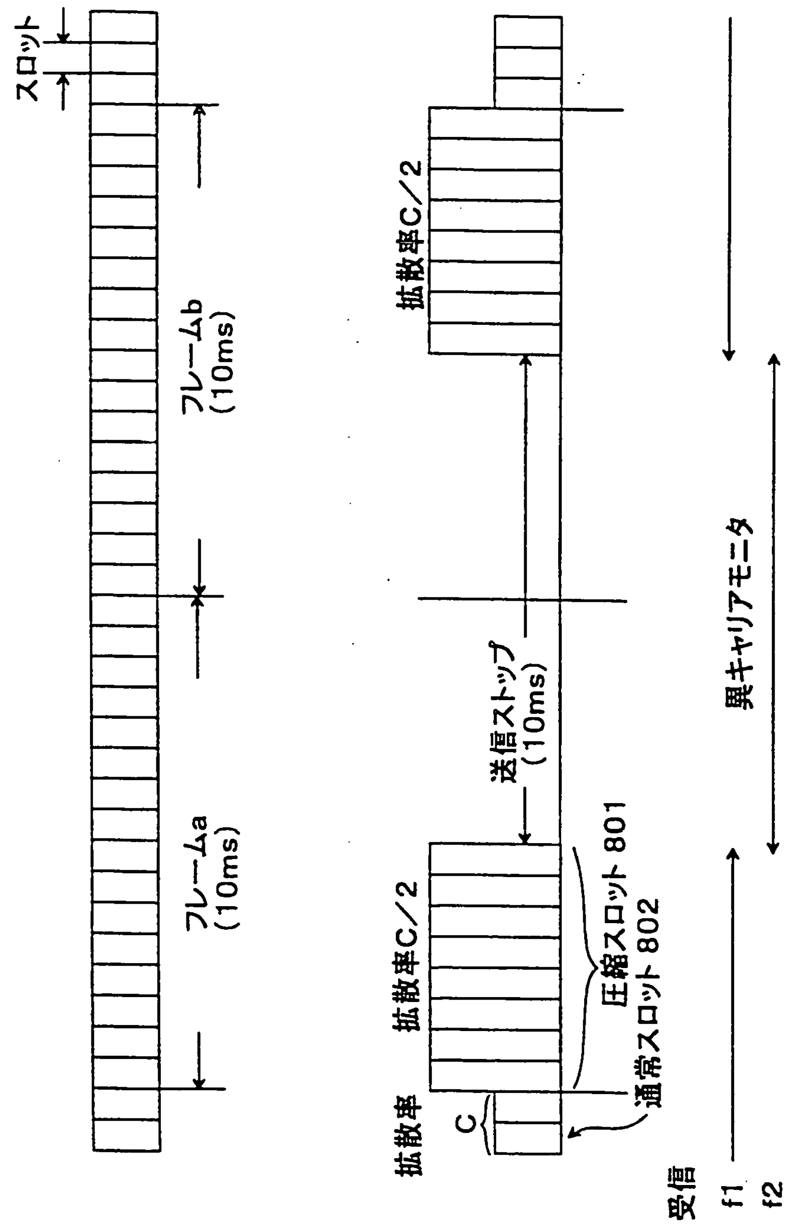

スロット
フレームb
（10ms）
フレームa
（10ms）
拡散率C／2
送信ストップ
（10ms）
拡散率C／2
圧縮スロット 801
通常スロット 802
拡散率
C
受信
f1
f2
異キャリアモニタ

図9A

図9B

図10A

通常スロット 801

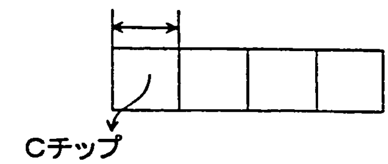


図10B

圧縮スロット 802

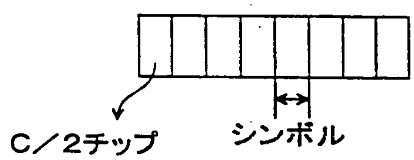


図11

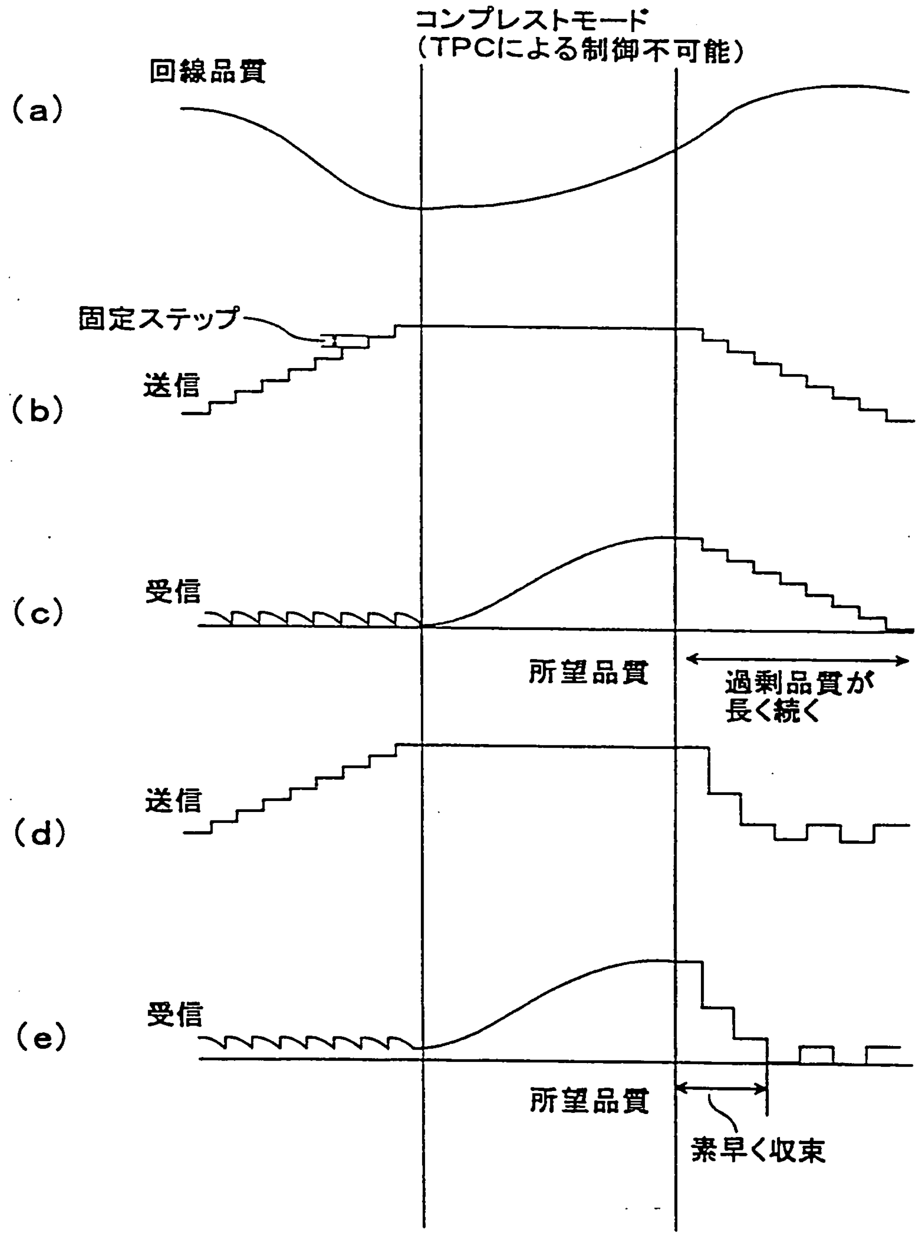

コンプレストモード
（TPCによる制御不可能）
回線品質
(a)
固定ステップ
送信
(b)
受信
(c)
所望品質
過剰品質が
長く続く
送信
(d)
受信
(e)
所望品質
素早く収束

図12

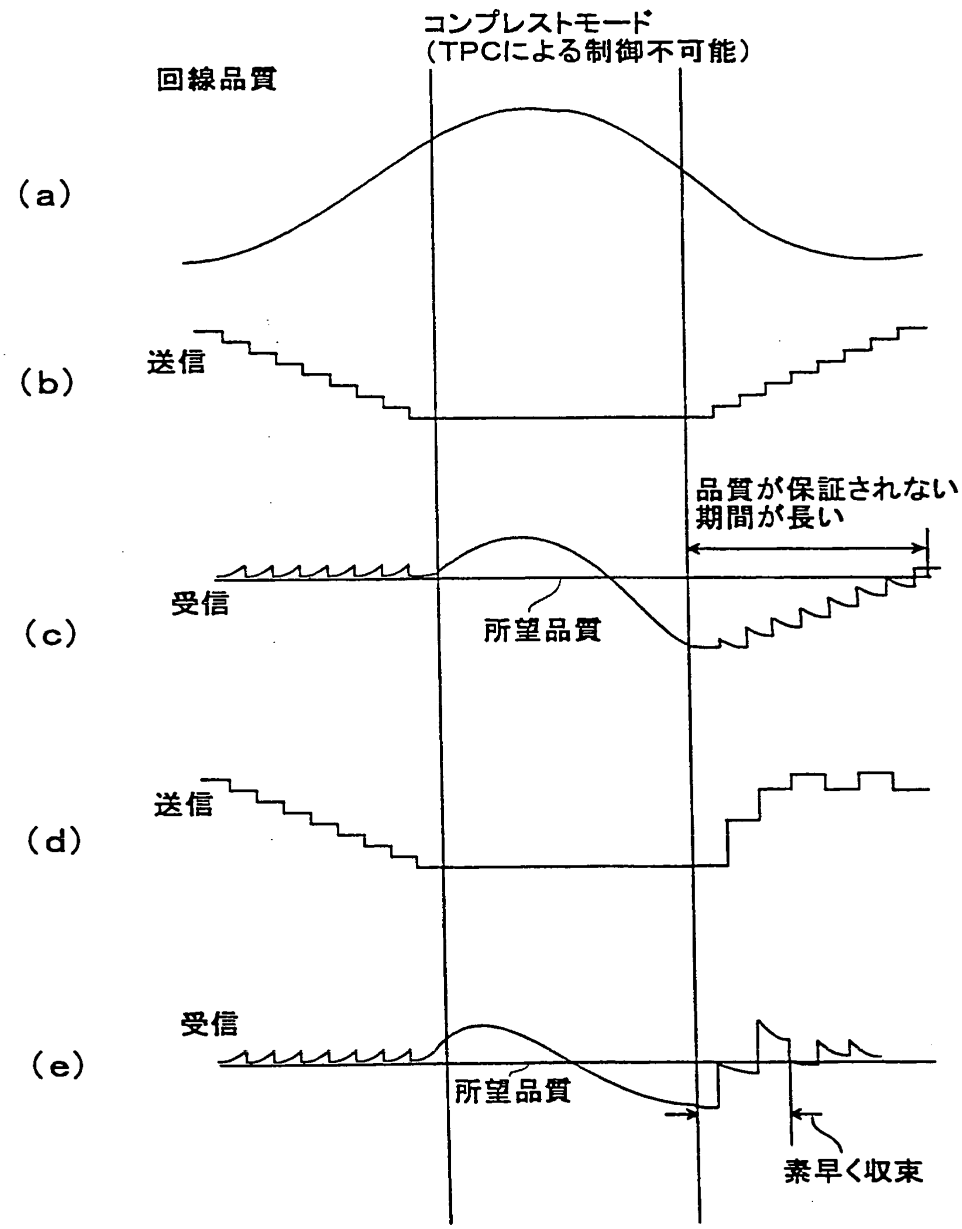

コンプレストモード
（TPCによる制御不可能）
回線品質
（a）
送信
（b）
品質が保証されない
期間が長い
受信
所望品質
（c）
送信
（d）
受信
（e）
所望品質
素早く収束

図13

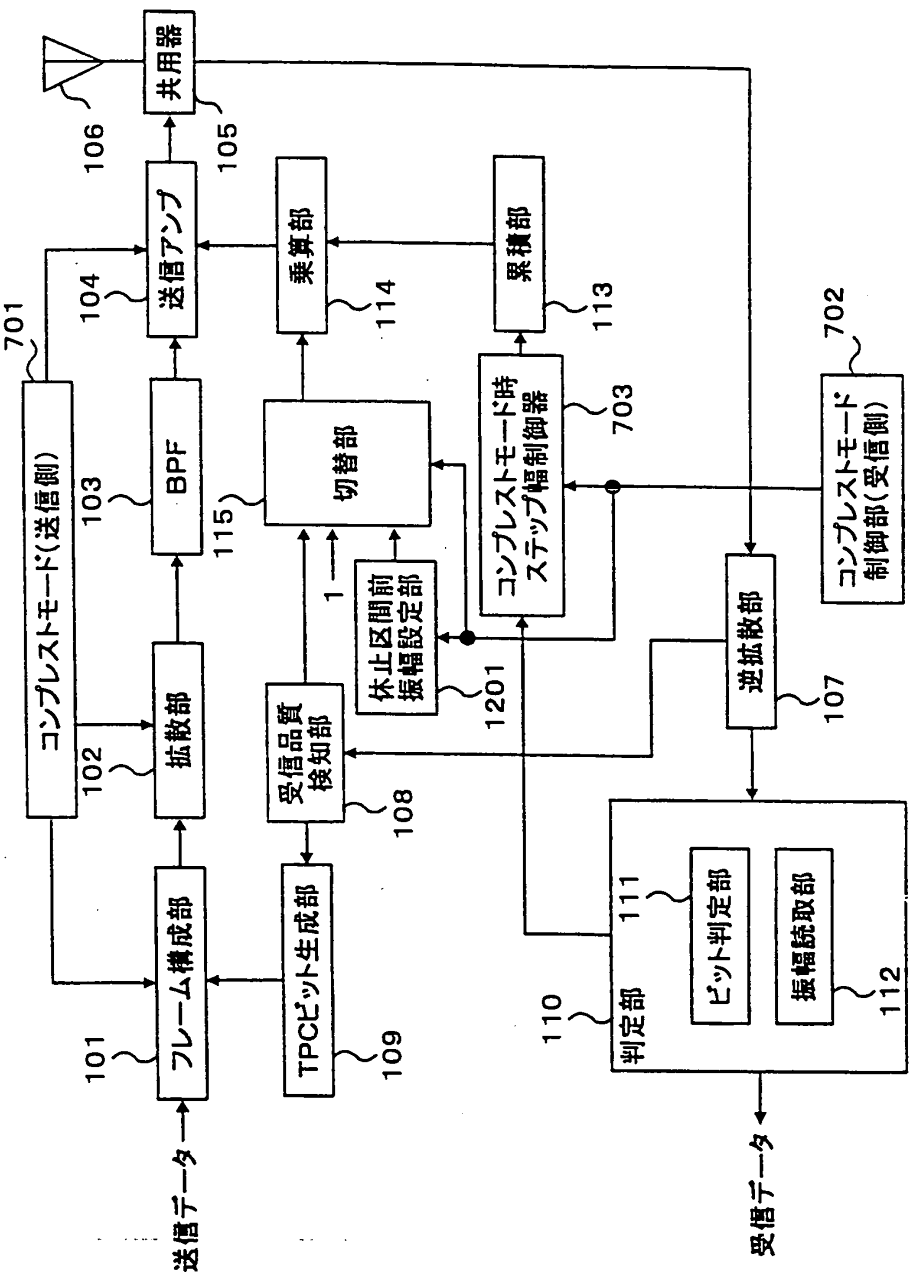

送信データ
フレーム構成部
101
拡散部
102
BPF
103
送信アンプ
104
105
共用器
106
コンプレストモード(送信側)
701
TPCビット生成部
109
受信品質検知部
108
休止区間前振幅設定部
1201
1
切替部
115
乗算部
114
累積部
113
コンプレストモード時ステップ幅制御器
703
コンプレストモード制御部(受信側)
702
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図14B

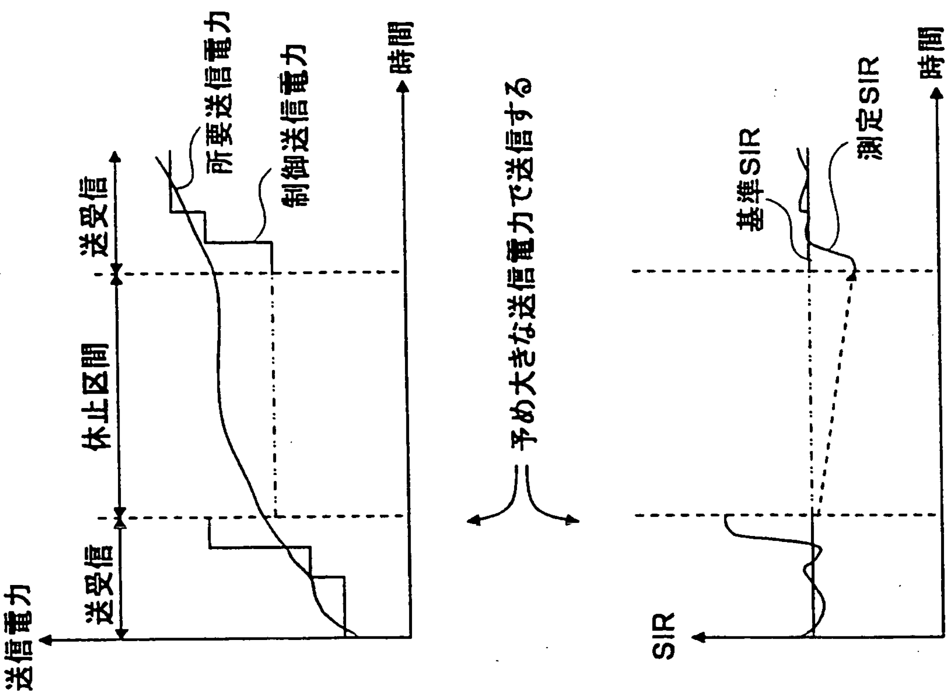

送信電力
送受信
休止区間
送受信
所要送信電力
制御送信電力
時間
予め大きな送信電力で送信する
SIR
基準SIR
測定SIR
時間

図14A

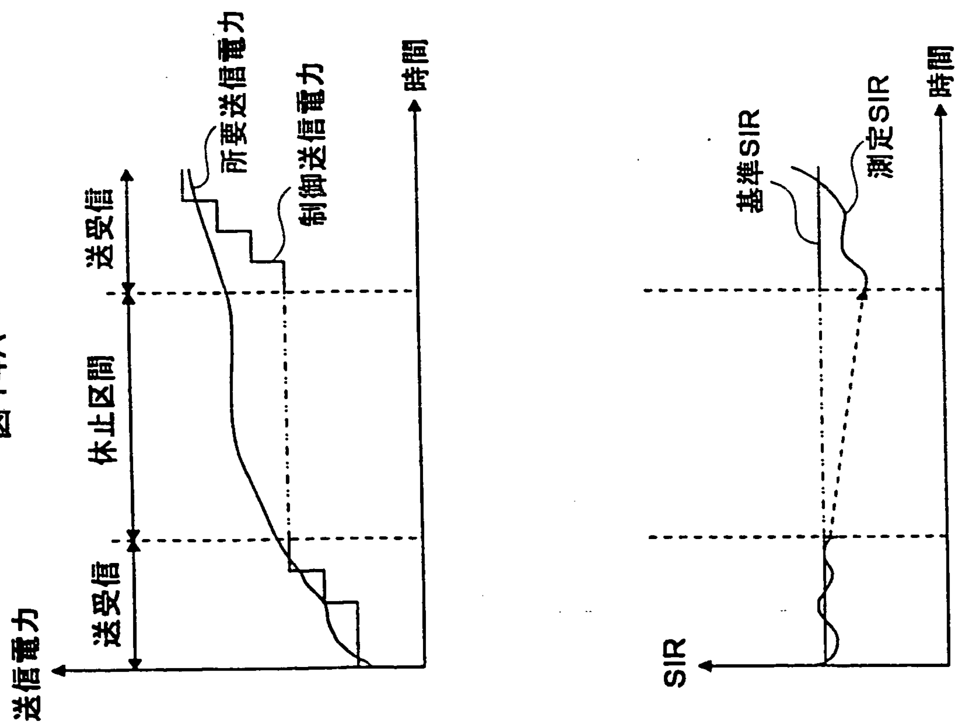

送信電力
送受信
休止区間
送受信
所要送信電力
制御送信電力
時間
SIR
基準SIR
測定SIR
時間

図15

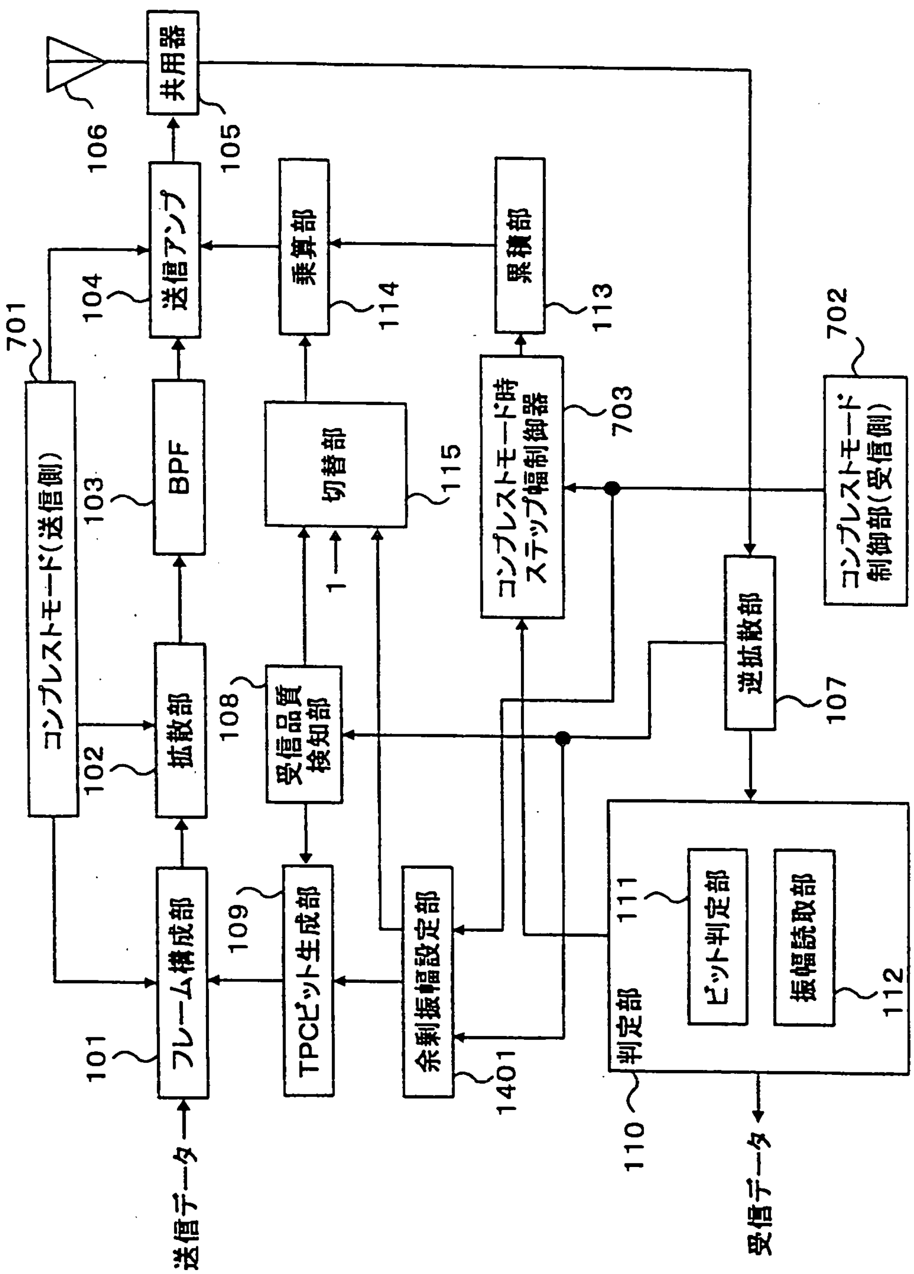
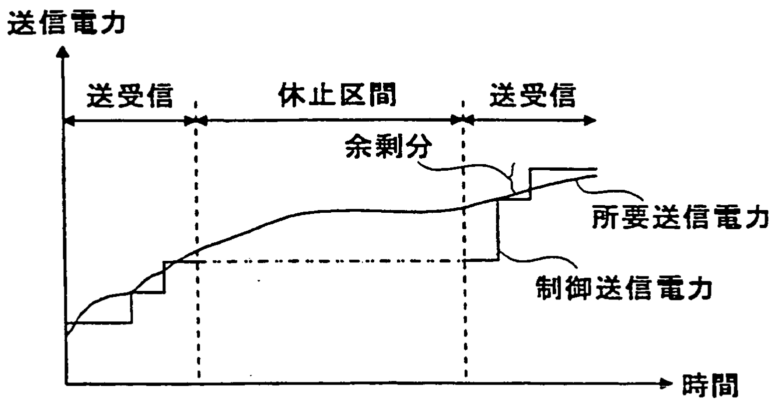

共用器
106
105
送信アンプ
104
701
BPF
103
拡散部
102
フレーム構成部
101
送信データ
コンプレストモード(送信側)
乗算部
114
切替部
115
1
受信品質検知部
108
TPCビット生成部
109
余剰振幅設定部
1401
累積部
113
コンプレストモード時ステップ幅制御器
703
逆拡散部
107
判定部
110
ビット判定部
111
振幅読取部
112
受信データ
コンプレストモード制御部(受信側)
702

図16



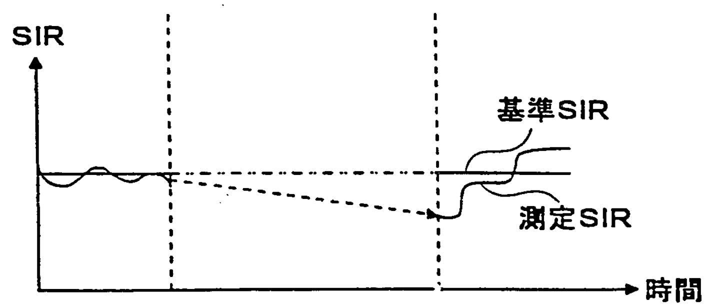


図17

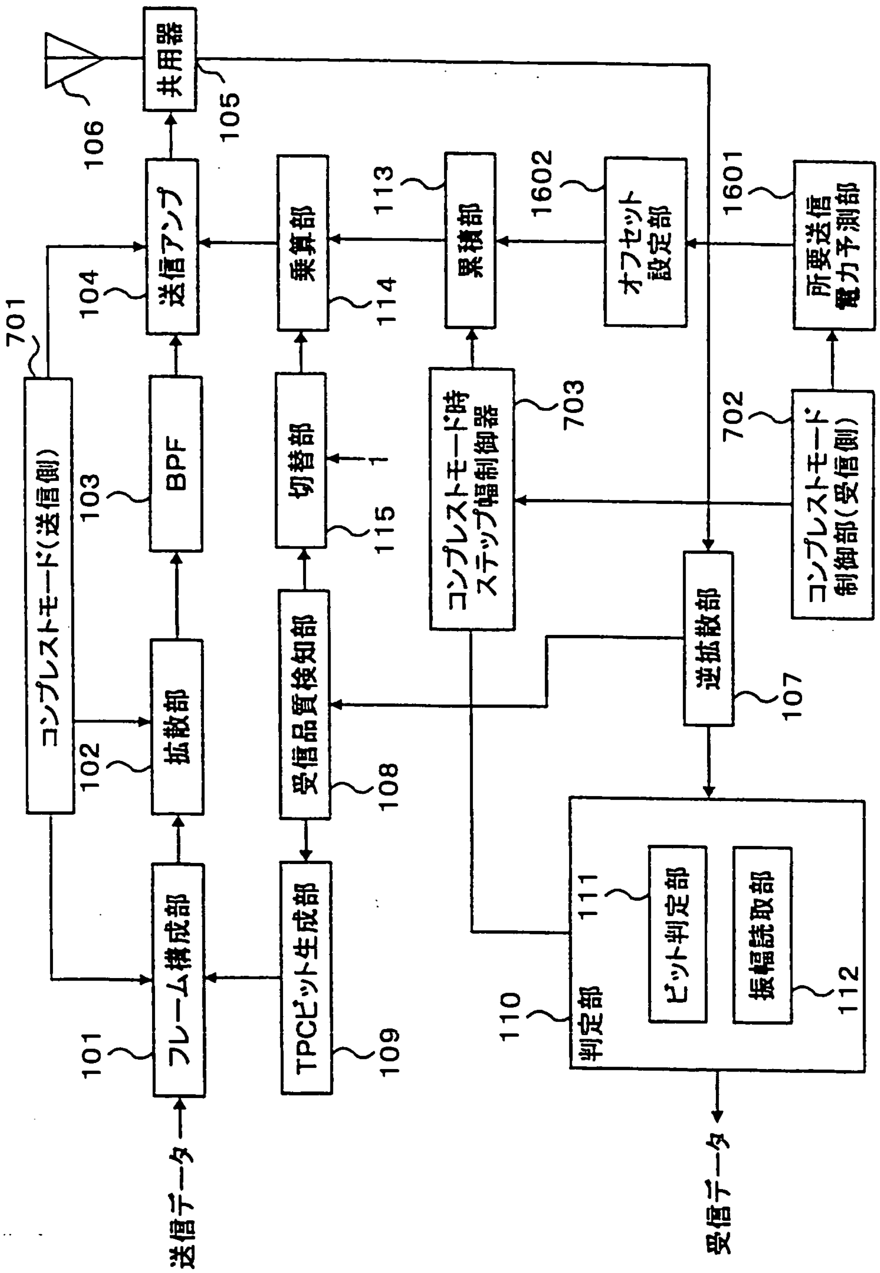

送信データ
101
フレーム構成部
102
拡散部
103
BPF
104
送信アンプ
105
共用器
106
701
コンプレストモード(送信側)
109
TPCビット生成部
108
受信品質検知部
115
切替部
1
114
乗算部
113
累積部
1602
オフセット設定部
1601
所要送信電力予測部
703
コンプレストモード時ステップ幅制御器
702
コンプレストモード制御部(受信側)
107
逆拡散部
110
判定部
111
ビット判定部
112
振幅読取部
受信データ

図18

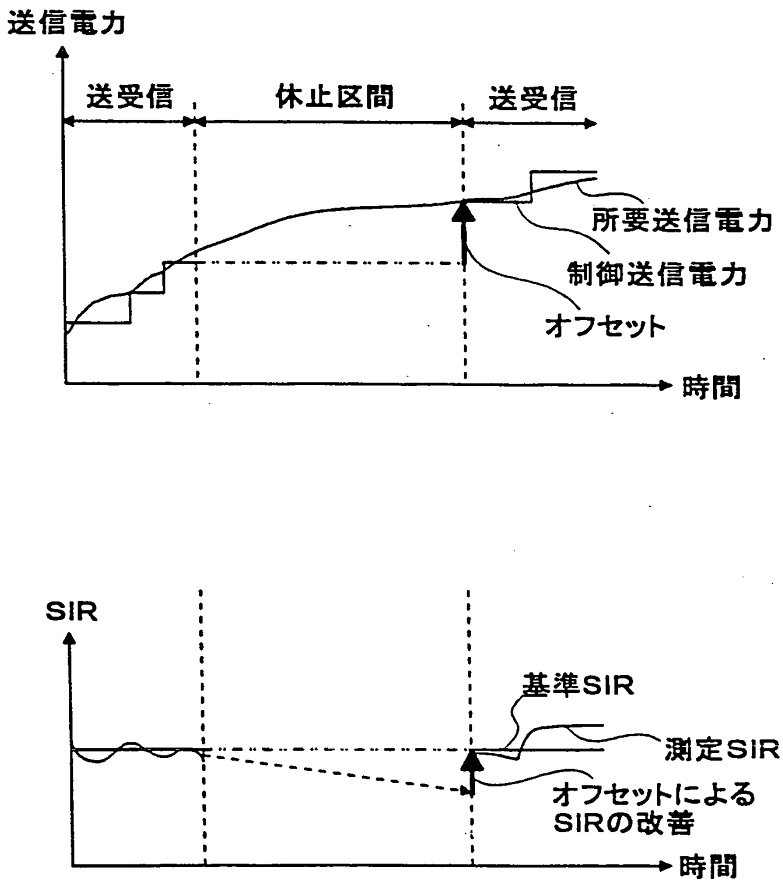

送信電力
送受信
休止区間
送受信
所要送信電力
制御送信電力
オフセット
時間
SIR
基準SIR
測定SIR
オフセットによる
SIRの改善
時間

図19

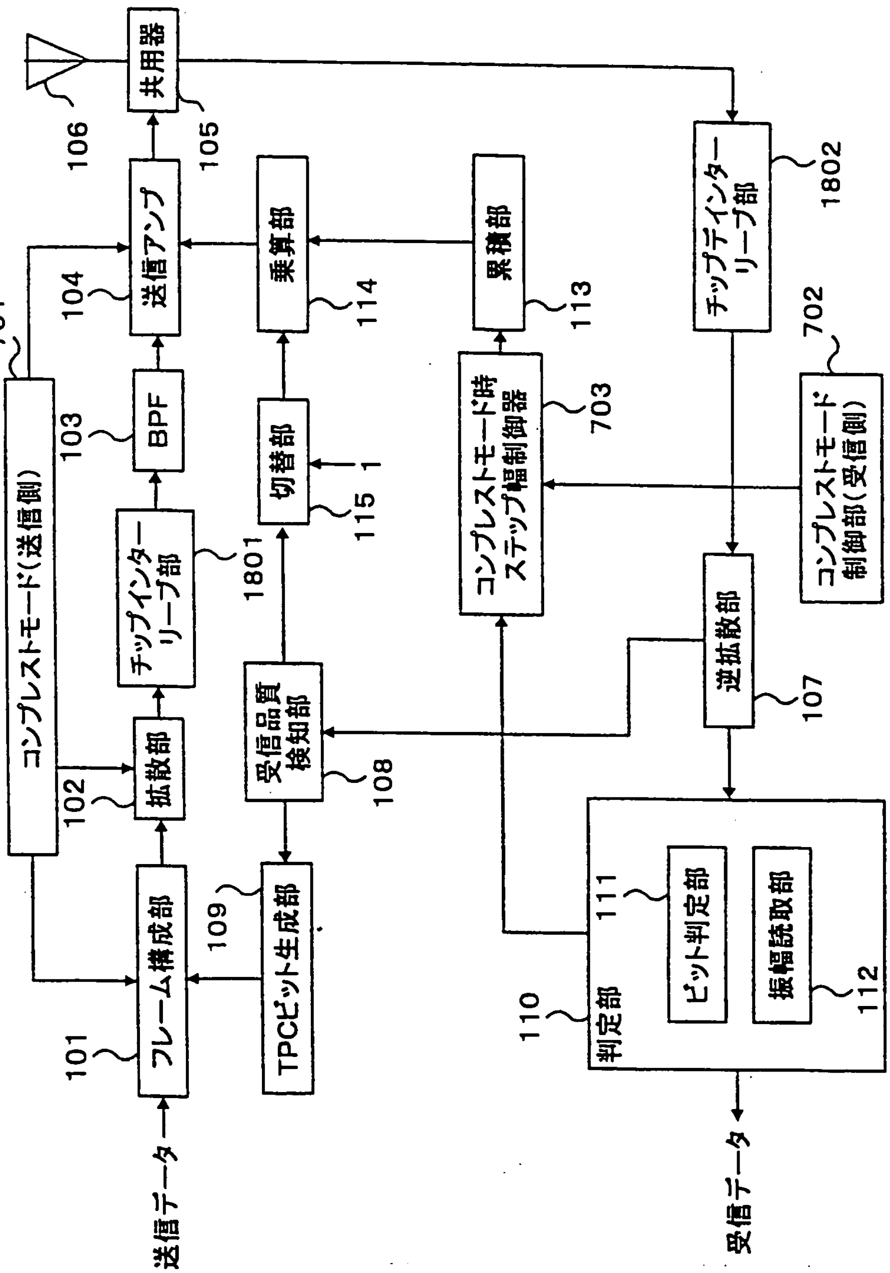
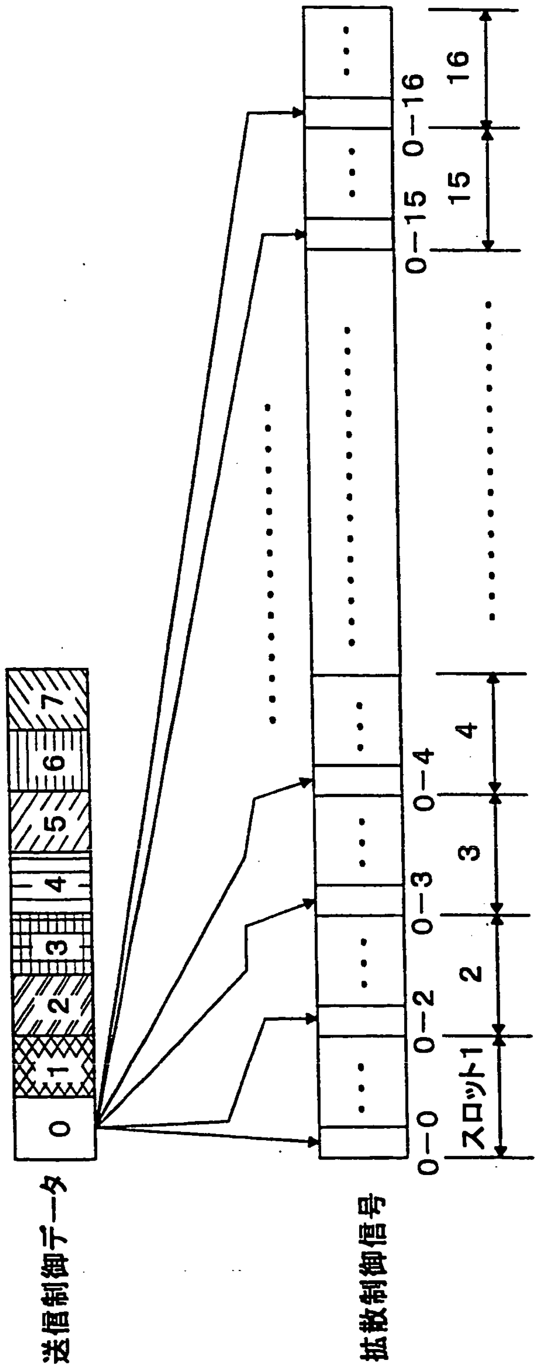

送信データ
フレーム構成部
101
拡散部
102
チップインターリーブ部
1801
BPF
103
送信アンプ
104
共用器
105
106
コンプレストモード(送信側)
701
TPCビット生成部
109
受信品質検知部
108
切替部
115
1
乗算部
114
累積部
113
コンプレストモード時ステップ幅制御器
703
チップデインターリーブ部
1802
逆拡散部
107
コンプレストモード制御部(受信側)
702
判定部
110
ビット判定部
111
振幅読取部
112
受信データ

図20



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/04628

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl^6 H04B1/04, H04B7/26, 102

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl^6 H04B1/04, H04B7/26, 102, H04J13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1999 Toroku Jitsuyo Shinan Koho 1994-1999
Kokai Jitsuyo Shinan Koho 1971-1999

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 10-22978, A (Oki Electric Industry Co., Ltd.), 23 January, 1998 (23. 01. 98), Refer to Figs. 2, 4 ; particularly page 3, right column, Par. No. [0015], last sentence (Family: none)	1, 3, 19, 20, 21, 23
Y	JP, 10-22978, A (Oki Electric Industry Co., Ltd.), 23 January, 1998 (23. 01. 98), Figs. 2, 4 (Family: none)	2, 22
Y	JP, 10-108249, A (Nippon Telegraph & Telephone Corp.), 24 April, 1998 (24. 04. 98), Fig. 2 (Family: none)	2, 22
A	JP, 5-102943, A (Nippon Telegraph & Telephone Corp.), 23 April, 1993 (23. 04. 93), Fig. 1 (Family: none)	13-18 27-32

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 October, 1999 (08. 10. 99)	26 October, 1999 (26. 10. 99)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/04628

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 19, 20
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
The last parts of the statements of claims are both "...*wo gubisuru*" in the original Japanese claims ("be provided with ..." in the translated English claims). Therefore, the constituent features of the inventions are unclear.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

国際調査報告	国際出願番号　ＰＣＴ／ＪＰ９９／０４６２８

Ａ．　発明の属する分野の分類（国際特許分類（ＩＰＣ））
Int Cl⁶　Ｈ０４Ｂ　１／０４
　　　　Ｈ０４Ｂ　７／２６、１０２

Ｂ．　調査を行った分野
調査を行った最小限資料（国際特許分類（ＩＰＣ））
Int Cl⁶　Ｈ０４Ｂ　１／０４
　　　　Ｈ０４Ｂ　７／２６、１０２
　　　　Ｈ０４Ｊ　１３／００

最小限資料以外の資料で調査を行った分野に含まれるもの
日本国実用新案公報　　　１９２６－１９９９年
日本国公開実用新案公報　１９７１－１９９９年
日本国登録実用新案公報　１９９４－１９９９年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

Ｃ．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
Ｘ	ＪＰ，１０－２２９７８，Ａ（沖電気工業株式会社），２３．１月．１９９８（２３．０１．９８）第２，４図、特に第３頁右欄第１５段落の最後の文章を参照。（ファミリーなし）	１、３、１９，２０，２１、２３
Ｙ	ＪＰ，１０－２２９７８，Ａ（沖電気工業株式会社），２３．１月．１９９８（２３．０１．９８）第２，４図、（ファミリーなし）	２、２２
Ｙ	ＪＰ，１０－１０８２４９，Ａ（日本電信電話株式会社），２４．４月．１９９８（２４．０４．９８）第２図（ファミリーなし）	２、２２
Ａ	ＪＰ，５－１０２９４３，Ａ（日本電信電話株式会社），２３．４月．１９９３（２３．０４．９３）第１図（ファミリーなし）	１３－１８ ２７－３２

☐ Ｃ欄の続きにも文献が列挙されている。　　☐ パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー
「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの
「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「Ｏ」口頭による開示、使用、展示等に言及する文献
「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「＆」同一パテントファミリー文献

国際調査を完了した日　０８．１０．９９	国際調査報告の発送日　26.10.99
国際調査機関の名称及びあて先 日本国特許庁（ＩＳＡ／ＪＰ） 郵便番号１００－８９１５ 東京都千代田区霞が関三丁目４番３号	特許庁審査官（権限のある職員）　５Ｗ　９１８２ 彦田　克文　印 電話番号　０３－３５８１－１１０１　内線　３５７５

様式ＰＣＴ／ＩＳＡ／２１０（第２ページ）（１９９８年７月）

国際調査報告	国際出願番号　ＰＣＴ／ＪＰ９９／０４６２８

第Ｉ欄　請求の範囲の一部の調査ができないときの意見（第１ページの２の続き）

法第８条第３項（ＰＣＴ１７条(2)(a)）の規定により、この国際調査報告は次の理由により請求の範囲の一部について作成しなかった。

1. ☐ 請求の範囲 ＿＿＿＿＿＿＿ は、この国際調査機関が調査をすることを要しない対象に係るものである。つまり、

2. ☒ 請求の範囲 第１９、２０項 は、有意義な国際調査をすることができる程度まで所定の要件を満たしていない国際出願の部分に係るものである。つまり、
   両請求項の語尾が「・・・を具備する。」という記載になっているため、両請求項に係る発明の構成が不明瞭となっている。

3. ☐ 請求の範囲 ＿＿＿＿＿＿＿ は、従属請求の範囲であってＰＣＴ規則6.4(a)の第２文及び第３文の規定に従って記載されていない。

第II欄　発明の単一性が欠如しているときの意見（第１ページの３の続き）

次に述べるようにこの国際出願に二以上の発明があるとこの国際調査機関は認めた。

1. ☐ 出願人が必要な追加調査手数料をすべて期間内に納付したので、この国際調査報告は、すべての調査可能な請求の範囲について作成した。

2. ☐ 追加調査手数料を要求するまでもなく、すべての調査可能な請求の範囲について調査することができたので、追加調査手数料の納付を求めなかった。

3. ☐ 出願人が必要な追加調査手数料を一部のみしか期間内に納付しなかったので、この国際調査報告は、手数料の納付のあった次の請求の範囲のみについて作成した。

4. ☐ 出願人が必要な追加調査手数料を期間内に納付しなかったので、この国際調査報告は、請求の範囲の最初に記載されている発明に係る次の請求の範囲について作成した。

追加調査手数料の異議の申立てに関する注意
☐ 追加調査手数料の納付と共に出願人から異議申立てがあった。
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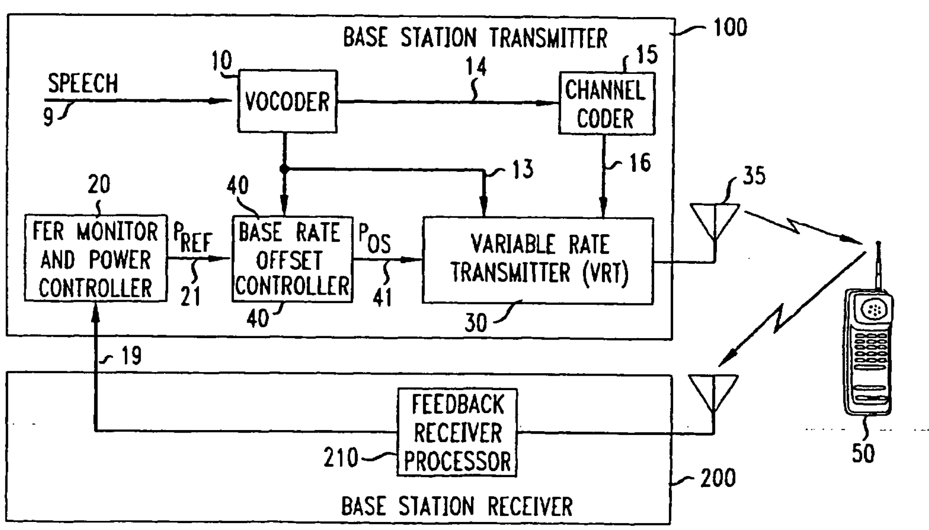
(54) **Method and apparatus for controlling power in a forward link of a CDMA telecommunications system**

(57) A facility is provided for more efficiently controlling transmitted power in a forward link of CDMA telecommunications system. This is done by offsetting a power reference level that adjusts the level of the transmitted power using an power offset selected as a function of a transmission rate specified for the transmission of a coded frame. The coded frame is then transmitted at a power level selected as function of the adjusted power reference level, rather than the unadjusted level. Such efficiently is particularly noticeable when there is transition from one frame transmission rate to another such rate and vice-versa.

FIG. 3



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Description

FIELD OF THE INVENTION

The invention relates to wireless telecommunications, and more particularly relates to controlling transmitted power in a code-division multiple access (CDMA) system.

BACKGROUND OF THE INVENTION

In wireless, cellular, telecommunications systems, a base station transmits information bits grouped into frames at a power level that is intended to be sufficient to permit a receiver to receive the frames at a desired frame error rate, e.g., a frame error rate of about 1%. The receiver continually returns (feedback) information indicative of the Frame Error Rate (FER) to the base station. If the feedback indicates that the FER occurring at the receiver is greater than the desired FER, then the base station (transmitter) increases the transmit power level. Conversely, if such feedback indicates otherwise, then the base station lowers the transmit power level.

In voice communications systems, a variable rate vocoder processes speech and periodically produces a frame containing a variable number of bits, for example, a full-, half-, quarter-, or eighth-rate frame, as disclosed in the Telecommunications Industries Associations (TIA) Interim Standard IS 95, available from TIA located in Washington, D.C., U.S.A.

Moreover, in wireless systems adhering to the IS 95 standard, it is common practice to keep the total transmitted energy per bit (Eb) substantially the same for any of the aforementioned frame rates. A wireless system may achieve this for a half-, quarter-, or eighth-rate frame, by transmitting a symbol repeatedly for two, four or eight times, respectively, with the transmitted power reduced correspondingly, as specified in the IS 95 standard.

We have observed that maintaining substantially the same transmit energy per bit for all of the aforementioned frame rates results in (a) inefficient use of transmitted power, (b) high frame error rates during transitions between frame rates and (c) an increase in interference experienced by receivers other than the targeted receiver.

SUMMARY OF THE INVENTION

We deal with the foregoing problems and advance the relevant art of controlling the transmitted power in a forward link of a CDMA telecommunications system by adjusting the power reference value as a function of a power offset value selected as a function of the transmission rate at which a coded frame is to be transmitted The coded frame is then transmitted at a power level selected as a function of the adjusted power reference value.

In accord with one illustrative embodiment of the invention, we generate a plurality of power offset values associated with respective frame transmission rates, and, responsive to receipt of an indication identifying the transmission frame rate for the coded frame the appropriate power offset value is selected as a function of the identified transmission frame rate. The value of the reference power level is then adjusted as a function of the selected offset value and the coded frame is then transmitted at a power level derived as a function of the adjusted reference power level.

These and other aspects of the invention are disclosed in the following detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 illustrates a prior art transmitter arranged to control the level of forward link transmitted power as a function of a power reference level in a CDMA telecommunication system;

FIG. 2 illustrates graphically the way in which the power reference level adapts to a change in the transmission rate applied to coded frames;

FIG. 3 illustrates one way in which the transmitter of FIG. 1 may be arranged to implement the principles of the invention;

FIG. 4 illustrates graphically the way in which the power reference level adapts in accord with an aspect of invention to a change in the transmission rate applied to coded frames;

FIG. 5 shows in flow chart form an illustrative program which implements the principles of the invention in the rate-based controller of FIG. 3;

FIG. 6 shows a table of offset values associated with respective frame rates that is used by the program of FIG. 5; and

FIG. 7 shows in flow chart form another illustrative program which may be used to implement the principles of the invention in the rate-based controller of FIG. 3 and which adapts such offset values to the environmental conditions of a locality in which a target receiver is present.

BRIEF DESCRIPTION OF THE INVENTION

The transmitter section of a conventional base station transmitter 100, FIG. 1, for wireless telecommunications system includes, inter alia, vocoder 10, channel coder 15, Frame Error Rate (FER) monitor and power controller 20 and Variable Rate Transmitter (VRT) 30. Vocoder 10, more particularly, receives speech signals via path 9 that are to be transmitted to mobile station 50 via antenna 35 and encodes the speech signals in accord with a predetermined encoding scheme, e.g., linear predictive coding, to produce a coded speech frame. Such a frame is generated periodically, e.g., once every twenty milliseconds. Vocoder 10, based on the speech activity that occurs at its input in a twenty millisecond period, determines the frame rate that should be used in the encoding of the speech signals. For example, in the above-mentioned IS 95 standard, the number of bits forming a frame may vary and take one of four different values respectively corresponding to a full-, half-, quarter- or eighth-rate frame. Vocoder 10 then outputs the coded frame to channel coder 15 via path 14. In addition, vocoder 10 presents to VRT 30 via path 13 the frame rate that was used in the encoding of the frame outputted to path 14.

Channel coder 15 further processes the encoded frame to add so-called forward error correction capability, using, for example, the convolutional coding scheme specified in the IS 95 standard. Channel coder 15 then outputs the resulting encoded frame (also referred to hereinafter as the channel coded frame) to VRT 30 via path 16.

VRT 30 uses the frame rate received via path 13 to select one of a number of different transmission schemes that it will use to transmit the channel coded frame received via path 16. VRT 30 also uses a reference power level that it receives via path 21 to determine the power level that will be used in the transmission of the channel coded frame. VRT 30 transmits the channel coded frame via antenna 35 in accord with the selected transmission scheme and at a power level corresponding to the reference power level such that the energy per transmitted bit is substantially the same for all frame rates.

Such transmitting may be achieved, for example, in accord with the rate based transmission scheme specified in the IS 95 standard, in which, for a partial rate (e. g., half-, quarter- or eighth-rate) channel-coded frame, an encoded bit is repeatedly transmitted in inverse proportion to its frame rate (i.e., two, four or eight times, respectively). To maintain the same transmission energy per bit for all frame rates, the transmit power level is reduced as a function of the frame rate. For example, in a quarter-rate frame, an encoded bit is transmitted four times at a power level that is one-fourth of the power level corresponding to the value of the reference power level received via path 21. Whereas, for a full-rate frame, an encoded bit is transmitted once at the power level corresponding to the value of the reference power level.

Information that VTR 30 transmits via antenna 35 is received by a target mobile station, e.g., station 50, as well as other mobile stations (not shown) that are within the coverage area (cell) of base station transmitter 100. Mobile station 50 receives the transmitted channel coded frame and processes it in accord with a predetermined decoding scheme to recover the original information. In doing so, mobile station 50 determines if the frame was received correctly or contains errors and transmits the result of the determination to base station receiver 200 via a reverse "feedback" channel. That is, mobile station 50 transmits an indication of the error rate that it is experiencing with respect to the channel coded frame that it received from the base station. This error indication may be transmitted "raw" identifying the error status of each received frame on a frame by frame basis. Such an error indication may be sent, on the other hand, less frequently in an aggregate form where the mobile station informs the base station of the average received FER that occurred over a certain "observation" interval. Feedback processor 210 of receiver section 200 receives the content of the feedback channel and supplies such content to FER monitor and power controller 20 via path 19. Controller 20 processes the feedback information to generate an estimate of the error rate that is occurring at station 50 and adjusts the reference power level, Pref, as a function of the estimate and supplies the adjusted value to path 21, as mentioned above. That is, if the estimated FER is lower (higher) than the desired FER, then the reference power level is increased (decreased), for example, as shown in FIG. 2 .

For example, assume a system in which mobile 50 provides on a frame by frame basis an indication of whether the received frame was error free or contained errors. Also assume that transmitter 100 is transmitting a series of frames at a full frame rate, and that at a particular instant in time, transmitter 100 is transmitting a frame at a reference power level "a", as shown in FIG. 2. If the above-mentioned feedback indicates that the transmitted frame was received free of errors, then FER monitor and power controller 20 reduces the reference power level by a value equal to a down-step size "b". If such error-free transmission continues, as verified by the feedback provided by receiver 50, then FER monitor and power controller 20 further reduces Pref for the frames transmitted during time period "c". Assume now that the next frame that station 50 receives contains errors and that station 50 advises base station transmitter 100 of that fact via the reverse "feedback" channel. In that case then, FER monitor and power controller 20 raises the value of Pref by a value equal to an up-step size "d". (Note that it is common practice to choose the ratio of the down-step size to the up-step equal to the desired FER.)

Assume now that at time t_1 transmitter 100 begins to transmit a series of frames at an eighth rate. Recall that for the same frame error rate, the transmit energy per bit needed for an eighth-rate frame is lower than that for a full rate frame. The reasons for this include (a) since symbols in a channel coded eighth rate frame are repeated eight times with the same energy per bit, the so-called diversity gain results in a much lower symbol error rate, leading to an even lower frame error probability;

and (b) since the total number of information bits transmitted in eighth-rate frame is smaller by a factor of eight, the frame error probability for the same the symbol error rate is smaller. It can be appreciated that when an eighth-rate frame is transmitted at a power level corresponding to Pref at "e", the FER at the receiver will be well below the desired FER. Thus, FER monitor and power controller 20 continues to decrease Pref as long as the feedback from receiver 50 indicates error free transmission. This continuous decrease in Pref extends from time t_1 to time t_2. The duration of time represented by t_2 minus t_1 may be, for example, several hundred milliseconds to one or more seconds -- which means that the transmit power level during that time is too high and, therefore, inefficient in the use of power and generates excessive interference to other connections.

Assume now that the at time t3 transmitter 100 begins to transmit a series of full rate frames, and transmits the first of the frames at a power level corresponding to a particular value of Pref, e.g., the value represented at "e2", which is likely to be close to the reference power level at "e_1". It may be appreciated that when a full-rate frame is transmitted at a power level corresponding to Pref at "e_1", the FER at the receiver will be well above the desired error rate. For this case, then, FER monitor and power controller 20 increases Pref as long as the feedback from receiver 50 indicates that the FER at receiver 50 is higher than the desired FER. This continuous increase in Pref may extend from time t_3 to time t_4. The duration of time extending from t_3 to t_4 represents a period of time during which the FER at the receiver is much larger than the desired error rate.

We deal with the inefficient use of power problem and the latter error rate problem by responding to changes in the frame rate more quickly than prior base station transmitters. Specifically, when the frame rate changes, we quickly adapt the value of Pref so that it is substantially close to the value that is appropriate for the new frame rate. This is achieved, in accord with an aspect of the invention, by using an off-set controller in the prior art circuit of FIG. 1, as shown in FIG. 3.

In particular, rate-based offset controller 40 is disposed between FER monitor and power controller 20 and VRT 30 for the purpose of off-setting Pref to a level suited for the current frame rate. That is, rate-based offset controller 40 receives the value of Pref via path 21 and adjusts that value as a function of the frame rate that it receives from vocoder 10 via path 13. If the frame rate changes, then controller 40 adjusts the value of Pref as a function of an offset value that is selected (generated) for the new frame rate, as will be explained below. Controller 40 then supplies the adjusted value of Pref as an offset power level Pos to VRT 30 via path 41. Similarly, VRT 30 transmits the channel coded frame at a power level corresponding to the value of a offset power level that it receives via path 41, namely the value of Pos.

FIG. 4 illustrates the way in which an offset quickly adjusts Pref so that it is substantially close to the value appropriate for a new frame rate. FIG. 4 assumes the same conditions assumed for FIG. 2. It is also assumed that Δ_{os} (1), the off-set value for a full-rate frame, is chosen to be zero (0) dB. Thus, it is seen that from t_0 to t_1 when VRT 30 is transmitting the series of full rate frames, Pos substantially follows the values shown for Pref in FIG. 2 (and as also shown in FIG. 4). At time t_1, when the transmitter begins to transmit the series of frames at the eighth-rate, rate-based offset controller 40 applies an offset of size Δ_{os} (1/8) to Pref, which causes the resulting Pos value to quickly adapt to the desired level for the eighth frame rate. It is thus seen from FIG. 4 that as a result of applying the offset to Pref, the offset power level, Pos, that is supplied to VRT 30 is changed quickly and coincidentally with the change in the frame rate, which is unlike the slow response that is obtained by the prior art as is illustrated in FIG. 2 between times t_1 and t_2. A similar offset, Δ_{os} (1), is applied at t3 when the full rate frame transmission is resumed, which eliminates the response time t_3 to t_4 (FIG. 2) that is consumed in prior art arrangements to change Pref to the desired level.

It is also seen from FIG. 4 that the values that Pref assumes (as shown by the dashed line) do not track the values shown for Pref in FIG. 2 for the period from t_1 to t_2. The reason for this is that the offset power level, Pos, provides the appropriate power level indicator to VRT 30. Accordingly, Pref does not have to change substantially whenever the frame rate changes, since that function is now largely assumed by the value of the offset.

FIG. 5 illustrates in flow chart form the program which implements the invention in rate-based offset controller 40. Specifically, the program (500) is entered upon receipt of a current value of Pref from circuit 20 and a current frame rate from vocoder 10 and proceeds to block 501. At block 501, the program stores the current frame rate in associated memory (not shown), and then uses the current frame rate as an index to access a table of offset values that correspond to respective frame rates. An example of such a table is shown in FIG. 6 and includes a plurality of entries, e.g., four entries 601 through 604, respectively, corresponding to full rate-, half rate-, quarter rate-and eighth rate frames and specifying an offset for the corresponding frame rate. For example, for a half-rate frame, the offset $\Delta_{os}(1/2)$ is 1.0 dB. Table 600 also specifies an offset for each of the other frame rates, namely, offsets of 0 dB, 2.5 dB and 4.0 dB, respectively. It is noted that such offsets were determined experimentally by determining the difference in the energy per bit required to achieve the desired frame error rate at each of the aforementioned frame rates.

Thus, at block 501 of FIG. 5, if the current frame is an eighth-rate frame, then the program unloads the contents of entry 604 of table 600. The program (block 502) then applies the offset to the current value of Pref. That is, the program subtracts the value of the offset, e.g., 4.0 dB, from Pref and supplies the result to VRT 30 as Pos. The program then exits to await receipt of the next value of Pref and frame rate.

It is noted that an adaptation process may be used in place of the entries recorded in table 600 to account for changes in the transmission link between the base station and target mobile station, e.g., station 50, as the mobile station changes its position and/or velocity, as well as changes in the surrounding environment and topography. It is likely that such changes would require corresponding changes in the energy per bit for each frame rate. Moreover, the difference in energy per bit required for different frame rates is not a constant, but is itself dependent upon the environment. Accordingly, there may be a need to adapt the offset to meet the current environment of the target mobile station.

An illustrative example of such an adaptation process is shown in FIG. 7. Again, the conditions for FIG. 7 assume frame by frame feedback. Specifically, the program is entered at block 700 responsive to receipt of a frame error indication via the reverse feedback channel. When so entered, the program proceeds to block 701 where it gets the frame rate (r_0) for the corresponding transmitted frame associated with the received frame error indication. The frame rate (r_0) is assumed to have been stored by rate based offset controller 40 as described at block 501, FIG. 5. When the frame error indication is received, the program (block 701) correlates that indication with the appropriate frame that was previously transmitted, thereby associating the error indication with the appropriate frame rate. The program (block 702) then updates the corresponding frame error rate FER(r_0) using the received frame error indication. One such method that may be used to achieve such updating is disclosed in U.S. Patent No. 5,383,219 issued January 17, 1995 to C. E. Wheatley III et al, at column 7, line 45 et seq.,

Following such updating the program (block 703) compares the ratio of FER(r_0) with the FER for a full rate frame, i.e., FER(1). If the value of the ratio exceeds the value of variable a (e.g., a value greater than one, such as 2), then the program (block 704) decreases the value of the offset corresponding to the rate r_0. The program (block 705) then updates the latter value, $\Delta_{os}(r_0)$, in table 600 for the corresponding frame rate and then exits.

Otherwise, the program (block 706) checks to see if the value of the aforementioned ratio is less than the value of a variable β (e.g., a value less than one, such as 1/2). If that is the case, then the program (block 707) increases the value of the offset corresponding to the rate r_0. Similarly, the program (block 705) updates the value of $\Delta_{os}(r_0)$ in table 600 for the corresponding frame rate and then exits. Otherwise, the program exits without updating the corresponding offset in table 600. (It is noted that, in practice, upper and lower limits are typically placed on the values that these offsets may take.)

The foregoing is merely illustrative of the principles of the invention. Those skilled in the art will be able to devise numerous arrangements, which, although not explicitly shown or described herein, nevertheless embody those principles that are within the spirit and scope of the invention. For example, although the claimed invention has been discussed in the context of a particular receiver feedback arrangement, it is clear that the invention may be used in conjunction with other forms of receiver feedback. As another example, it also clear that the claimed system may be used in other than a wireless system, e.g., a wired system. As a further example, a separate reference power level is maintained for each respective frame rate and then adapted to achieve a desired error rate for that frame rate at the remote receiver. Accordingly, a coded frame is transmitted at a reference transmit power level corresponding to the frame rate for the coded frame.

Claims

1. A method of operating a transmitter in a cellular communications system, said method comprising the steps of

   generating a coded frame of signals,

   generating a plurality of power offset values associated with respective frame transmission rates,

   generating an indication identifying the frame transmission rate for the coded frame and selecting one of the power offset values as a function of the identified frame transmission rate,

   responsive to the selection, applying the selected offset value to a reference power level to obtain an offset power level value, and

   transmitting the coded frame at a power level derived as a function of at least the offset power level.

2. The method of claim 1 further comprising the step of transmitting each bit forming the coded frame repeatedly a number of times in which said number is inversely proportional to said indication.

3. The method of claim 1 further comprising the steps of

   receiving the coded frame at a target receiver,

   at said target receiver, generating an error rate from which the transmitter may determine an error rate at the receiver, and

   transmitting the error rate indicator via a reverse feedback channel.

4. The method of claim 3 further comprising the steps of

at said transmitter, receiving said error rate indicator via said reverse feedback channel and adjusting said power reference level as a function of the received error rate.

5. The method of claim 3 wherein each of said power offset values are initially set to predetermined values and each is thereafter adaptively changed to adjust to a transmission environment associated with a location in which the target receiver situated.

6. A method of operating a transmitter for a cellular communications system, said method comprising the steps of

generating an encoded frame of speech signals,

generating a reference power level which is thereafter adjusted as a function of an estimated error rate occurring at a remote receiver and a predetermined error rate,

generating a plurality of power offset values associated with respective frame transmission rates,

receiving an indication identifying the transmission frame rate for the encoded frame and selecting a previously stored power offset value associated with the identified transmission rate,

responsive to the selection, generating a offset power level, Pos, as a function of the reference power level, Pref, and the selected power offset value, Δ_{os},

transmitting the encoded frame at a power level derived as a function of the offset power level, Pos,

changing the power offset value, Δ_{os}, such that an error rate at the remote receiver substantially meets a predetermined error rate and storing the current power offset value, Δ_{os}, in the memory in place of the previously stored power offset value for the identified frame rate.

7. A cellular communications system having a transmitter, said transmitter comprising,

means for generating a coded frame of speech signals,

means for generating a plurality of power offset values associated with respective frame transmission rates,

means for receiving an indication identifying the transmission frame rate for the coded frame and for selecting one of the power offset values as a function of the identified transmission frame rate,

means, responsive to the selection, for adjusting a reference power level by the selected power offset value, and

means for transmitting the coded frame at a power level derived as a function of the adjusted reference power level.

8. The transmitter of claim 1 further comprising means for transmitting each bit forming the coded frame repeatedly for a number of times that is inversely proportional to said indication.

9. The cellular communications system of claim 7 including at one target receiver, said one target receiver comprising

means for receiving the coded frame,

means for generating an error rate indicator indicative of whether said code frame was received in error and extent of such error, and

means for transmitting the error rate indicator via a reverse feedback channel to said transmitter.

10. The transmitter of claim 9 further comprising

means for receiving said error rate indicator via said reverse feedback channel and for adjusting said power reference level as a function of the received error rate.

11. The transmitter of claim 9 wherein said power offset values are initially set to respective predetermined values and each is thereafter adaptively changed to adjust to an environment associated with a location in which the target receiver situated.

12. A method of operating a transmitter for a cellular communications system, said method comprising the steps of

generating an encoded frame of speech signals,

generating a reference power level such that when the coded frame is received at a remote receiver a frame error rate at the receiver meets a predetermined frame error rate,

generating a plurality of power offset values associated with respective frame transmission rates,

receiving an indication identifying the transmission frame rate for the encoded frame and selecting a previously stored power offset value associated with the identified transmission rate,

responsive to the selection, generating an offset power level based on the reference power level and the selected power offset value,

transmitting the encoded frame at a power level derived as a function of the changed offset power level,

changing selected power offset value until a coded frame is received at the remote receiver at an error rate which substantially meets a predetermined error rate and storing the current power offset value in the memory in place of the previously stored power offset value for the identified frame rate.

13. A method of operating a transmitter in a cellular communications system, said method comprising the steps of

generating a plurality reference power levels associated with respective frame transmission rates,

generating a coded frame of signals,

selecting one of the plurality of reference power levels associated with a frame rate at which said coded frame is to be transmitted to a remote receiver, and

transmitting the coded frame at a power level derived as a function of the selected reference power level.

FIG. 1

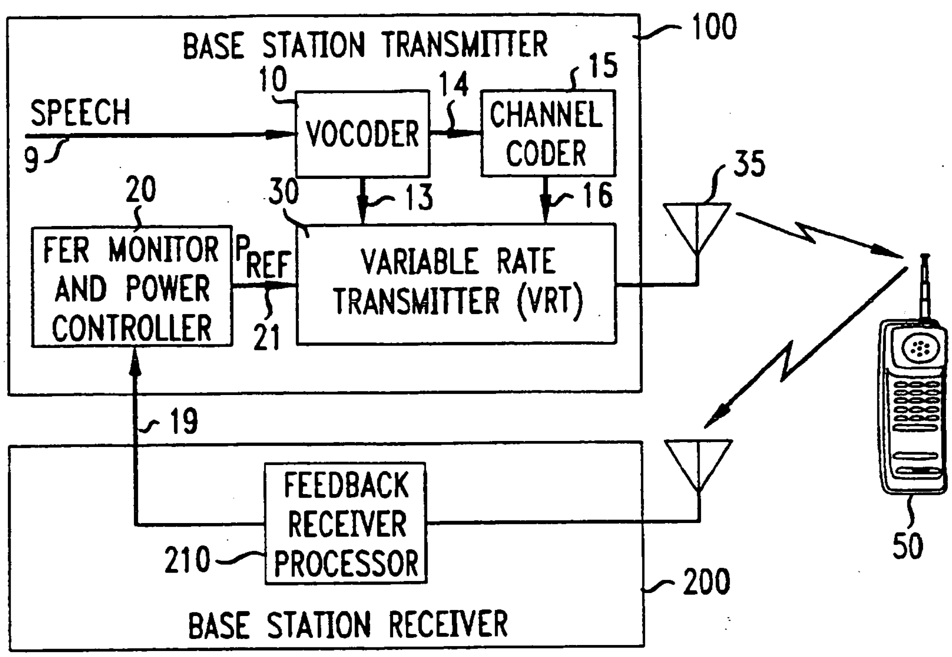

BASE STATION TRANSMITTER
100
10
14
15
SPEECH
VOCODER
CHANNEL CODER
9
20
30
13
16
35
FER MONITOR AND POWER CONTROLLER
P REF
VARIABLE RATE TRANSMITTER (VRT)
21
19
FEEDBACK RECEIVER PROCESSOR
210
50
200
BASE STATION RECEIVER

FIG. 2

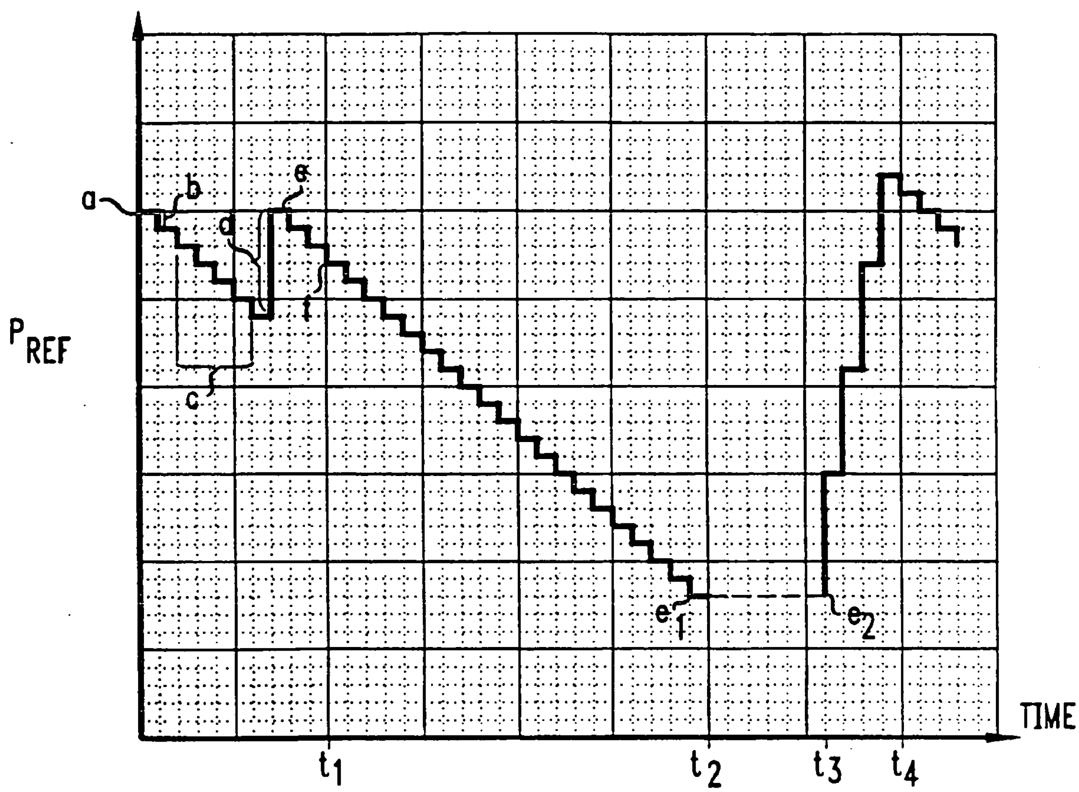
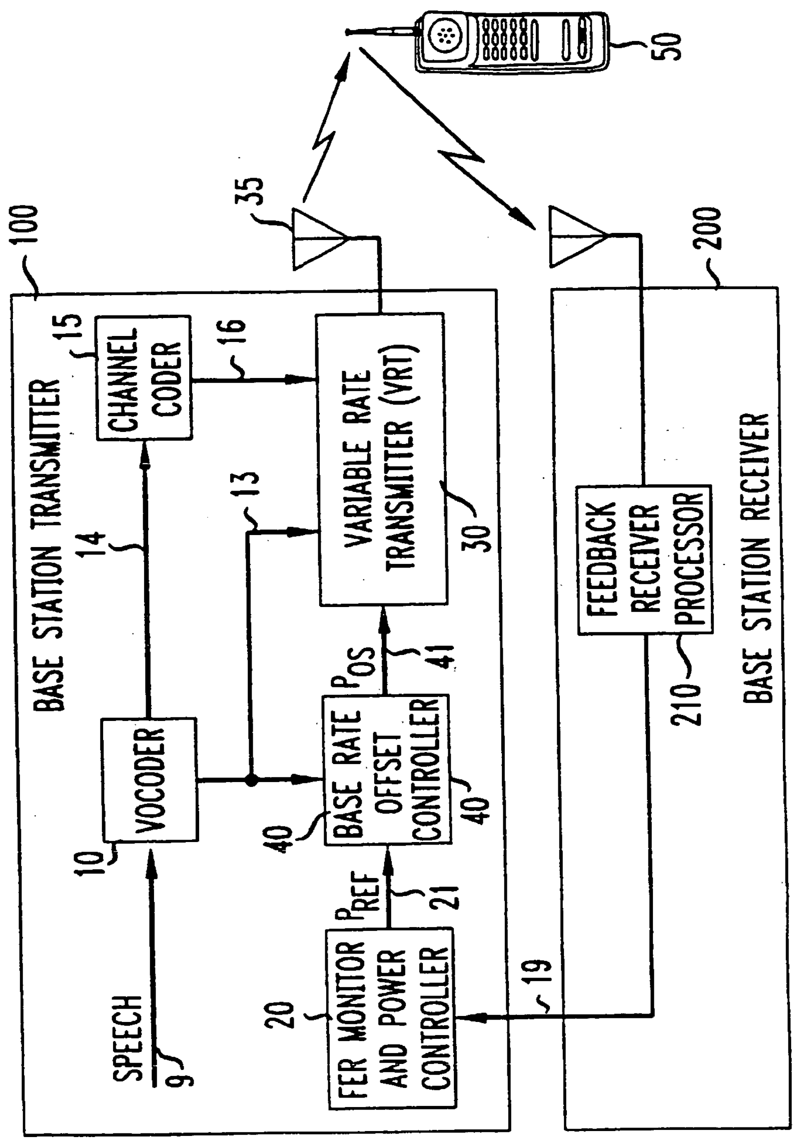


FIG. 3



BASE STATION TRANSMITTER
100
SPEECH
9
VOCODER
10
14
CHANNEL CODER
15
16
13
VARIABLE RATE TRANSMITTER (VRT)
30
35
50
FER MONITOR AND POWER CONTROLLER
20
P_{REF}
21
BASE RATE OFFSET CONTROLLER
40
P_{OS}
41
19
FEEDBACK RECEIVER PROCESSOR
210
BASE STATION RECEIVER
200

FIG. 4

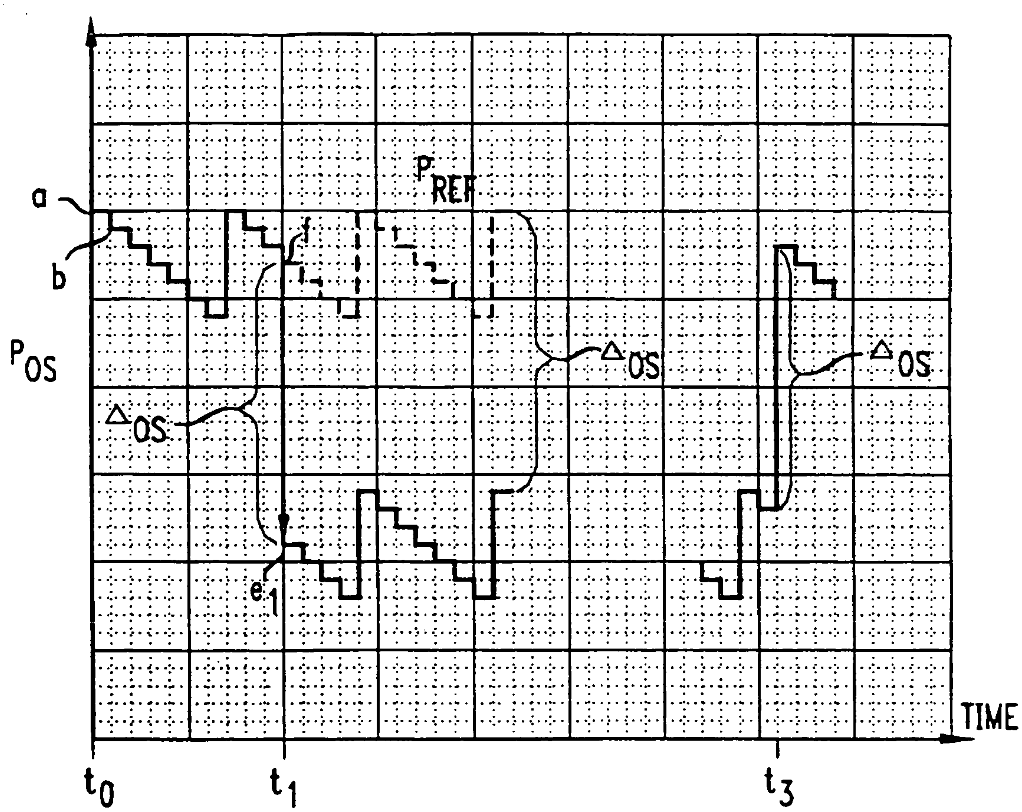


FIG. 5

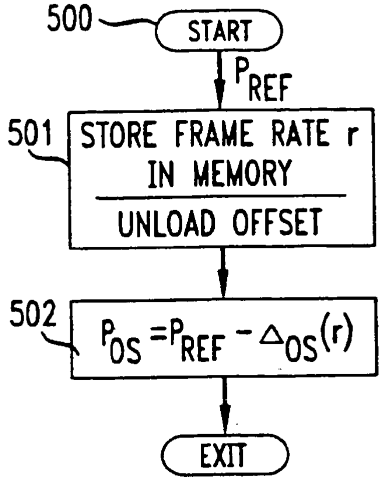
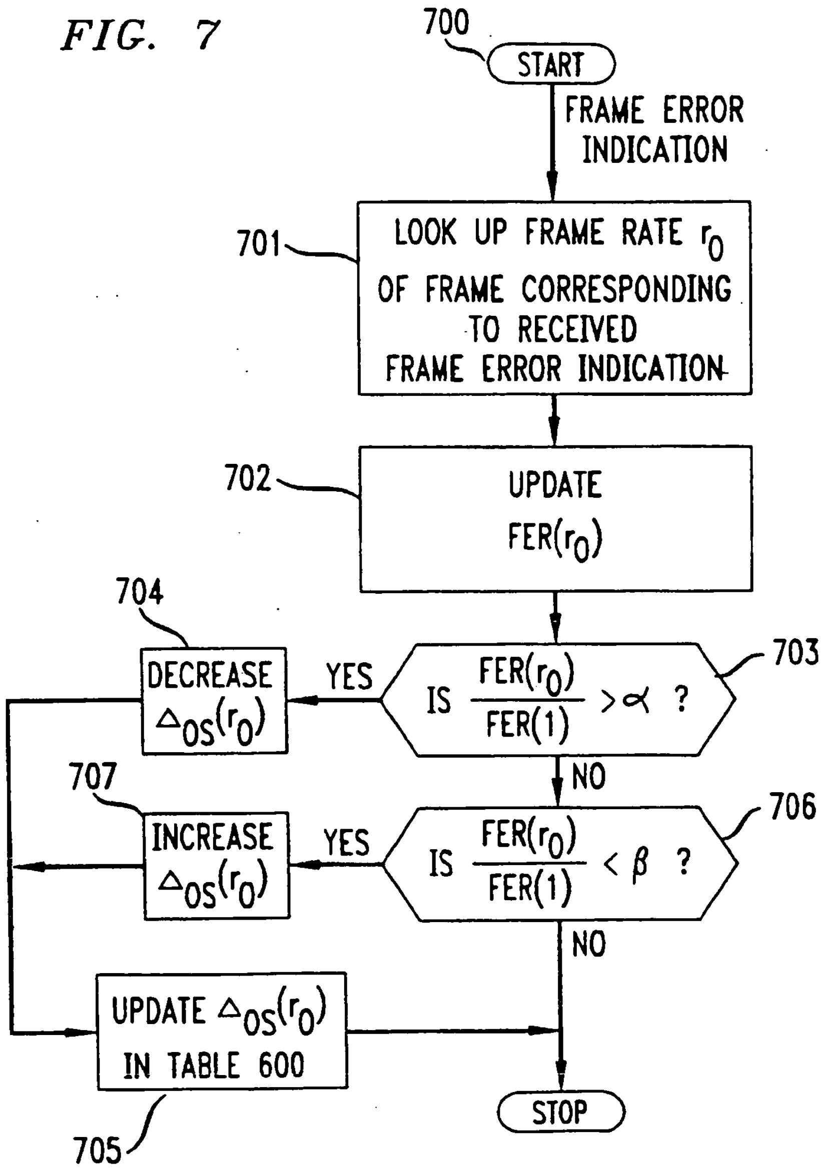


FIG. 6

600

	TABLE	
601	$\Delta_{OS}(1)$	0.0 dB
602	$\Delta_{OS}(1/2)$	1.0 dB
603	$\Delta_{OS}(1/4)$	2.5 dB
604	$\Delta_{OS}(1/8)$	4.0 dB

FIG. 7


700
START
FRAME ERROR INDICATION
701
LOOK UP FRAME RATE r_0 OF FRAME CORRESPONDING TO RECEIVED FRAME ERROR INDICATION
702
UPDATE $FER(r_0)$
703
IS $\frac{FER(r_0)}{FER(1)} > \alpha$?
YES
704
DECREASE $\Delta_{OS}(r_0)$
NO
706
IS $\frac{FER(r_0)}{FER(1)} < \beta$?
YES
707
INCREASE $\Delta_{OS}(r_0)$
NO
UPDATE $\Delta_{OS}(r_0)$ IN TABLE 600
705
STOP

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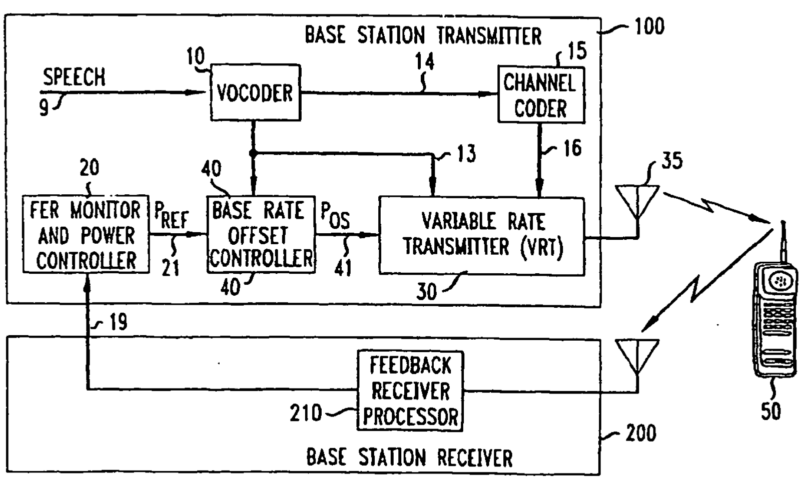
Woodford Green Essex, IG8 0TU (GB)

(54) Method and apparatus for controlling power in a forward link of a CDMA telecommunications system

(57) A facility is provided for more efficiently controlling transmitted power in a forward link of CDMA telecommunications system. This is done by offsetting a power reference level that adjusts the level of the transmitted power using an power offset selected as a function of a transmission rate specified for the transmission of a coded frame. The coded frame is then transmitted at a power level selected as function of the adjusted power reference level, rather than the unadjusted level. Such efficiently is particularly noticeable when there is transition from one frame transmission rate to another such rate and vice-versa.

FIG. 3



EP 0 802 638 A3

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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 2216

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 396 516 A (ZIV NOAM ET AL) 7 March 1995 (1995-03-07) * abstract * * figures 3A,3B,3C * * column 6, line 39 - column 7, line 62 * * column 9, line 33 - line 53 * * column 10, line 7 - line 19 * * column 10, line 53 - line 63 * ---	1,3-7, 9-13	H04B7/005
A	EP 0 548 939 A (NIPPON ELECTRIC CO) 30 June 1993 (1993-06-30) * abstract * * column 2, line 12 - line 42 * * column 3, line 11 - line 41 * ---	1,6,7, 12,13	
A	US 5 333 175 A (ARIYAVISITAKUL SIRIKIAT ET AL) 26 July 1994 (1994-07-26) * abstract * * column 9, line 30 - line 22 * -----	1,6,7, 12,13	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 February 2003	Lustrini, D

CATEGORY OF CITED DOCUMENTS

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17-02-2003

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			MX	9401298	A1	31-08-1994
			PL	309726	A1	13-11-1995
			RU	2114508	C1	27-06-1998
			SG	52679	A1	28-09-1998
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41 2683

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) (Large Entity)	Docket No. L9289.02149B

In Re Application Of: **Kenichi MIYOSHI, et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/321,623	December 18, 2002	D. C. Le	24257	2683	5366

Invention: **COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD**

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COMMISSIONER FOR PATENTS:

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response to the Office Action of April 22, 2004 (*Date*) above-identified application.

The requested extension is as follows (check time period desired):

☐ One month ☐ Two months ☒ Three months ☐ Four months ☐ Five months

from: July 22, 2004 (*Date*) until: October 22, 2004 (*Date*)

The fee for the extension of time is **$980** and is to be paid as follows:

☒ A check in the amount of the fee is enclosed.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. **19-4375**

☒ If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No. **19-4375**

☐ Payment by credit card. Form PTO-2038 is attached.

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Dated: **October 22, 2004**

James E. Ledbetter
STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street NW, Suite 850
P.O. Box 34387
Washington, DC 20043-4387

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P12LARGE/REV08

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): **Kenichi MIYOSH, et al.**	Docket No. **L9289.02149B**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/321,623	**December 18, 2002**	**D. C. Le**	**24257**	**2683**	**5366**

Invention: **COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD**

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Transmitted herewith is an amendment in the above-identified application.
The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

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TOTAL CLAIMS	9	-	20	=	0	x	$18.00	$0.00
INDEP. CLAIMS	9	-	3	=	6	x	$88.00	$528.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$528.00

- ☐ No additional fee is required for amendment.
- ☐ Please charge Deposit Account No. in the amount of
- ☒ A check in the amount of **$528.00** to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account **19-4375**
  - ☒ Any additional filing fees required under 37 C.F.R. 1.16.
  - ☒ Any patent application processing fees under 37 CFR 1.17.
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James E. Ledbetter

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Dated: **October 22, 2004**

James E. Ledbetter
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1615 L Street NW, Suite 850
P.O. Box 34387
Washington, DC 20043-4387

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor: Kenichi MIYOSHI et al. Group Art Unit: 2683

Appln. No.: 10/321,623 Examiner: D.C. Le

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

AMENDMENT UNDER 37 CFR § 1.111

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated April 22, 2004, Applicants petition for a Three-Month Extension of Time and request that the above-captioned application be amended as follows:

IN THE CLAIMS

Please amend the claims to read as follows:

Listing of Claims

Claims 1-20 (Cancelled).

21. (New) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits the notification signal using a higher transmission power than a pilot signal transmission power, when said measured downlink channel quality is better than a predetermined channel quality, and

the transmitter transmits the notification signal using a lower transmission power than the pilot signal transmission power, when said measured downlink channel quality is poorer than the predetermined channel quality.

22. (New) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality;

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality;

a table that indicates a correspondence between the notification signal and transmission power; and

a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein:

the transmitter adjusts the transmission power used to transmit the notification signal based on the contents of said table.

23. (New) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the information of the notification signal, prior to its transmission, is converted to a code word whose code-word minimum distance is proportional to the degree of measured downlink channel quality.

24. (New) A communication terminal apparatus, comprising:

a measuring device that measures downlink channel quality;

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality;

a table that indicates a correspondence between the notification signal and a code word; and

a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein:

the transmitter converts the notification signal, prior to its transmission, to a code word based on the contents of said table.

25. (New) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

each of a plurality of digits representing the information of the notification signal is converted, prior to its transmission, to a code word whose code length is proportional the digit's degree of significance.

26. (New) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits each of a plurality of digits representing the information of the notification signal using a transmission power that is proportionate to the digit's degree of significance.

27. (New) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits each of a plurality of digits representing the information of the notification signal using a spreading code whose spreading factor is proportionate to the digit's degree of significance.

28. (New) A communication terminal apparatus comprising:

a measuring device that measures reception quality of a pilot signal to output information having a plurality of bits that indicate the measured reception quality;

a coding device that encodes the information to obtain a code word; and

a transmitter that transmits the code word, wherein:

the coding device encodes the information such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits.

29. (New) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from a communication terminal apparatus;

a measurement device that measures reception power or the likelihood of having received the notification signal correctly;

a detector that detects whether the measured reception power or measured likelihood is less than a first threshold value;

a determination device that determines downlink communication resource allocation based on one or more received notification signals, while excluding from use a received notification signal whose measured reception power or measured likelihood is detected to be less than the first threshold value;

a calculator that calculates the ratio of excluded notification signals to received notification signals; and

a transmitter that transmits a control signal instructing the communication terminal apparatus to rewrite a table based on a result of comparison of the calculated ratio a second threshold value.

REMARKS

Reconsideration and allowance are respectfully requested in light of the above amendments and the following remarks.

Applicants acknowledge with appreciation the indication in the Office Action of allowable subject matter in claims 4-7, 11-13, 15, and 17.

Claims 1-20 have been cancelled in favor of new claims 21-29, which better define the subject matter Applicants regard as the invention. Support for the new claims is provided in the original claims.

Claims 1-3, 8-10, 14, 16, and 18-20 were rejected, under 35 USC §103(a), as being unpatentable over Tong et al. (US 2001/0038630) in view of Juntti (US 5,564,074). The claims have been amended to overcome the rejections by re-drafting the allowable subject matter in independent claims, as described below.

New claim 21 recites features of claim 1 and allowable claim 4. Claim 22 recites features of claim 1 and allowable claim 5. Claim 23 recites features of claim 1 and allowable claim 6. Claim 24 recites features of claim 1 and allowable claim 7. Claim 25 recites features of claim 1 and allowable claim 11. Claim 26 recites features of claim 1 and allowable claim 12. Claim 27 recites features of claim 1 and allowable claim 13.

Claim 28 recites features of claim 10 and features generic to the allowable subject matter of claims 11-13. Claim 29 recites features of claim 14 and allowable claims 15 and 17.

In view of the incorporating of allowable subject matter into each of the new claims, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: October 22, 2004
JEL/DWW/att

Attorney Docket No. L9289.02149B
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PATENT APPLICATION FEE DETERMINATION RECORD
Effective November 10, 1998

Application or Docket Number: 10321623

CLAIMS AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA
BASIC FEE		
TOTAL CLAIMS	20 minus 20=	* —
INDEPENDENT CLAIMS	3 minus 3 =	* —
MULTIPLE DEPENDENT CLAIM PRESENT		

* If the difference in column 1 is less than zero, enter "0" in column 2

	SMALL ENTITY TYPE ☐ RATE	FEE	OR	OTHER THAN SMALL ENTITY RATE	FEE
BASIC FEE			OR		
TOTAL CLAIMS			OR		
INDEPENDENT CLAIMS			OR		
MULTIPLE DEPENDENT CLAIM PRESENT			OR		
TOTAL			OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 9	Minus	** 20	= —
Independent	* 9	Minus	*** 3	= 6
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total			OR		
Independent			OR	88	528
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM			OR		
TOTAL ADDIT. FEE			OR	TOTAL ADDIT. FEE	528

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total			OR		
Independent			OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM			OR		
TOTAL ADDIT. FEE			OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total			OR		
Independent			OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM			OR		
TOTAL ADDIT. FEE			OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 8/98) 1198

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

OIPE JC98
MAR 0 8 2005
PATENT & TRADEMARK OFFICE

JTW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application

Inventors: Kenichi MIYOSHI, et al. Art Unit: 2683

Appln. No.: 10/321,623

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

CERTIFICATION UNDER 37 CFR §1.97(e)(1)

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

In fulfillment of 37 CFR 1.97(c)(1) and 1.97(e)(1), it is hereby certified that each item of information contained in the attached Information Disclosure Statement was first cited in any communication (see the attached of the Foreign Office Action dated December 21, 2004) from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: March 8, 2005

JEL/ejw

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al.

Appln. No.: 10/321,623

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

Pursuant to Rules 56 and 99, Applicants hereby call the attention of the Patent Office to the documents listed on the attached Form PTO 1449. These references were cited in a Japanese Office Action dated December 21, 2004 (copy attached). JP '914 corresponds to US '197, JP '171 corresponds to US '211, and JP '131 corresponds to EP '581.

Applicants present this art so that the Patent Office may, in the first instance, determine any relevancy thereof to the presently claimed invention, see Beckman Instruments, Inc. v. Chemtronics, Inc., 439 F.2d 1369, 1380, 165 USPQ 355, 364 (5th Cir. 1970). Also see Patent Office Rules 104 and 106. Applicants respectfully request that this art be expressly considered during the prosecution of this application and made of record herein and appear among the "References Cited" on any patent to issue herefrom.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: March 8, 2005

JEL/ejw

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SHEET 1 OF 1

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use several sheets if necessary)

OIPE JC98 MAR 0 8 2005 PATENT & TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
L9289.02149B	10/321,623
APPLICANT	Kenichi MIYOSHI, et al.
FILING DATE December 18, 2002	GROUP 2683

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	6 7 5 1 1 9 7	06/2004	Sadanaka			
	6 6 5 1 2 1 1	11/2003	Abe et al.			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	NO
	2000 1 2 4 9 1 4	04/2000	JP			Abstract	
	2000 6 8 9 5 9	03/2000	JP			Abstract	
	2000 4 1 7 1	01/2000	JP			Abstract	
	1 1 3 3 1 1 3 1	11/1999	JP			Abstract	
	0 9 5 9 5 8 1	11/1999	EP				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

Japanese Office Action dated December 21, 2004, with English translation.

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

Information processing apparatus and method, and provision medium

Patent Number: US6751197

Publication date: 2004-06-15

Inventor(s): SADANAKA NOBUYUKI (JP)

Applicant(s): SONY CORP (JP)

Requested Patent: JP2000124914

Application Number: US19990419935 19991018

Priority Number(s): JP19980296498 19981019

IPC Classification: H04B7/00; H04L12/56; H04Q7/20

EC Classification: H04B7/005B2E

Equivalents:

Abstract

In an information processing apparatus for transmitting information to and/or receiving the same from another information processing apparatus via radio communication, the information transmitted from a transmitting node is received by a receiving node, and a bit error rate of the information is counted by an error correction decoder. A processor recognizes the communication quality on the basis of the bit error rate thus counted. The host processor controls the transmission output level of a transmitting amplifier or controls the modulation mode of a modulator in accordance with the recognized communication quality, whereby the communication quality in such radio communication can be exactly grasped to consequently realize satisfactory communication with a stable quality.

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（A）　(11)特許出願公開番号

特開2000－124914

（P2000－124914A）

(43)公開日　平成12年４月28日(2000.4.28)

(51)Int.Cl.^{7}	識別記号	F I		テーマコード(参考)
Ｈ０４Ｌ　12/28		Ｈ０４Ｌ　11/00	３１０Ｂ	５Ｋ０１４
Ｈ０４Ｑ　7/38		1/20		５Ｋ０３３
Ｈ０４Ｌ　1/20		Ｈ０４Ｂ　7/26	１０９Ａ	５Ｋ０６７

審査請求　未請求　請求項の数７　ＯＬ　（全 ９ 頁）

(21)出願番号　特願平10－296498

(22)出願日　平成10年10月19日(1998.10.19)

(71)出願人　000002185
ソニー株式会社
東京都品川区北品川６丁目７番35号

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東京都品川区北品川６丁目７番35号　ソニー株式会社内

(74)代理人　100082131
弁理士　稲本　義雄

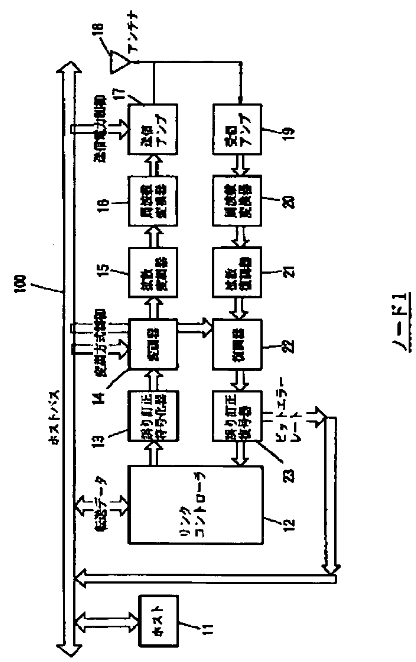
Ｆターム(参考)　5K014 AA01 BA01 FA12 GA01
5K033 AA05 CB01 CB03 CC04 DA17 DB09 DB14 DB16 DB20 EA06 EA07 EC01
5K067 AA23 BB21 DD45 DD46 DD52 EE02 EE10 GG04 GG08 KK13

(54)【発明の名称】　情報処理装置および方法、並びに提供媒体

(57)【要約】

【課題】　無線通信において、通信品質を把握することができ、安定化した通信品質で通信できるようにする。

【解決手段】　送信ノード１より送信されたデータは、受信ノード１により受信され、誤り訂正復号器２３でビットエラーレートが計測される。ホスト１１は、計測されたビットエラーレートに基づいて、通信品質を認識する。ホスト１１は、認識した通信品質に基づいて、送信アンプ１７の送信電力を制御したり、変調器１４の変調方式を制御する。



【特許請求の範囲】
【請求項１】　他の情報処理装置と情報を送受信する情報処理装置において、
情報を受信する受信手段と、
前記受信手段により受信された情報に基づいて、通信品質を認識する通信品質認識手段と、
前記通信品質認識手段により認識された通信品質に基づいて、通信品質情報を生成する通信品質情報生成手段と、
前記通信品質情報生成手段により生成された通信品質情報を送信する送信手段とを備えることを特徴とする情報処理装置。
【請求項２】　前記受信手段は、前記他の情報処理装置により送信された通信品質情報を受信し、
前記受信手段により受信された通信品質情報に基づいて、通信品質を制御する通信品質制御手段をさらに備え、
前記送信手段は、前記通信品質制御手段により制御された通信品質で情報を送信することを特徴とする請求項１に記載の情報処理装置。
【請求項３】　前記通信品質制御手段は、情報の送信出力の大きさを制御し、
前記送信手段は、前記通信品質制御手段により制御された送信出力の大きさで情報を送信することを特徴とする請求項２に記載の情報処理装置。
【請求項４】　前記通信品質制御手段は、情報の送信レートを制御し、
前記送信手段は、前記通信品質制御手段により制御された送信レートで情報を送信することを特徴とする請求項３に記載の情報処理装置。
【請求項５】　前記受信手段により情報が受信されたことを示す受信確認情報を生成する受信確認情報生成手段をさらに備え、
前記送信手段は、前記受信確認情報生成手段により生成された受信確認情報を送信することを特徴とする請求項４に記載の情報処理装置。
【請求項６】　他の情報処理装置と情報を送受信する情報処理装置の情報処理方法において、
情報を受信する受信ステップと、
前記受信ステップで受信された情報に基づいて、通信品質を認識する通信品質認識ステップと、
前記通信品質認識ステップで認識された通信品質に基づいて、通信品質情報を生成する通信品質情報生成ステップと、
前記通信品質情報生成ステップで生成された通信品質情報を送信する送信ステップとを含むことを特徴とする情報処理方法。
【請求項７】　他の情報処理装置と情報を送受信する情報処理装置に、
情報を受信する受信ステップと、
前記受信ステップで受信された情報に基づいて、通信品質を認識する通信品質認識ステップと、
前記通信品質認識ステップで認識された通信品質に基づいて、通信品質情報を生成する通信品質情報生成ステップと、
前記通信品質情報生成ステップで生成された通信品質情報を送信する送信ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする提供媒体。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は情報処理装置および方法、並びに提供媒体に関し、特に、受信された情報に基づいて、通信品質を認識し、認識した通信品質に基づいて、通信品質を制御することにより、通信品質を把握することができ、安定化した通信品質で通信することができるようにした情報処理装置および方法、並びに提供媒体に関する。
【０００２】
【従来の技術】近年、無線LAN（Local Area Network）、携帯電話、PHS（Personal Handyphone System）などの無線通信が普及しつつある。
【０００３】
【発明が解決しようとする課題】しかしながら、無線通信においては、通信品質が保証され難く、受信したデータに何らかの要因でビットエラーが発生し易いが、アイソクロナス転送では、受信ノードよりアクノリッジ信号が返送されないため、送信ノードでは、送信したデータが正しく受信されているか否かが把握できない課題があった。
【０００４】また、ディジタル無線通信においては、ビットエラーを減少するために、送信ノードで送信出力を上げたり、転送するビットレートを下げたりすることなどが行われているが、アイソクロナス転送では、受信ノードでの受信品質を確認できないため、通信品質が良好にもかかわらず、必要以上の高出力で送信したり、低レートで転送したりするというように、送信出力やビットレートを送信ノードで最適に制御できない課題があった。
【０００５】本発明はこのような状況に鑑みてなされたものであり、通信品質を把握することができ、安定化した通信品質で通信することができるようにするものである。
【０００６】
【課題を解決するための手段】請求項１に記載の情報処理装置は、他の情報処理装置と情報を送受信する情報処理装置において、情報を受信する受信手段と、受信手段により受信された情報に基づいて、通信品質を認識する通信品質認識手段と、通信品質認識手段により認識された通信品質に基づいて、通信品質情報を生成する通信品質

質情報生成手段と、通信品質情報生成手段により生成された通信品質情報を送信する送信手段とを備えることを特徴とする。
【０００７】請求項６に記載の情報処理方法は、他の情報処理装置と情報を送受信する情報処理装置の情報処理方法において、情報を受信する受信ステップと、受信ステップで受信された情報に基づいて、通信品質を認識する通信品質認識ステップと、通信品質認識ステップで認識された通信品質に基づいて、通信品質情報を生成する通信品質情報生成ステップと、通信品質情報生成ステップで生成された通信品質情報を送信する送信ステップとを含むことを特徴とする。
【０００８】請求項７に記載の提供媒体は、他の情報処理装置と情報を送受信する情報処理装置に、情報を受信する受信ステップと、受信ステップで受信された情報に基づいて、通信品質を認識する通信品質認識ステップと、通信品質認識ステップで認識された通信品質に基づいて、通信品質情報を生成する通信品質情報生成ステップと、通信品質情報生成ステップで生成された通信品質情報を送信する送信ステップとを含む処理を情報処理装置に実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする。
【０００９】請求項１に記載の情報処理装置、請求項６に記載の情報処理方法、および請求項７に記載の提供媒体においては、情報が受信され、受信された情報に基づいて、通信品質が認識され、認識された通信品質に基づいて、通信品質情報が生成され、生成された通信品質情報が送信される。
【００１０】
【発明の実施の形態】以下に本発明の実施の形態を説明するが、特許請求の範囲に記載の発明の各手段と以下の実施の形態との対応関係を明らかにするために、各手段の後の括弧内に、対応する実施の形態（但し一例）を付加して本発明の特徴を記述すると、次のようになる。
【００１１】請求項１に記載の情報処理装置は、他の情報処理装置と情報を送受信する情報処理装置において、情報を受信する受信手段（例えば、図２のアンテナ１８）と、受信手段により受信された情報に基づいて、通信品質を認識する通信品質認識手段（例えば、図２のホスト１１）と、通信品質認識手段により認識された通信品質に基づいて、通信品質情報を生成する通信品質情報生成手段（例えば、図２のホスト１１）と、通信品質情報生成手段により生成された通信品質情報を送信する送信手段（例えば、図２のアンテナ１８）とを備えることを特徴とする。
【００１２】請求項２に記載の情報処理装置は、受信手段（例えば、図２のアンテナ１８）は、他の情報処理装置により送信された通信品質情報を受信し、受信手段により受信された通信品質情報に基づいて、通信品質を制御する通信品質制御手段（例えば、図２のホスト１１）をさらに備え、送信手段（例えば、図２のアンテナ１８）は、通信品質制御手段により制御された通信品質で情報を送信することを特徴とする。
【００１３】請求項５に記載の情報処理装置は、受信手段により情報が受信されたことを示す受信確認情報を生成する受信確認情報生成手段（例えば、図２のホスト１１）をさらに備え、送信手段（例えば、図２のアンテナ１８）は、受信確認情報生成手段により生成された受信確認情報を送信することを特徴とする。
【００１４】但し勿論この記載は、各手段を記載したものに限定することを意味するものではない。
【００１５】図１は、本発明を適用したネットワークシステムの構成例を示すブロック図である。図１のネットワークシステムは、ノード１－１乃至ノード１－ｎ（以下、ノード１－１乃至ノード１－ｎを個々に区別する必要がないとき、ノード１と記述する）が、ルータ２を介して、IEEE1394高速シリアルバスの規格に基づいて、無線通信するようになされており、ルータ２は、その無線通信路を管理するようになされている。
【００１６】図２は、ノード１の構成例を表している。ホスト１１は、ホストバス１００を介して、リンクコントローラ１２にデータを転送したり、PSK（Phase Shift Keying）変調器１４の変調方式を制御したり、送信アンプ１７に供給する電力を制御したりするようになされている。
【００１７】リンクコントローラ１２は、ホスト１１より供給されたデータを通信路のプロトコルに合わせてアイソクロナス転送するためのヘッダを付加し、パケットを生成するようになされている。誤り訂正符号化器１３は、リンクコントローラ１２より供給されたパケットに誤り訂正符号を付加した後、ディジタル変調するようになされている。変調器１４は、供給されたデータを変調するようになされており、ホスト１１の制御により変調方式をQPSK（Quadrate Phse Shift Keying）変調またはBPSK（Binary Phase Sift Keying）変調に切り換えることができるようになされている。変調器１４の構成については、後述する。
【００１８】拡散変調器１５は、供給されたデータをスペクトラム拡散変調するようになされている。周波数変換器１６は、供給されたデータの周波数を伝送周波数に変換するようになさている。送信アンプ１７は、供給されたデータを所定の送信電力で増幅し、アンテナ１８に出力するようになされている。アンテナ１８は、データを送受信するようになされている。
【００１９】受信アンプ１９は、アンテナ１８により受信されたデータを増幅するようになされている。周波数変換器２０は、供給されたデータの周波数を変換するようになされている。拡散復調器２１は、供給されたデータをスペクトラム逆拡散復調するようになされている。
【００２０】復調器２２は、供給されたデータを復調す

るようになされており、ホスト１１の制御により復調方式をQPSK復調またはBPSK復調に切り換えることができるようになされている。誤り訂正復号器２３は、供給されたデータを誤り訂正復号した後に、ディジタル復調するようになされている。そして、誤り訂正復号器２３は、供給されたデータをリンクコントローラ１２に供給するとともに、供給されたデータからパケット毎などの一定の単位毎に、符号の誤っている量（ビットエラーレート）を計測し、ホストバス１００を介して、ホスト１１に通知するようになされている。リンクコントローラ１２は、供給されたデータのパケットのヘッダをチェックし、受信したデータが自分のノード宛であるか否かを判定するようになされている。

【００２１】図３は、変調器１４の構成例を表している。変調器１４は、スイッチ３１とスイッチ３８の切り換えにより、QPSK変調とBPSK変調との切り換えができるようになされている。変調器１４は、スイッチ３１をシリアルパラレル変換回路３２側に切り換え、スイッチ３８を加算回路３９に接続することによりQPSK変調器となり、スイッチ３１をD/A変換回路３３Ａ側に切り換え、スイッチ３８を加算回路３９から切り離すことにより、BPSK変調器となるように構成されている。

【００２２】シリアルパラレル変換回路３２は、入力されたデータを、２ビット単位のパラレルデータ、すなわち、（０，０），（０，１），（１，０），（１，１）のうちいずれかのシンボルに変換するようになされている。シンボルの上位ビット（MSB）であるＩデータは、D/A変換回路３３Ａに供給されるようになされており、シンボルの下位ビット（LSB）であるＱデータは、D/A変換回路３３Ｂに供給されるようになされている。

【００２３】D/A変換回路３３ＡおよびD/A変換回路３３Ｂは、供給されたＩデータおよびＱデータをアナログ変換し、LPF（Low Pass Filter）３４ＡおよびLPF３４Ｂに供給するようになされている。LPF３５ＡおよびLPF３５Ｂは、供給されたＩデータおよびＱデータを平滑化し、乗算回路３５Ａおよび乗算回路３５Ｂに供給する。

【００２４】乗算回路３５Ａには、Ｉデータの他、発振回路３６から副搬送波が供給されている。ここで、発振回路３６は、例えば、ｓｉｎ波を発生しており、これを副搬送波として、乗算回路３５Ａおよび位相回路３７に供給するようになされている。乗算回路３５Ａは、発振回路３６からの副搬送波とＩデータとを乗算し、加算回路３９に出力する。

【００２５】一方、乗算回路３５Ｂには、Ｑデータの他、発振回路３６から位相器３７を介して、副搬送波が供給されている。位相器３７は、発振回路３６からの副搬送波を、その位相をπ／２だけ回転して出力するようになされており、乗算回路３５Ｂには、乗算回路３５Ａにおける場合とはπ／２だけ位相の異なる副搬送波が供給されるようになされている。乗算回路３５Ｂは、そのような副搬送波と、Ｑデータとを乗算し、加算回路３９に出力する。

【００２６】加算回路３９は、乗算回路３５Ａおよび乗算回路３５Ｂの出力を加算し、これにより、ＩデータおよびＱデータに基づいて副搬送波をQPSK変調した変調信号としてのRF（Radio Frequency）信号が生成される。LPF４０は、供給されたRF信号をフィルタリングして拡散変調器１５に供給するようになされている。

【００２７】図４は、アイソクロナス転送と非同期転送の混在する無線バスパケットの構成例を表している。バスサイクル上のパケットは、サイクルスタートパケット、アイソクロナスパケット、非同期パケット、およびアクノリッジパケットより構成されている。バスサイクルは、１２５μSEC（８ＫＨｚ）の同期とされており、ルート２が全てのノード１－１乃至１－ｎに対してブロードキャストするサイクルスタートパケットから開始するようになされている。アイソクロナスパケットは、所定のサイクルで、その先頭から所定の帯域（時間単位であるが帯域と呼ばれる）で配置される。このため、アイソクロナス伝送では、データの一定時間内の伝送が保証される。但し、伝送エラーが発生した場合は、保護する仕組みが無く、データは、失われる。各サイクルのアイソクロナス伝送に使用されていない時間に、通信が確保されているノードが、非同期パケットを送出する。非同期パケット伝送では、アクノリッジパケットを用いることにより、確実な伝送は保証されるが、伝送のタイミングは保障されない。

【００２８】次に、図１のネットワークシステムの動作について説明する。ここでは、ノード１－１がデータを送信し、ノード１－２がデータを受信するものとし、ノード１－１を送信ノードと称し、ノード１－２を受信ノードと称する。

【００２９】まず、送信ノードにおいて、ホスト１１内部の不図示の送信要求生成部は、送信要求信号を生成し、その信号をホスト１１内部の不図示の帯域取得処理部に供給する。帯域取得処理部は、アイソクロナスチャネルの帯域の使用が可能か否か（空いている帯域があるか否か）をルート２に問い合わせる。送信ノードは、ルータ２からアイソクロナスチャンネルに空きがあるとの通知を受信した場合、必要な帯域を予約し、そのチャネルとそのＩＤを確保する。

【００３０】そして、送信ノードは、受信ノードにデータを送信する。すなわち、送信ノードのホスト１１は、送信するデータをホストバス１００を介して、リンクコントローラ１２に供給する。リンクコントローラ１２は、通信路のプロトコルに合わせてアイソクロナス転送するためのヘッダを付加してパケットを生成し、誤り訂正符号化器１３に供給する。誤り訂正符号化器１３は、供給されたパケットに誤り訂正符号を付加した後、伝送のためにディジタル変調し、変調器１４に供給する。

【００３１】変調器１４は、ホスト１１により、例えば、QPSK変調方式に切り換えられているとし、供給されたデータをQPSK変調する。すなわち、変調器１４に供給されたデータは、シリアルパラレル変換回路３２に供給されるとともに、D/A変換回路３３Ａに供給される。シリアルパラレル変換回路３２は、入力されたデータを、２ビット単位のパラレルデータ、すなわち、（０，０），（０，１），（１，０），（１，１）のうちいずれかのシンボルに変換する。上位ビットであるＩデータは、D/A変換回路３３Ａに供給され、下位ビットであるＱデータは、D/A変換回路３３Ｂに供給される。

【００３２】D/A変換回路３３ＡおよびD/A変換回路３３Ｂは、供給されたＩデータおよびＱデータをアナログ変換し、LPF３４ＡおよびLPF３４Ｂに供給する。LPF３５ＡおよびLPF３５Ｂは、供給されたＩデータおよびＱデータを平滑化し、乗算回路３５Ａおよび乗算回路３５Ｂに供給する。

【００３３】乗算回路３５Ａには、Ｉデータの他、発振回路３６から副搬送波が供給されている。発振回路３６は、例えば、ｓｉｎ波を発生しており、これを副搬送波として、乗算回路３５Ａおよび位相回路３７に供給する。乗算回路３５Ａは、発振回路３６からの副搬送波とＩデータとを乗算し、加算回路３９に出力する。

【００３４】一方、乗算回路３５Ｂには、Ｑデータの他、発振回路３６から位相器３７を介して、副搬送波が供給されている。位相器３７は、発振回路３６からの副搬送波を、その位相を$\pi/2$だけ回転して出力し、乗算回路３５Ｂには、乗算回路３５Ａにおける場合とは$\pi/2$だけ位相の異なる副搬送波が供給される。乗算回路３５Ｂは、そのような副搬送波と、Ｑデータとを乗算し、加算回路３９に出力する。

【００３５】加算回路３９は、乗算回路３５Ａおよび乗算回路３５Ｂの出力を加算し、これにより、ＩデータおよびＱデータに基づいて副搬送波をQPSK変調した変調信号としてのRF（Radio Frequency）信号が生成される。LPF４０は、供給されたRF信号をフィルタリングして拡散変調器１５に供給する。

【００３６】拡散変調器１５は、QPSK変調されたデータをスペクトラム拡散変調し、周波数変換器１６に供給する。周波数変換器１６は、供給されたデータの周波数を伝送周波数に変換し、送信アンプ１７に供給する。送信アンプ１７は、供給されたデータを所定の送信電力で増幅し、アンテナ１８に供給する。アンテナ１８は、供給されたデータを送信する。なお、この送信は、予約されたアイソクロナスチャネル１の帯域で行われる。

【００３７】送信されたデータは、受信ノードにより受信される。すなわち、受信ノードのアンテナ１８は、送信ノードより送信されたデータを受信し、受信したデータを受信アンプ１９に供給する。受信アンプ１９は、供給されたデータを所定の受信電力で増幅し、周波数変換器２０に供給する。周波数変換器２０は、供給されたデータの周波数を変換し、拡散復調器２１に供給する。拡散復調器２１は、供給されたデータを拡散復調し、復調器２２に供給する。復調器２２は、例えば、QPSK復調方式に切り換えられており、供給されたデータをQPSK復調し、誤り訂正復号器２３に供給する。誤り訂正復号器２３は、供給されたデータを誤り訂正復号し、ディジタル変調した後、リンクコントローラ１２に供給する。また、誤り訂正復号器２３は、供給されたデータから、パケット毎などの一定の単位毎に、ビットエラーレートを計測し、ホスト１１に供給する。ホスト１１は、供給されたビットエラーレートを記憶する。

【００３８】リンクコントローラ１２は、供給されたデータのパケットのヘッダをチェックし、チェックしたヘッダが自分のノード（受信ノード）に対応するものか（受信すべきパケットであるか）否かを判定する。チェックしたヘッダが自分のノードに対応するものであると判定された場合、受信ノードは、非同期転送の伝送帯域を使用可能か否かをルート２に問い合わせ、ルート２が使用可能であると通知してきた場合、その帯域を予約する。そして、受信ノードは、図５に示すように、予約された伝送帯域でアクノリッジパケットを送信ノードに送信する。

【００３９】また、受信ノードのホスト１１は、誤り訂正復号器２３より供給されたビットエラーレートをリンクコントローラ１２、誤り訂正符号化器１３，変調器１４、拡散変調器１５、周波数変換器１６、および送信アンプ１７を介して、アンテナ１８より送信ノードに送信する。この転送は、非同期転送で行われるため、必ずしも受信報告の対象となるアイソクロナスパケットとは同一のバスサイクル期間に完了する保証はないし、その必要もない。

【００４０】受信ノードのリンクコントローラ１２は、供給されたパケットを解き、送信ノードから受信ノードへのアイソクロナスパケットによる伝送が完了する。

【００４１】一方、送信ノードは、受信ノードから送信された非同期転送のビットエラーレートを、アンテナ１８で受信する。受信されたビットエラーレートは、受信アンプ１９、周波数変換器２０、拡散復調器２１、復調器２２、誤り訂正復号器２３、およびリンクコントローラ１２を介して、ホスト１１に供給される。ホスト１１は、供給されたビットエラーレートがアイソクロナス転送中のデータを扱うアプリケーションにとって必要な通信品質を確保できているか否かを判定し、確保できていないと判定した場合、送信アンプ１７の送信電力（送信レベル）を増大するか、変調器１４の変調方式が例えばQPSK変調のとき、BPSK変調に切り換えて伝送レートを半分にし、アイソクロナス転送を続ける。逆に、ホスト１１は、通信品質に十分なマージンがあると判定した場合、送信アンプ１７の送信電力を減少したり、変調器１

４の変調方式がBPSK変調の場合、QPSK変調に切り換えて伝送レートを２倍にする。

【００４２】以上のように、図１のネットワークシステムによれば、受信したデータからビットエラーレートを計測し、計測したビットエラーレートから通信品質を認識し、認識した通品品質に基づいて、送信電力や伝送レートを変化して通信するようにしたので、送信ノードは、通信品質を把握することができるとともに、安定化した通信品質で通信することができる。また、省電力化や他のネットワークへの妨害を抑制することができ、周波数資源を効率よく利用できる。

【００４３】以上においては、受信ノードから送信ノードに非同期転送でビットエラーレートを送信するようにしたが、アイソクロナス転送を受信したということを示すだけの信号（以下、擬似アクノリッジ信号と称する）を非同期転送で送信ノードに送信するようにしてもよい。この場合、アイソクロナスの送信側である送信ノードは、受信ノードからの非同期転送による擬似アクノリッジ信号を受信し、送信ノードは、受信した擬似アクノリッジ信号のビットエラーレートを計測するようにする。この計測したビットエラーレートから受信ノードとの通信品質を推測し、必要な通信品質を確保できていないと判定された場合、送信ノードは、送信アンプ１７の送信電力を増大したり、変調器１４の変調方式がQPSK変調の場合、BPSK変調に切り換えて、伝送レートを半分にしたりして、受信ノードで必要な通信品質を保証するようにする。逆に、通信品質に十分なマージンがあると判定されれば、送信アンプ１７の送信電力を減少したり、変調器１４の変調方式がBPSK変調の場合、QPSK変調に変換して伝送レートを２倍にしたりする。

【００４４】図６は、本発明を適用したノード１の他の構成例を表している。図６のノード１は、図２のノード１に、さらにMPEG（Moving Picture Experts Group）符号化器５１が設けられており、MPEG符号化器５１は、ホスト１１より供給されたデータ発生符号量の制御信号に基づいて、生成する画像データ符号量を変化できるようになされている。

【００４５】次に、図６のノードを用いたネットワークの動作について説明する。送信ノードのホスト１１は、送信するデータをMPEG符号化器５１に供給する。MPEG符号化器５１は、供給されたデータをMPEG方式で符号化し、リンクコントローラ１２に出力する。リンクコントローラ１２は、供給されたデータからパケットを生成する。生成されたパケットは、誤り訂正符号化器１３、変調器１４、拡散変調器１５、周波数変換器１６、送信アンプ１７、およびアンテナ１８を介して送信される。

【００４６】送信ノードより送信されたデータは、受信ノードのアンテナ１８で受信され、受信アンプ１９、周波数変換器２０、拡散復調器２１、および復調器２２を介して、誤り訂正復号器２３に供給される。誤り訂正復号器２３は、供給されたデータからビットエラーレートを計測し、計測したビットエラーレートをホスト１１に供給する。ホスト１１は、上述した場合と同様に、このビットエラーレートを非同期パケットで送信ノードに送信する。

【００４７】受信ノードのホスト１１は、送信されてきたビットエラーレートに基づいて、受信ノードとの通信において必要な通信品質を確保できているか否かを判定し、必要な通信品質を確保できていないと判定すれば、通信品質を確保できる画像データ発生符号化量の制御信号をMPEG符号化器５１に出力する。MPEG符号化器５１は、供給された制御信号に基づいた符号化量のデータを生成する。

【００４８】以上のように、図６のノード１を用いたネットワークシステムによれば、送信ノードが、通信品質に基づいて、画像データ発生符号量を制御するようにしたので、受信ノードは、画像（音声）の品質を平均的に制御することができ、再生画像（音声）の全体的あるいは部分的な破綻を抑止することができる。

【００４９】図６のノード１を用いたネットワークシステムにおいては、ホスト１１が必要な通信品質を確保できていないと判定した場合、通信品質に基づいて、画像データ発生符号量を制御するようにしたが、さらに、送信アンプ１７の送信出力を制御したり、変調器１４の変調方式を制御するようにしてもよい。これにより、さらに良好な通信品質で通信することができる。

【００５０】なお、図１のネットワークを携帯電話、PHSなどのネットワーク網に適用するようにすれば、安定化した通信品質で通信することができる。

【００５１】また、本明細書中において、システムの用語は、複数の装置、手段などにより構成される全体的な装置を意味するものとする。

【００５２】さらに、本明細書中において、上記処理を実行するコンピュータプログラムをユーザに提供する記録媒体には、磁気ディスク、ＣＤ－ＲＯＭなどの情報記録媒体の他、インターネット、ディジタル衛星などのネットワークによる伝送媒体も含まれる。

【００５３】

【発明の効果】以上のように、請求項１に記載の情報処理装置、請求項６に記載の画像処理方法、請求項７に記載の提供媒体によれば、受信した情報に基づいて、通信品質情報を送信するようにしたので、通信品質を把握することができる。

【図面の簡単な説明】

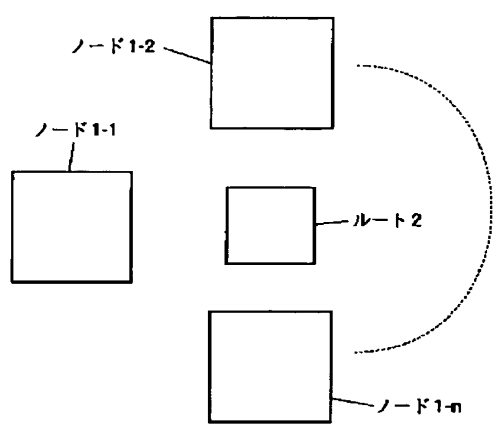
【図１】本発明を適用したネットワークシステムの構成例を示すブロック図である。

【図２】図１のノード１の構成例を示すブロック図である。

【図３】図２の変調器１４の構成例を示すブロック図である。

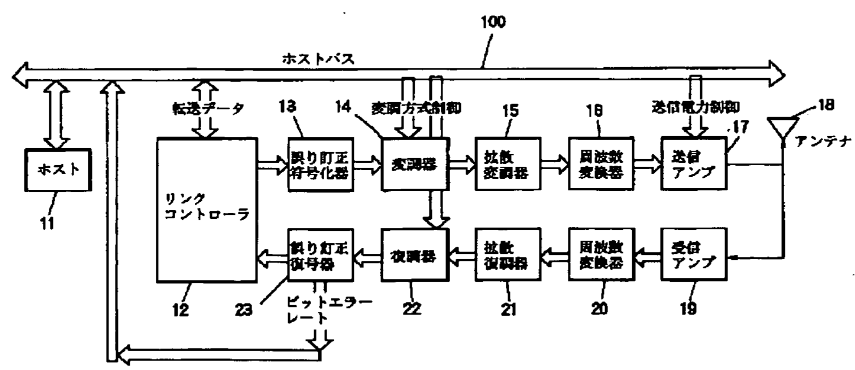
【図４】バスサイクルを説明する図である。
【図５】バスサイクルを説明する他の図である。
【図６】図１のノード１の他の構成例を示すブロック図である。
【符号の説明】
１　ノード，　２　ルート，　１１　ホスト，　１２　リンクコントローラ，１３　誤り訂正符号化器，　１４　変調器，　１５　拡散変調器，　１６，２０　周波数変換器，　１７　送信アンプ，　１８　アンテナ，　１９　受信アンプ，　２１　拡散復調器，　２２　復調器，　２３　誤り訂正復号器，　３１，３８　スイッチ，　３２　シリアルパラレル変換回路，　３３　D/A変換回路，３４，４０　LPF，　３５　乗算回路，　３６　発振回路，　３７　位相回路，　３９　加算回路，　５１　MPEG符号化器，　１００　ホストバス

【図１】



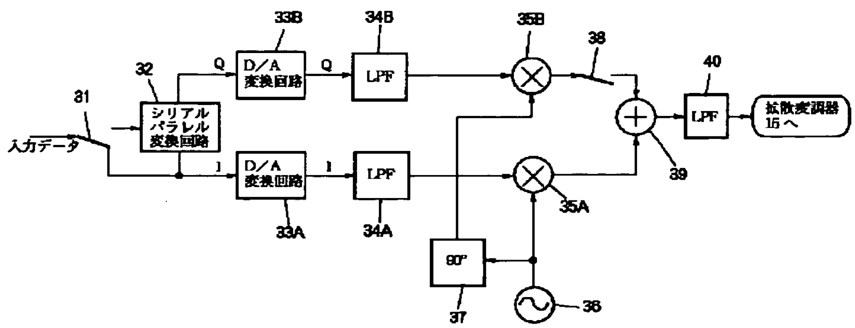
ネットワークシステム

【図２】



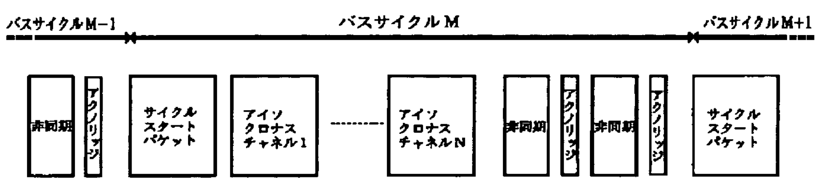
ノード1

【図3】

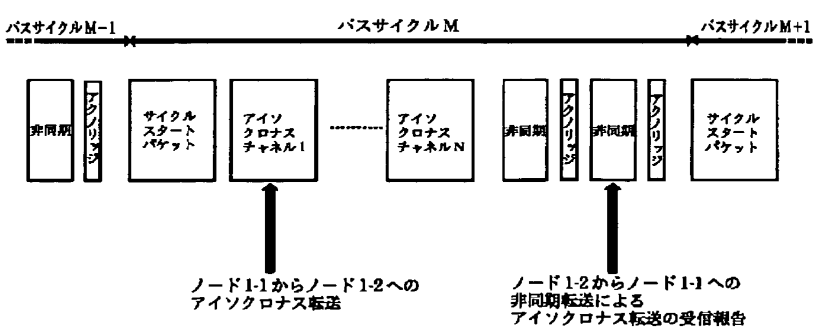


変調器 14

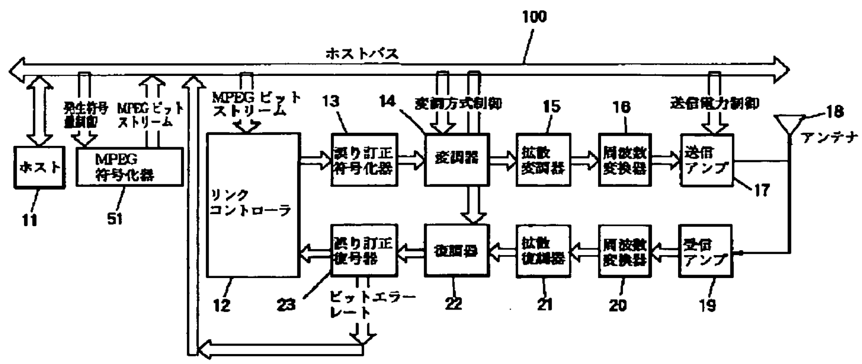
【図4】



【図5】



【図６】


100
ホストバス
発生符号量制御
MPEG ビットストリーム
MPEG ビットストリーム
13
14
変調方式制御
15
16
送信電力制御
18
アンテナ
ホスト
MPEG 符号化器
リンクコントローラ
誤り訂正符号化器
変調器
拡散変調器
周波数変換器
送信アンプ
17
11
51
誤り訂正復号器
復調器
拡散復調器
周波数変換器
受信アンプ
12
23
ビットエラーレート
22
21
20
19

ノード１

RADIO TRANSMISSION DEVICE AND RADIO COMMUNICATION EQUIPMENT

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Publication date:	2000-03-03
Inventor(s):	OKUDA SHINJI; MIURA SHUNJI
Applicant(s):	NIPPON TELEGR & TELEPH CORP <NTT>
Requested Patent:	JP2000068959
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Priority Number(s):	
IPC Classification:	H04J3/00; H04B7/26; H04Q7/36; H04L12/28
EC Classification:	
Equivalents:	

Abstract

PROBLEM TO BE SOLVED: To simultaneously transmit data to a plurality of terminals with one slot and to improve transmission efficiency by hierarchizing data and hierarchy-multiplexing/transmitting data through the use of a hierarchy modulation system when data is transmitted to a plurality of radio terminals from the radio base station by a TDMA system.
SOLUTION: Whenever a radio transmission/reception part 12 receives a signal from a radio terminal, a reception level measurement part 13 measures a signal level and stores it in a terminal information storage part 16 with transmission source terminal information taken in a demodulation circuit 17. On the other hand, transmission data to the radio terminal is once accumulated in a transmission buffer 18 and a buffer control part 19 decides the hierarchizing of output data based on terminal information of the terminal information storage part 16. Transmission data is sent from the transmission buffer 18 to a hierarchy modulation circuit 15. Resistance against noise is improved by allocating data to the hierarchy of the signal of high quality in order from the smallest reception level. Hierarchy is modulated and the radio transmission/reception part 12 transmits data as a transmission frequency. Thus, transmission success probability is improved and transmission efficiency is improved.

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H04B　7/26		H04B　7/26	K
H04Q　7/36			105D
H04L　12/28		H04L　11/00	310B
// H04L　27/34		27/00	E

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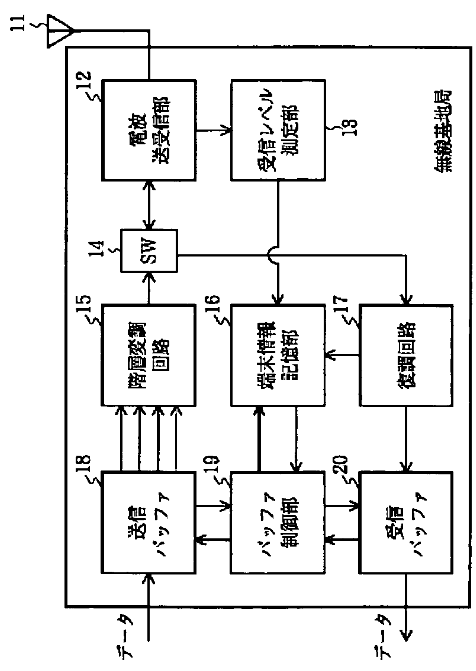
弁理士　井出　直孝　（外1名）

(54)【発明の名称】　無線送信装置および無線通信装置

(57)【要約】

【課題】　一つの無線基地局から複数の無線端末にTDMA方式でデータを伝送する場合に、複数の無線端末に同時にデータを送信する。

【解決手段】　階層変調方式を用いて、複数の無線端末宛てのデータを、変調シンボルの異なるビットに割当て階層化することにより、品質の異なる信号で階層多重し伝送する。



【特許請求の範囲】

【請求項１】　複数Ｎの宛先端末に対する個別の通信情報が伝送されるＮ回線の情報を一つの搬送波に同時に多重変調する変調手段を備えた無線送信装置において、

前記変調手段には、複数種類の通信品質の異なる回線が設定され、宛先端末毎にその必要な通信品質に応じて回線を割当てる手段を含むことを特徴とする無線送信装置。

【請求項２】　前記必要な通信品質は、前記宛先端末と自無線送信装置との距離に応じて設定され、前記宛先端末からの受信信号レベルを検出する手段と、この検出する手段により検出された受信信号レベルにしたがって前記距離の遠近を推定する手段とを備えた請求項１記載の無線送信装置。

【請求項３】　前記必要な通信品質は、前記宛先端末の要求にしたがって設定される請求項１記載の無線送信装置。

【請求項４】　前記変調手段は多値ＱＡＭ変調手段を含み、ＩＱ平面上の隣あう信号点間の距離を不均一に配置してその受信側での識別品質に差を設けることにより前記通信品質の異なる回線が設定された請求項１記載の無線送信装置。

【請求項５】　前記多値ＱＡＭ変調手段は、前記ＩＱ平面上の信号点の配置は、前記平面上の象限間の信号間距離ｄ１がその象限内の信号間距離ｄ２より大きく設定され、象限を識別するためのビットを通信品質の高い回線に割当て、象限内で信号点を区別するためのビットを通信品質の低い回線に割当てる手段を含む請求項４記載の無線送信装置。

【請求項６】　前記多値ＱＡＭ変調手段は、１６ＱＡＭ変調手段である請求項５記載の無線送信装置。

【請求項７】　一つの無線基地局と、この無線基地局と相互に通信を行う複数の無線端末とを備え、

前記無線基地局には、請求項１記載の無線送信装置と、前記無線端末からの信号を受信する無線受信装置と、この無線受信装置に受信される前記複数の無線端末からの信号品質にしたがって通信品質別の回線割当を自動的に行う手段とを備えたことを特徴とする無線通信装置。

【発明の詳細な説明】

【０００１】

【発明が属する技術分野】本発明は、一つの無線基地局と複数の端末との間で行う無線通信に利用する。本発明は、一つの室内または一つの建物内など近距離で使用する無線ＬＡＮ（Local Area Network）のために開発された技術であるが、これ以外にも広く利用することができる。本発明は、一つの搬送波に複数の端末に宛てる複数回線の情報を同時に変調する多重変調に関し、特にその多重変調される複数の回線に通信品質のグレード（階層）を設ける技術に関する。情報の重要度に応じて異なる品質で変調することを「階層化して変調する」と画像処理技術の分野で表現することにならい、この明細書では、複数の回線の通信品質にグレード（階層）を設けて一つの搬送波に多重変調することを「階層変調」と表現する。

【０００２】

【従来の技術】従来、複数の無線端末と一つの無線基地局との間で通信を行うシステムの一つとして無線ＬＡＮがある。この無線ＬＡＮシステムにおいて、一つの無線基地局に対し複数の無線端末が通信のために割り当てられたある決まった通信回線を共用し通信を行うために、その通信回線を周波数や時間で分割し、それを一つの無線端末との間の通信に割り当て通信を行う方法をとっている。このとき、周波数を分割する方法は周波数多重アクセス（ＦＤＭＡ）、時間を分割する方法は時間多重アクセス（ＴＤＭＡ）と呼ばれている。

【０００３】以上のようなシステムにおいては、通信回線の使用効率を向上させるために、周波数や時間で分割した通信回線を各無線端末に固定的に割り当てておくのではなく、送信するデータが発生する度に、各送信先無線端末に通信回線を割り当てる方法（予約方式と呼ぶ）がある。これにより、一つの無線基地局は、より多くの無線端末との通信を限られた帯域を用いて効率的に行うことができる。

【０００４】ＴＤＭＡ方式とし、上記に説明した予約方式とした場合において、無線基地局と各無線端末との間でデータを伝送する伝送フレームの一例を図８に示す。予約スロットは、無線端末が無線基地局に対し使用する通信回線を予約するため、または無線基地局が無線端末に対し使用する通信回線を報知するために用いる。許可スロットは、無線基地局が無線端末に送信を許可するために用いる。データスロットは、データを送信するために用いる。確認スロットは、無線基地局、無線端末へデータの送信が正しく行われたかの確認のために用いる。予約、許可、データ、確認の各スロットは、時間的に多重するために、図８のデータミニスロットに示すように、さらに幾つかの複数のミニスロットに分割されている。

【０００５】無線基地局から無線端末へデータパケットを送信する場合、データの送信に先立って、無線基地局は、予約スロットを用いて送信宛先となる無線端末を報知する。その後、無線基地局は、時間で分割されたデータミニスロットを用いて、順に各無線端末宛てのデータパケットを送信する。そして、先にデータ送信を報知されている無線端末は、報知されたデータミニスロットで無線基地局から送信されるデータパケットを受信し、これを正しく受信すると、その確認信号を受信したデータスロットに対応する確認ミニスロットで送信する。

【０００６】

【発明が解決しようとする課題】近年、コンピューターの普及、マルチメディア通信の増加に伴い、無線ＬＡＮ

システムに代表される無線パケット通信システムにおいて、一つの無線基地局と通信可能な無線端末数の増加や、伝送効率の向上、伝送容量の増大が望まれている。
【０００７】前述のように、ＴＤＭＡ方式においては、時間で分割した通信回線を複数の端末で共有して使用するため、図８の伝送フレームの構成から分かるように、一つのスロットで伝送できるデータパケットはたかだか一個であり、一つのスロットで複数の無線端末に同時に送信することはできない。このため、一つの無線基地局と通信を行う無線端末の数が増えると、無線基地局に送信を待つデータパケットの数が増えるため、伝送遅延が大きくなる等の伝送品質の低下を招く、また、パケットの衝突等により伝送効率の低下を招くことにもなる。さらに、無線基地局において送信待ちデータパケットを蓄積しておくバッファの容量を増やさなければならないといった問題も生じる。
【０００８】本発明は、このような背景に行われたものであって、一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合に、複数の無線端末に同時にデータを送信することを可能にする無線送信装置および無線通信装置を提供することを目的とする。本発明は、伝送効率の向上、伝送容量の増大を図ることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、送信データの送信成功確率を高めることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、信号伝送品質を向上させることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、送信待ちデータを蓄積する無線基地局の送信バッファの容量を小さくすることができる無線送信装置および無線通信装置を提供することを目的とする。本発明は、一つの無線基地局と通信可能な無線端末の数を増加させることができる無線送信装置および無線通信装置を提供することを目的とする。
【０００９】
【課題を解決するための手段】本発明は、無線基地局から複数の無線端末宛てのデータを伝送するのに、階層変調方式を用いて、複数の無線端末宛てのデータを、変調シンボルの異なるビットに割当て階層化することにより、品質の異なる信号で階層多重し伝送する。これにより、無線基地局は、一つのスロットで複数の無線端末へ同時に送信できる。また、無線基地局は、複数の無線端末宛てのデータを階層化する際に、予め測定してある無線端末から最後に送信された信号の受信レベルをもとに、受信レベルの小さい無線端末宛てのデータから順に品質の高い信号の階層に割り当て伝送する。
【００１０】一般に、受信信号レベルが小さい無線端末は無線基地局から遠い地点に位置し、大きい無線端末は無線基地局に近い地点に位置する。受信レベルが小さく、一般に無線基地局から遠い地点に位置する無線端末に対するデータは、高い品質の信号に割り当てられ、雑音に対する耐性を高くして送信されるため、その無線端末と無線基地局との伝送路が多少粗悪であっても、その送信成功確率を高くすることができる。
【００１１】また、受信レベルが大きく、一般に無線基地局の近くに位置する無線端末へのデータは、比較的その無線端末と無線基地局との間の伝送路が良好であるので、ある程度低い品質の信号に割り当て伝送しても、その送信成功確率は下がることはない。
【００１２】これにより、無線基地局から送信されるデータの送信成功確率が向上し、送信待ちデータを蓄積する無線基地局のバッファの容量を小さくできるだけでなく、データの伝送遅延を小さくでき、かつ伝送効率を向上できる。
【００１３】また、無線端末ごとに要求される通信品質を持つような場合には、その要求品質の高さの順に伝送品質を割り当てることから、データの送信成功確率が向上し、同様に、送信待ちデータを蓄積する無線基地局のバッファの容量を小さくできるだけでなく、データの伝送遅延を小さくでき、かつ伝送効率を向上できる。
【００１４】すなわち、本発明の第一の観点は無線送信装置であって、複数Ｎの宛先端末に対する個別の通信情報が伝送されるＮ回線の情報を一つの搬送波に同時に多重変調する変調手段を備えた無線送信装置である。
【００１５】ここで、本発明の特徴とするところは、前記変調手段には、複数種類の通信品質の異なる回線が設定され、宛先端末毎にその必要な通信品質に応じて回線を割当てる手段を含むところにある。
【００１６】前記必要な通信品質は、前記宛先端末と自無線送信装置との距離に応じて設定され、このとき、前記宛先端末からの受信信号レベルを検出する手段と、この検出する手段により検出された受信信号レベルにしたがって前記距離の遠近を推定する手段とを備えることが望ましい。
【００１７】すなわち、自無線送信装置からの距離が遠い宛先端末については、宛先端末における受信信号レベルが小さくなり、Ｃ／Ｎ（搬送波対雑音比）が小さくなってしまうことが予想されるので、良好な通信品質の回線を割当てることが送信成功確率を向上させるために必要である。これに対し、自無線送信装置からの距離が近い宛先端末については、宛先端末における受信信号レベルが大きく、Ｃ／Ｎも大きいことが予想されるので、通信品質が比較的粗悪な回線を割当てたとしても、送信成功確率が下がることはない。したがって、宛先端末からの受信信号レベルにより、自無線送信装置と宛先端末との距離を推定し、これに応じて必要な通信品質の回線を割当てることがよい。
【００１８】また、前記必要な通信品質は、前記宛先端末の要求にしたがって設定されるようにしてもよい。すなわち、音声や画像、データといったように、宛先端末

が扱うデータ種類に応じてそれぞれ必要な通信品質が異なるので、これを無線送信装置側にて把握し、これに応じて必要な通信品質の回線を割当てるようにしてもよい。

【0019】前記変調手段は多値ＱＡＭ変調手段を含み、ＩＱ平面上の隣あう信号点間の距離を不均一に配置してその受信側での識別品質に差を設けることにより前記通信品質の異なる回線を設定することができる。

【0020】前記多値ＱＡＭ変調手段は、前記ＩＱ平面上の信号点の配置は、前記平面上の象限間の信号間距離ｄ１がその象限内の信号間距離ｄ２より大きく設定され、象限を識別するためのビットを通信品質の高い回線に割当て、象限内で信号点を区別するためのビットを通信品質の低い回線に割当てる手段を含むことが望ましい。前記多値ＱＡＭ変調手段は、１６ＱＡＭ変調手段であることができる。これにより、受信側では、通信品質の高い回線と通信品質の低い回線との識別を容易に行うことができる。

【0021】本発明の第二の観点は無線通信装置であって、一つの無線基地局と、この無線基地局と相互に通信を行う複数の無線端末とを備え、前記無線基地局には、本発明の無線送信装置と、前記無線端末からの信号を受信する無線受信装置と、この無線受信装置に受信される前記複数の無線端末からの信号品質にしたがって通信品質別の回線割当を自動的に行う手段とを備えることを特徴とする。

【0022】これにより、一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合に、複数の無線端末に同時にデータを送信することを可能にする。したがって、伝送効率の向上、伝送容量の増大を図ることができる。また、送信データの送信成功確率を高めることができる。これにより、信号伝送品質を向上させることができる。さらに、送信待ちデータを蓄積する無線基地局の送信バッファの容量を小さくすることができる。また、一つの無線基地局と通信可能な無線端末の数を増加させることができる。

【0023】本発明の第三の観点は、複数の端末に宛てる個別の情報を論理的に通信品質の異なる回線に割当て一つの搬送波に同時に多重変調する階層変調方法である。

【0024】

【発明の実施の形態】発明の実施の形態を図１および図２を参照して説明する。図１は本発明実施例の無線基地局の要部ブロック構成図である。図２は階層１６ＱＡＭの信号点配置を示す図である。

【0025】本発明実施例では、本発明の無線送信装置を無線基地局に適用する。すなわち、図１に示すように、本発明は無線基地局であって、複数Ｎの宛先無線端末に対する個別の通信情報が伝送されるＮ回線の情報を一つの搬送波に同時に多重変調する変調手段である階層変調回路１５を備えた無線基地局である。

【0026】ここで、本発明の特徴とするところは、階層変調回路１５には、複数種類の通信品質の異なる回線が設定され、宛先無線端末毎にその必要な通信品質に応じて回線を割当てる手段である受信レベル測定部１３、端末情報記憶部１６、バッファ制御部１９を含むところにある。

【0027】前記必要な通信品質は、前記宛先無線端末と自無線基地局との距離に応じて設定され、前記宛先無線端末からの受信信号レベルを検出する手段である受信レベル測定部１３を備え、端末情報記憶部１６は、受信レベル測定部１３により検出された受信信号レベルにしたがって前記距離の遠近を推定する。あるいは、前記必要な通信品質は、前記宛先無線端末の要求にしたがって設定される。

【0028】このとき、バッファ制御部１９は、複数の端末からの信号品質にしたがって通信品質別の回線割当を自動的に行う。

【0029】階層変調回路１５は多値ＱＡＭ変調を行い、ＩＱ平面上の隣あう信号点間の距離を不均一に配置してその受信側での識別品質に差を設けることにより前記通信品質の異なる回線が設定される。

【0030】図２に示すように、前記ＩＱ平面上の信号点の配置は、前記平面上の象限間の信号間距離ｄ１がその象限内の信号間距離ｄ２より大きく設定され、象限を識別するためのビットを通信品質の高い回線に割当て、象限内で信号点を区別するためのビットを通信品質の低い回線に割当てる。また、前記多値ＱＡＭ変調は、１６ＱＡＭ変調である。

【0031】

【実施例】本発明実施例を説明する。図３は本発明実施例の無線基地局と無線端末との間でデータを伝送するために用いる伝送フレームの構成例を示す図である。この例は、先に説明した図８に示した従来技術のＴＤＭＡ方式における伝送フレームに対応するものであり、無線基地局から二つの無線端末へ同時に送信することが可能な例を示したものである。二つの無線端末宛てのデータは、階層変調方式により実現する品質の異なる高品質チャネルと低品質チャネルの二つの信号に階層多重して同時に送信される。

【0032】同時に伝送が可能な無線端末数は、適用する階層変調方式の階層数により決まる。階層変調方式の階層数以上の多重数とする場合は、図３に示すように従来のＴＤＭＡ方式と同様に時間的に分割したスロット構成とする。ここではデータスロットを階層によって二つに分け、さらに、時間的に分割して二つに分け、合計四つのスロット構成としている。

【0033】次に、階層変調方式について説明する。階層変調方式は、伝送品質の異なる信号を階層多重して伝送することが可能である変調方式である。図４はその一

例である階層１６ＱＡＭの信号点配置を示す図であり、図４の四桁の数字は各信号点に割当てられた４ビットの符号を示している。各数字の上位２ビットは、各信号点が位置する象限に対応しており、下位２ビットは、各象限内の信号点の位置に対応している。

【００３４】一般に信号点間の距離が大きいほど雑音に対する耐性が高い。したがって、上位２ビットについては、各符号間の距離が大きく、雑音に対する耐性が高く、低Ｃ／Ｎでの送信が可能であるが、下位２ビットについては、各符号間の距離が小さく、上位２ビットと比べ高いＣ／Ｎが要求される。そこで、高品質チャネル側の情報を上位２ビットに割り当て、低品質チャネル側の情報を下位２ビットに割り当てることにより、階層数２の階層変調が可能となる。

【００３５】以上のように、階層変調方式は、情報をどのビットに割り当てるかにより、その耐雑音性が異なり、これにより伝送品質の異なる信号を階層多重して伝送することを可能にする変調方式である。なお、信号点配置とビットの割り当て方法を工夫することにより、３以上の階層数を持つようにすることもできる。

【００３６】図１に示すように、無線基地局は、無線端末が送信した信号を受信する電波送受信部１２と、電波送受信部１２が受信した信号の受信レベルを測定する受信レベル測定部１３と、電波送受信部１２が受信した信号から送信元端末情報とデータを復調する復調回路１７と、復調回路１７が復調した送信元端末情報と受信レベル測定部１３が測定した送信端末情報を含む信号の受信レベルとを記憶する端末情報記憶部１６と、端末情報記憶部１６の情報を基に無線端末宛て送信データの伝送品質を決定するバッファ制御部１９と、無線端末宛て送信データを一時格納しバッファ制御部１９で決定された伝送品質により送信データを階層化し出力する送信バッファ１８と、送信バッファ１８から出力されたデータを階層変調する階層変調回路１５と、階層変調回路１５の出力する変調信号を送信する電波送受信部１２から構成されている。

【００３７】送信バッファ１８は、適用する階層変調方式の階層数と同じ出力を持ち、バッファ内のデータのうち先に入力されたデータから順に、バッファ制御部１９で決定された伝送品質の階層で変調されるように階層変調回路１５へ出力する。

【００３８】図４は階層変調回路１５の要部ブロック構成図であるが、階層変調回路１５は、例えば、図４に示すように、マッピング回路３１と、直交変調器３２とから構成される。

【００３９】図５は本発明実施例の無線端末の要部ブロック構成図である。無線端末は、無線基地局が送信した電波を受信する電波送受信部２２、電波送受信部２２が受信した信号を復調する階層復調回路２４と、復調されたデータ宛先情報とデータを一時格納しデータ宛先情報を基に自無線端末宛てのデータだけを出力する受信バッファ２６と、送信データを一時格納し送信元端末情報を送信データに付与し出力する送信バッファ２８と、送信バッファ２８から出力されたデータを変調する変調回路２５と、変調回路２５の出力する変調信号を送信する電波送受信部２２から構成される。

【００４０】送信バッファ２８でデータに付与する無線基地局宛て送信元端末情報は、無線基地局において無線端末を織別する情報や無線端末が要求する通信品質の情報がある場合にはその情報である。

【００４１】図６は階層復調回路２４の要部ブロック構成図であるが、階層復調回路２４は、図６に示すように、直交復調器３３と、判別回路３４から構成される。

【００４２】図７は本発明実施例のデータ伝送手順を示すフローチャートである。図１～図７を参照して本発明実施例のデータ伝送手順について説明する。無線基地局において、受信レベル測定部１３は、無線端末からの信号を電波送受信部１２が受信するたびに信号レベルを測定し、これを端末情報記憶部１６に出力する。復調回路１７は、受信した信号を復調し、これに含まれる送信元端末情報を取り出し、これを端末情報記憶部１６に出力する。端末情報記憶部１６は、無線端末ごとに最新の受信レベルと端末情報を更新している（Ｓ１～Ｓ５）。

【００４３】送信バッファ１８は、無線基地局から無線端末へ送信するデータを受けて一時蓄積し、これを階層変調回路１５に出力する。ただし、階層変調回路１５への出力は、バッファ制御部１９の命令によるものとする。

【００４４】バッファ制御部１９は、階層変調回路１５へ出力するデータの宛先の無線端末を認織し、端末情報記憶部１６に蓄積されている端末情報をもとに、出力するデータの階層化を決定し、その階層化に従って階層変調回路１５に出力するように、送信バッファ１８に命令する。

【００４５】ここで、階層化の第一の方法は、端末情報として最新の信号の受信レベルを用いて、受信レベルの小さい無線端末宛てのデータから順に品質の高い信号の階層に割当てるという階層化である。一般に、受信信号レベルが小さい無線端末は無線基地局から遠い地点に位置し、大きい無線端末は無線基地局に近い地点に位置する。受信レベルが小さく、一般に無線基地局から遠い地点に位置する無線端末に対するデータを高い品質の信号に割当て、雑音に対する耐性を高くして伝送することで、その無線端末と無線基地局との伝送路が多少粗悪であっても、その送信成功確率を高くすることができる。また、受信レベルが大きく、一般に無線基地局の近くに位置する無線端末へのデータは、比較的その無線端末と無線基地局との間の伝送路が良好であるので、ある程度低い品質の信号に割り当て伝送しても、その送信成功確率が下がる確率は小さい。

【００４６】また、階層化の第二の方法は、音声や画像、データといったように、無線端末ごとに要求する通信品質が異なるような場合において、無線端末の要求する通信品質の情報を無線基地局で管理し、これを無線端末情報として用いて、その要求する品質の高さの順に品質の高い信号の階層に割当てるという階層化である。

【００４７】階層変調回路１５は、図４に示す構成であり、送信バッファ１８から出力されたデータを用いて、マッピング回路３１でＩ、Ｑ軸からなる複素平面上に階層化マッピングし、マッピング回路３１から出力された信号を直交変調器３２で直交変調する。

【００４８】階層変調回路１５から出力された信号は、電波送受信部１２で送信周波数帯に周波数変換された後、アンテナ１１から電波として無線基地局の通信ゾーン内の無線端末に送信される（Ｓ６～Ｓ９）。

【００４９】無線端末において、無線基地局からの電波をアンテナ２１で受信し、電波送受信部２２で所要周波数帯域の信号を抽出し、階層復調回路２４に出力する。

【００５０】階層復調回路２４は、図６に示す構成であり、直交復調器３３で入力された信号を復調し、この復調信号を判別回路３４に入力し、階層化し多重されているデータを復調し受信バッファ２６に出力する。

【００５１】受信バッファ２６は、復調されたデータを一時的に蓄積し、バッファ制御部２７の命令により、データを出力する。バッファ制御部２７は、受信バッファ２６に蓄積されているデータの宛先の無線端末を認識し、自端末宛てのデータだけを出力するように受信バッファ２６に命令する（Ｓ１０～Ｓ１３）。以上のように無線基地局から無線端末へのデータの伝送がなされる。

【００５２】

【発明の効果】以上説明したように、本発明によれば、一つの無線基地局から複数の無線端末にＴＤＭＡ方式でデータを伝送する場合において、従来は同時にただ一つの無線端末宛てのデータしか送信できなかったという問題を解決し、階層変網方式を用いて、複数の無線端末宛てのデータを、変調シンボルの異なるビットに割り当てて階層化し、品質の異なる信号で重畳し伝送することにより、一つのスロットで複数の端末へ同時に伝送することを可能にする。

【００５３】また、本発明によれば、無線基地局において、蓄積しておいた無線端末から最後に送信された信号の受信レベルや、各無線端末が要求する通信品質の情報をもとに、送信データの階層化を行い無線端末に送信することにより、送信データの送信成功確率を高めることができ、データの伝送遅延や伝送品質といった信号伝送品質を向上させることを可能にし、かつ伝送効率を向上させることを可能にするという効果がある。また、送信待ちデータを蓄積する無線基地局の送信バッファの容量を小さくすることを可能にするという効果がある。

【００５４】また、本発明によれば、上述のような効果により、一つの無線基地局と通信可能な無線端末の数を増加させることができ、また伝送容量を増大させることができるという利点がある。

【図面の簡単な説明】

【図１】本発明実施例の無線基地局の要部ブロック構成図。

【図２】階層１６ＱＡＭの信号点配置を示す図。

【図３】本発明実施例の無線基地局と無線端末との間でデータを伝送するために用いる伝送フレームの構成例を示す図。

【図４】階層１６ＱＡＭの信号点配置を示す図。

【図５】本発明実施例の無線端末の要部ブロック構成図。

【図６】階層復調回路の要部ブロック構成図。

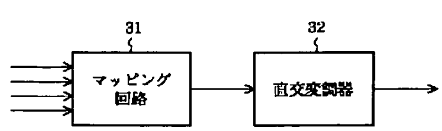
【図７】本発明実施例のデータ伝送手順を示すフローチャート。

【図８】ＴＤＭＡ方式かつ予約方式の無線基地局と各無線端末との間でデータを伝送する伝送フレームの一例を示す図。

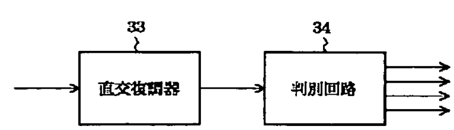
【符号の説明】

１１、２１　アンテナ
１２、２２　電波送受信部
１３　受信レベル測定部
１４、２３　スイッチ
１５　階層変調回路
１６　端末情報記憶部
１７　復調回路
１８、２８　送信バッファ
１９、２７　バッファ制御部
２０、２６　受信バッファ
２４　階層復調回路
２５　変調回路
３１　マッピング回路
３２　直交変調器
３３　直交復調器
３４　判別回路

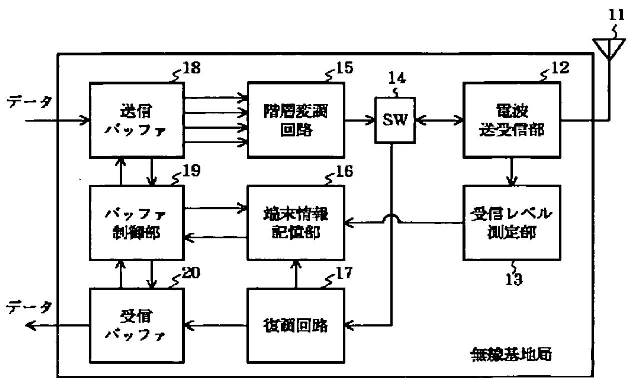
【図４】



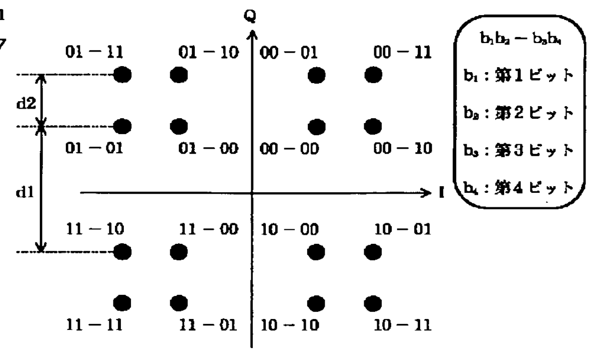
【図６】



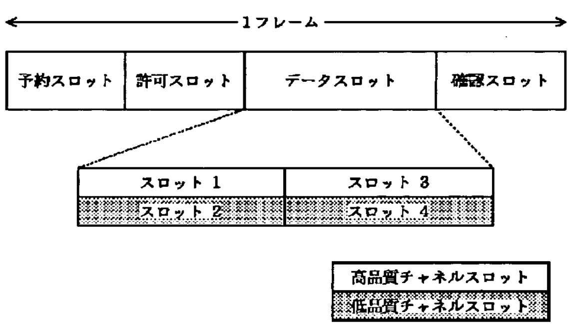
【図１】


データ
送信バッファ
階層変調回路
SW
電波送受信部
バッファ制御部
端末情報記憶部
受信レベル測定部
データ
受信バッファ
復調回路
無線基地局
11
12
13
14
15
16
17
18
19
20

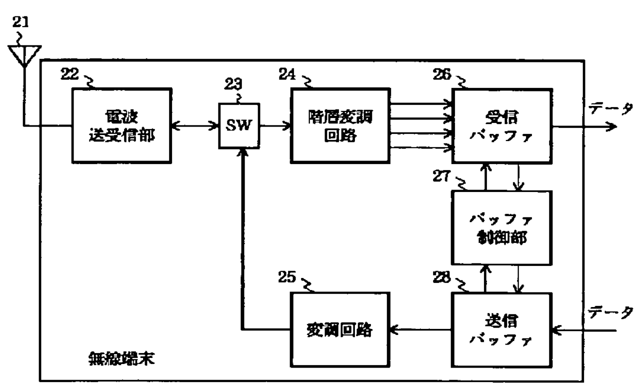
【図２】


Q
I
01－11
01－10
00－01
00－11
01－01
01－00
00－00
00－10
11－10
11－00
10－00
10－01
11－11
11－01
10－10
10－11
d2
d1
$b_1b_2-b_3b_4$
b_1：第１ビット
b_2：第２ビット
b_3：第３ビット
b_4：第４ビット

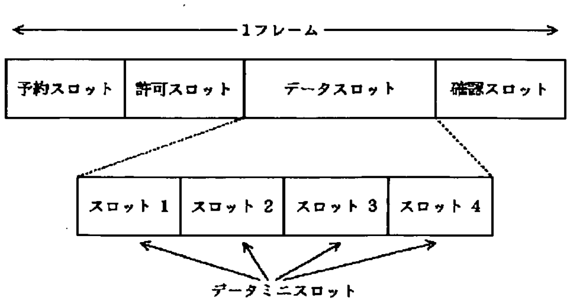
【図３】


１フレーム
予約スロット
許可スロット
データスロット
確認スロット
スロット１
スロット３
スロット２
スロット４
高品質チャネルスロット
低品質チャネルスロット

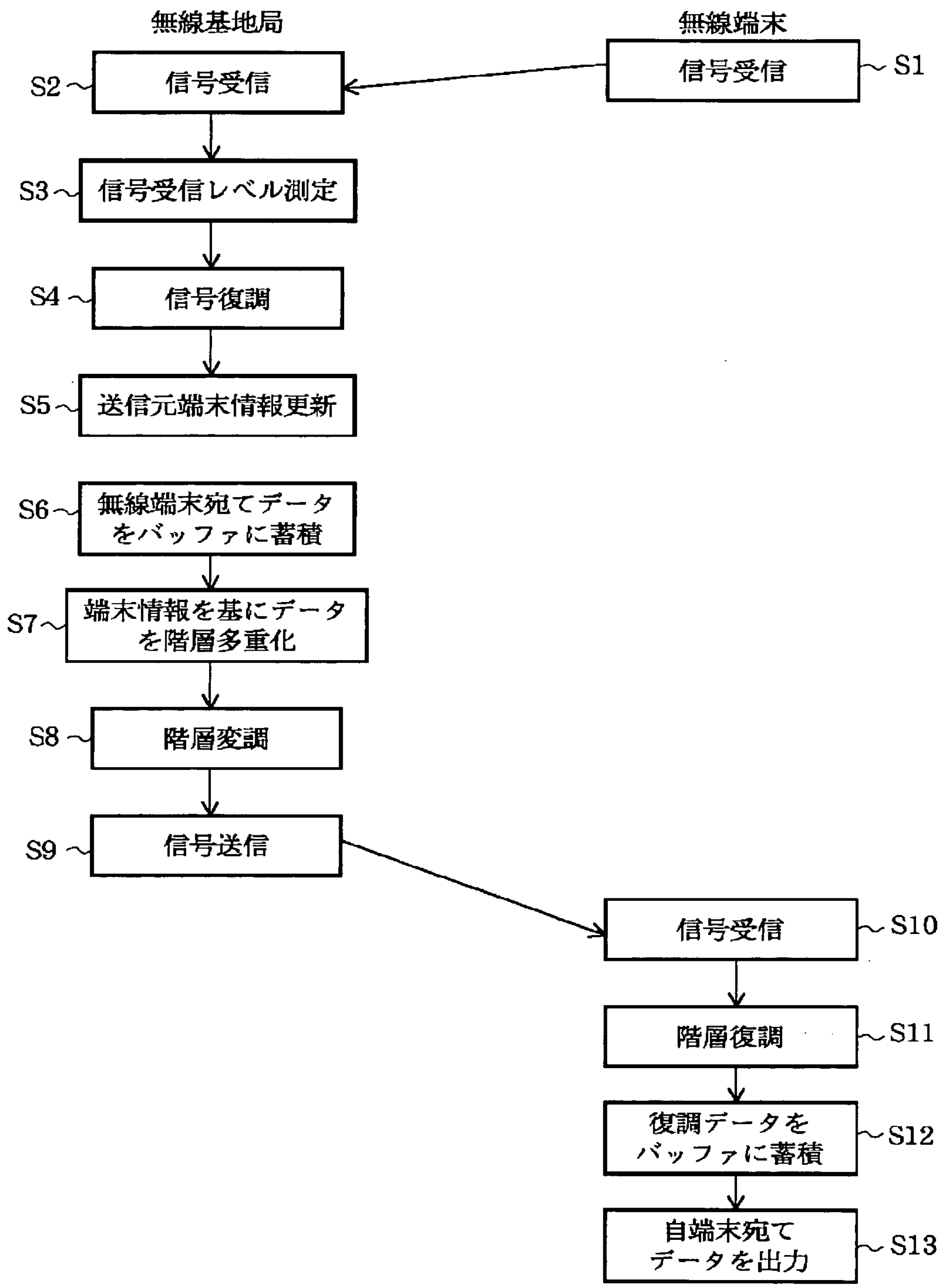
【図５】


21
22
23
24
25
26
27
28
電波送受信部
SW
階層変調回路
受信バッファ
データ
バッファ制御部
変調回路
送信バッファ
データ
無線端末

【図８】


１フレーム
予約スロット
許可スロット
データスロット
確認スロット
スロット１
スロット２
スロット３
スロット４
データミニスロット

【図7】


無線基地局
無線端末
信号受信
S1
S2
信号受信
S3
信号受信レベル測定
S4
信号復調
S5
送信元端末情報更新
S6
無線端末宛てデータをバッファに蓄積
S7
端末情報を基にデータを階層多重化
S8
階層変調
S9
信号送信
信号受信
S10
階層復調
S11
復調データをバッファに蓄積
S12
自端末宛てデータを出力
S13

【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第７部門第３区分
【発行日】平成１３年１０月２６日（２００１．１０．２６）

【公開番号】特開２０００－６８９５９（Ｐ２０００－６８９５９Ａ）
【公開日】平成１２年３月３日（２０００．３．３）
【年通号数】公開特許公報１２－６９０
【出願番号】特願平１０－２４０４５８
【国際特許分類第７版】

H04J 3/00
H04B 7/26
H04Q 7/36
H04L 12/28
// H04L 27/34

【ＦＩ】

H04J	3/00		H
H04B	7/26		K
		105	D
H04L	11/00	310	B
	27/00		E

【手続補正書】
【提出日】平成１３年１月２２日（２００１．１．２２）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】００３３
【補正方法】変更
【補正内容】
【００３３】次に、階層変調方式について説明する。階層変調方式は、伝送品質の異なる信号を階層多重して伝送することが可能である変調方式である。図２はその一例である階層１６ＱＡＭの信号点配置を示す図であり、図２の四桁の数字は各信号点に割当てられた４ビットの符号を示している。各数字の上位２ビットは、各信号点が位置する象限に対応しており、下位２ビットは、各象限内の信号点の位置に対応している。

Method of mobile telecommunications

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Publication date:	2003-11-18
Inventor(s):	KATO TOSHIO (JP); ABE MASAMI (JP)
Applicant(s):	OKI ELECTRIC IND CO LTD (JP)
Requested Patent:	JP2000004171
Application Number:	US19990332530 19990614
Priority Number(s):	JP19980166436 19980615
IPC Classification:	H03M13/17; H03M13/35
EC Classification:	H03M13/23, H04L1/00B3, H04L1/00F2
Equivalents:	JP3249471B2

Abstract

A to-be-sent signal (20) is comprised of a header (21) and convolution encoded data (22). An error correcting code (23) has a capability to correct a bit error or burst error contained in an objective data (24) placed apart from the header (21) in said convolution encoded data (22). Because an error arises easily in data placed apart from a header compared with that positioned near said header generally, said error correcting code (23) is added to data placed apart from said header and the addition of said error correcting code is omitted in data placed near to said header, thereby reducing whole information contents and transmission power.

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（P2000－4171A）
(43)公開日　平成12年1月7日(2000.1.7)

(51)Int.Cl.⁷	識別記号	ＦＩ	テーマコード゛(参考)
Ｈ０３Ｍ　13/23		Ｈ０３Ｍ　13/12	５Ｊ０６５
Ｈ０４Ｌ　1/00		Ｈ０４Ｌ　1/00　　Ｆ	５Ｋ０１４

審査請求　未請求　請求項の数８　ＯＬ　（全 ７ 頁）

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(22)出願日　平成10年６月15日(1998.6.15)
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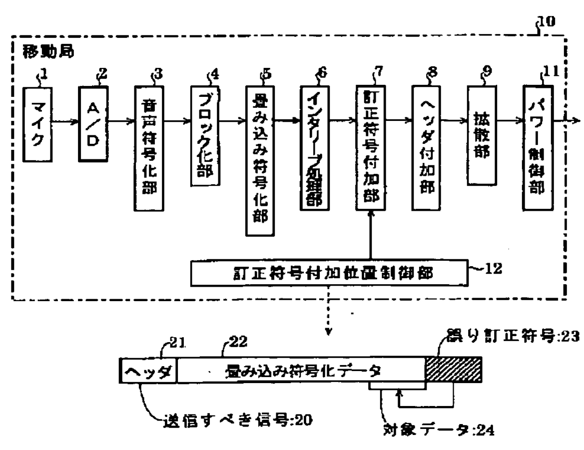
Ｆターム(参考)　5J065 AA01 AA03 AB05 AC02 AD10 AD11 AE06 AF03 AG06 AH07
5K014 AA01 BA07 BA10

(54)【発明の名称】　移動体通信方法

(57)【要約】
【解決手段】　送信すべき信号２０は、ヘッダ２１と畳み込み符号化データ２２から構成される。誤り訂正符号２３は、ヘッダ２１から離れた部分の一部の対象データ２４について、ビット誤りやバースト誤りの訂正機能を持つ。
【効果】　ヘッダに近い部分よりもヘッダから離れた部分に誤りが発生しやすいため、その部分には誤り訂正符号２３を付加し、他の部分の誤り訂正符号を省略することによって全体として情報量を縮小して、送信電力を低く抑えることができる。



本発明の移動体通信方法説明図

【特許請求の範囲】
【請求項1】　送信すべき信号を所定のサンプリング周期でサンプリングして符号化し、制御用のヘッダを付加して送信する場合において、
前記ヘッダから離れた部分にのみ、前記符号化された信号に誤り訂正符号を含めることを特徴とする移動体通信方法。
【請求項2】　送信すべき信号を所定のサンプリング周期でサンプリングして畳み込み符号化をし、制御用のヘッダを付加して送信するものにおいて、
前記ヘッダから離れた部分にのみ、前記畳み込み符号化された信号の誤りを訂正するためのビット誤り訂正符号を含めることを特徴とする移動体通信方法。
【請求項3】　送信すべき信号を所定のサンプリング周期でサンプリングして畳み込み符号化をし、制御用のヘッダを付加して送信するものにおいて、
前記ヘッダから離れた部分にのみ、前記畳み込み符号化された信号の誤りを訂正するためのバースト誤り訂正符号を含めることを特徴とする移動体通信方法。
【請求項4】　請求項2または3に記載の移動体通信方法において、
隣り合うヘッダの間に挟まれたデータの場合に、前記隣り合うヘッダのいずれからも離れた中間部分にのみ、誤り訂正符号を含めることを特徴とする移動体通信方法。
【請求項5】　送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、前記送信すべき信号中に、それぞれ区別することができる複数種類の送信データを混在させ、各送信データの重要度に着目した重み付けを施し、重要度の高いものほど誤り訂正符号の訂正能力を高めたことを特徴とする移動体通信方法。
【請求項6】　送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、
送信すべき信号中に、上位ビット操作した音声データが含まれるとき、上位ビット群に相当する送信データにのみ誤り訂正符号を付加したことを特徴とする移動体通信方法。
【請求項7】　送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、
送信すべき信号中に、圧縮符号化の際に帰還するデータが含まれているとき、その帰還するデータに相当する送信データにのみ誤り訂正符号を付加したことを特徴とする移動体通信方法。
【請求項8】　送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、
送信フレーム中に含まれる複数の上位ビット群とそれに付加した誤り訂正符号をヘッダに近く再配置し、下位ビット群をヘッダから離れた部分に再配置したことを特徴とする移動体通信方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、移動体通信、特に音声信号を符号化して送信する場合に適する移動体通信方法に関する。
【０００２】
【従来の技術】自動車電話、携帯電話等の、移動体用の通信システムは、時代の要請に従って急激な発展を遂げている。こうした移動体通信においては、信号が電波によって送受信されることから、雑音等による誤りを訂正し、入力時の信号を忠実に再生する誤り訂正技術が不可欠となっている。この出力の技術として、従来、畳み込み符号化方式や、ＢＣＨ方式、ＲＳ方式等が知られている。
【０００３】
【発明が解決しようとする課題】ところで、上記のような従来の技術には次のような解決すべき課題があった。送信すべき信号に誤り訂正のための情報を付け加えると、送信すべき信号の情報量が増大する。情報量が多いと必要な送信電力が大きくなる。ところが、例えばＣＤＭＡ方式による移動体通信の場合、同一の通信エリアで同時に接続できる接続数は制御可能な最大電力によって制限される。従って、より多くの同時通話を可能にするためには、各通信とも送信情報量を極力少なくしたい。その一方で、各接続者による通信に対し一定以上の品質を保証しなければならないという相反する要求がある。
【０００４】
【課題を解決するための手段】本発明は以上の点を解決するため次の構成を採用する。
〈構成１〉送信すべき信号を所定のサンプリング周期でサンプリングして符号化し、制御用のヘッダを付加して送信する場合において、上記ヘッダから離れた部分にのみ、上記符号化された信号に誤り訂正符号を含めることを特徴とする移動体通信方法。
【０００５】〈構成２〉送信すべき信号を所定のサンプリング周期でサンプリングして畳み込み符号化をし、制御用のヘッダを付加して送信するものにおいて、上記ヘッダから離れた部分にのみ、上記畳み込み符号化された信号の誤りを訂正するためのビット誤り訂正符号を含めることを特徴とする移動体通信方法。
【０００６】〈構成３〉送信すべき信号を所定のサンプリング周期でサンプリングして畳み込み符号化をし、制御用のヘッダを付加して送信するものにおいて、上記ヘッダから離れた部分にのみ、上記畳み込み符号化された信号の誤りを訂正するためのバースト誤り訂正符号を含めることを特徴とする移動体通信方法。
【０００７】〈構成４〉構成２または３に記載の移動体通信方法において、隣り合うヘッダの間に挟まれたデー

タの場合に、上記隣り合うヘッダのいずれからも離れた中間部分にのみ、誤り訂正符号を含めることを特徴とする移動体通信方法。

【０００８】〈構成５〉送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、上記送信すべき信号中に、それぞれ区別することができる複数種類の送信データを混在させ、各送信データの重要度に着目した重み付けを施し、重要度の高いものほど誤り訂正符号の訂正能力を高めたことを特徴とする移動体通信方法。

【０００９】〈構成６〉送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、送信すべき信号中に、上位ビット操作した音声データが含まれるとき、上位ビット群に相当する送信データにのみ誤り訂正符号を付加したことを特徴とする移動体通信方法。

【００１０】〈構成７〉送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、送信すべき信号中に、圧縮符号化の際に帰還するデータが含まれているとき、その帰還するデータに相当する送信データにのみ誤り訂正符号を付加したことを特徴とする移動体通信方法。

【００１１】〈構成８〉送信すべき信号を所定のサンプリング周期でサンプリングして符号化して送信する場合において、送信フレーム中に含まれる複数の上位ビット群とそれに付加した誤り訂正符号をヘッダに近く再配置し、下位ビット群をヘッダから離れた部分に再配置したことを特徴とする移動体通信方法。

【００１２】

【発明の実施の形態】以下、本発明の実施の形態を具体例を用いて説明する。

〈具体例１〉図１は、本発明の移動体通信方法を示す説明図である。この図には、移動局１０の具体的なブロック図と送信すべき信号の内容とを示した。移動局１０は、マイク１、Ａ／Ｄ変換器２、音声符号化部３、ブロック化部４、畳み込み符号化部５、インタリーブ処理部６、訂正符号付加部７、ヘッダ付加部８、拡散部９及びパワー制御部１１を備える。さらに、訂正符号付加部７には、訂正符号付加位置制御部１２が接続されている。

【００１３】図のマイク１は、移動局１０の使用者が音声を入力したとき、これを電気信号に変える部分である。Ａ／Ｄ変換器２は、マイク１から入力したアナログ信号をディジタル信号に変換する部分である。音声符号化部３は、Ａ／Ｄ変換器２の出力を所定のサンプリング周期でサンプリングして符号化する部分である。ブロック化部４は、音声符号化部３の出力を所定の量ずつブロック化し、畳み込み符号化部５に向けて送り出す部分である。畳み込み符号化部５は、ブロック化部４から入力した信号をブロック毎に、従来からよく知られた畳み込み符号化処理する部分である。

【００１４】インタリーブ処理部６は、１群のディジタル信号の上位ビットから下位ビットまでをまとめてばらばらにスライスして、データの順序を入れ替える部分である。訂正符号付加部７は、インタリーブ処理部６の出力を受け入れて、図の下側に示したような誤り訂正符号２３を付加する部分である。なお、この誤り訂正符号２３を付加するための対象となる対象データ２４は、訂正符号付加位置制御部１２によって指定され、制御される。

【００１５】ヘッダ付加部８は、送信すべき信号２０に対しヘッダ２１を付加する処理を行う部分である。拡散部９は、ヘッダ付加部８の出力を拡散符号化し、パワー制御部１１はこれを図示しない送信回路に送り出す処理を行う部分である。この具体例は、従来の装置に対して、上記訂正符号付加部７と訂正符号付加位置制御部１２追加したことを特徴とする。その他の部分は従来装置と同様であり、そのより詳細な説明を省略する。

【００１６】この移動局１０は、図の下側に示すような送信すべき信号２０を送信する。この信号は、ヘッダ２１と、畳み込み符号化データ２２と、誤り訂正符号２３とから構成される。ヘッダ２１は、上記のように、ヘッダ付加部により生成されて付加され、各種の通信制御用信号等を含む。畳み込み符号化データ２２はインタリーブ処理部６の出力である。従来は、誤り訂正符号が各部に付加された信号を畳み込み符号化し、ヘッダを付加して送信をしていた。この具体例では、畳み込み符号化処理された後のデータに誤り訂正符号２３を付加する。

【００１７】しかも、誤り訂正符号２３は、畳み込み符号化データ２２のうちヘッダ２１から離れた部分にある特定の対象データ２４についてのみ付加する。この誤り訂正符号２３は、対象データ２４のビット誤りを訂正し、検出しあるいはバースト誤りを訂正するような機能を持つ。以上の構成の信号２０が拡散部９とパワー制御部１１を経て送信される。ヘッダ２１は位相同期に利用される。従って、ヘッダの近くにある信号は同期が取れており比較的受信誤りを生じ難い。ところが、ヘッダから遠い部分の信号ほど位相のずれが大きくなる。

【００１８】そこで、この具体例では、ヘッダから近い部分の誤り訂正機能は畳み込み符号化された信号の冗長ビットのみに委ね、ヘッダから遠い部分には誤り訂正符号２３を付加することによってその部分の誤り訂正機能を強化している。特に、このような構成によって、畳み込み符号化前の画一的な誤り訂正符号付加処理を省略することができれば、全体として情報量を削減して、送信電力を抑制できる。また、畳み込み符号化前に画一的な誤り訂正符号付加処理を施し、畳み込み符号化をし、さらに上記のように特定の対象データに誤り訂正符号を付加すれば、極めて信頼性の高い信号を効率よく送信できる。

【００１９】〈具体例１の効果〉以上のように、送信す

べき信号２０のヘッダ２１から離れた特定の対象データに対してのみ誤り訂正符号２３を含めるようにすると、畳み込み符号化データ２２の全ての部分に対して誤り訂正符号を付加する場合に較べ送信すべき情報量が減少する。これにより、訂正能力を上げた分だけ、送信パワーを低減できる。

【００２０】〈具体例２〉誤り訂正符号には各種のものが知られている。いずれの場合にも、所定の対象データに付加することによって、その対象データ中の誤りビットを検出し訂正を行うことができる。

【００２１】図２は、誤り訂正符号の種類と誤り訂正効果の説明図を示す。図２（ａ）には、よく知られたＢＣＨ符号によるビット誤り訂正検出符号２３Ａの内容説明図を示した。このＢＣＨ符号のうち、１ビット誤りの訂正と２ビット誤りの検出をするものをハミング符号と呼び、一般のデータ通信に広く採用されている。図の対象データ２４中に例えば１ビットのデータ誤りがあれば、これを検出して訂正し元の信号を得ることができる。また、２ビットの誤りがあれば、訂正はできないがそれを検出して、例えばその対象データ２４を含むフレーム全体を破棄するといった処理ができる。

【００２２】ビット誤り訂正検出符号２３Ａのビット数を増やせば、さらに誤り訂正能力や検出能力が増える。従って、図１に示した畳み込み符号化データ２２中の訂正を必要とする対象データ２４の長さが長い場合には、ビット誤り訂正検出符号２３Ａのビット長を適当に増加させればよい。また、対象データを適当に区切って、その間にビット誤り訂正検出符号２３Ａを混在させるようにしてもよい。

【００２３】図２（ｂ）には、ＲＳ符号の説明図を示す。ＲＳ符号は、リードソロモン符号と呼ばれ、シンボル誤り訂正に用いられている。１シンボルは複数ビットで形成されており、１シンボル８ビットの場合、１つのキャラクタコードをそのまま訂正することができる。従って、畳み込み符号化データと組み合わせることによって、強力な誤り訂正機能を付加することが可能である。特に、無線通信では、ヘッダから遠い対象データ２４について、位相のずれ等によりバースト誤りを発生しやすい。これを、バースト誤り訂正符号２３Ｂを付加することによって、送信すべき信号の信頼性が高まる。特に、図のような対象データ２４について、バースト誤りをバースト単位で訂正するため有効である。

【００２４】〈具体例２の効果〉以上のように、畳み込み符号化データ中の特定の対象データについて、ビット誤り訂正検出符号やバースト誤り訂正符号を付加することによって、信頼性の高い、誤り訂正能力の高い通信であって、電力消費の少ない移動体通信が可能となる。

【００２５】〈具体例３〉この具体例では、誤り訂正符号を付加する対象データの位置について一層の最適化を図る。図３には、トレーニング効果の説明図を示す。受信側においては、受信信号の同期をとり、畳み込み符号化データを処理するために、ヘッダ２１Ａの位置を基準にした位相合わせを含むトレーニング処理が行われる。このとき、図の矢印に示すように、トレーニングの効果は、各ヘッダ２１Ａ，２１Ｂの前後に影響し、ヘッダ２１Ａを中心とする前後のデータが最も位相がよく合う。即ち、この図に示すように、ヘッダ２１Ａとヘッダ２１Ｂに挟まれた畳み込み符号化データに着目すると、丁度両ヘッダ２１Ａ，２１Ｂから最も離れた中間部分の対象データ２４に最も誤りが発生しやすくなる。そこで、この具体例では、この対象データについてについてのみ誤り訂正符号２３を付加する。

【００２６】〈具体例３の効果〉以上のように、隣り合うヘッダの間に挟まれたデータの場合、両ヘッダのいずれからも離れた中間部分のみに誤り訂正符号を付加することによって、全体として送信電力を抑え、誤り訂正能力の高い移動体通信が可能となる。

【００２７】〈具体例４〉上記のように、送信すべき信号中には、ヘッダや、畳み込み符号化データ等、様々な種類の送信データが含まれる。この中から比較的重要度が高く誤り訂正が必要と思われるデータを選択して、これらにのみ誤り訂正符号を付加するようにすれば、これまでの具体例と同様、全体として送信電力を抑えることができる。さらに、誤り訂正能力が高い誤り訂正符号ほど情報量が多いことから、各送信データに付加する誤り訂正符号に重要度に合わせた重み付けをして、重要度の高い送信データほど誤り訂正能力の高い誤り訂正符号を付加するとよい。

【００２８】図４には、重要度が高く重み付けされる送信データの例説明図を図示した。図に示したＡ～Ｅのデータは、いずれも重要度の比較的高い送信データの例である。Ａは、既に説明した畳み込み符号化データ中のヘッダから離れた部分のデータである。この部分の信号誤りを訂正することにより、畳み込み符号化データ全体を正確に再現することが可能だからである。Ｂは、ＱＯＳと呼び、品質情報である。

【００２９】また、Ｃは多値化された音声信号の上位ビットである。例えば音声信号のような場合、下位ビットに多少誤りを生じたとしても、上位ビットが忠実に再生されれば、大幅な音質劣化は生じない。上位ビットが損傷すると、忠実な再現は不可能になる。従って、上位ビットは重要なデータといえる。Ｄは、圧縮符号化時の帰還データである。圧縮処理を行う場合に繰り返し参照される帰還データ部分は重要性が高い。こうしたデータは重要度が高いため、これらのデータにのみ誤り訂正符号を付加する。

【００３０】〈具体例４の効果〉以上のように、重要度の高いものほどその誤り訂正符号の訂正能力を高めるようにすれば、信号全体の信頼性を高めることができる。また、その一方で、比較的重要度の低いデータについて

は、誤り訂正符号の訂正能力を少なくしたり、あるいは誤り訂正符号を付加しないといった方法によって必要最小限の訂正能力で少ない電力による送受信が可能になる。

【００３１】〈具体例５〉図５には、上位ビット操作の説明図を示す。上位ビット操作では、例えば８ビットの音声データ２６について、その上位ビット群２７－１，２７－２から順にビットスライスしたデータを取り出し、シリアルに並べて送信する処理を行う。こうした上位ビット操作において、既に説明したように、上位ビット群２７－１や２７－２は、音声データ中、そのデータの内容を定める最も重要なデータである。従って、例えばこの上位ビット群２７－１や２７－２のみについて、誤り訂正符号を付加する。

【００３２】即ち、この図に示すように、上位ビット群２７－１には誤り訂正符号２３－１を付加し、次の上位ビット２７－２には誤り訂正符号２３－２を付加している。他の下位ビットには誤り訂正符号を付加しない。これによって、全体として誤り訂正符号の量を少なくし、送信電力を抑制している。

【００３３】さらにこの具体例では次のような信号処理を行う。上記のような上位ビット処理は、一定量のデータ群ごとに繰り返し実行される。しかしながら、既に説明したように、ヘッダに近いデータは誤りが生じにくく、ヘッダから遠いデータは誤りが生じやすい。このため、ヘッダに近い部分に各データ群の上位ビットを集中させ、ヘッダから遠い部分に下位ビットを配置するというようにデータの再配置をすれば、誤り訂正能力を最小限にしても信頼性の高い信号が送信できる。

【００３４】図６には、このような再配置動作の説明図を示す。図に示すように、ヘッダ２１の次には、上位ビット処理された信号の最上位ビットに相当するＭＳＢ１が配置され、これには誤り訂正ビット３０－１を付加する。また、別のブロックの最上位ビット列ＭＳＢ２が次に配置され、誤り訂正ビット３０－２が付加される。ヘッダ２１から遠い部分には下位ビットＬＳＢ１，ＬＳＢ２が配置される。

【００３５】〈具体例５の効果〉以上の例で、下位ビットＬＳＢ１，ＬＳＢ２については、ある程度の誤りが許容されるとすれば、最上位ビットにＭＳＢ１やＭＳＢ２のみ誤り訂正ビットを付加し、高品質な信号の送信が可能となる。また、ヘッダに近い部分は誤りが生じ難いとすれば、具体例１のように、ヘッダから遠い部分の下位ビットにのみ誤り訂正符号を付加して、信号全体の信頼性を高めてもよい。

【００３６】〈具体例６〉図７には、帰還データの説明図を示す。ここには、既に説明した帰還データに誤り訂正符号を付加する例のより具体的な内容を示した。この図に示す圧縮データ３１は、例えば帰還データ３２を参照しながら先頭から順に圧縮されたデータである。従って、圧縮されたデータを伸長する場合には、帰還データ３２が再び参照される。このように、帰還データ３２は他の部分に較べて重要なデータである。このため、この部分の誤り訂正能力を高めるために、その直後に誤り訂正符号２３を付加している。

【００３７】〈具体例６の効果〉この具体例６のみならず、具体例４や５においても、送信すべき信号中に、それぞれ区別することができるような複数の種類の送信データが混在されているとき、各送信データの重要度に応じて、必要な部分に訂正能力の高い誤り訂正符号を付加し、不要な部分には誤り訂正符号を省略するといった方法によって、送信電力を抑制し、品質の高い信号の送信が可能となる。なお、以上いずれの具体例においても、図１に示した移動局１０が送信すべき信号２０を生成して送信する処理について説明を行ったが、移動局と通信を行う基地局における信号の送信についても同様に適用が可能である。

【図面の簡単な説明】

【図１】本発明の移動体通信方法を示す説明図である。

【図２】誤り訂正効果の説明図である。

【図３】トレーニングの効果説明図である。

【図４】重要度が高く重み付けされる送信データ説明図である。

【図５】上位ビット操作の説明図である。

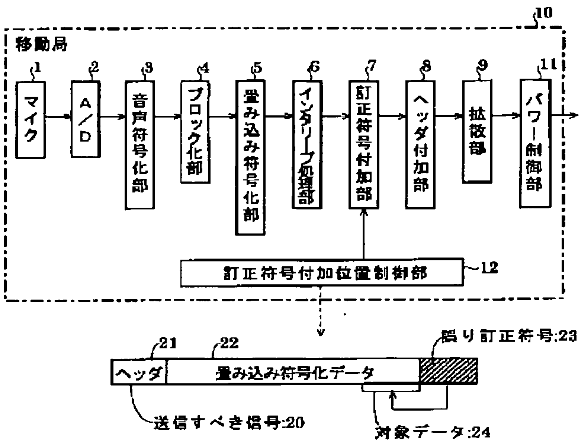
【図６】再配置動作の説明図である。

【図７】帰還データの説明図である。

【符号の説明】

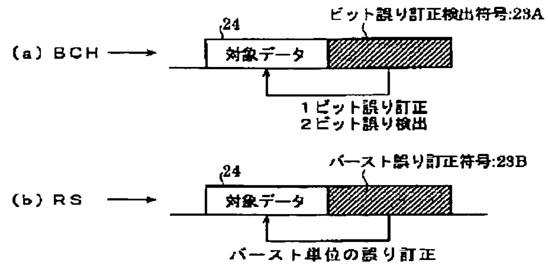
３　音声符号化部
４　ブロック化部
５　畳み込み符号化部
６　インタリーブ処理部
７　訂正符号付加部
８　ヘッダ付加部
１０　移動局
１２　訂正符号付加位置制御部
２０　送信すべき信号
２１　ヘッダ
２２　畳み込み符号化データ
２３　誤り訂正符号

【図1】



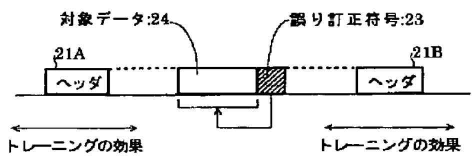
本発明の移動体通信方法説明図

【図2】



誤り訂正効果の説明図

【図3】



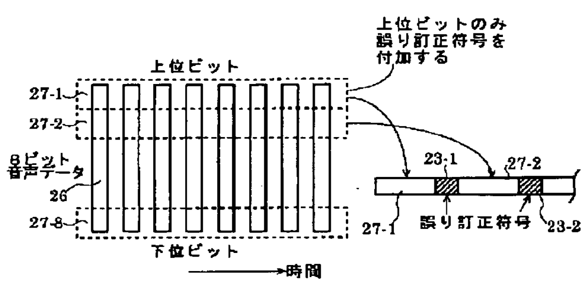
トレーニングの効果説明図

【図4】

A	ヘッダから離れた部分のデータ
B	QOS(品質保証情報)
C	多値化された音声信号の上位ビット
D	圧縮符号化時の帰還データ

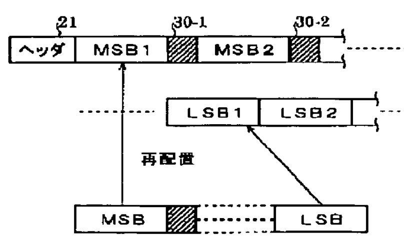
重要度が高く重み付けされる送信データ

【図5】



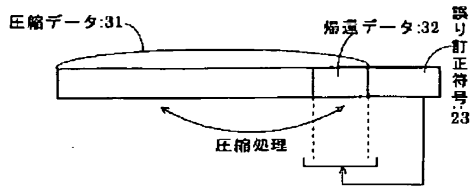
上位ビット操作の説明図

【図6】



再配置動作の説明図

【図７】



帰還データの説明図

Radio transmission system and transmission method with unequal error protection

Patent Number:	EP0959581
Publication date:	1999-11-24
Inventor(s):	TAKAYAMA YOSHIKAZU (JP)
Applicant(s):	NIPPON ELECTRIC CO (JP)
Requested Patent:	JP11331131
Application Number:	EP19990109863 19990519
Priority Number(s):	JP19980137296 19980520
IPC Classification:	H04L1/00
EC Classification:	H04L1/12D
Equivalents:	BR9902147, CN1236231
Cited Documents:	

Abstract

A radio transmission system transmits/receives information between a transmitter and receiver via a radio channel. The transmitter includes a plurality of power setting units and a transmission unit. The power setting units individually variably set the transmission powers of a plurality of pieces of information to be transmitted to the receiver to predetermined values. The transmission unit simultaneously transmits the plurality of pieces of information having the set transmission powers to the receiver. A radio transmission method is also disclosed.

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審査請求　有　請求項の数32　ＯＬ　（全 16 頁）

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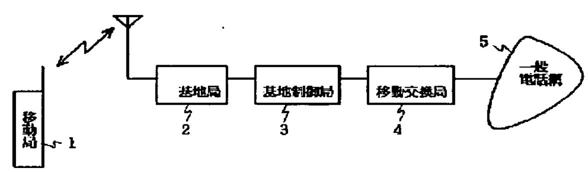
(54)【発明の名称】　無線伝送システム及びその伝送方法並びにその制御プログラムを記録した記録媒体

(57)【要約】
【課題】　必要なエラーレートに設定可能とし、周波数の有効利用が可能な無線伝送システムを提供する。
【解決手段】　マイク１１から入った音声信号はコーデック部１２でディジタル化された後に重要信号及び非重要信号に分けて出力される。重要信号及び非重要信号各々は拡散コード及びキャリア発生部１５，１６各々の拡散コードによって変調部１３，１４でスプレッドスペクトラムの変調がなされる。重要信号及び非重要信号各々に対しては電力設定制御部１９の制御に基づいて電力設定部１７，１８で重要度に応じた電力設定がなされる。電力設定部１７，１８の出力は合成部２０で合成された後、アンプ２１で増幅されてアンテナ２２から送信される。



【特許請求の範囲】
【請求項１】　送信機及び受信機間での情報の送受を無線にて行う無線伝送システムであって、前記送信機から複数の情報を送信する際に前記複数の情報を各々異なる送信電力で送信するようにしたことを特徴とする無線伝送システム。
【請求項２】　前記送信機は、一つの情報源からの情報を各々信頼度に応じて送信電力が異なる複数の通信路を含むことを特徴とする請求項１記載の無線伝送システム。
【請求項３】　前記送信機は、前記送信電力を前記複数の情報各々の種別に応じて設定自在としたことを特徴とする請求項１記載の無線伝送システム。
【請求項４】　前記送信機は、前記送信電力を信号源の必要信頼度に応じて設定自在としたことを特徴とする請求項１から請求項３のいずれか記載の無線伝送システム。
【請求項５】　前記送信機は、前記送信電力を前記受信機からの信号に応じて設定自在としたことを特徴とする請求項１から請求項４のいずれか記載の無線伝送システム。
【請求項６】　前記送信機は、前記送信電力を前記受信機からの受信レベル及びエラーレートの少なくとも一方に応じて設定自在としたことを特徴とする請求項１から請求項５のいずれか記載の無線伝送システム。
【請求項７】　前記送信機は、前記送信電力を前記受信機からの電力設定値及びその増減を指示する信号の少なくとも一方に応じて設定自在としたことを特徴とする請求項１から請求項６のいずれか記載の無線伝送システム。
【請求項８】　前記送信機は、複数の送信信号各々の同期をとって送信し、
前記受信機は、前記送信機から送られてきた前記複数の信号のうちのいずれかの信号で同期がとれた時に他の信号各々を同期がとれた信号に同期させて復調するようにしたことを特徴とする請求項１から請求項７のいずれか記載の無線伝送システム。
【請求項９】　送信機及び受信機間での情報の送受を無線にて行う無線伝送システムであって、前記受信機側に送信すべき複数の情報の送信電力を各々予め設定された値に可変する複数の電力設定手段と、前記複数の電力設定手段各々の出力を多重合成する合成手段とを前記送信機に有することを特徴とする無線伝送システム。
【請求項１０】　前記複数の情報は、一つの情報源からの情報を分割して生成され、
前記複数の電力設定手段各々は、前記複数の情報各々の送信電力を夫々の信頼度に応じた値に可変するよう構成したことを特徴とする請求項９記載の無線伝送システム。
【請求項１１】　前記複数の情報各々の種別を検出する複数の検出手段を前記送信機に含み、前記複数の電力設定手段各々が前記送信電力を前記複数の検出手段各々の検出結果に応じて可変するよう構成したことを特徴とする請求項９記載の無線伝送システム。
【請求項１２】　前記複数の電力設定手段各々は、前記送信電力を信号源の必要信頼度に応じて可変するよう構成したことを特徴とする請求項９から請求項１１のいずれか記載の無線伝送システム。
【請求項１３】　前記複数の電力設定手段各々は、前記送信電力を前記受信機からの信号に応じて可変するよう構成したことを特徴とする請求項９から請求項１２のいずれか記載の無線伝送システム。
【請求項１４】　前記複数の電力設定手段各々は、前記送信電力を前記受信機からの受信レベル及びエラーレートの少なくとも一方に応じて可変するよう構成したことを特徴とする請求項９から請求項１３のいずれか記載の無線伝送システム。
【請求項１５】　前記複数の電力設定手段各々は、前記送信電力を前記受信機からの電力設定値及びその増減を指示する信号の少なくとも一方に応じて可変するよう構成したことを特徴とする請求項９から請求項１４のいずれか記載の無線伝送システム。
【請求項１６】　前記複数の情報各々の同期をとって送信する手段を前記送信機に含み、
前記送信機から送られてきた前記複数の情報のうちのいずれかの信号で同期がとれた時に他の情報各々を同期がとれた信号に同期させて復調する手段を前記受信機に含むことを特徴とする請求項９から請求項１５のいずれか記載の無線伝送システム。
【請求項１７】　送信機及び受信機間での情報の送受を無線にて行う無線伝送方法であって、前記受信機側に送信すべき複数の情報の送信電力を各々予め設定された値に可変制御するステップを前記送信機に有することを特徴とする無線伝送方法。
【請求項１８】　前記複数の情報の送信電力を各々可変制御するステップは、前記複数の情報が一つの情報源からの情報を分割して生成される場合に、前記複数の情報各々の送信電力を夫々の信頼度に応じた値に可変制御するようにしたことを特徴とする請求項１７記載の無線伝送方法。
【請求項１９】　前記複数の情報各々の種別を検出するステップを前記送信機に含み、前記複数の情報の送信電力を各々可変制御するステップでその検出結果に応じて前記送信電力を可変制御するようにしたことを特徴とする請求項１７記載の無線伝送方法。
【請求項２０】　前記複数の情報の送信電力を各々可変制御するステップは、前記送信電力を信号源の必要信頼度に応じて可変制御するようにしたことを特徴とする請求項１７から請求項１９のいずれか記載の無線伝送方法。

【請求項２１】　前記複数の情報の送信電力を各々可変制御するステップは、前記送信電力を前記受信機からの信号に応じて可変制御するようにしたことを特徴とする請求項１７から請求項２０のいずれか記載の無線伝送方法。

【請求項２２】　前記複数の情報の送信電力を各々可変制御するステップは、前記送信電力を前記受信機からの受信レベル及びエラーレートの少なくとも一方に応じて可変制御するようにしたことを特徴とする請求項１７から請求項２１のいずれか記載の無線伝送方法。

【請求項２３】　前記複数の情報の送信電力を各々可変制御するステップは、前記送信電力を前記受信機からの電力設定値及びその増減を指示する信号の少なくとも一方に応じて可変制御するようにしたことを特徴とする請求項１７から請求項２２のいずれか記載の無線伝送方法。

【請求項２４】　前記送信機から前記複数の情報各々の同期をとって送信し、前記受信機において前記送信機から送られてきた前記複数の情報のうちのいずれかの信号で同期がとれた時に他の情報各々を同期がとれた信号に同期させて復調するようにしたことを特徴とする請求項１７から請求項２３のいずれか記載の無線伝送方法。

【請求項２５】　送信機及び受信機間での情報の送受を無線にて行わせるための無線伝送制御プログラムを記録した記録媒体であって、前記無線伝送制御プログラムは前記送信機に、前記受信機側に送信すべき複数の情報の送信電力を各々予め設定された値に可変制御させることを特徴とする無線伝送制御プログラムを記録した記録媒体。

【請求項２６】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報の送信電力を各々可変制御させる際に、前記複数の情報が一つの情報源からの情報を分割して生成される場合に、前記複数の情報各々の送信電力を夫々の信頼度に応じた値に可変制御させることを特徴とする請求項２５記載の無線伝送制御プログラムを記録した記録媒体。

【請求項２７】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報各々の種別を検出させ、前記複数の情報の送信電力を各々可変制御させる際に、その検出結果に応じて前記送信電力を可変制御させることを特徴とする請求項２５記載の無線伝送制御プログラムを記録した記録媒体。

【請求項２８】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報の送信電力を各々可変制御させる際に、前記送信電力を信号源の必要信頼度に応じて可変制御させることを特徴とする請求項２５から請求項２７のいずれか記載の無線伝送制御プログラムを記録した記録媒体。

【請求項２９】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報の送信電力を各々可変制御させる際に、前記送信電力を前記受信機からの信号に応じて可変制御させることを特徴とする請求項２５から請求項２８のいずれか記載の無線伝送制御プログラムを記録した記録媒体。

【請求項３０】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報の送信電力を各々可変制御させる際に、前記送信電力を前記受信機からの受信レベル及びエラーレートの少なくとも一方に応じて可変制御させることを特徴とする請求項２５から請求項２９のいずれか記載の無線伝送制御プログラムを記録した記録媒体。

【請求項３１】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報の送信電力を各々可変制御させる際に、前記送信電力を前記受信機からの電力設定値及びその増減を指示する信号の少なくとも一方に応じて可変制御させることを特徴とする請求項２５から請求項３０のいずれか記載の無線伝送制御プログラムを記録した記録媒体。

【請求項３２】　前記無線伝送制御プログラムは前記送信機に、前記複数の情報各々の同期をとって送信させ、前記無線伝送制御プログラムは前記受信機に、前記送信機から送られてきた前記複数の情報のうちのいずれかの信号で同期がとれた時に他の情報各々を同期がとれた信号に同期させて復調させることを特徴とする請求項２５から請求項３１のいずれか記載の無線伝送制御プログラムを記録した記録媒体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は無線伝送システムに関し、特に携帯電話システム等におけるエラーレートを確保するための方法に関する。

【０００２】

【従来の技術】従来、携帯電話におけるコーデックは低ビットレートであるため、誤りがあると音質が悪くなり、１ビット（ｂｉｔ）の影響が大きくでてくる。しかしながら、すべてのビットが等しく影響を与えるわけではない。

【０００３】このため、重要なビットと非重要なビットとに分け、重要なビットには誤り訂正を強くかけることが行われている。例えば、音声の場合にはその通話相手が音声を聞き分けることが重要なので、音声信号の上位ビットを重要なビットとし、下位ビットを非重要なビットとしており、重要なビットにはチェックビットを多くして誤りを訂正するが、非重要なビットにはチェックビットをつけないで伝送されたものをそのまま使用している。

【０００４】ＰＤＣ（Ｐｅｒｓｏｎａｌ　Ｄｉｇｉｔａｌ　Ｃｅｌｌｕｌａｒ）ではコーダからの１３４ｂｉｔの情報のうち５９ｂｉｔは非重要としてそのまま伝送する。残りの７５ｂｉｔのうちの４４ｂｉｔは最重要として７ｂｉｔのＣＲＣ（Ｃｙｃｌｉｃ　Ｒｅｄｕｎｄａｎ ｃｙ　Ｃｈｅｃｋ）を付加し（４４ｂｉｔ＋７ｂｉｔ＝５１ｂｉｔ）、これら８２ｂｉｔを重要な情報として伝送する。

【０００５】この場合、上記の情報には畳み込み符号で７８ｂｉｔのチェックビットと、５ｂｉｔのテールビットとが付加され、１６５ｂｉｔ（＝８２ｂｉｔ＋７８ｂｉｔ＋５ｂｉｔ）となる。よって、上記の情報は全体として２２４ｂｉｔ（＝５９ｂｉｔ＋１６５ｂｉｔ）となり、この２２４ｂｉｔの情報が送信されることとなる。

【０００６】

【発明が解決しようとする課題】上述した従来の携帯電話端末装置では、誤り訂正能力が符号で定まっており、通信中に誤り訂正能力を任意に変えることはできない。しかしながら、通信状態によって重要な情報と非重要な情報とには夫々最適な信頼度があるが、その信頼度に応じて誤り訂正能力を設定することはできない。

【０００７】そこで、本発明の目的は上記の問題点を解消し、必要なエラーレートに設定することができ、他のチャネルへの干渉を最小として周波数を有効に利用することができる無線伝送システムを提供することにある。

【０００８】

【課題を解決するための手段】本発明による無線伝送システムは、送信機及び受信機間での情報の送受を無線にて行う無線伝送システムであって、前記送信機から複数の情報を送信する際に前記複数の情報を各々異なる送信電力で送信するようにしている。

【０００９】本発明による他の無線伝送システムは、送信機及び受信機間での情報の送受を無線にて行う無線伝送システムであって、前記受信機側に送信すべき複数の情報の送信電力を各々予め設定された値に可変する複数の電力設定手段と、前記複数の電力設定手段各々の出力を多重合成する合成手段とを前記送信機に具備している。

【００１０】本発明による無線伝送システムの伝送方法は、送信機及び受信機間での情報の送受を無線にて行う無線伝送システムの無線伝送方法であって、前記受信機側に送信すべき複数の情報の送信電力を各々予め設定された値に可変制御するステップを前記送信機に備えている。

【００１１】本発明による無線伝送システムの伝送制御プログラムを記録した記録媒体は、送信機及び受信機間での情報の送受を無線にて行わせるための無線伝送制御プログラムを記録した記録媒体であって、前記無線伝送制御プログラムは前記送信機に、前記受信機側に送信すべき複数の情報の送信電力を各々予め設定された値に可変制御させている。

【００１２】すなわち、本発明の無線伝送システムは、無線局間で通信を行う時に送信する信号の信頼度に応じて送信電力を設定している。すなわち、本発明の無線伝送システムでは、複数信号を多重して送信する時に各信号によって必要な信頼度が異なるので、その信頼度に応じて送信電力を設定している。

【００１３】これによって、送信電力が信号の信頼度に関連して変化するため、必要なエラーレートに設定することが可能となる。また、最適な送信電力にすることが可能となるため、余分な送信電力を使用せず、他の無線局に与える妨害を少なくし、周波数の有効利用を可能とする。

【００１４】さらに、コーデックを切替えた時に、コーデックの特性にあったエラーレートに設定することが可能となる。さらにまた、通信中に最適なエラーレートに設定可能なため、いつでも最適な状態での通信が可能となる。

【００１５】上述したように、送信時に必要なだけの送信電力を使用すればよいので、他のチャネルへの干渉を最小とすることができ、周波数を有効に利用することが可能となる。

【００１６】

【発明の実施の形態】次に、本発明の実施例について図面を参照して説明する。図１は本発明の第１の実施例による無線伝送システムの構成を示すブロック図である。図において、本発明の第１の実施例による無線伝送システムは移動局（ＭＳ）１と、基地局（ＢＴＳ）２と、基地制御局（ＢＳＣ）３と、移動交換局４と、一般電話網５とから構成されている。

【００１７】図１には携帯電話システムのシステム構成を示しており、移動局１は電波（無線）で基地局２に接続され、基地局２から基地制御局３及び移動交換局４を経由して一般電話網５に接続されている。

【００１８】図２は本発明の第１の実施例による無線伝送システムで用いられる送信機の構成を示すブロック図である。図において、本発明の第１の実施例による送信機はマイク（ＭＩＣ）１１と、コーデック部１２と、変調部１３，１４と、拡散コード及びキャリア発生部１５，１６と、電力設定部１７，１８と、電力設定制御部１９と、合成部２０と、アンプ（ＡＭＰ）２１と、アンテナ２２とを備えている。ここで、送信機は上記の移動局１の構成を示している。

【００１９】図３は図２のコーデック部１２の構成を示すブロック図である。図において、コーデック部１２はＡ／Ｄ（アナログ／ディジタル）変換器１２ａと、分散処理部１２ｂとから構成されている。

【００２０】Ａ／Ｄ変換器１２ａは入力された信号（アナログ信号）をディジタル信号に変換して分散処理部１２ｂに出力し、分散処理部１２ｂはＡ／Ｄ変換器１２ａからのディジタル信号を重要信号と非重要信号とに分割して出力する。

【００２１】この分散処理部１２ｂによる重要信号と非重要信号との分割はコーデック方法の違いによって、例えば８ビット１ブロックの信号の場合、重要信号として

上位４ビット、非重要信号として下位４ビットとしたり、あるいは重要信号として上位２ビット、非重要信号として下位６ビットとすること等が可能である。

【００２２】これら図１～図３を参照して本発明の第１の実施例による無線伝送システムの動作について説明する。移動局１において、マイク１１から入った音声信号はコーデック部１２のＡ／Ｄ変換器１２ａでディジタル化され、分散処理部１２ｂで重要信号及び非重要信号に分けて出力される。

【００２３】重要信号及び非重要信号各々は拡散コード及びキャリア発生部１５，１６各々の拡散コードによって変調部１３，１４でスプレッドスペクトラムの変調がなされる。その後、重要信号及び非重要信号各々に対しては電力設定部１７，１８で重要度に応じた電力設定がなされる。電力設定部１７，１８の出力は合成部２０で合成された後、アンプ２１で増幅されてアンテナ２２から送信される。

【００２４】ここで、重要信号は音声信号を分析した結果のパワーレベルや音源信号、及び気道フィルタ定数等の上位ビットが相当し、非重要信号はそれらの下位ビットが相当する。

【００２５】この場合、重要信号は電力設定制御部１９の制御によって電力設定部１７でアンテナ２２の出力が１Ｗになるようなレベルに設定され、非重要信号は電力設定制御部１９の制御によって電力設定部１８でアンテナ２２の出力が０．５Ｗになるようなレベルに設定される。実際のアンテナ２２からは合成部２０でそれらの信号両方が合成された１．５Ｗの出力が放射されることになる。

【００２６】尚、上記の例ではアンテナ２２の出力が１：０．５になるように設定しているが、この比率はコーデック部１２の特性によって決定される。つまり、上記の比率はコーデック部１２によるコーデック方法の違いに応じて決定されるが、コーデック部１２の特性は予め判っているので、決定された比率は以後固定された値となる。

【００２７】図４は本発明の第２の実施例による送信機の構成を示すブロック図である。図において、本発明の第２の実施例による送信機は複数のコーデック部１２－１，１２－２を設けた以外は図１に示す本発明の第１の実施例と同様の構成となっており、同一構成要素には同一符号を付してある。また、同一構成要素の動作は本発明の第１の実施例と同様である。

【００２８】本発明の第２の実施例では複数のコーデック部１２－１，１２－２の特性に応じてアンテナ２２からの送信電力の配分を、そのシステムに最適な値に制御することが行われる。

【００２９】上記のように、複数のコーデック部１２－１，１２－２が配置されている場合、重要な情報と非重要な情報とにおける必要な電力比はいつも一定とは限らないので、電力設定制御部１９にはコーデック部１２－１，１２－２に対応した制御情報が予め記憶されている。

【００３０】電力設定制御部１９はスイッチ部（ＳＷ）２３，２４によってコーデック部１２－１，１２－２を変更する度に最適な値がセットされるように制御している。これは、例えばＰＤＣ（Ｐｅｒｓｏｎａｌ Ｄｉｇｉｔａｌ Ｃｅｌｌｕｌａｒ）のフルレート／ハーフレートの切替え時に使用することができる。

【００３１】ここで、電力設定制御部１９による制御動作は制御メモリ２５に記憶されたプログラムを実行することで実現され、制御メモリ２５としてはＲＯＭ（リードオンリメモリ）やＲＡＭ（ランダムアクセスメモリ）、あるいはメモリカード等が使用可能となっている。

【００３２】図５は図４の電力設定制御部１９の制御動作を示すフローチャートである。これら図４及び図５を参照して本発明の第２の実施例による送信機の動作について説明する。

【００３３】電力設定制御部１９は図示せぬ信号線を介して制御信号が入力されると、その制御信号に付加されたコーデック種別を指定する情報を基に通信に必要なコーデック種別を判定する（図５ステップＳ１）。

【００３４】電力設定制御部１９は通信に必要なコーデック種別をコーデック＃１（コーデック部１２－１）と判定すると、スイッチ部２３，２４がコーデック部１２－１への入力及びコーデック部１２－１の出力を選択するよう設定するための信号をスイッチ部２３，２４に出力する（図５ステップＳ２）。

【００３５】その後に、電力設定制御部１９は上述した制御情報が予め記憶された内部の表（図示せず）からコーデック部１２－１に対応する電力設定信号を読出して電力設定部１７，１８に出力する（図５ステップＳ３）。

【００３６】一方、電力設定制御部１９は通信に必要なコーデック種別をコーデック＃２（コーデック部１２－２）と判定すると、スイッチ部２３，２４がコーデック部１２－２への入力及びコーデック部１２－２の出力を選択するよう設定するための信号をスイッチ部２３，２４に出力する（図５ステップＳ４）。

【００３７】その後に、電力設定制御部１９は内部の表からコーデック部１２－２に対応する電力設定信号を読出して電力設定部１７，１８に出力する（図５ステップＳ５）。

【００３８】これによって、通信に必要なコーデック種別を選択する際に、選択されたコーデック種別に必要なエラーレートに応じて送信電力を設定することができる。この場合、従来例において必要なエラーレートを得るために必要とされた大きなチェックビットが不要となり、必要最小限のチェックビットを付加するだけで、必

要なエラーレートを得ることができる。

【００３９】図６は本発明の第３の実施例による送信側の移動局の構成を示すブロック図であり、図７は本発明の第３の実施例による受信側の基地局の構成を示すブロック図である。

【００４０】これらの図において、本発明の第３の実施例による送信側の移動局はマイク（ＭＩＣ）１１と、コーデック部１２と、変調部１３，１４と、拡散コード及びキャリア発生部１５，１６と、電力設定部１７，１８と、電力設定制御部１９と、合成部２０と、アンプ（ＡＭＰ）２１と、アンテナ２２と、送受共用器２５と、受信器２６と、音声処理部２７と、受話器２８とを備えている。

【００４１】また、本発明の第３の実施例による受信側の基地局はアンテナ３０と、送受共用器３１と、高周波部３２と、復調部３３，３４と、制御部３５と、音声処理部３６と、送信部３７とを備えている。

【００４２】復調部３３，３４は移動局１の送信に対応して重要情報と非重要情報との２系統があり、制御部３５は夫々の受信レベルまたはエラーレートに応じて移動局１に夫々の送信電力設定値を変更するように送信部３７から送受共用器３１を介して移動局１に制御情報を送信している。尚、図５においては変調の部分を省略しており、図６においては復調した後の処理を省略している。

【００４３】基地局２では復調部３３，３４で夫々エラー検出訂正を行っており、復調部３３，３４はそれを基に受信レベル及びエラーレートを検出し、その検出結果を制御部３５に渡す。制御部３５はその検出結果からエラーレートが悪いことを知ると、アップ信号［ＵＰ（＋）］を移動局１に出力するよう送信部３７に指示し、エラーレートが良いことを知ると、ダウン信号［ＤＯＷＮ（－）］を移動局１に出力するよう送信部３７に指示する。送信部３７は制御部３５からの制御情報を送受共用器３１及びアンテナ３０を介して移動局１に送信する。

【００４４】移動局１ではアンテナ２２及び送受共用器２６を介して基地局２からの制御情報を受信部２７で受信すると、受信部２７はその制御情報を電力設定制御部１９に渡す。電力設定制御部１９は基地局２からの制御情報に基づいて電力設定部１７，１８を制御する。

【００４５】上述したように、本発明の第３の実施例ではこれら送信機及び受信機を用いてアダプティブに各情報の送信電力の設定を制御するように構成されている。すなわち、基地局２からの各情報毎の送信電力設定信号によって、移動局１における各情報の送信電力が最適な値に設定される。

【００４６】移動通信では電波の伝搬状態の変化が大きく、重要情報と非重要情報との電力比が常に一定の値がよいとは限らない。このため、本発明の第３の実施例においてはコーデック部１２に応じて初期値として決められた電力比が設定されているが、基地局２からの各情報毎の送信電力設定信号によって移動局１からの送信電力が最適な値に再設定される。

【００４７】この送信電力設定信号は基地局２から送信電力の値で受信したり、電力ＵＰ／ＤＯＷＮで指示されるかはシステムによって自由に設定することができる。また、基地局２で受信したレベル信号を元に移動局１が送信電力を決めてもよい。

【００４８】上記の例では移動局１が送信を、基地局２が受信を行う場合を示しているが、この逆、すなわち基地局２が送信を、移動局１が受信を行う場合でも上記と同様の動作が行われる。このとき、移動局１は受信レベルまたはエラーレートを基地局２に報告することで、基地局２がその情報を元に送信電力を自ら設定する。

【００４９】図８は図７の制御部３５の処理動作を示すフローチャートであり、図９は図６の電力設定制御部１９の処理動作を示すフローチャートである。これら図６～図９を参照して本発明の第３の実施例による送信電力制御について説明する。

【００５０】ここで、基地局２において重要信号のエラーレートをＡ、重要信号の規定範囲の上限値及び下限値をＬ11，Ｌ12、非重要信号のエラーレートをＢ、非重要信号の上限値及び下限値をＬ21，Ｌ22とする。

【００５１】また、移動局１において現在の重要信号の送信電力値をＰ１、基地局２からの制御信号を基に計算する電力値をＰA 、現在の非重要信号の送信電力値をＰ２、基地局２からの制御信号を基に計算する電力値をＰB とする。

【００５２】制御部３５は復調部３３，３４で検出されるエラーレートを基に送信電力のアップまたはダウン、あるいは現状維持を決定し、それを制御情報として送信部３７から移動局１に送信する。

【００５３】すなわち、制御部３５は復調部３３からの重要信号のエラーレートＡが規定範囲内（Ｌ12≦Ａ≦Ｌ11）にあるか否かを判定する（図８ステップＳ１１）。制御部３５は重要信号のエラーレートＡが規定範囲よりも小さい（Ａ＜Ｌ12）と判定すると、重要信号送信電力としてパワーダウン（Ｐｏｗｅｒ　Ｄｏｗｎ）を指定する（図８ステップＳ１２）。

【００５４】また、制御部３５は重要信号のエラーレートＡが規定範囲内（Ｌ12≦Ａ≦Ｌ11）と判定すると、重要信号送信電力として現状維持を指定し（図８ステップＳ１３）、重要信号のエラーレートＡが規定範囲よりも大きければ（Ａ＞Ｌ11）と判定すると、重要信号送信電力としてパワーアップ（Ｐｏｗｅｒ　Ｕｐ）を指定する（図８ステップＳ１４）。

【００５５】制御部３５は重要信号の送信電力に対する制御を決定すると、復調部３４からの非重要信号のエラーレートＢが規定範囲内（Ｌ22≦Ｂ≦Ｌ21）にあるか否

かを判定する（図８ステップＳ１５）。制御部３５は非重要信号のエラーレートＢが規定範囲よりも小さい（Ｂ＜L22）と判定すると、重要信号送信電力としてパワーダウン（Ｐｏｗｅｒ　Ｄｏｗｎ）を指定する（図８ステップＳ１６）。

【００５６】また、制御部３５は非重要信号のエラーレートＢが規定範囲内（L22≦Ｂ≦L21）と判定すると、非重要信号送信電力として現状維持を指定し（図８ステップＳ１７）、非重要信号のエラーレートＢが規定範囲よりも大きければ（Ｂ＞L21）と判定すると、非重要信号送信電力としてパワーアップ（Ｐｏｗｅｒ　Ｕｐ）を指定する（図８ステップＳ１８）。

【００５７】この後に、制御部３５は重要信号及び非重要信号の送信電力制御を制御情報として送信部３７から移動局１に送信する（図８ステップＳ１９）。但し、上記の説明では送信電力制御をパワーアップ、パワーダウン、現状維持で移動局１に指示するようにしているが、絶対値（例えば、ｘワットに設定等）で送信電力制御を行うことも可能であり、これに限定されない。

【００５８】一方、移動局１の電力設定制御部１９では基地局２からの制御情報を待って送信電力の設定制御をスタートする。すなわち、電力設定制御部１９は基地局２からの制御情報を受信すると（図９ステップＳ２１）、その制御情報の中の重要信号の電力制御値がパワーアップか、パワーダウンか、現状維持かを判定する（図９ステップＳ２２）。

【００５９】電力設定制御部１９は重要信号の電力制御値をパワーダウンと判定すると、PA ＝Ｐ１×１／２を計算する（図９ステップＳ２３）。また、電力設定制御部１９は重要信号の電力制御値を現状維持と判定すると、PA ＝Ｐ１×１を計算する（図９ステップＳ２４）。さらに、電力設定制御部１９は重要信号の電力制御値をパワーアップと判定すると、PA ＝Ｐ１×２を計算する（図９ステップＳ２５）。

【００６０】電力設定制御部１９は上記の計算結果PA を予め設定された規定値以内かどうかを判定し（図９ステップＳ２６）、規定値以内であれば現在の送信電力値Ｐ１を計算結果PA に設定する（図９ステップＳ２７）。電力設定制御部１９は規定値を越えていれば（Ｏｖｅｒ）、現在の送信電力値Ｐ１を規定値に設定する（図９ステップＳ２８）。

【００６１】続いて、電力設定制御部１９は制御情報の中の非重要信号の電力制御値がパワーアップか、パワーダウンか、現状維持かを判定する（図９ステップＳ２９）。電力設定制御部１９は非重要信号の電力制御値をパワーダウンと判定すると、PB ＝Ｐ２×１／２を計算する（図９ステップＳ３０）。

【００６２】また、電力設定制御部１９は非重要信号の電力制御値を現状維持と判定すると、PB ＝Ｐ２×１を計算する（図９ステップＳ３１）。さらに、電力設定制御部１９は非重要信号の電力制御値をパワーアップと判定すると、PB ＝Ｐ２×２を計算する（図９ステップＳ３２）。

【００６３】電力設定制御部１９は上記の計算結果PB を予め設定された規定値以内かどうかを判定し（図９ステップＳ３３）、規定値以内であれば現在の送信電力値Ｐ２を計算結果PB に設定する（図９ステップＳ３４）。電力設定制御部１９は規定値を越えていれば（Ｏｖｅｒ）、現在の送信電力値Ｐ２を（規定値－Ｐ１）に設定する（図９ステップＳ３５）。

【００６４】図１０は本発明の第４の実施例による受信機の構成を示す図である。図において、本発明の第４の実施例による受信機はアンテナ４０と、高周波部４１と、復調部４２，４３と、クロック再生回路（ＣＬＫ）４４，４５と、クロック（ＣＬＫ）制御部４６と、スイッチ部４７，４８とを備えている。

【００６５】アンテナ４０で受信された信号は高周波部４１で所望の周波数に切り分けられ、復調部４２，４３及びクロック再生回路４４，４５に入力される。クロック再生回路４４，４５は入力信号から同期を検出し、予め設定されたクロック信号を再生してスイッチ部４７，４８に出力する。

【００６６】ＣＬＫ制御部４６はクロック再生回路４４，４５における同期検出を基にスイッチ部４７，４８に選択信号を出力するので、クロック再生回路４４，４５で再生されたクロック信号のうちの同期がとれた方が復調部４２，４３に供給されることとなる。同期が取れなかった方の復調部４２，４３ではスイッチ部４７，４８を介して供給されるクロック信号を基に高周波部４１で切り分けられた信号を復調する。

【００６７】移動局１では重要情報と非重要情報とのデータを同期させて送信している。受信機（基地局２）側では復調部４２，４３のどちらか一方で同期がとれれば、他方でもそれを使用することによって安定した同期を使用することができる。また、二つの信号を合成してその中からクロックを抽出し、より安定にクロックを再生することも可能である。

【００６８】図１１は本発明の第５の実施例による無線伝送システムで用いられる送信機の構成を示すブロック図である。図において、本発明の第５の実施例による送信機は変調部１３，１４と、拡散コード及びキャリア発生部１５，１６と、電力設定部１７，１８と、電力設定制御部１９と、合成部２０と、アンプ（ＡＭＰ）２１と、アンテナ２２と、制御メモリ２５と、信号種別検出部５１，５２とを備えている。

【００６９】上記の送信機において、入力信号＃１，＃２各々は拡散コード及びキャリア発生部１５，１６各々の拡散コードによって変調部１３，１４でスプレッドスペクトラムの変調がなされる。その後、入力信号＃１，＃２各々に対しては電力設定部１７，１８で電力設定制

御部１９の制御に応じた電力設定がなされる。電力設定部１７，１８の出力は合成部２０で合成された後、アンプ２１で増幅されてアンテナ２２から送信される。

【００７０】一方、入力信号＃１，＃２各々は信号種別検出部５１，５２で夫々信号の種別（例えば、音声データや画像データ等）が検出される。これら信号種別検出部５１，５２での検出結果は電力設定制御部１９に送られるので、電力設定制御部１９は信号種別検出部５１，５２の検出結果に基づいて電力設定部１７，１８への設定を行う。

【００７１】ここで、電力設定制御部１９による制御動作は制御メモリ２５に記憶されたプログラムを実行することで実現され、制御メモリ２５としてはＲＯＭ（リードオンリメモリ）やＲＡＭ（ランダムアクセスメモリ）、またはメモリカード、あるいはフロッピディスク等が使用可能となっている。

【００７２】図１２は図１１の電力設定制御部１９の制御動作を示すフローチャートである。これら図１１及び図１２を参照して本発明の第５の実施例による送信機の動作について説明する。

【００７３】電力設定制御部１９は信号種別検出部５１，５２から入力信号＃１，＃２各々の種別が入力されると、その信号の種別を判定する（図１２ステップＳ４１）。電力設定制御部１９は通信に必要な信号種別を信号種別＃１と判定すると、内部の表（図示せず）から信号種別＃１に対応する電力設定信号を読出して電力設定部１７，１８に出力する（図１２ステップＳ４２）。

【００７４】一方、電力設定制御部１９は通信に必要な信号種別を信号種別＃２と判定すると、内部の表から信号種別＃２に対応する電力設定信号を読出して電力設定部１７，１８に出力する（図１２ステップＳ４３）。

【００７５】これによって、通信に必要な信号種別を選択する際に、選択された信号種別に必要なエラーレートに応じて送信電力を設定することができる。この場合、従来例において必要なエラーレートを得るために必要とされた大きなチェックビットが不要となり、必要最小限のチェックビットを付加するだけで、必要なエラーレートを得ることができる。

【００７６】図１３は本発明の第６の実施例による無線伝送システムの構成を示すブロック図である。図において、本発明の第６の実施例による無線伝送システムは移動局（ＭＳ）１と、基地局（ＢＴＳ）２－１，２－２と、基地制御局（ＢＳＣ）３－１，３－２と、移動交換局４と、一般電話網５とから構成されている。

【００７７】図１３は携帯電話システムのシステム構成を示しており、移動局１は電波（無線）で基地局２－１，２－２に接続され、基地局２から基地制御局３及び移動交換局４を経由して一般電話網５に接続されている。ここで、移動局１としては上述した本発明の第１～第５の各実施例に示す送信機のいずれの構成を採用してもよい。

【００７８】移動局１は重要信号及び非重要信号、あるいは信号種別＃１，＃２を夫々合成して無線信号にて基地局２－１，２－２に発信する。基地局２－１，２－２各々は移動局１からの無線信号を受信すると、その信号を基地制御局３－１～３－２各々を経て移動交換局４に送出する。

【００７９】移動交換局４はスイッチ部（ＳＷ＃１，ＳＷ＃２）６１，６３と、基地局切替部６２と、制御チャネル制御部６４と、制御チャネル信号発生部６５とを備えている。

【００８０】移動交換局４の基地局切替部６２はスイッチ部６１を通して基地局２－１，２－２各々からの信号が入力されると、その信号のフレーム（ブロック）毎に誤りのない信号を選択し、その選択した信号を音声信号に変換してスイッチ部６２を通して一般電話網５に送出する。

【００８１】この場合、基地局２－１，２－２のうちの一方からの信号にエラーがあったとしても、基地局２－１，２－２のうちの他方からの信号が正しければその信号を使用することができるため、誤り率が改善される。この誤り率が改善された状態で規定の誤り率を確保することができれば、正常な通話が可能となる。この時、基地局切替部６２は誤り率が改善された状態を制御チャネル制御部６４に出力する。

【００８２】制御チャネル制御部６４は基地局切替部６２からの誤り率が改善された状態を制御チャネル信号発生部６５から制御チャネル信号として、基地制御局３－１～３－２各々を経て基地局２－１，２－２に送り、誤り率が改善された状態を基地局２－１，２－２にフィードバックする。基地局２－１，２－２では移動交換局４からの誤り率が改善された状態に基づいて移動局１からの複数の信号（重要信号及び非重要信号、あるいは信号種別＃１，＃２等）に対する送信電力設定を制御する。

【００８３】図１４は図１３の基地局２－１，２－２の構成を示すブロック図である。図において、基地局２－１，２－２各々はアンテナ３０と、送受共用器３１と、高周波部３２と、復調部３３，３４と、制御部３５と、送信部３７と、合成部６０とを備えている。

【００８４】復調部３３，３４は移動局１の送信に対応して重要情報と非重要情報との２系統があり、夫々エラー検出訂正を行っており、エラーレートを検出して制御部３５に渡す。

【００８５】制御部３５はその検出結果を基に、エラー状態の信号を合成部６０で多重化される複数の信号（重要信号及び非重要信号、あるいは信号種別＃１，＃２等）に付加する。例えば、制御部３５は２０ｍｓのフレームにおいて、そのフレーム毎に誤っているか正しいかの信号を付加する。

【００８６】また、制御部３５は移動交換局４との間の

制御チャネルを介して複数の信号各々毎の合成されたエラーレートを受信すると、このエラーレートと復調部３３，３４からのエラーレートとを合わせて移動局１の送信電力を複数の信号毎に制御する。

【００８７】図１５は図１３の基地局切替部６２の構成を示すブロック図である。図において、基地局切替部６２は信号分離部６２ａ，６２ｂと、スイッチ部（ＳＷ）６２ｃ，６２ｄと、音声処理部６２ｅと、切替制御部６２ｆとを備えている。

【００８８】信号分離部６２ａ，６２ｂは基地局２－１，２－２各々で復調された複数の信号を重要信号と非重要信号とに、あるいは信号種別＃１，＃２毎に分離する。これら信号分離部６２ａ，６２ｂでは回線を有効利用するために、一つのチャネルで送れるように多重及び分離を行っている。但し、有線回線を潤沢に使用可能であれば、複数の信号各々やエラー状況信号等を分離したまま伝送してもよい。

【００８９】切替制御部６２ｆはエラー状況信号からエラーの有無を判定し、エラーのない信号を選択するようにスイッチ部６２ｃ，６２ｄを制御する。この場合、切替制御部６２ｆは複数の信号各々を独立に制御している。

【００９０】また、切替制御部６２ｆは合成した後のエラー状況を出力する。この出力は制御チャネル制御部で６４で処理され、有線区間の制御チャネルを通して必要な基地局２－１，２－２に通報される。

【００９１】上述したように、携帯電話システムにて２つの基地局２－１，２－２を同時に使用してソフトハンドオーバ（基地局間における通話の無瞬断切替）を行っている場合には移動交換局４でエラー検出を行うことによって、移動局１からの送信電力を一層減少させることが可能となる。

【００９２】このように、電力設定制御部１９の制御を基に電力設定部１７，１８で送信電力を可変することによって、送信すべき信号の信頼度に関連してその送信電力を変化させることができるので、必要なエラーレートに応じて送信電力を設定することができる。この場合、従来例において必要なエラーレートを得るために必要とされた大きなチェックビットが不要となり、必要最小限のチェックビットを付加するだけで、必要なエラーレートを得ることができる。

【００９３】これによって、最適な送信電力にすることが可能となり、その場合、余分な送信電力を使用しないので、他の無線局に与える妨害が少なくなり、周波数の有効利用を図ることができる。その際、コーデック部１２－１，１２－２を切替えた時にコーデック部１２－１，１２－２の特性にあったエラーレートに設定することもできる。

【００９４】また、受信機側からの電力設定信号や電力ＵＰ／ＤＯＷＮの指示に応じて対応する信号の送信電力を設定することによって、通信中に最適なエラーレートに設定することができるため、いつでも最適な状態で通信ができる。

【００９５】上記の例はCDMA（Ｃｏｄｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ：符号分割多元接続）を使用したものに適用可能であるが、アナログでも適用可能である。このとき、ＣＤＭＡの拡散コードを周波数分割のＣＨ（チャネル）と考えれば、アナログに適用することができる。

【００９６】また、ＴＤＭＡ（Ｔｉｍｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ：時分割多元接続）においてはバースト単位またはタイムスロットをサブタイムスロットに分割すること、または二つ以上のタイムスロットを使用することによって適用可能となる。

【００９７】

【発明の効果】以上説明したように本発明によれば、送信機及び受信機間での情報の送受を無線にて行う無線伝送システムにおいて、送信機から複数の情報を送信する際に複数の情報を各々異なる送信電力で送信することによって、必要なエラーレートに設定することができ、周波数を有効に利用することができるという効果がある。

【図面の簡単な説明】

【図１】本発明の第１の実施例による無線伝送システムの構成を示すブロック図である。

【図２】本発明の第１の実施例による無線伝送システムで用いられる送信機の構成を示すブロック図である。

【図３】図１のコーデック部の構成を示すブロック図である。

【図４】本発明の第２の実施例による送信機の構成を示すブロック図である。

【図５】図４の電力設定制御部の制御動作を示すフローチャートである。

【図６】本発明の第３の実施例による送信側の移動局の構成を示すブロック図である。

【図７】本発明の第３の実施例による受信側の基地局の構成を示すブロック図である。

【図８】図７の制御部の処理動作を示すフローチャートである。

【図９】図６の電力設定制御部１９の処理動作を示すフローチャートである。

【図１０】本発明の第４の実施例による受信機の構成を示す図である。

【図１１】本発明の第５の実施例による無線伝送システムで用いられる送信機の構成を示すブロック図である。

【図１２】図１１の電力設定制御部の制御動作を示すフローチャートである。

【図１３】本発明の第６の実施例による無線伝送システムの構成を示すブロック図である。

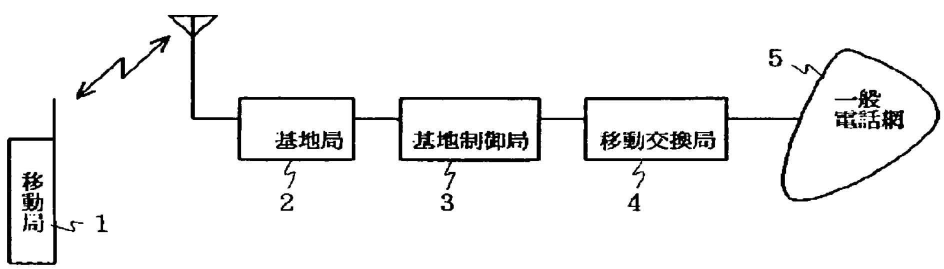
【図１４】図１３の基地局の構成を示すブロック図である。

【図１５】図１３の基地局切替部の構成を示すブロック図である。

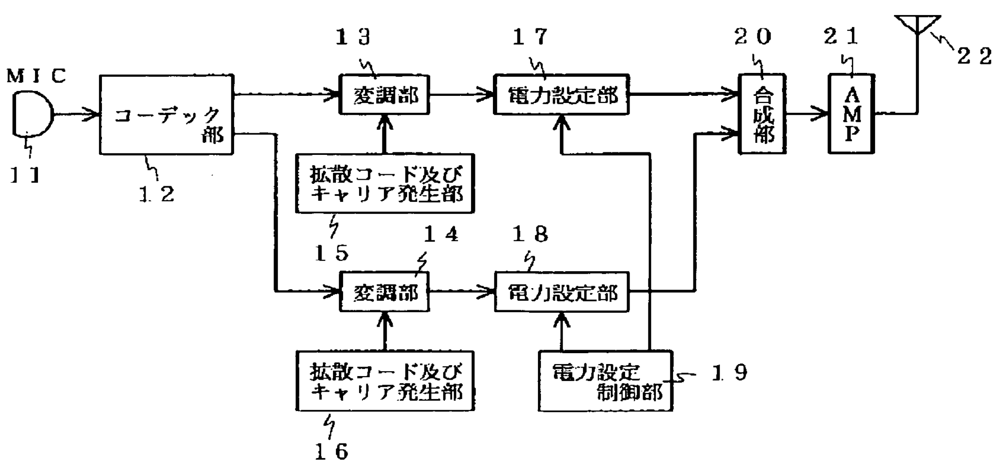
【符号の説明】

１　移動局
２，２－１，２－２　基地局
３，３－１，３－２　基地制御局
４　移動交換局
５　一般電話網
１１　マイク
１２，１２－１，１２－２　コーデック部
１２ａ　Ａ／Ｄ変換器
１２ｂ　分散処理部
１３，１４　変調部
１５，１６　拡散コード及びキャリア発生部
１７，１８　電力設定部
１９　電力設定制御部
２０　合成部
２１　アンプ
２２，３０，４０　アンテナ
２３，２４，４７，４８，６１，６２ｃ，６２ｄ，６３　スイッチ部
２５　制御メモリ
２６，３１　送受共用器
２７　受信器
２８，３６　音声処理部
２９　受話器
３２　高周波部
３３，３４，４２，４３　復調部
３５　制御部
３７　送信部
４１　高周波部
４４，４５　クロック再生回路
４６　クロック制御部
５１，５２　信号種別検出部
６０　合成部
６２　基地局切替部
６２ａ，６２ｂ　信号分離部
６２ｅ　音声処理部
６２ｆ　切替制御部
６４　制御チャネル制御部
６５　制御チャネル信号発生部

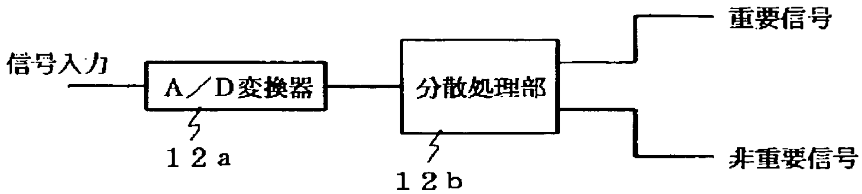
【図１】



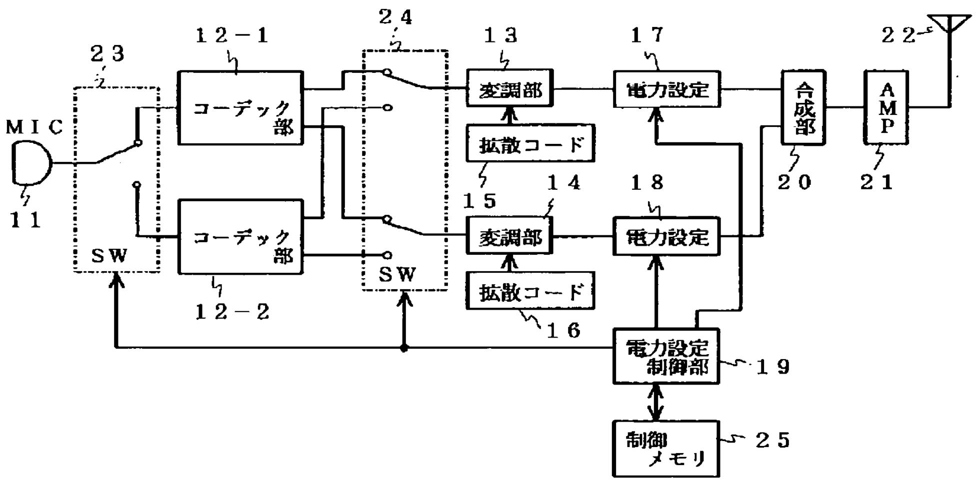
【図２】



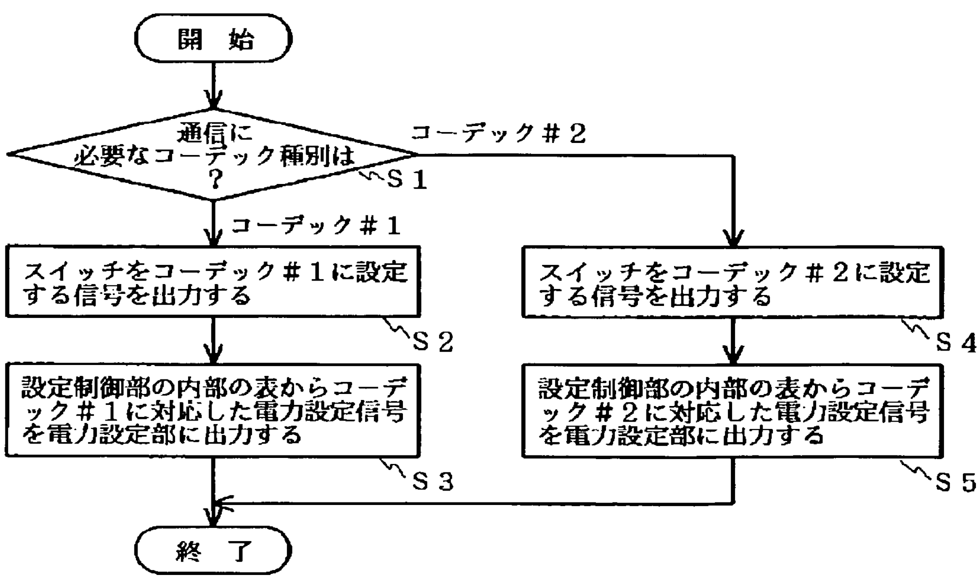
【図3】


信号入力
A／D変換器
12a
分散処理部
12b
重要信号
非重要信号

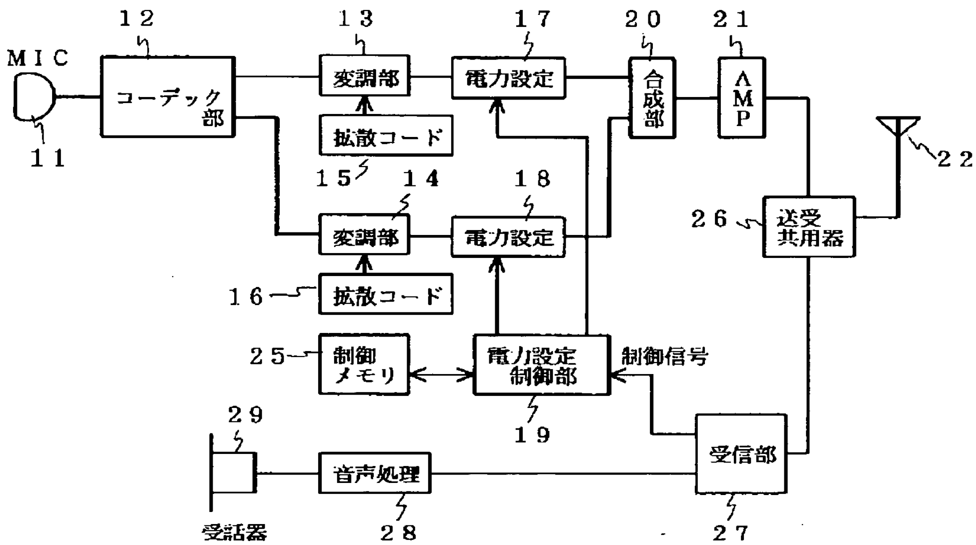
【図4】


MIC
11
23
SW
12−1
コーデック部
12−2
コーデック部
24
SW
13
変調部
拡散コード
15
14
変調部
拡散コード
16
17
電力設定
18
電力設定
電力設定制御部
19
制御メモリ
25
合成部
20
AMP
21
22

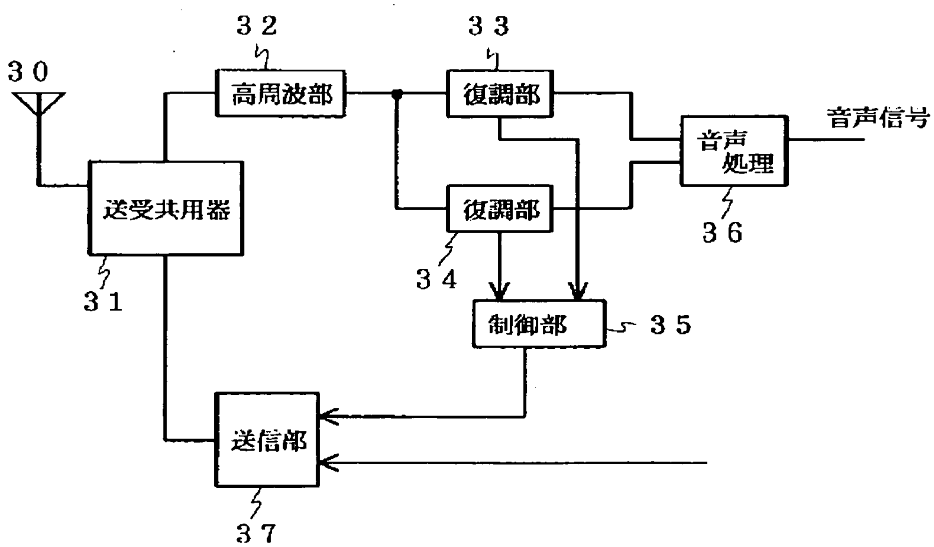
【図5】


開 始
通信に必要なコーデック種別は？
S1
コーデック＃2
コーデック＃1
スイッチをコーデック＃1に設定する信号を出力する
S2
設定制御部の内部の表からコーデック＃1に対応した電力設定信号を電力設定部に出力する
S3
スイッチをコーデック＃2に設定する信号を出力する
S4
設定制御部の内部の表からコーデック＃2に対応した電力設定信号を電力設定部に出力する
S5
終 了

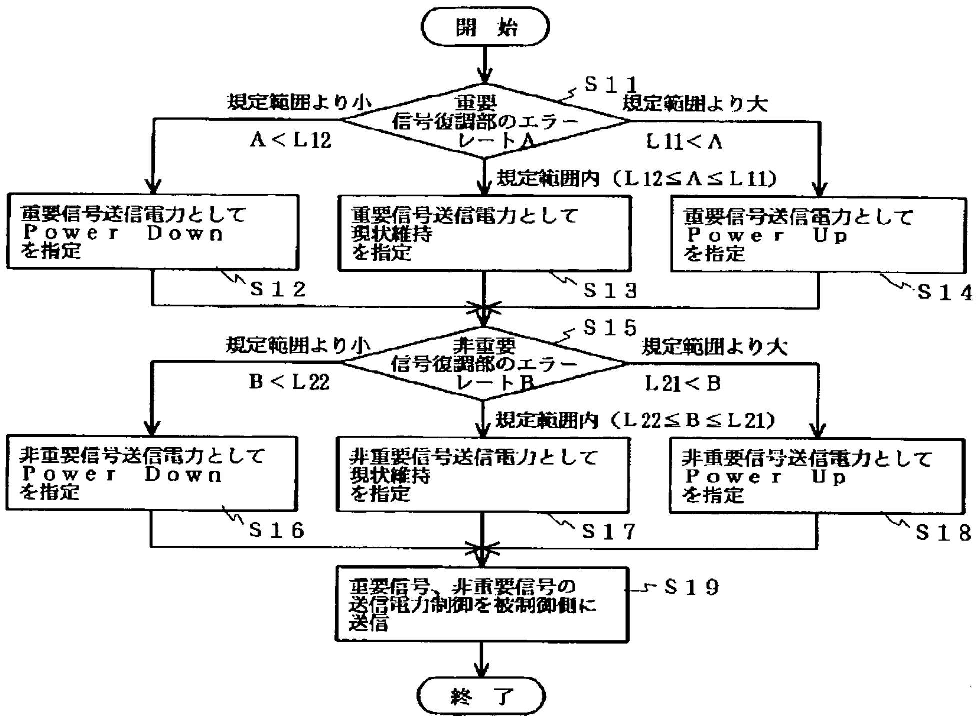
【図6】


MIC
コーデック部
変調部
拡散コード
電力設定
合成部
AMP
送受共用器
制御メモリ
電力設定制御部
制御信号
受信部
音声処理
受話器
11
12
13
14
15
16
17
18
19
20
21
22
25
26
27
28
29

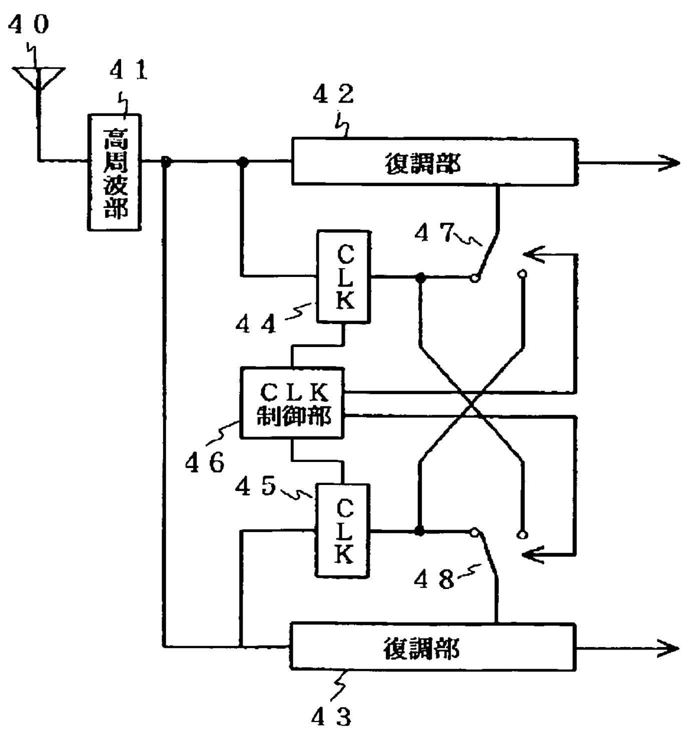
【図7】


高周波部
復調部
復調部
音声処理
音声信号
送受共用器
制御部
送信部
30
31
32
33
34
35
36
37

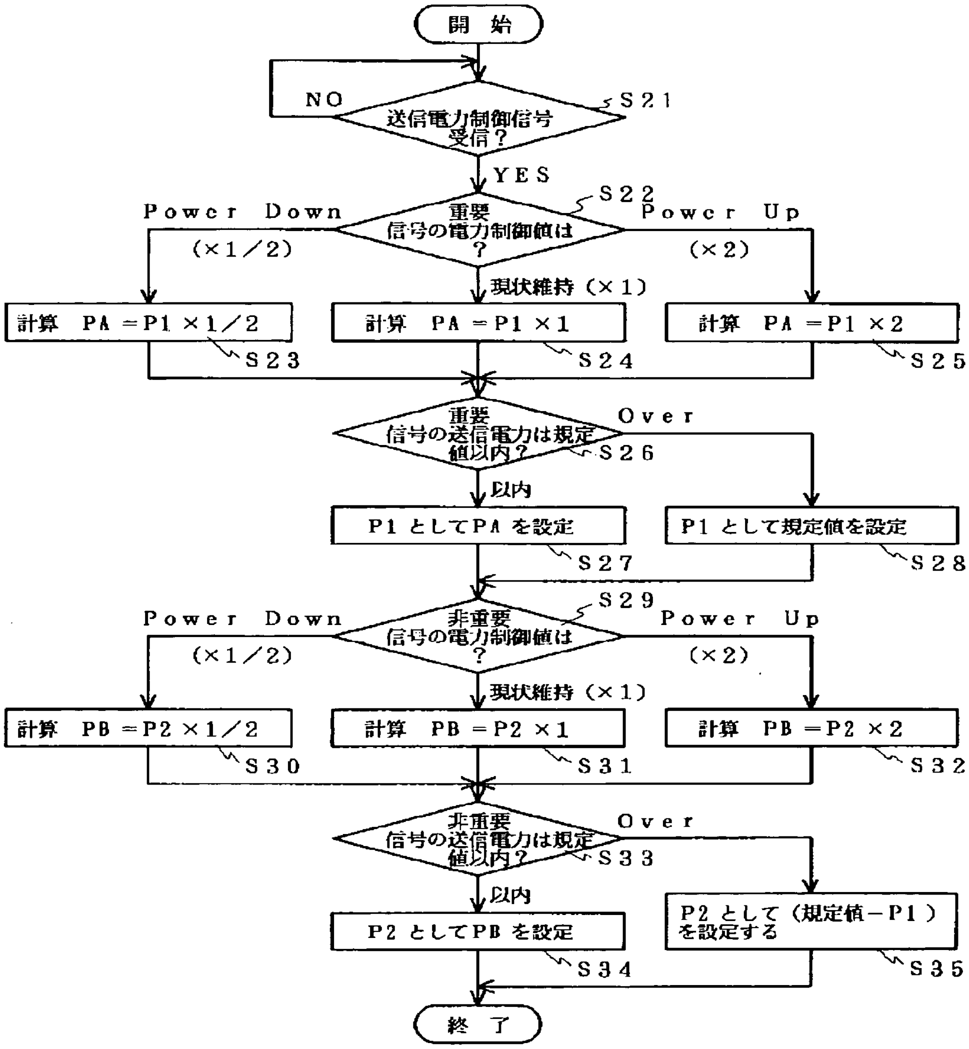
【図８】


開　始
重要信号復調部のエラーレートA
S11
規定範囲より小
A＜L12
規定範囲より大
L11＜A
規定範囲内（L12≦A≦L11）
重要信号送信電力として Power Down を指定
S12
重要信号送信電力として 現状維持 を指定
S13
重要信号送信電力として Power Up を指定
S14
非重要信号復調部のエラーレートB
S15
規定範囲より小
B＜L22
規定範囲より大
L21＜B
規定範囲内（L22≦B≦L21）
非重要信号送信電力として Power Down を指定
S16
非重要信号送信電力として 現状維持 を指定
S17
非重要信号送信電力として Power Up を指定
S18
重要信号、非重要信号の送信電力制御を被制御側に送信
S19
終　了

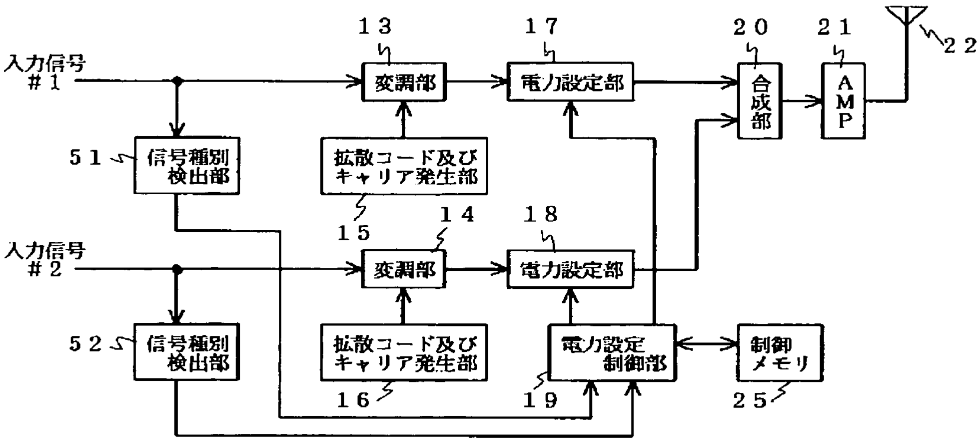
【図１０】


40
41
高周波部
42
復調部
47
CLK
44
CLK制御部
46
45
CLK
48
復調部
43

【図9】

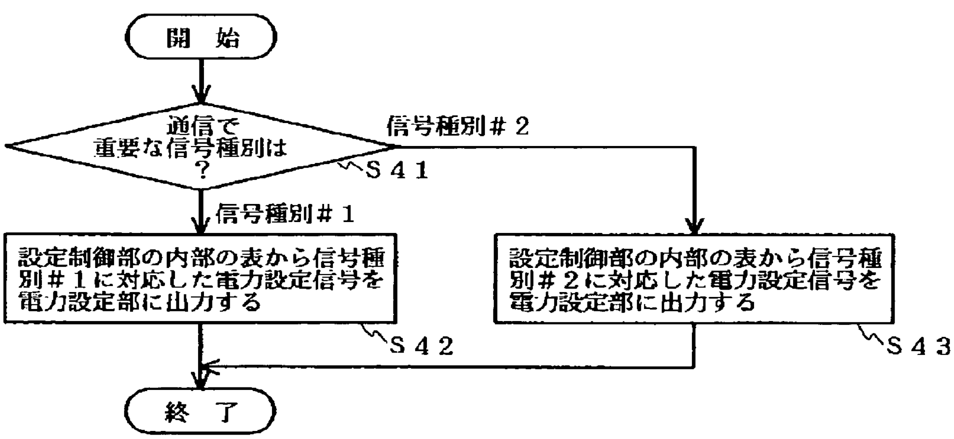

開 始
NO
送信電力制御信号受信？
S21
YES
重要信号の電力制御値は？
S22
Power Down
(×1/2)
Power Up
(×2)
現状維持（×1）
計算 PA＝P1×1/2
計算 PA＝P1×1
計算 PA＝P1×2
S23
S24
S25
重要信号の送信電力は規定値以内？
Over
S26
以内
P1としてPAを設定
P1として規定値を設定
S27
S28
非重要信号の電力制御値は？
S29
Power Down
(×1/2)
Power Up
(×2)
現状維持（×1）
計算 PB＝P2×1/2
計算 PB＝P2×1
計算 PB＝P2×2
S30
S31
S32
非重要信号の送信電力は規定値以内？
Over
S33
以内
P2としてPBを設定
P2として（規定値－P1）を設定する
S34
S35
終 了

【図１１】



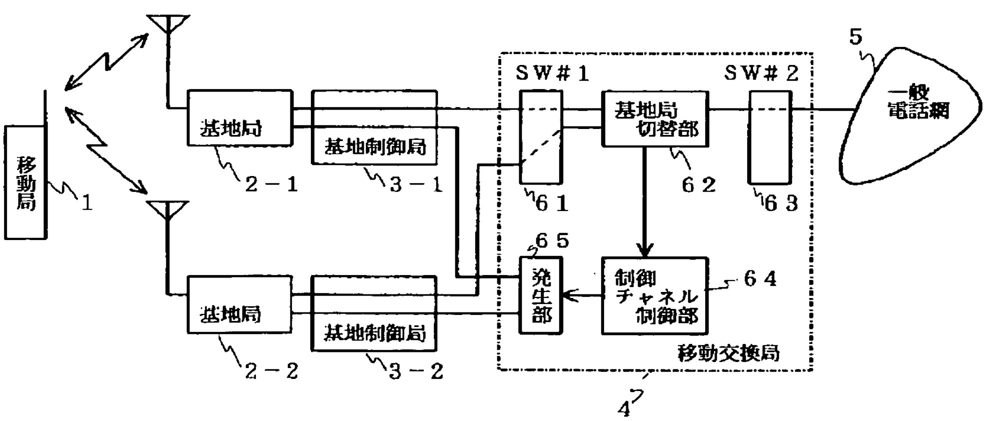
入力信号 #1
入力信号 #2
変調部
電力設定部
合成部
AMP
信号種別検出部
拡散コード及びキャリア発生部
電力設定制御部
制御メモリ
13
14
15
16
17
18
19
20
21
22
25
51
52

【図１２】



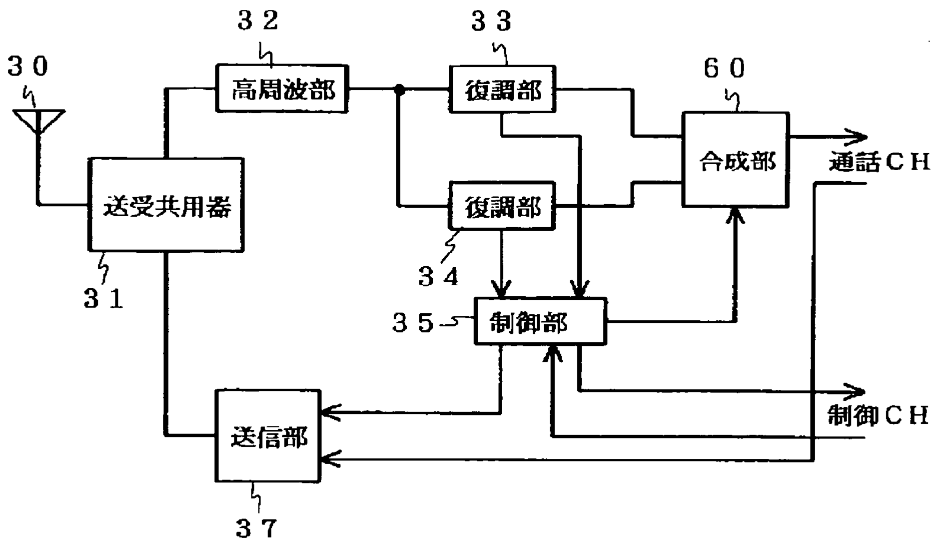
開　始
通信で重要な信号種別は？
S41
信号種別＃２
信号種別＃１
設定制御部の内部の表から信号種別＃１に対応した電力設定信号を電力設定部に出力する
S42
設定制御部の内部の表から信号種別＃２に対応した電力設定信号を電力設定部に出力する
S43
終　了

【図１３】

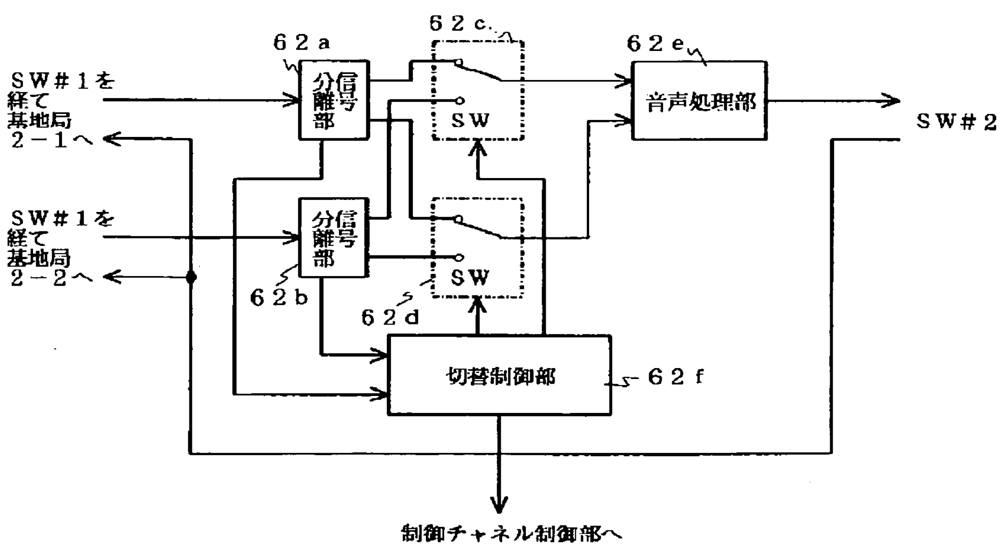


移動局
1
基地局
2－1
2－2
基地制御局
3－1
3－2
SW＃1
SW＃2
基地局切替部
61
62
63
64
65
発生部
制御チャネル制御部
移動交換局
4
5
一般電話網

【図１４】


３０
３２
高周波部
３３
復調部
６０
合成部
通話ＣＨ
送受共用器
復調部
３１
３４
３５
制御部
制御ＣＨ
送信部
３７

【図１５】


ＳＷ＃１を経て基地局２－１へ
６２ａ
分離信号部
６２ｃ
ＳＷ
６２ｅ
音声処理部
ＳＷ＃２
ＳＷ＃１を経て基地局２－２へ
分離信号部
６２ｂ
ＳＷ
６２ｄ
切替制御部
６２ｆ
制御チャネル制御部へ

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(54) **Radio transmission system and transmission method with unequal error protection**

(57) A radio transmission system transmits/receives information between a transmitter and receiver via a radio channel. The transmitter includes a plurality of power setting units and a transmission unit. The power setting units individually variably set the transmission powers of a plurality of pieces of information to be transmitted to the receiver to predetermined values. The transmission unit simultaneously transmits the plurality of pieces of information having the set transmission powers to the receiver. A radio transmission method is also disclosed.

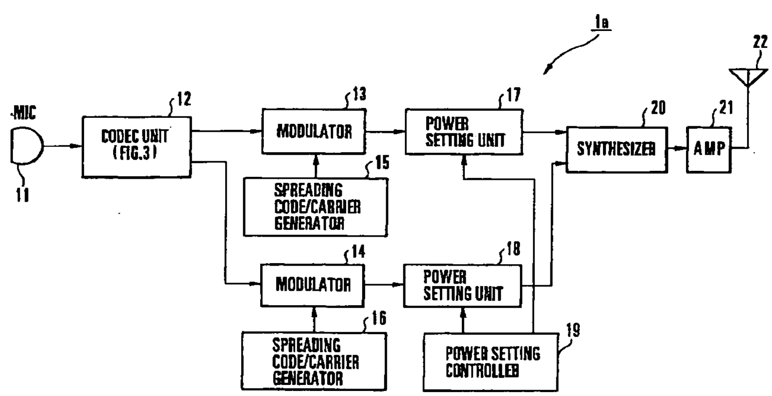


FIG.2

EP 0 959 581 A2

Description

Background of the Invention

[0001] The present invention relates to a radio transmission system and, more particularly, to a method for ensuring the error rate in a portable telephone system and the like.

[0002] A CODEC in a portable telephone has conventionally had a low bit rate, so the tone quality is degraded by an error and greatly influenced by one bit. However, not all bits equally influence the tone quality.

[0003] For this reason, bits are classified into important and unimportant bits, and the important bits are subjected to strong error correction. For example, the speech partner must recognize speech, and thus the upper and lower bits of a speech signal are respectively defined as important and unimportant bits. The important bits are subjected to error correction with many check bits, whereas the unimportant bits transmitted are directly used without adding any check bits.

[0004] In a PDC (Personal Digital Cellular), 59 bits of 134-bit information from the coder are directly transmitted as unimportant information. A 7-bit CRC (Cyclic Redundancy Check) is added to 44 bits of the remaining 75-bit information to obtain the most important 51-bit information. The 82 bits (= 75 bits + 7 bits) are transmitted as important information.

[0005] In this case, a convolutional code adds to this information 78 check bits and 5 tail bits, resulting in 165 bits (= 82 bits + 78 bits + 5 bits). The resultant information is made from 224 bits (= 59 bits + 165 bits) as a whole, and this 224-bit information is transmitted.

[0006] In the conventional portable telephone terminal equipment, the error correction ability is determined by the code and cannot be arbitrarily changed during communication. The optimum reliability changes for important information and unimportant information depending on the communication state, but the error correction ability cannot be set in accordance with the reliability.

Summary of the Invention

[0007] It is an object of the present invention to provide a radio transmission system and transmission method capable of setting a necessary error rate.

[0008] It is another object of the present invention to provide a radio transmission system and transmission method capable of minimizing interference with another channel and effectively using the frequency.

[0009] To achieve the above objects, according to the present invention, there is provided a radio transmission system for transmitting/receiving information between a transmitter and a receiver via a radio channel, the transmitter comprising a plurality of power setting means for individually variably setting transmission powers of a plurality of pieces of information to be transmitted to the receiver to predetermined values, and transmission means for simultaneously transmitting the plurality of pieces of information having the set transmission powers to the receiver.

Brief Description of the Drawings

[0010]

Fig. 1 is a block diagram showing a mobile communication system according to the first embodiment of the present invention;

Fig. 2 is a block diagram showing the transmitter of a mobile station shown in Fig. 1;

Fig. 3 is a block diagram showing a CODEC unit shown in Fig. 2;

Fig. 4 is a block diagram showing the transmitter of a mobile station according to the second embodiment of the present invention;

Fig. 5 is a flow chart showing power setting operation by a power setting controller in Fig. 4;

Fig. 6 is a block diagram showing the multiplexer of a mobile station according to the third embodiment of the present invention;

Fig. 7 is a block diagram showing the multiplexer of a base station according to the third embodiment of the present invention;

Fig. 8 is a flow chart showing control operation by a controller in Fig. 7;

Fig. 9 is a flow chart showing power setting operation by a power setting controller in Fig. 6;

Fig. 10 is a block diagram showing the receiver of a base station according to the fourth embodiment of the present invention;

Fig. 11 is a block diagram showing the transmitter of a mobile station according to the fifth embodiment of the present invention;

Fig. 12 is a flow chart showing power setting operation by a power setting controller in Fig. 11;

Fig. 13 is a block diagram showing the schematic arrangement of a mobile communication system according to the sixth embodiment of the present invention;

Fig. 14 is a block diagram showing a base station shown in Fig. 13; and

Fig. 15 is a block diagram showing a base station switching unit shown in Fig. 13.

Description of the Preferred Embodiments

[0011] The present invention will be described in detail below with reference to the accompanying drawings.

[0012] Fig. 1 shows the schematic arrangement of a mobile communication system according to the first embodiment of the present invention. In Fig. 1, the mobile communication system comprises a mobile station 1, a base station 2 for performing radio communication with the mobile station 1, a base control station 3 for controlling the base station 2, a mobile switching station

4 connected to the base control station 3, and a general telephone network 5 connected to the mobile switching station 4.

[0013] The mobile station 1 has a transmitter 1a and receiver 1b, and the base station 2 has a transmitter 2a and receiver 2b. The mobile station 1 is connected to the base station 2 via a radio channel, and the base station 2 is connected to the general telephone network 5 via the base control station 3 and mobile switching station 4.

[0014] Fig. 2 shows the transmitter 1a of the mobile station 1 shown in Fig. 1. Note that the transmitter 2a of the base station 2 has the same arrangement as shown in Fig. 2.

[0015] As shown in Fig. 2, the transmitter 1a comprises a microphone (MIC) 11, a CODEC unit 12 for coding an output from the MIC 11, modulators 13 and 14 for modulating an output from the CODEC unit 12, spreading code/carrier generators 15 and 16 for respectively outputting spreading codes and carriers to the modulators 13 and 14, power setting units 17 and 18 for respectively setting the powers of outputs from the modulators 13 and 14, a power setting controller 19 for controlling the power setting units 17 and 18, a synthesizer 20 for synthesizing outputs from the power setting units 17 and 18, an amplifier (AMP) 21 for amplifying an output from the synthesizer 20, and an antenna 22 connected to the AMP 21.

[0016] Fig. 3 shows the CODEC unit 12 shown in Fig. 2. As shown in Fig. 3, the CODEC unit 12 is constituted by an A/D (analog/digital) converter 12a, and a distributed processing unit 12b connected to the A/D converter 12a. The A/D converter 12a converts an input analog signal into a digital signal and outputs it to the distributed processing unit 12b. The distributed processing unit 12b separates the digital signal from the A/D converter 12a into important and unimportant signals and outputs them.

[0017] The distributed processing unit 12b separates the digital signal into important and unimportant signals in accordance with the CODEC method. For example, for a signal of one 8-bit block, the distributed processing unit 12b outputs upper 4 bits as an important signal and lower 4 bits as an unimportant signal. Alternatively, the distributed processing unit 12b outputs upper 2 bits as an important signal and lower 6 bits as an unimportant signal.

[0018] Operation of the mobile communication system having this arrangement will be explained.

[0019] In the mobile station 1, a speech signal from the MIC 11 is converted into a digital signal by the A/D converter 12a of the CODEC unit 12, and the digital signal is separated into and output as important and unimportant signals by the distributed processing unit 12b.

[0020] The important and unimportant signals from the CODEC unit 12 are subjected to spread spectrum modulation by the modulators 13 and 14 using spreading codes and carriers from the spreading code/carrier generators 15 and 16. The modulated important and unimportant signals are respectively input to the power setting units 17 and 18, which set powers corresponding to the importance for the modulated important and unimportant signals. Outputs from the power setting units 17 and 18 are synthesized by the synthesizer 20, amplified by the AMP 21, and transmitted from the antenna 22.

[0021] The important signal corresponds to upper bits of a power level, sound source signal, or air conduction filter constant obtained by analyzing the speech signal, whereas the unimportant signal corresponds to the lower bits.

[0022] In this case, the important signal is set by the power setting unit 17 to such level as to output 1 W from the antenna 22 under the control of the power setting controller 19. To the contrary, the unimportant signal is set by the power setting unit 18 to such level as to output 0.5 W from the antenna 22 under the control of the power setting controller 19. The two signals are synthesized by the synthesizer 20, and thus the antenna 22 outputs 1.5 W.

[0023] In the first embodiment, the powers of the important and unimportant signals are set to attain 1 : 0.5 as the output ratio of the antenna 22, and this ratio is determined by the characteristics of the CODEC unit 12. That is, the ratio is determined in accordance with the CODEC method of the CODEC unit 12. Since the characteristics of the CODEC unit 12 are known in advance, the determined ratio is used as a fixed value.

[0024] Fig. 4 shows a transmitter 1a of a mobile station 1 according to the second embodiment of the present invention. Note that a transmitter 2a of a base station 2 has the same arrangement as in Fig. 4.

[0025] As shown in Fig. 4, the transmitter 1a further comprises, in addition to the arrangement shown in Fig. 2, a plurality of CODEC units 12-1 and 12-2, a switch (SW) 23 for selectively switching an output from a MIC 11 between the CODEC units 12-1 and 12-2, a switch (SW) 24 for selectively switching a pair of important and unimportant signals from the CODEC units 12-1 and 12-2 between modulators 13 and 14, and a program memory 25.

[0026] Switching operation of the SWs 23 and 24 is controlled by a power setting controller 19. The same reference numerals as in Fig. 2 denote the same parts, and a description thereof will be omitted.

[0027] In Fig. 4, distribution of the transmission power from an antenna 22 is controlled to an optimum value for the system in accordance with the characteristics of the CODEC units 12-1 and 12-2. In this case, since a necessary power ratio between important information and unimportant information is not always constant, control information corresponding to the CODEC units 12-1 and 12-2 is stored in advance in a memory 19a of the power setting controller 19.

[0028] The power setting controller 19 sets optimum values in power setting units 17 and 18 every time the

CODEC units 12-1 and 12-2 are switched by the SWs 23 and 24. The SWs 23 and 24 are switched in switching, e.g., a PDC (Personal Digital Cellular) between full and half rates.

[0029] Control by the power setting controller 19 is realized by executing a program stored in the program memory 25. As the program memory 25, a ROM (Read-Only Memory), RAM (Random Access Memory), memory card, or the like is used.

[0030] Power setting control by the power setting controller 19 will be explained with reference to the flow chart in Fig. 5.

[0031] The power setting controller 19 checks the CODEC type necessary for communication on the basis of information designating the CODEC type that is added to an input control signal (step S1). If the power setting controller 19 determines CODEC#1 (CODEC unit 12-1) as the CODEC type necessary for communication, it outputs to the SWs 23 and 24 a control signal for selecting an input to the CODEC unit 12-1 and an output from the CODEC unit 12-1 (step S2).

[0032] The power setting controller 19 reads out a power setting signal corresponding to the CODEC unit 12-1 from the memory 19a in which the above-described control information is stored in advance, and outputs the readout signal to the power setting units 17 and 18 (step S3).

[0033] If the power setting controller 19 determines CODEC#2 (CODEC unit 12-2) as the CODEC type necessary for communication, it outputs to the SWs 23 and 24 a control signal for selecting an input to the CODEC unit 12-2 and an output from the CODEC unit 12-2 (step S4). The power setting controller 19 reads out a power setting signal corresponding to the CODEC unit 12-2 from the memory 19a and outputs the readout signal to the power setting units 17 and 18 (step S5).

[0034] In this manner, in selecting the CODEC type necessary for communication, the transmission power can be set in accordance with an error rate necessary for the selected CODEC type. In the second embodiment, a large number of check bits, which are required to obtain a necessary error rate in the prior art, can be eliminated, and a necessary error rate can be attained by only adding a minimum number of check bits.

[0035] Figs. 6 and 7 show mobile and base stations 1 and 2 according to the third embodiment of the present invention. In the following description, the mobile station 1 serves as a transmission side, and the base station 2 serves as a reception side.

[0036] The mobile station 1 shown in Fig. 6 further comprises, in addition to the arrangement shown in Fig. 2, a multiplexer 26 formed from a hybrid circuit for performing 2-to-4-wire conversion between an antenna 22, transmitter 1a, and receiver 1b, a receiver 27 for receiving a received signal from the antenna 22 via the multiplexer 26, a speech processing unit 28 for performing speech processing for a signal output from the receiver 27, and a receiver 29 for converting a speech signal output from the speech processing unit 28 into an audible signal.

[0037] As shown in Fig. 7, the base station 2 comprises an antenna 30, a multiplexer 31 formed from a hybrid circuit for performing 2-to-4-wire conversion between the antenna 30, transmitter 2a, and receiver 2b, an RF unit 32 for amplifying a received signal from the antenna 30 via the transmitter 31, demodulators 33 and 34 for demodulating a signal output from the RF unit 32, a controller 35, a speech processing unit 36 for outputting a speech signal in accordance with the demodulated signals from the demodulators 33 and 34, and a transmitter 37 for outputting a transmission signal to the antenna 30 via the multiplexer 31.

[0038] The demodulators 33 and 34 separate a signal into important information and unimportant information in correspondence with the mobile station 1, demodulate them, and output the reception levels or error rates of the important information and unimportant information to the controller 35. The controller 35 transmits from the transmitter 37 to the mobile station 1 a control signal instructing the mobile station 1 to change the transmission power setting values of the two pieces of information in accordance with the signals indicating the reception levels or error rates from the demodulators 33 and 34.

[0039] Note that a demodulation circuit is not illustrated in Fig. 6 and a modulation circuit is not illustrated in Fig. 7.

[0040] In the base station 2, the demodulators 33 and 34 respectively perform error detection/correction to detect reception levels and error rates, and output the detection results to the controller 35. If the controller 35 recognizes the error rate to be low from the detection results from the demodulators 33 and 34, it instructs the transmitter 37 to output an up signal [(UP(+)] to the mobile station 1. If the controller 35 recognizes the error rate to be high, it instructs the transmitter 37 to output a down signal [DOWN(-)] to the mobile station 1.

[0041] Then, the transmitter 37 transmits control information made of the up or down signal from the controller 35, to the mobile station 1 via the multiplexer 31 and antenna 30.

[0042] In the mobile station 1, the control information from the base station 2 is received by the receiver 27 via the antenna 22 and multiplexer 26, and output to a power setting controller 19. The power setting controller 19 controls the power setting units 17 and 18 on the basis of the control information from the base station 2 that is received by the receiver 27.

[0043] According to the third embodiment, setting of the transmission power of each information is adaptively controlled in the mobile station 1. In other words, the transmission power of each information in the mobile station 1 is set to an optimum value in accordance with a transmission power setting signal for each information from the base station 2.

[0044] In mobile communication, the propagation state of radio waves greatly changes, and the power ratio between important information and unimportant information is not desirable to be always constant. For this reason, in the third embodiment, a predetermined power ratio is set as an initial value in accordance with the type of processing in a CODEC unit 12, and the transmission power from the mobile station 1 is reset to an optimum value in accordance with a transmission power setting signal for each information from the base station 2.

[0045] This transmission power setting signal may be a signal indicating a transmission power value from the base station 2 or a signal indicating power-up/down, and can be freely set in accordance with the system. Alternatively, the mobile station 1 may determine the transmission power on the basis of the level of a signal received by the base station 2.

[0046] The third embodiment has exemplified the case in which the mobile station 1 performs transmission and the base station 2 performs reception. However, the same operation is also done even when the base station 2 performs transmission and the mobile station 1 performs reception. At this time, the mobile station 1 reports a reception level or error rate to the base station 2, and the base station 2 sets its transmission power based on the information from the mobile station 1.

[0047] Transmission power control of the mobile communication system having this arrangement will be described with reference to Figs. 8 and 9.

[0048] In the base station 2, reference symbol A denotes the error rate of an important signal; L11 and L12, the upper and lower limits of the prescribed range of the important signal; B, the error rate of an unimportant signal; and L21 and L22, the upper and lower limits of the prescribed range of the unimportant signal.

[0049] In the mobile station 1, reference symbol P1 denotes the transmission power value of a current important value; PA, a power value calculated based on a control signal from the base station 2; P2, the transmission power value of a current unimportant value; and PB, a power value calculated based on the control signal from the base station 2.

[0050] The controller 35 determines whether the transmission power is increased/decreased or maintained on the basis of error rates detected by the demodulators 33 and 34, and transmits the determination results to the mobile station 1 using the transmitter 37.

[0051] More specifically, in Fig. 8, the controller 35 checks whether the error rate A of an important signal from the demodulator 33 falls within a prescribed range ($L12 \leq A \leq L11$) (step S11). If the error rate A of the important signal is smaller than the prescribed range ($A < L12$), the controller 35 instructs power-down as an important signal transmission power (step S12).

[0052] If the error rate A of the important signal falls within the prescribed range ($L12 \leq A \leq L11$) in step S11, the controller 35 instructs maintenance as an important signal transmission power (step S13). If the error rate A of the important signal is larger than the prescribed range ($A > L11$), the controller 35 instructs power-up as an important signal transmission power (step S14).

[0053] After determining control for the transmission power of the important signal, the controller 35 checks whether the error rate B of an unimportant signal from the demodulator 34 falls within a prescribed range ($L22 \leq B \leq L21$) (step S15). If the error rate B of the unimportant signal is smaller than the prescribed range ($B < L22$), the controller 35 instructs power-down as an unimportant signal transmission power (step S16).

[0054] If the error rate B of the unimportant signal falls within the prescribed range ($L22 \leq B \leq L21$) in step S15, the controller 35 instructs maintenance as an unimportant signal transmission power (step S17). If the error rate B of the unimportant signal is larger than the prescribed range ($B > L21$), the controller 35 instructs power-up as an unimportant signal transmission power (step S18). Then, the controller 35 controls the transmitter 37 to transmit to the mobile station 1 control information instructing control of the transmission powers of the important and unimportant signals (step S19).

[0055] In the third embodiment, transmission power control is instructed to the mobile station 1 in three, power-up, power-down, and maintenance modes. Instead, transmission power control may be instructed using the absolute value of the transmission power (e.g., setting to x W or the like).

[0056] On the other hand, the mobile station 1 waits for control information from the base station 2 to start controlling transmission power setting. That is, in Fig. 9, when the power setting controller 19 of the mobile station 1 receives the control information from the base station 2 (step S21), it checks whether the power control value of the important signal included in the received control information indicates any one of power-up, power-down, and maintenance (step S22).

[0057] If the control information indicates power-down of the power control value of the important signal, the power setting controller 19 calculates $PA = P1 \times 1/2$ (step S23). If the control information indicates maintenance of the power control value of the important signal, the power setting controller 19 calculates $PA = P1 \times 1$ (step S24). If the control information indicates power-up of the power control value of the important signal, the power setting controller 19 calculates $PA = P1 \times 2$ (step S25).

[0058] The power setting controller 19 checks whether the calculation result PA is equal to or smaller than a prescribed value set in advance (step S26). If YES in step S26, the power setting controller 19 sets the current transmission power value P1 to the calculation result PA (step S27). If NO in step S26, the power setting controller 19 sets the current transmission power value P1 to the prescribed value (step S28).

[0059] Subsequently, the power setting controller 19 checks whether the power control value of the unimportant signal included in the control information indicates any one of power-up, power-down, and maintenance (step S29). If the control information indicates power-down of the power control value of the unimportant signal, the power setting controller 19 calculates PB = P2 × 1/2 (step S30). If the control information indicates maintenance of the power control value of the unimportant signal, the power setting controller 19 calculates PB = P2 × 1 (step S31). If the control information indicates power-up of the power control value of the unimportant signal, the power setting controller 19 calculates PB = P2 × 2 (step S32).

[0060] The power setting controller 19 checks whether the calculation result PB is equal to or smaller than a prescribed value set in advance (step S33). If YES in step S33, the power setting controller 19 sets the current transmission power value P2 to the calculation result PB (step S34). If NO in step S33, the power setting controller 19 sets the current transmission power value P2 to (the prescribed value - P1) (step S35).

[0061] Fig. 10 shows a receiver 2b of a base station 2 according to the fourth embodiment of the present invention. Note that a receiver 1b of a mobile station 1 has the same arrangement as in Fig. 10.

[0062] The receiver 2b shown in Fig. 10 comprises an antenna 40, an RF unit 41 for amplifying a received signal from the antenna 40, demodulators 42 and 43 for demodulating an output from the RF unit 41, clock (CLK) regenerators 44 and 45 for regenerating clocks (CLKs) from the output from the RF unit 41, a clock (CLK) controller 46 for controlling the CLK regenerators 44 and 45, and switches 47 and 48 for respectively switching CLKs from the CLK regenerators 44 and 45 between the demodulators 42 and 43.

[0063] A signal received by the antenna 40 is divided into a desired frequency by the RF unit 41, and output to the demodulators 42 and 43 and CLK regenerators 44 and 45. The CLK regenerators 44 and 45 detect synchronization from the signal received via the RF unit 41, regenerate predetermined CLK signals, and output them to the switches 47 and 48.

[0064] The clock (CLK) controller 46 outputs a switching signal to the switches 47 and 48 in accordance with synchronization detection signals from the CLK regenerators 44 and 45. Then, one of the two CLKs from the CLK regenerators 44 and 45 that establishes synchronization is commonly supplied to the demodulators 42 and 43. If the demodulator 42 fails synchronization, it demodulates the signal divided by the RF unit 41 in accordance with the CLK from the CLK regenerator 45 that is supplied via the switch 47.

[0065] In the mobile station 1, data of important information and data of unimportant information are transmitted in synchronism with each other. On the base station 2 side, if either one of the demodulators 42 and 43 establishes synchronization, the CLK also synchronized in the other demodulator is employed to use stable synchronization. If two signals from the RF unit 41 are synthesized to extract a CLK from the synthesis signal, the CLK can be more stably regenerated.

[0066] Fig. 11 shows a transmitter 1a of a mobile station 1 according to the fifth embodiment of the present invention.

[0067] As shown in Fig. 11, the transmitter 1a comprises modulators 13 and 14, spreading code/carrier generators 15 and 16, power setting units 17 and 18, a power setting controller 19, a synthesizer 20, an amplifier (AMP) 21, an antenna 22, a program memory 25, and signal type detectors 51 and 52.

[0068] In the transmitter 1a having this arrangement, input signals #1 and #2 are subjected to spread spectrum modulation by the modulators 13 and 14 using spreading codes and carriers from the spreading code/carrier generators 15 and 16. After that, the powers of the input signals #1 and #2 are set by the power setting units 17 and 18 in accordance with the control of the power setting controller 19. Outputs from the power setting units 17 and 18 are synthesized by the synthesizer 20, amplified by the AMP 21, and transmitted from the antenna 22.

[0069] The signal types (e.g., speech data or image data) of input signals #1 and #2 are respectively detected by the signal type detectors 51 and 52. The detection results of the signal type detectors 51 and 52 are sent to the power setting controller 19, which controls power setting in the power setting units 17 and 18 on the basis of the detection results of the signal type detectors 51 and 52.

[0070] Operation of the transmitter 1a shown in Fig. 11 will be explained with reference to the flow chart shown in Fig. 12.

[0071] When the power setting controller 19 receives the types of input signals #1 and #2 from the signal type detectors 51 and 52, it determines a signal type important in communication (step S41). If the signal type necessary for communication is the signal type #1, the power setting controller 19 reads out a power setting signal corresponding to the signal type #1 from a memory 19a, and outputs the readout signal to the power setting units 17 and 18 (step S42).

[0072] If the signal type necessary for communication is the signal type #2, the power setting controller 19 reads out a power setting signal corresponding to the signal type #2 from the memory 19a, and outputs the readout signal to the power setting units 17 and 18 (step S43).

[0073] Hence, in selecting the type signal of signal necessary for communication, the transmission power can be set in accordance with an error rate necessary for the selected signal type. In the fifth embodiment, a large check bit, which is required to obtain a necessary error rate in the prior art, can be eliminated, and a necessary error rate can be attained by only adding a minimum check bit.

[0074] Fig. 13 shows the schematic arrangement of a mobile communication system according to the sixth embodiment of the present invention. As shown in Fig. 13, the mobile communication system is constituted by a mobile station 1, base stations 2-1 and 2-2, base control stations 3-1 and 3-2, a mobile switching station 4, and a general telephone network 5. The mobile switching station 4 comprises switches (SW#1 and SW#2) 61 and 63, a base station switching unit 62, a control channel controller 64, and a control channel signal generator 65.

[0075] The mobile station 1 is connected to the base stations 2-1 and 2-2 via radio waves, and connected from the base stations 2-1 and 2-2 to the general telephone network 5 via the base control stations 3-1 and 3-2 and mobile switching station 4. The mobile station 1 may adopt any one of the transmitter arrangements described in the first to fifth embodiments of the present invention.

[0076] The mobile station 1 synthesizes important and unimportant signals or signal types #1 and #2, and transmits the synthesis signal as a radio signal to the base stations 2-1 and 2-2. Upon reception of the radio signal from the mobile station 1, the base stations 2-1 and 2-2 transmit the received signal to the mobile switching station 4 via the base control stations 3-1 and 3-2.

[0077] In the mobile switching station 4, the base station switching unit 62 selects a signal free from any error every frame (block) of signals input from the base stations 2-1 and 2-2 via the switch 61, converts the selected signal into a speech signal, and transmits the speech signal to the general telephone network 5 via the switch 63.

[0078] In this case, even if one of signals from the base stations 2-1 and 2-2 has an error, the other signal can be used so long as this signal is free from any error, and the error rate can therefore be increased. If the increased error rate can ensure a prescribed error rate, normal speech communication can be realized. At this time, the base station switching unit 62 outputs a signal representing the increased error rate to the control channel controller 64.

[0079] The control channel controller 64 controls the control channel signal generator 65 to send the signal representing the increased error rate that is output from the base station switching unit 62, as a control channel signal to the base stations 2-1 and 2-2 via the base control stations 3-1 and 3-2. As a result, the increased error rate is fed back to the base stations 2-1 and 2-2. The base stations 2-1 and 2-2 control transmission power setting for a plurality of signals (important and unimportant signals, signal types #1 and #2, and the like) from the mobile station 1 on the basis of the increased error rate notified from the mobile switching station 4.

[0080] Fig. 14 shows the base station 2-1 shown in Fig. 13. Note that the base station 2-2 has the same arrangement as in Fig. 14. As shown in Fig. 14, the base station 2-1 or 2-2 comprises an antenna 30, a multiplexer 31, an RF unit 32, demodulators 33 and 34, a controller 35, a transmitter 37, and a synthesizer 60.

[0081] The demodulators 33 and 34 respectively perform error detection/correction for important information and unimportant information transmitted from the mobile station 1, and detect error rates to output them to the controller 35. The controller 35 adds a signal representing an error state to a signal (a multiplexed signal of important and unimportant signals, signal types #1 and #2, or the like) multiplexed by the synthesizer 60 on the basis of the detection results from the demodulators 33 and 34. For example, the controller 35 adds a signal representing an erroneous or normal state every 20-ms frame.

[0082] The controller 35 adds a synthesized error rate in units of a plurality of signals received from the mobile switching station 4 via the control channel, and error rates from the demodulators 33 and 34, and controls the transmission power of the mobile station 1 in units of a plurality of signals.

[0083] Fig. 15 shows the base station switching unit 62 shown in Fig. 13. As shown in Fig. 15, the base station switching unit 62 comprises signal separators 62a and 62b, switches (SWs) 62c and 62d, a speech processing unit 62e, and a switch controller 62f.

[0084] The signal separator 62a and 62b separate a plurality of signals demodulated by the base stations 2-1 and 2-2 into important and unimportant signals or signal types #1 and #2. The signal separators 62a and 62b multiplex and separate signals so as to transmit them via one channel in order to effectively use the line. However, if the line has a large capacity, a plurality of signals or error state signals may be separately transmitted.

[0085] The switch controller 62f determines the presence/absence of an error from the error state signal, and controls the switches 62c and 62d so as to select a signal free from any error. In this case, the switch controller 62f individually controls a plurality of signals.

[0086] The switch controller 62f outputs an error state signal obtained after synthesizing signals to the control channel controller 64. The control channel controller 64 notifies a necessary one of the base stations 2-1 and 2-2 via the control channel in the wire section of the error state signal.

[0087] As described above, when the two base stations 2-1 and 2-2 are simultaneously used to perform soft handover (no-hit switching of speech communication between base stations), the mobile switching station 4 can detect an error to further reduce the transmission power from the mobile station 1.

[0088] Since the transmission power can be changed in association with the reliability of a signal to be transmitted under the control of the power setting controller 19, the transmission power can be set in accordance with a necessary error rate. A large check bit, which is required to obtain a necessary error rate in the prior art, can be eliminated, and a necessary error rate can be attained by only adding a minimum check bit.

[0089] Accordingly, the transmission power can be optimized. Since no extra transmission power is used, interference with another radio station can be prevented to effectively use the frequency. The error rate can also be set in accordance with the characteristics of the CODEC units 12-1 and 12-2 upon switching the CODEC units 12-1 and 12-2.

[0090] By setting the transmission power of a corresponding signal in accordance with a power setting signal or power-up/down instruction from the receiver side, the error rate can be optimized during communication, which always enables communication in the optimum state.

[0091] The above embodiments are applicable to, e.g., a mobile communication system using CDMA (Code Division Multiple Access) but also to an analog signal. These embodiments can be applied to an analog signal if the spreading code of CDMA is regarded as a frequency division channel.

[0092] In TDMA (Time Division Multiple Access), the embodiments can be applied using the burst unit, the time slot divided into sub-time slots, or two or more time slots.

[0093] As has been described above, according to the present invention, in the radio transmission system for transmitting/receiving information between the transmitter and receiver by radio waves, when a plurality of pieces of information are to be transmitted from the transmitter, they are transmitted with different transmission powers. This allows setting a necessary error rate and effectively using the frequency.

Claims

1. A radio transmission system characterized by transmitting/receiving information between a transmitter (1a, 2a) and a receiver (1b, 2b) via a radio channel,

   said transmitter comprising:
   a plurality of power setting means (17, 18) for individually variably setting transmission powers of a plurality of pieces of information to be transmitted to said receiver to predetermined values; and
   transmission means (21, 22) for simultaneously transmitting the plurality of pieces of information having the set transmission powers to said receiver.

2. A system according to claim 1, wherein said system further comprises synthesis means (20) for multiplexing and synthesizing the plurality of pieces of information having the set transmission powers, and

   said transmission means transmits a multiplexed signal output from said synthesis means to said receiver.

3. A system according to claim 1, wherein said transmitter further comprises separation means (12) for separating input information from one information source into a plurality of pieces of information, and

   said power setting means respectively set transmission powers of the plurality of pieces of information from said separation means in accordance with reliability of the information.

4. A system according to claim 3, wherein said separation means comprises a CODEC unit for separating input information into important and unimportant signals depending on a CODEC method.

5. A system according to claim 1, wherein said transmitter further comprises a plurality of detection means (51, 52) for detecting the type of information in correspondence with a plurality of pieces of input information, and

   said power setting means respectively set transmission powers of the pieces of input information on the basis of detection results of said detection means.

6. A system according to claim 1, wherein said power setting means respectively set transmission powers of a plurality of pieces of input information on the basis of reliabilities of the pieces of input information.

7. A system according to claim 1, wherein said receiver comprises information generation means (37) for generating control information on the basis of information received from said transmitter, and

   said power setting means set transmission powers of a plurality of pieces of information on the basis of a control signal from said receiver.

8. A system according to claim 7, wherein said receiver further comprises:

   separation means (32) for separating information received from said transmitter into a plurality of pieces of information in accordance with the type of signal; and
   a plurality of detection means (51, 52) for detecting reception levels and error rates of the plurality of pieces of information output from said separation means and outputting the reception levels and error rates to said transmission means,
   said information generation means generates a control signal on the basis of one of the reception levels and error rates from said detection

means, and

said power setting means respectively set transmission powers of a plurality of pieces of information on the basis of at least one of the reception levels and error rates when said transmitter receives the control signal from said receiver.

9. A system according to claim 7, wherein said power setting means set transmission powers of a plurality of pieces of information on the basis of at least one of a control signal indicating a power setting value from said receiver and a control value instructing increasing/decreasing the transmission power.

10. A system according to claim 1, wherein a plurality of pieces of information transmitted from said transmitter to said receiver are synchronized with each other, and

said receiver comprises:
a plurality of signal synchronization means (44, 45) for respectively synchronizing signals of the plurality of pieces of information transmitted from said transmitter; and
a plurality of demodulation means (42, 43) for respectively demodulating the plurality of pieces of information in accordance with a common synchronized signal when either one of said signal synchronization means establishes synchronization.

11. A radio transmission method of transmitting/receiving information between a transmitter (1a, 2a) and a receiver (1b, 2b) via a radio channel, characterized by comprising the steps of:

individually variably setting transmission powers of a plurality of pieces of information to be transmitted to predetermined values; and
simultaneously transmitting the pieces of information having the set transmission powers to said receiver.

12. A method according to claim 11, wherein the variable setting step comprises the steps of:

dividing information from one information source into a plurality of pieces of information; and
setting transmission powers of the plurality of pieces of divided information in accordance with reliability of the information.

13. A method according to claim 12, wherein the division step comprises the step of separating information into important and unimportant signals depending on a CODEC method.

14. A method according to claim 11, wherein the method further comprises the step of detecting the types of pieces of information, and

the variable setting step comprises the step of setting transmission powers of the pieces of information on the basis of the detected types of pieces of information.

15. A method according to claim 11, wherein the variable setting step further comprises the step of setting transmission powers of a plurality of pieces of information in accordance with reliability of the information.

16. A method according to claim 11, wherein the method further comprises the step of generating control information in said receiver on the basis of information received from said transmitter, and

the variable setting step comprises the step of setting transmission powers of a plurality of pieces of information in accordance with a control signal from said receiver.

17. A method according to claim 16, further comprising the steps of:

detecting a reception level and error rate of information in said receiver and outputting the reception level and error rate to said transmitter; and
setting transmission powers of a plurality of pieces of information in said transmitter on the basis of at least one of the transmitted reception level and error rate.

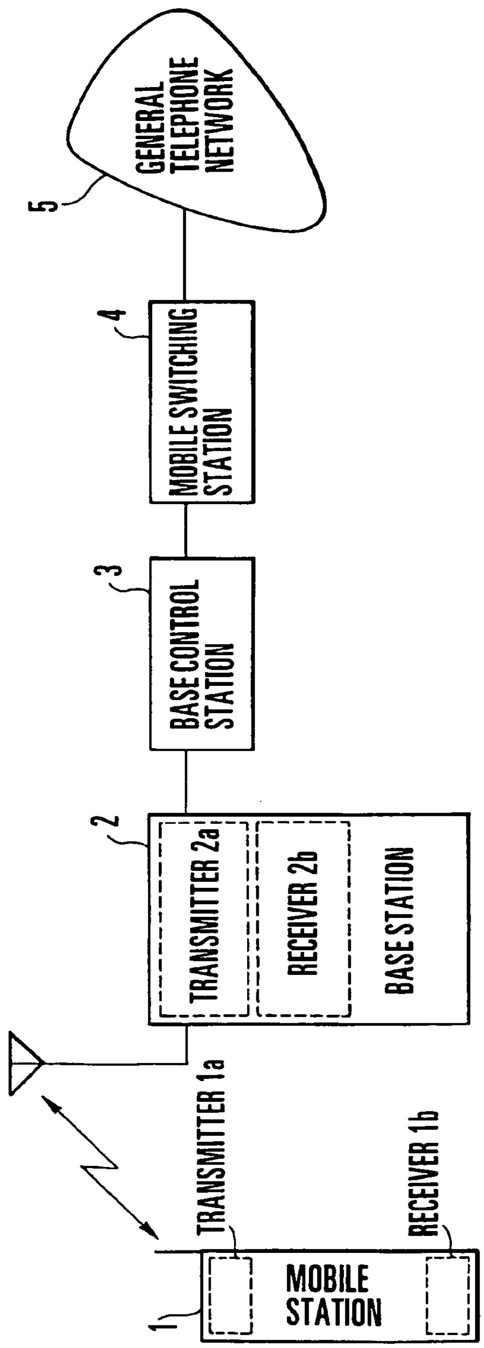
18. A method according to claim 16, wherein the variable setting step comprises the step of setting transmission powers of a plurality of pieces of information in accordance with at least one of a control signal indicating a power setting value from said receiver and a control value instructing increasing/decreasing the transmission power.

19. A method according to claim 11, further comprising the steps of:

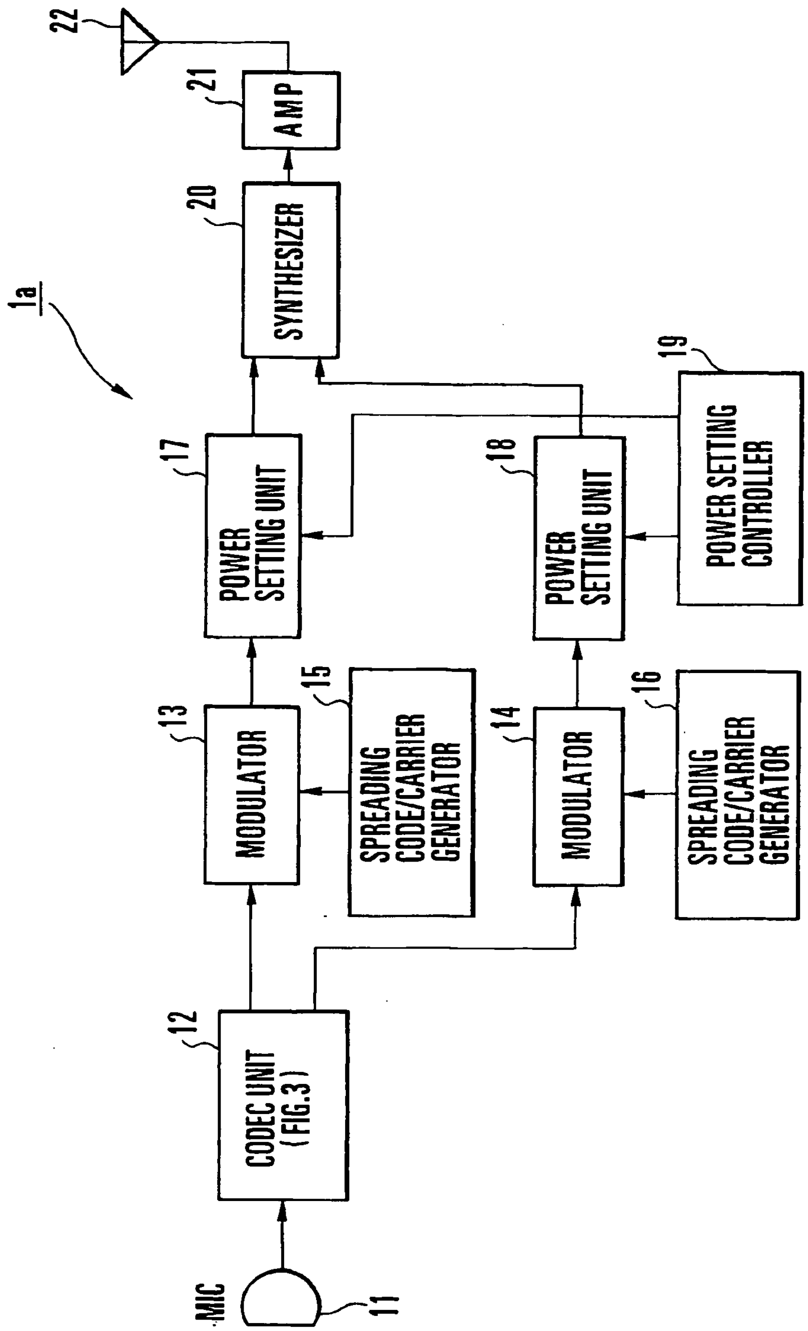
transmitting a plurality of pieces of information synchronized with each other to said receiver in said transmitter;
individually synchronizing the plurality of pieces of information transmitted from said transmitter in said receiver; and
demodulating the plurality of pieces of information on the basis of synchronized signals of the pieces of synchronized information.

20. A recording medium for recording a radio transmission control program for transmitting/receiving information between a transmitter (1a, 2a) and a receiver (1b, 2b) via a radio channel, characterized by comprising:

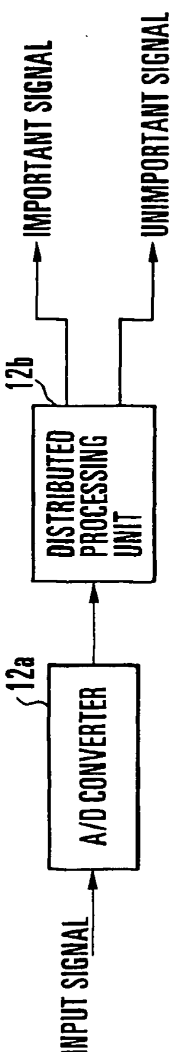
a procedure of individually variably setting transmission powers of a plurality of pieces of information to be transmitted to predetermined values; and
a procedure of simultaneously transmitting the pieces of information having the set transmission powers to said receiver.


GENERAL TELEPHONE NETWORK
5
MOBILE SWITCHING STATION
4
BASE CONTROL STATION
3
TRANSMITTER 2a
RECEIVER 2b
BASE STATION
2
TRANSMITTER 1a
RECEIVER 1b
MOBILE STATION
1

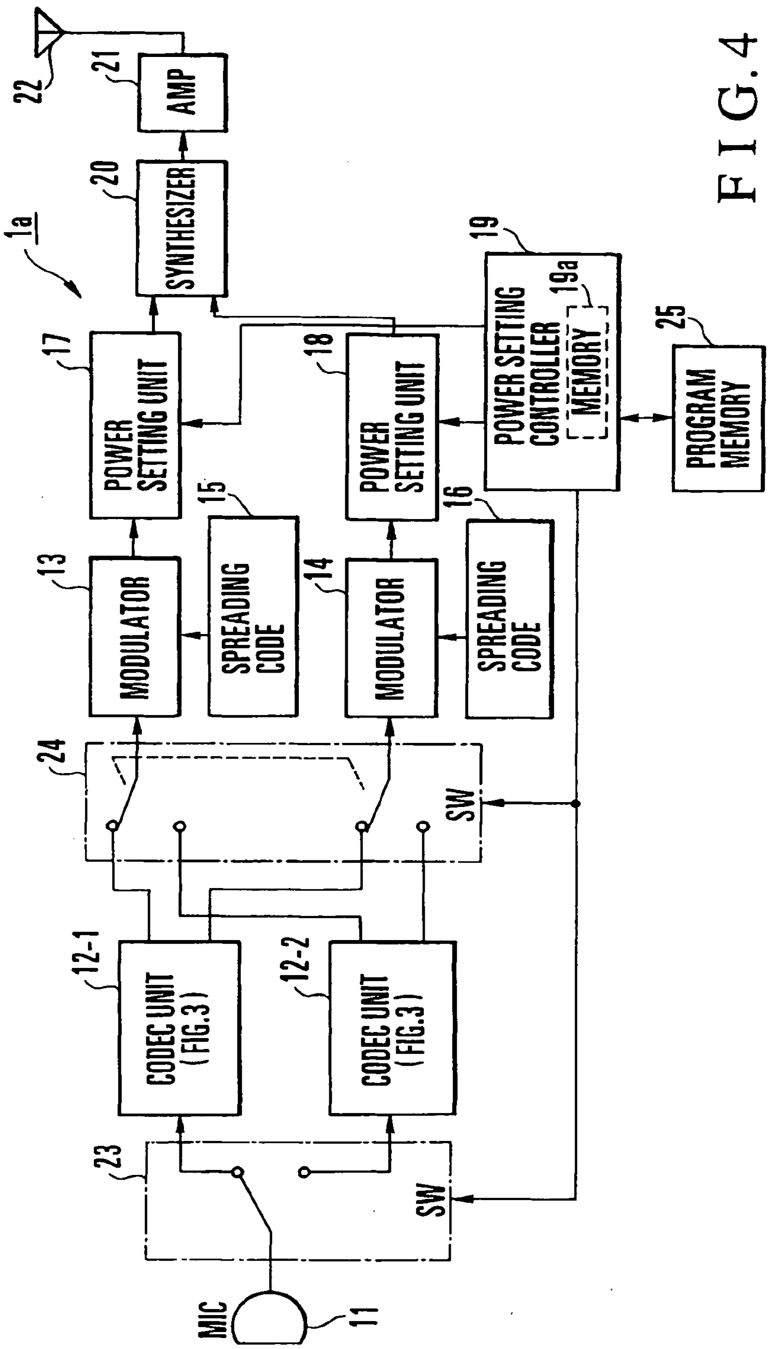
F I G. 1


1a
MIC
11
CODEC UNIT (FIG.3)
12
MODULATOR
13
MODULATOR
14
SPREADING CODE/CARRIER GENERATOR
15
SPREADING CODE/CARRIER GENERATOR
16
POWER SETTING UNIT
17
POWER SETTING UNIT
18
POWER SETTING CONTROLLER
19
SYNTHESIZER
20
AMP
21
22

F I G. 2


INPUT SIGNAL
A/D CONVERTER
12a
DISTRIBUTED PROCESSING UNIT
12b
IMPORTANT SIGNAL
UNIMPORTANT SIGNAL

F I G. 3


MIC
11
SW
23
CODEC UNIT (FIG.3)
12-1
CODEC UNIT (FIG.3)
12-2
SW
24
MODULATOR
13
MODULATOR
14
SPREADING CODE
15
SPREADING CODE
16
POWER SETTING UNIT
17
POWER SETTING UNIT
18
SYNTHESIZER
20
AMP
21
22
1a
POWER SETTING CONTROLLER
19
MEMORY
19a
PROGRAM MEMORY
25

F I G. 4

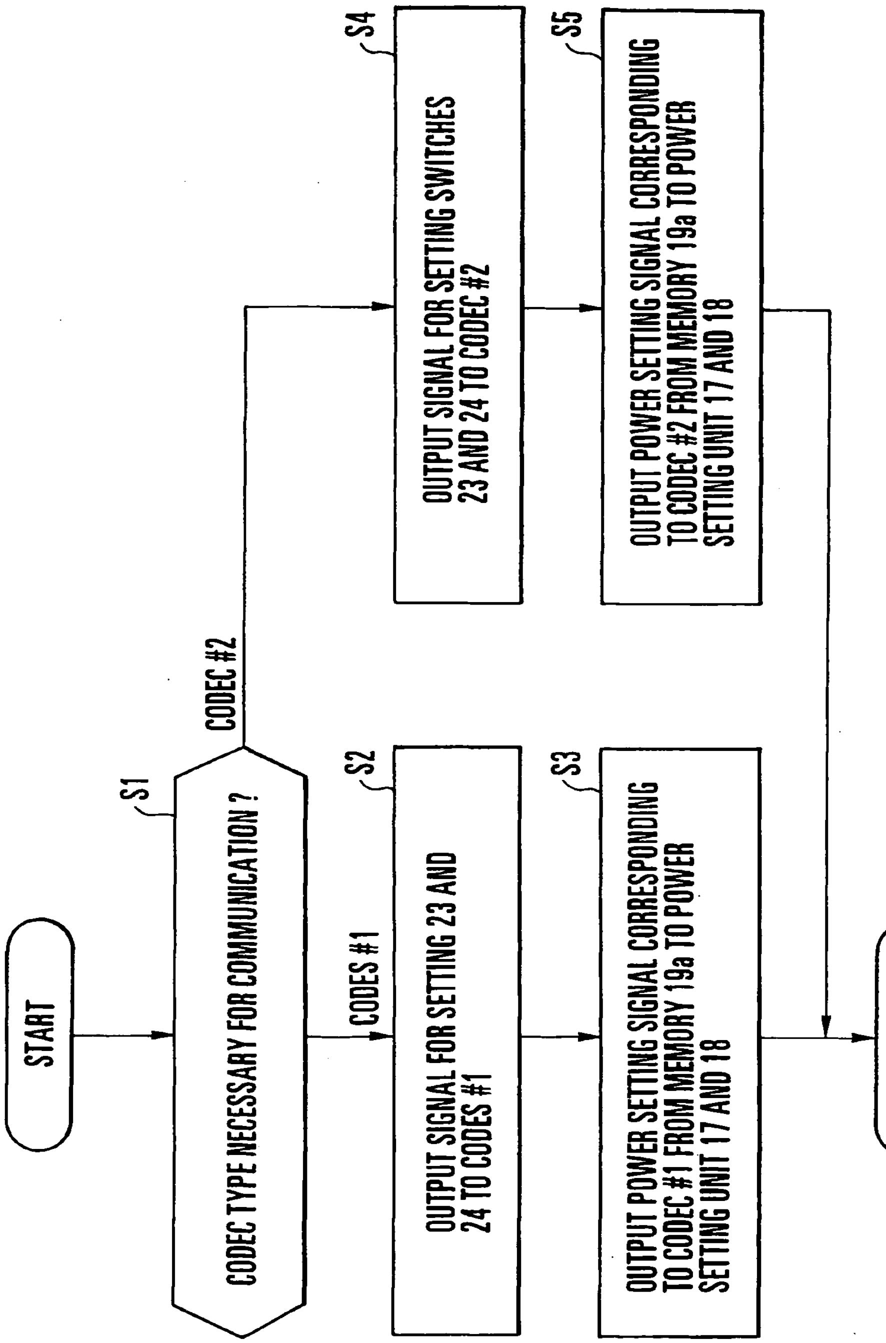
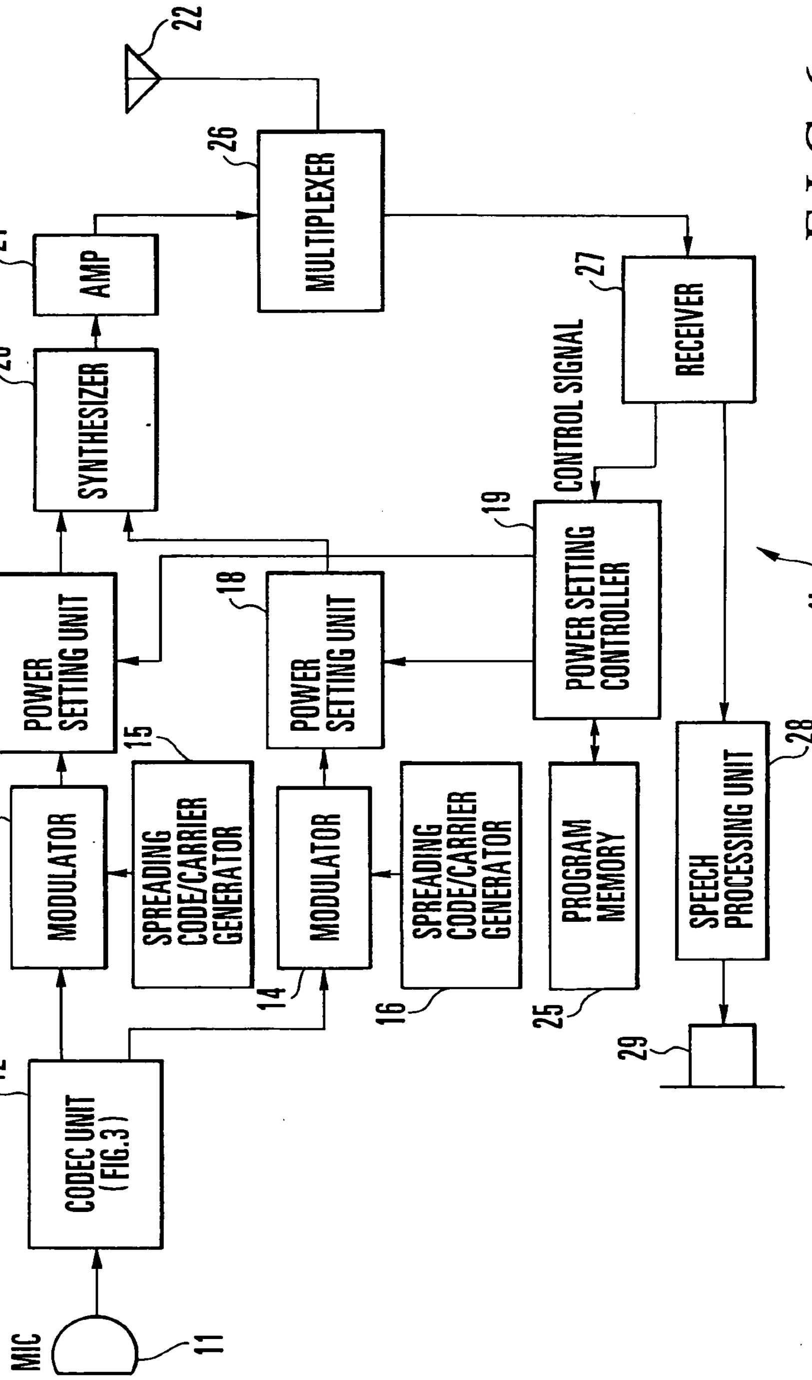
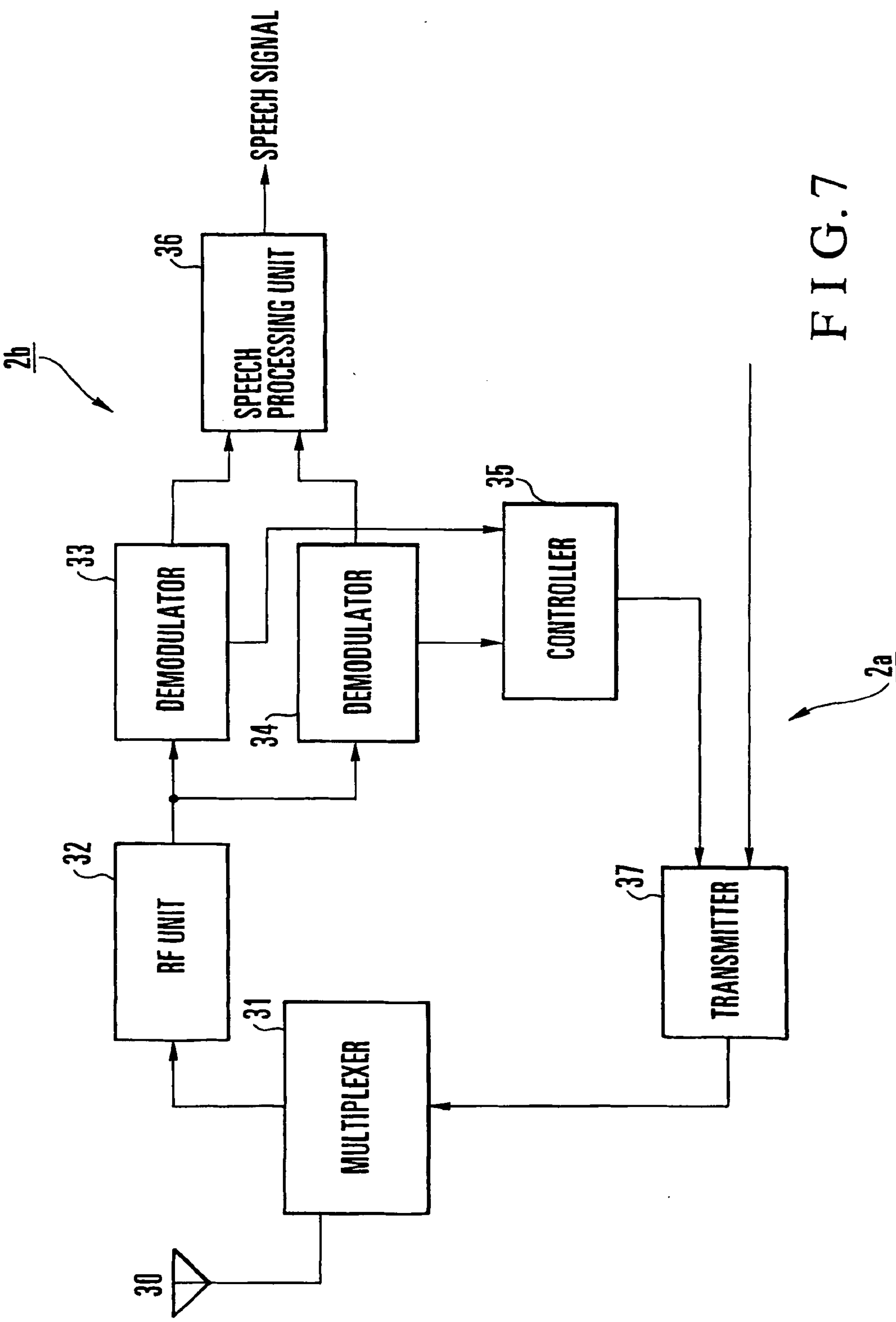

START
S1
CODEC TYPE NECESSARY FOR COMMUNICATION ?
CODES #1
CODEC #2
S2
OUTPUT SIGNAL FOR SETTING 23 AND 24 TO CODES #1
S3
OUTPUT POWER SETTING SIGNAL CORRESPONDING TO CODEC #1 FROM MEMORY 19a TO POWER SETTING UNIT 17 AND 18
S4
OUTPUT SIGNAL FOR SETTING SWITCHES 23 AND 24 TO CODEC #2
S5
OUTPUT POWER SETTING SIGNAL CORRESPONDING TO CODEC #2 FROM MEMORY 19a TO POWER SETTING UNIT 17 AND 18
END

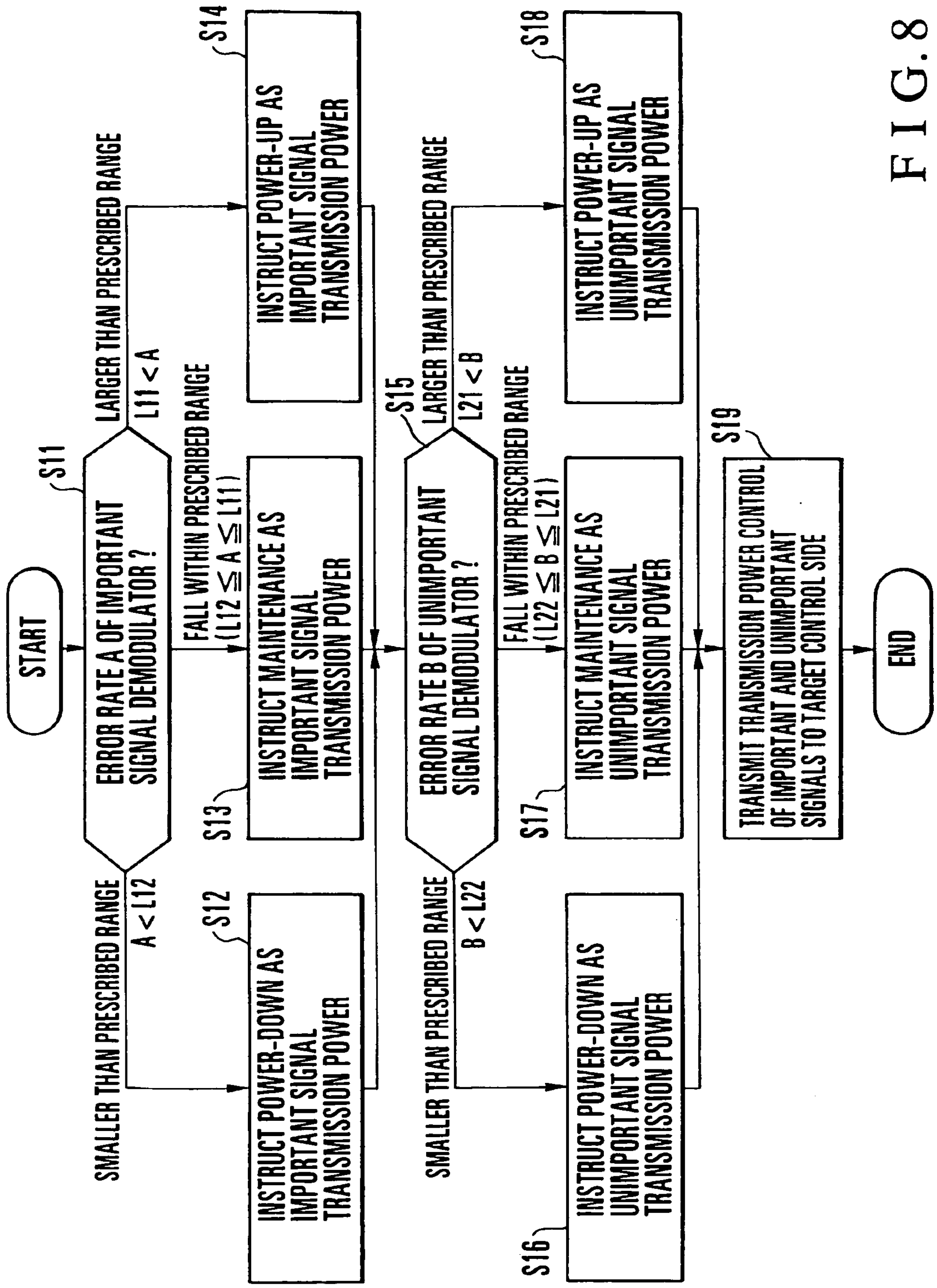
FIG.5


MIC
11
CODEC UNIT (FIG.3)
12
MODULATOR
13
MODULATOR
14
SPREADING CODE/CARRIER GENERATOR
15
SPREADING CODE/CARRIER GENERATOR
16
POWER SETTING UNIT
17
POWER SETTING UNIT
18
POWER SETTING CONTROLLER
19
SYNTHESIZER
20
AMP
21
22
PROGRAM MEMORY
25
MULTIPLEXER
26
RECEIVER
27
CONTROL SIGNAL
SPEECH PROCESSING UNIT
28
29
1a
1b

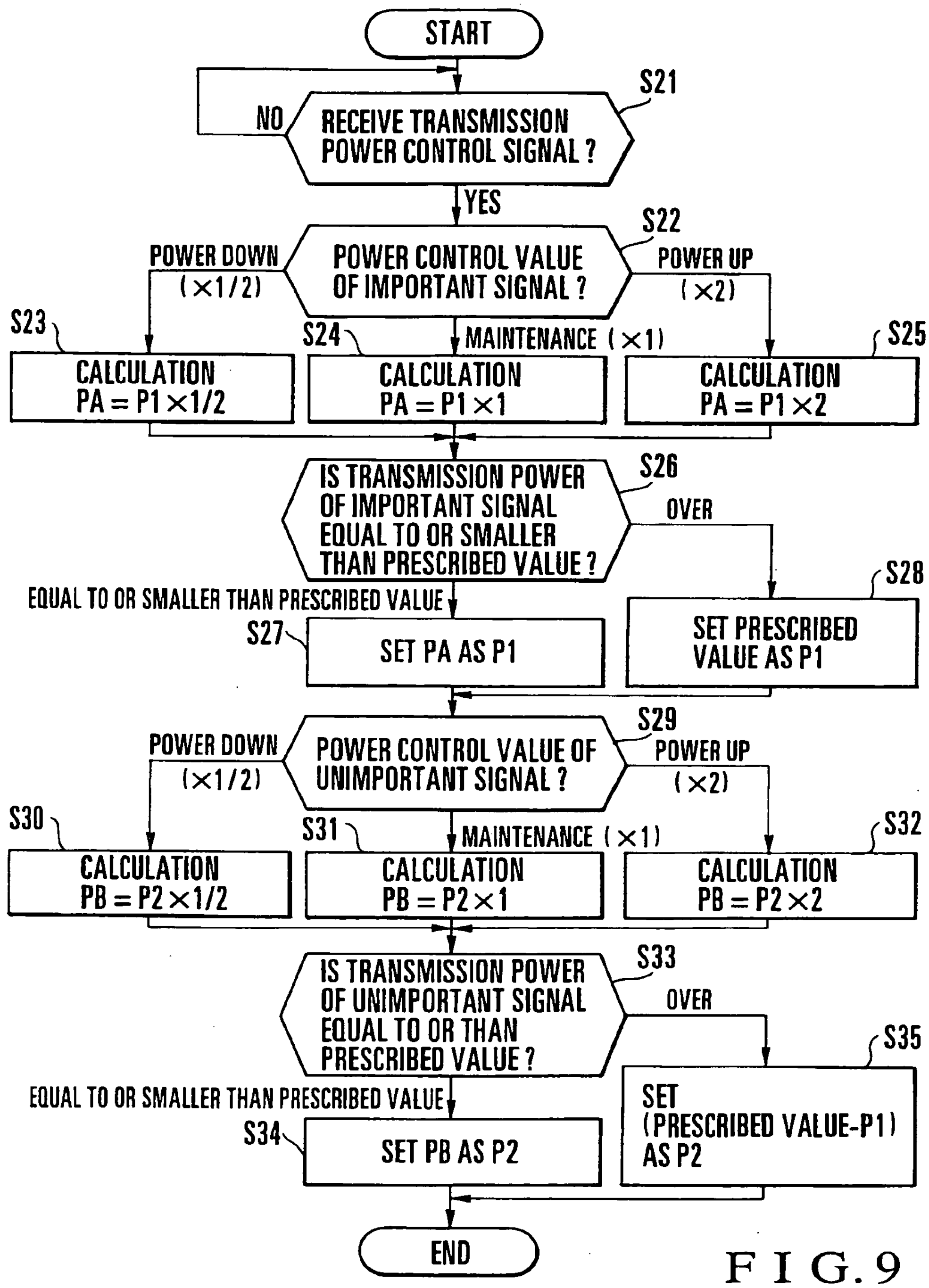
F I G. 6


2b
SPEECH SIGNAL
36
SPEECH PROCESSING UNIT
33
DEMODULATOR
34
DEMODULATOR
35
CONTROLLER
32
RF UNIT
31
MULTIPLEXER
30
37
TRANSMITTER
2a

F I G. 7


START
S11
ERROR RATE A OF IMPORTANT SIGNAL DEMODULATOR ?
SMALLER THAN PRESCRIBED RANGE
A < L12
FALL WITHIN PRESCRIBED RANGE
(L12 ≦ A ≦ L11)
LARGER THAN PRESCRIBED RANGE
L11 < A
S12
INSTRUCT POWER-DOWN AS IMPORTANT SIGNAL TRANSMISSION POWER
S13
INSTRUCT MAINTENANCE AS IMPORTANT SIGNAL TRANSMISSION POWER
S14
INSTRUCT POWER-UP AS IMPORTANT SIGNAL TRANSMISSION POWER
S15
ERROR RATE B OF UNIMPORTANT SIGNAL DEMODULATOR ?
SMALLER THAN PRESCRIBED RANGE
B < L22
FALL WITHIN PRESCRIBED RANGE
(L22 ≦ B ≦ L21)
LARGER THAN PRESCRIBED RANGE
L21 < B
S16
INSTRUCT POWER-DOWN AS UNIMPORTANT SIGNAL TRANSMISSION POWER
S17
INSTRUCT MAINTENANCE AS UNIMPORTANT SIGNAL TRANSMISSION POWER
S18
INSTRUCT POWER-UP AS UNIMPORTANT SIGNAL TRANSMISSION POWER
S19
TRANSMIT TRANSMISSION POWER CONTROL OF IMPORTANT AND UNIMPORTANT SIGNALS TO TARGET CONTROL SIDE
END

F I G. 8


START
S21
NO
RECEIVE TRANSMISSION POWER CONTROL SIGNAL ?
YES
S22
POWER DOWN (×1/2)
POWER CONTROL VALUE OF IMPORTANT SIGNAL ?
POWER UP (×2)
S23
S24
MAINTENANCE (×1)
S25
CALCULATION PA = P1×1/2
CALCULATION PA = P1×1
CALCULATION PA = P1×2
S26
IS TRANSMISSION POWER OF IMPORTANT SIGNAL EQUAL TO OR SMALLER THAN PRESCRIBED VALUE ?
OVER
S28
EQUAL TO OR SMALLER THAN PRESCRIBED VALUE
S27
SET PA AS P1
SET PRESCRIBED VALUE AS P1
S29
POWER DOWN (×1/2)
POWER CONTROL VALUE OF UNIMPORTANT SIGNAL ?
POWER UP (×2)
S30
S31
MAINTENANCE (×1)
S32
CALCULATION PB = P2×1/2
CALCULATION PB = P2×1
CALCULATION PB = P2×2
S33
IS TRANSMISSION POWER OF UNIMPORTANT SIGNAL EQUAL TO OR THAN PRESCRIBED VALUE ?
OVER
S35
EQUAL TO OR SMALLER THAN PRESCRIBED VALUE
S34
SET PB AS P2
SET (PRESCRIBED VALUE-P1) AS P2
END

F I G. 9

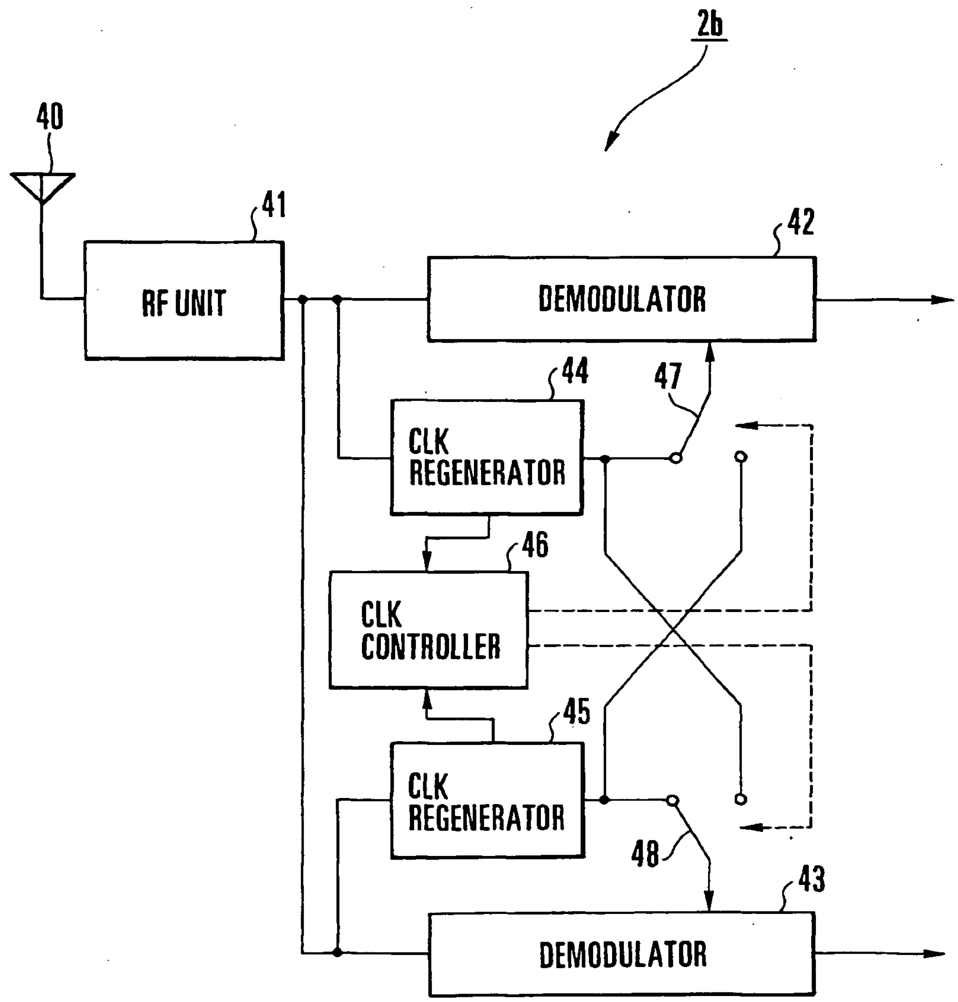
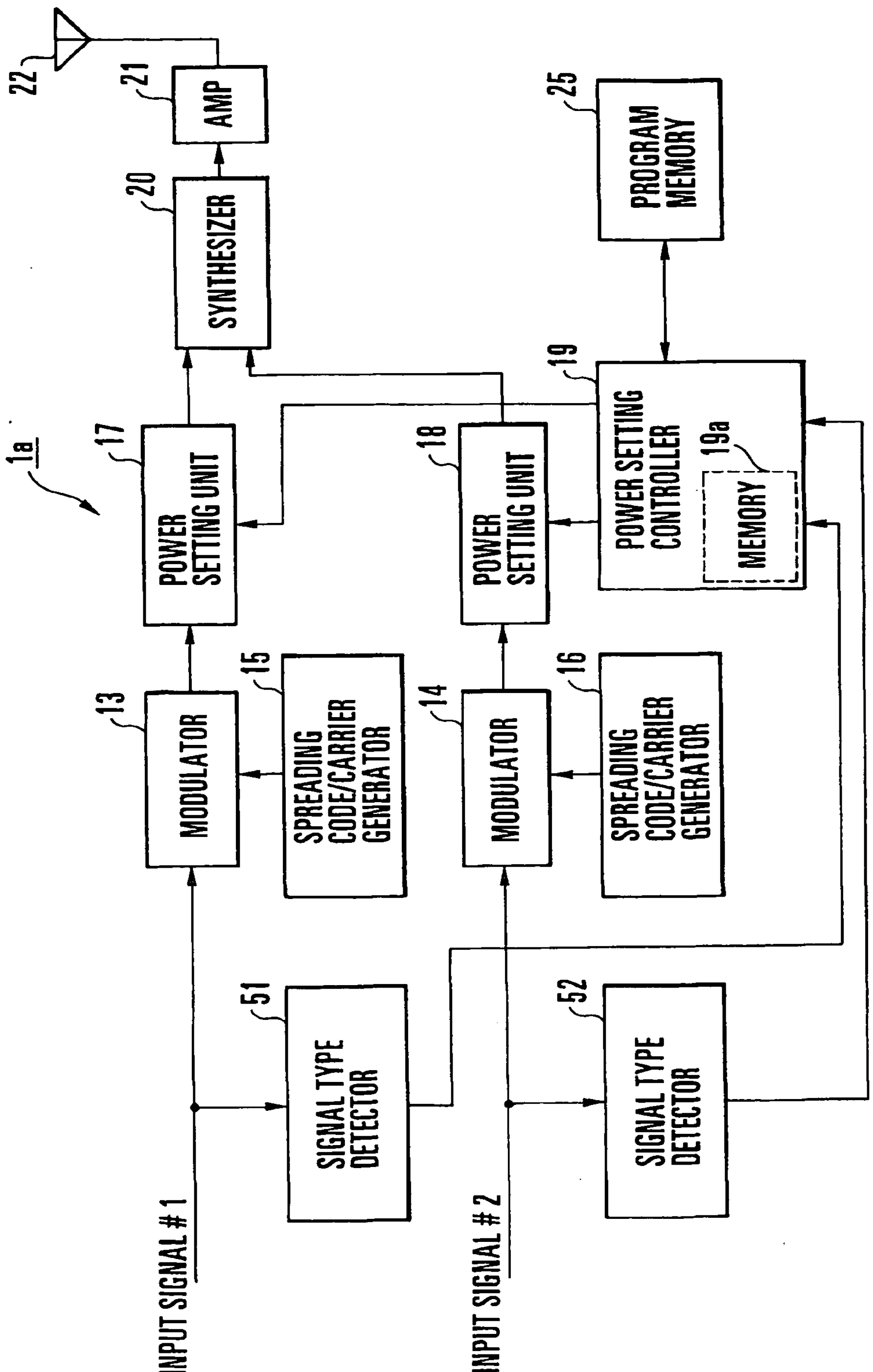
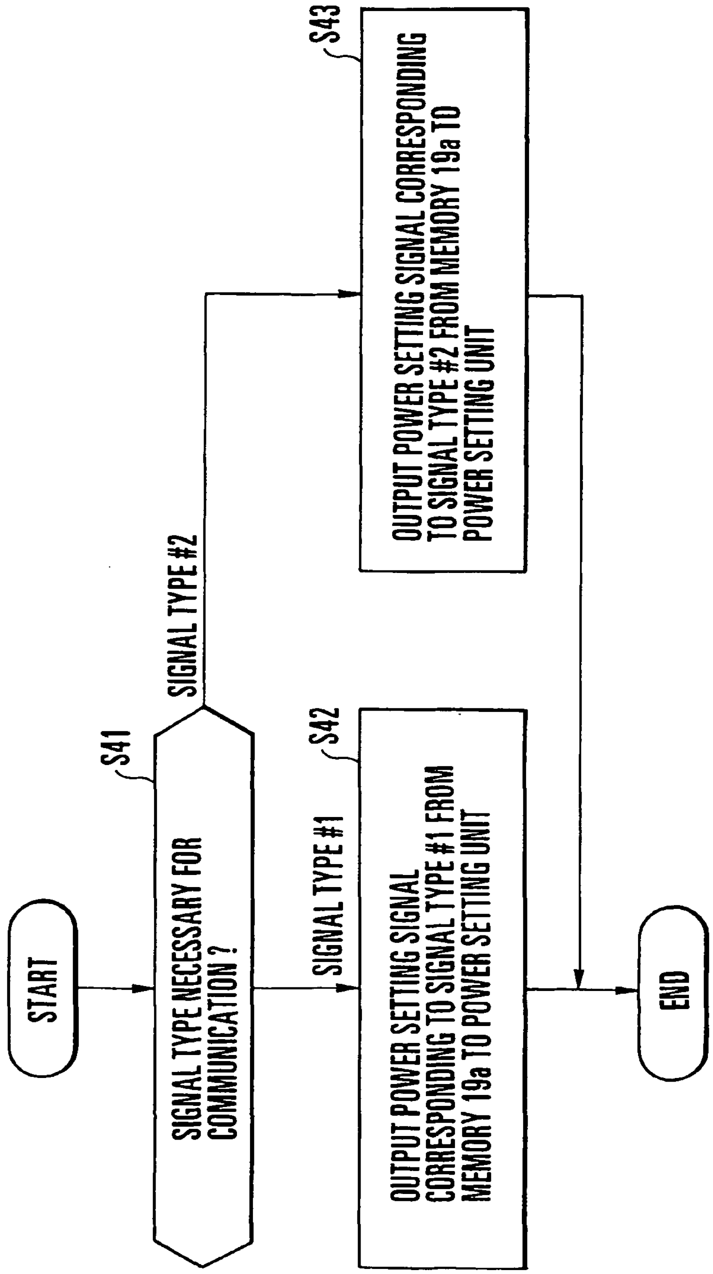

2b
40
41
RF UNIT
42
DEMODULATOR
44
47
CLK
REGENERATOR
46
CLK
CONTROLLER
45
CLK
REGENERATOR
48
43
DEMODULATOR

FIG. 10


1a
22
21
AMP
20
SYNTHESIZER
25
PROGRAM MEMORY
17
POWER SETTING UNIT
18
POWER SETTING UNIT
19
POWER SETTING CONTROLLER
19a
MEMORY
13
MODULATOR
15
SPREADING CODE/CARRIER GENERATOR
14
MODULATOR
16
SPREADING CODE/CARRIER GENERATOR
51
SIGNAL TYPE DETECTOR
52
SIGNAL TYPE DETECTOR
INPUT SIGNAL # 1
INPUT SIGNAL # 2

F I G. 11


START
S41
SIGNAL TYPE NECESSARY FOR COMMUNICATION ?
SIGNAL TYPE #1
SIGNAL TYPE #2
S42
OUTPUT POWER SETTING SIGNAL CORRESPONDING TO SIGNAL TYPE #1 FROM MEMORY 19a TO POWER SETTING UNIT
S43
OUTPUT POWER SETTING SIGNAL CORRESPONDING TO SIGNAL TYPE #2 FROM MEMORY 19a TO POWER SETTING UNIT
END

F I G. 12

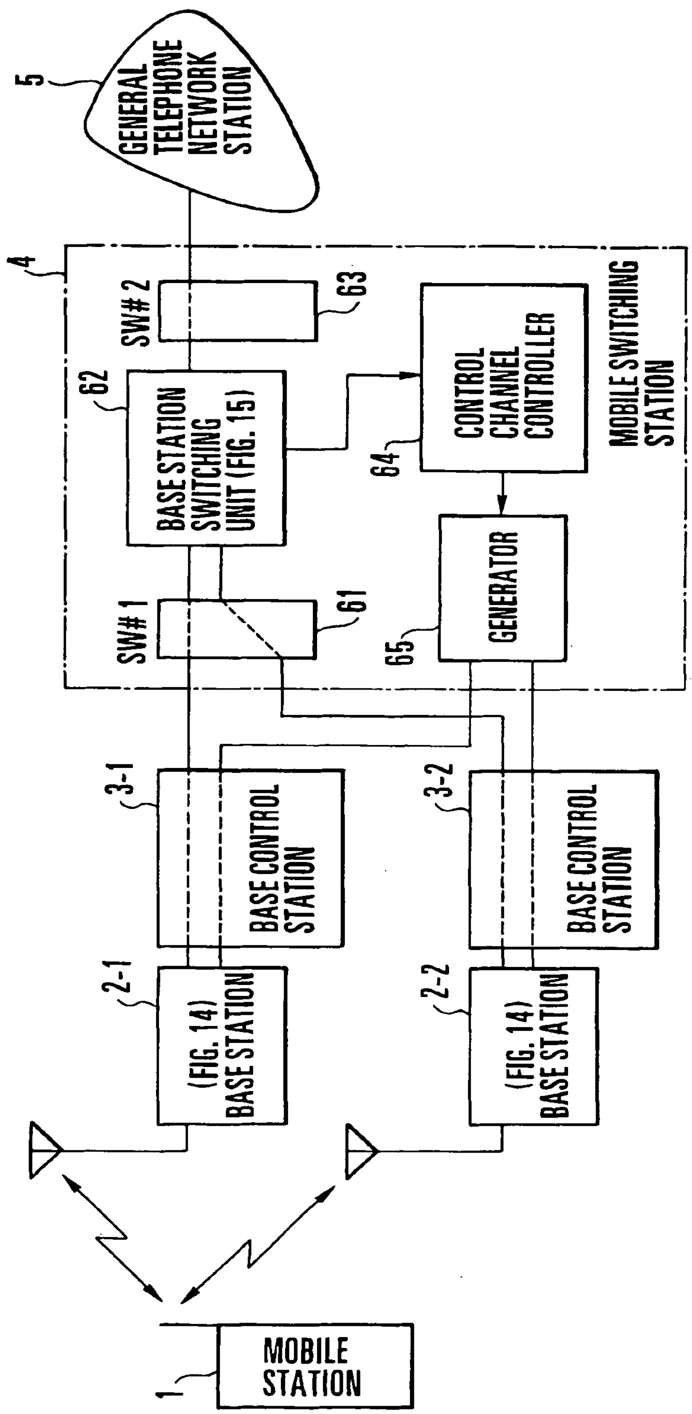
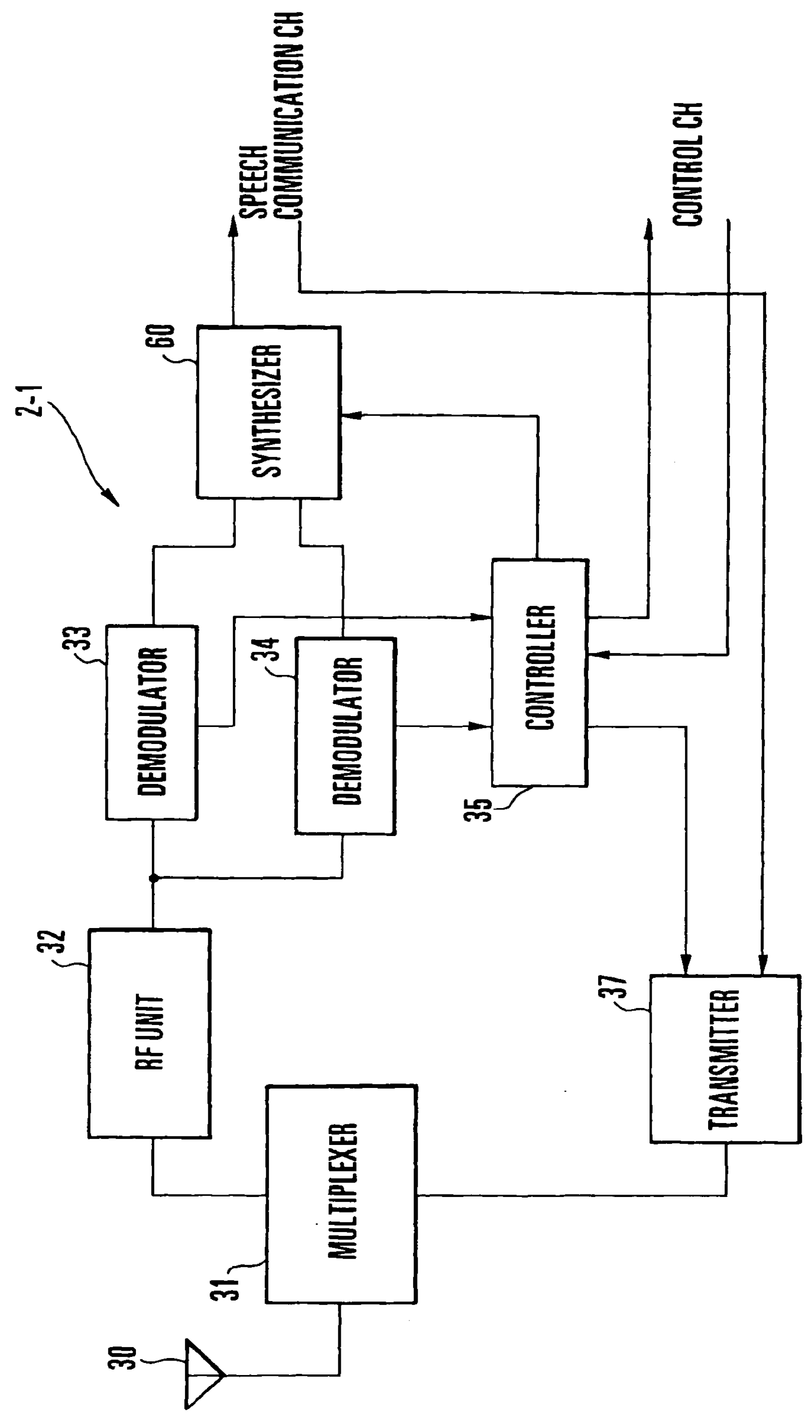

5
GENERAL TELEPHONE NETWORK STATION
4
SW# 2
63
62
BASE STATION SWITCHING UNIT (FIG. 15)
CONTROL CHANNEL CONTROLLER
64
MOBILE SWITCHING STATION
SW# 1
61
GENERATOR
65
3-1
BASE CONTROL STATION
3-2
BASE CONTROL STATION
2-1
(FIG. 14) BASE STATION
2-2
(FIG. 14) BASE STATION
MOBILE STATION
1

FIG. 13


SPEECH COMMUNICATION CH
CONTROL CH
2-1
60
SYNTHESIZER
33
DEMODULATOR
34
DEMODULATOR
CONTROLLER
35
32
RF UNIT
37
TRANSMITTER
MULTIPLEXER
31
30

F I G. 14

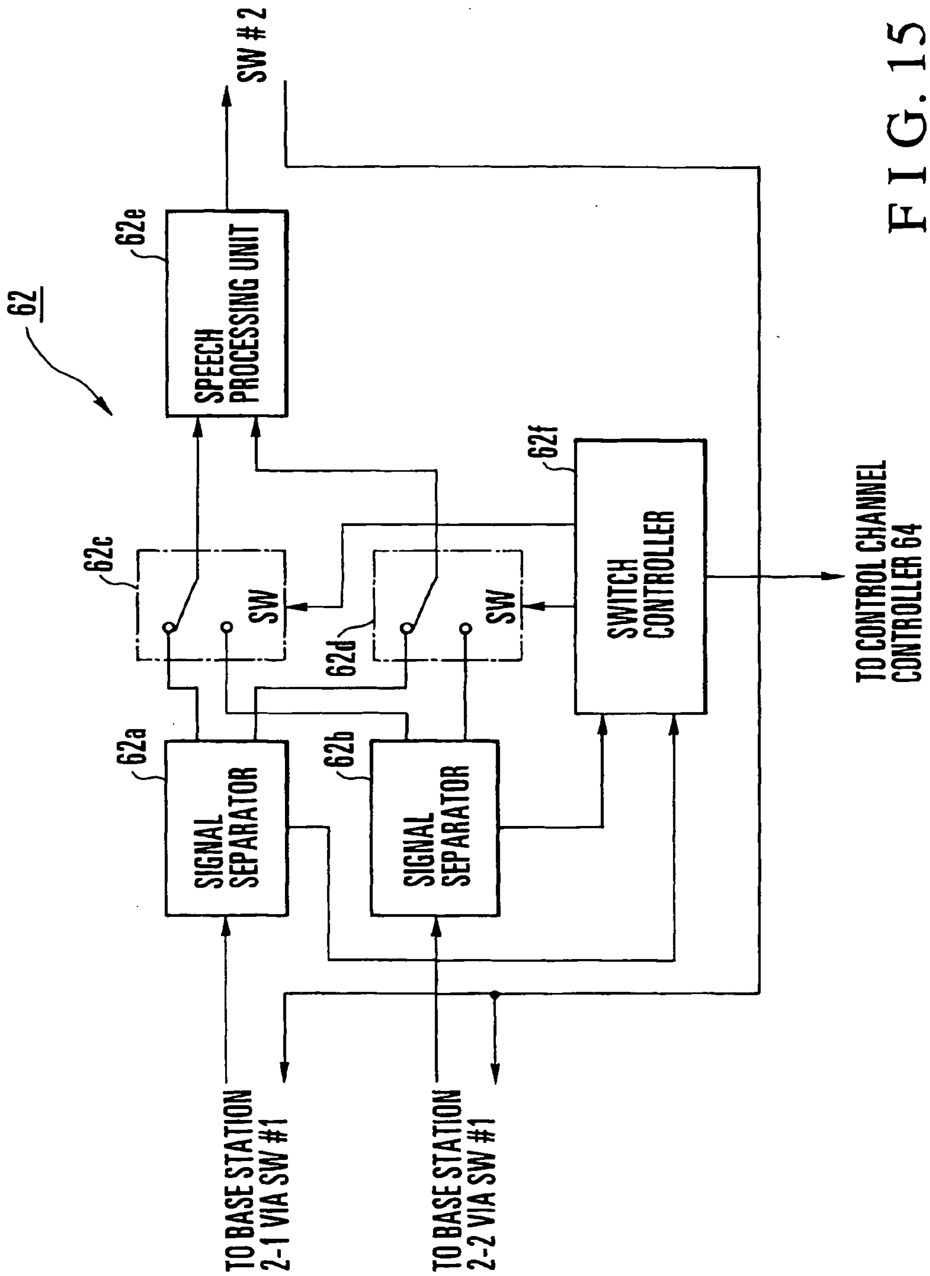

62
62e
SPEECH PROCESSING UNIT
SW # 2
62c
SW
62d
SW
62f
SWITCH CONTROLLER
62a
SIGNAL SEPARATOR
62b
SIGNAL SEPARATOR
TO CONTROL CHANNEL CONTROLLER 64
TO BASE STATION 2-1 VIA SW #1
TO BASE STATION 2-2 VIA SW #1

FIG. 15

5

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 03/16/2005

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	

ART UNIT	PAPER NUMBER
2683	

DATE MAILED: 03/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/321,623	MIYOSHI ET AL.	
	Examiner	Art Unit	
	DANH C LE	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _1_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _22 October 2004_.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _21-29_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) _21-29_ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _7/7/04_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 21, 22, 29, drawn to transmission power control technique, classified in class 455, subclass 522.

II. Claims 24-26 and 28, drawn to conbining or distribution information via code word channels using multiple access techniques, classified in class 370, subclass 335.

III. Claim 27, drawn to spread spectrum, classified in class 375, subclass 130.

The inventions are distinct, each from the other because of the following reasons:

Inventions I, II and III are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention III has separate utility such as receiving having specific code synchronization. See MPEP § 806.05(d).

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C LE whose telephone number is 703-306-0542. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Danh

March 09, 2005

DANH CONG LE
PATENT EXAMINER

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
L9289.02149B	10/321,623
APPLICANT	Kenichi MIYOSHI, et al.
FILING DATE December 18, 2002	GROUP 2683

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		6 6 0 3 9 8 0	08/2003	Kitagawa			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DCL		0 9 8 6 2 8 2	03/2000	Europe				
		0 9 8 6 1 9 2	03/2000	Europe				
		0 0 1 3 3 2 5	03/2000	WO			Abstract	
		0 8 0 2 6 3 8	10/1997	Europe				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

European Search Report dated March 5, 2004

EXAMINER	[signature]	DATE CONSIDERED	3/06/05

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors:	Kenichi MIYOSHI, et al.	Art Unit: 2683
Appln. No.:	10/321,623	Examiner: D. Le
Filed:	December 18, 2002	
For:	COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD	

RESPONSE TO RESTRICTION REQUIREMENT AND SUMMARY OF SUBSTANCE OF TELEPHONE INTERVIEW

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

In response to the Restriction Requirement of March 16, 2005, Applicants hereby elect Group II, claims 23-26 and 28 drawn to combining or distribution information via code work channels using multiple access techniques, classified in class 370, subclass 335, with traverse.

During a telephone interview on April 29, 2005, Examiner Le confirmed that claim 23 is directed to the invention of Group II.

Applicants respectfully request withdrawal of the Restriction Requirement. No unduly extensive or burdensome search would be required to examine the various claims of the noted Groups in the same application. MPEP §803 states:

> "If the search and examination of an entire application can be made without serious burden, the Examiner *must* examine it on the merits even though it includes claims to distinct or independent inventions." (Emphasis added)

OIPE JC98
APR 2 9 2005
PATENT & TRADEMARK OFFICE

In the present case, the search for all pending claims together would not be burdensome.

Moreover, from the standpoint of costs to the Applicants involved in filing, issuance and maintenance fees relating to separate applications if the present Restriction Requirement is maintained, it is clear that there is substantially more burden on Applicants by imposing the present Requirement than on the Patent Office if the Requirement were withdrawn.

In addition, it is noted that to require the claims of the various Groups to issue in separate patents would result in inconvenience to the public by necessitating reference to more than one patent during searching, to review closely related subject matter.

Therefore, withdrawal of the Restriction Requirement is warranted.

Reconsideration and withdrawal of the Restriction Requirement are respectfully requested.

Respectfully submitted,

Date: April 29, 2005

James E. Ledbetter
Registration No. 28,732

JEL/spp

ATTORNEY DOCKET NO. L9289.02149B

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, NW, Suite 850
P.O. Box 34387
Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

TC 2683 #

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) (Large Entity)	Docket No. L9289.02149B

OIPE JC98 APR 2 9 2005 PATENT & TRADEMARK OFFICE

In Re Application Of: **Kenichi MIYOSHI, et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/321,623	December 18, 2002	D. Le	24257	2683	5366

Invention: **COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD**

COMMISSIONER FOR PATENTS:

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response to the Office Action of **March 16, 2005** (*Date*) above-identified application.

The requested extension is as follows (check time period desired):

☒ One month ☐ Two months ☐ Three months ☐ Four months ☐ Five months

from: **April 16, 2005** (*Date*) until: **May 16, 2005** (*Date*)

The fee for the extension of time is **$120** and is to be paid as follows:

☒ A check in the amount of the fee is enclosed.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. **19-4375**

☒ If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No. **19-4375**

☐ Payment by credit card. Form PTO-2038 is attached.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

James E. Ledbetter
Signature

Dated: **April 29, 2005**

James E. Ledbetter, Reg. No. 28,732
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. Street, NW, Suite 850
Washington, DC 20036

05/03/2005 HALI11 00000087 10321623
01 FC:1251 120.00 OP

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

____________________.
(Date)

____
Signature of Person Mailing Correspondence

____
Typed or Printed Name of Person Mailing Correspondence

cc:

P12LARGE/REV09

25

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 07/18/2005

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 07/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/321,623	MIYOSHI ET AL.	
	Examiner	Art Unit	
	DANH C. LE	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *1* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 April 2005*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *21-29* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 21, 22, 29, drawn to transmission power control technique, classified in class 455, subclass 522.

II. Claims 23-26 and 28, drawn to conbining or distribution information via code word channels using multiple access techniques, classified in class 370, subclass 335.

III. Claim 27, drawn to spread spectrum, classified in class 375, subclass 130.

The inventions are distinct, each from the other because of the following reasons:

Inventions I, II and III are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention III has separate utility such as receiving having specific code synchronization. See MPEP § 806.05(d).

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C LE whose telephone number is 703-306-0542. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Danh

July 13, 2003

DANH CONG LE
PATENT EXAMINER

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AUG 0 5 2005

CERTIFICATE OF TRANSMISSION BY FACSIMILE (37 CFR 1.8) Applicant(s): **Kenichi MIYOSHI, et al.**			Docket No. **L9289.02149B**
Application No. **10/321,623**	Filing Date **December 18, 2002**	Examiner **D. Le**	Group Art Unit **2683**

Invention:
COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

I hereby certify that this **Response**
(Identify type of correspondence)
is being facsimile transmitted to the United States Patent and Trademark Office (Fax. No. **571-273-8300**

on **August 5, 2005**
(Date)

James E. Ledbetter, Reg. No. 28,732
(Typed or Printed Name of Person Signing Certificate)

(Signature)

Note: Each paper must have its own certificate of mailing.

P18/REV02

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al. Art Unit: 2683

Appln. No.: 10/321,623 Examiner: D. Le

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

RESPONSE TO RESTRICTION REQUIREMENT

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

In response to the Restriction Requirement of July 18, 2005, the Applicants hereby confirm their Response filed April 29, 2005, electing Group II, claims 23-26 and 28 drawn to combining or distribution information via code work channels using multiple access techniques, classified in class 370, subclass 335, with traverse.

The new Restriction Requirement merely confirms in writing that claim 23 is directed to the invention of Group II.

Applicants respectfully request withdrawal of the Restriction Requirement for the reasons set forth in the Response filed April 29, 2005.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: April 29, 2005
JEL/spp
ATTORNEY DOCKET NO. L9289.02149B

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, NW, Suite 850
P.O. Box 34387
Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

BEST AVAILABLE COPY

PATENT APPLICATION FEE DETERMINATION RECORD
Effective November 10, 1998

Application or Docket Number
10321623

CLAIMS AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)
BASIC FEE		
TOTAL CLAIMS	20 minus 20=	* —
INDEPENDENT CLAIMS	3 minus 3 =	* —
MULTIPLE DEPENDENT CLAIM PRESENT		

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE RATE	SMALL ENTITY FEE		OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
		OR		
		OR		
		OR		
TOTAL		OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)
Total	* 9	Minus	** 20	= —
Independent	* 9	Minus	*** 3	= 6
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
		OR		
		OR	88	528
		OR		
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	528

8/5/05

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)
Total	* 9	Minus	** 20	= —
Independent	* 9	Minus	*** 9	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
		OR		
		OR		
		OR		
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
		OR		
		OR		
		OR		
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 6/00)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S315	304	@rlad<"20000901" and (code word) with (proportaion$4 ratio) and "370"/$.ccls.	US-PGPUB; USPAT	OR	ON	2005/10/20 10:28

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 10/25/2005

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 10/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/321,623	Applicant(s) MIYOSHI ET AL.
	Examiner DANH C. LE	Art Unit 2683

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 August 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *24* is/are allowed.

6)☒ Claim(s) *23,25,26 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12/18/02* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

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1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 8/3/05 and 6/7/04 have been considered by the examiner and made of record in the application file.

Election/Restrictions

2. Applicant's election with traverse of claims 23-26 and 28 in the reply filed on 08/05/05 is acknowledged. However, the applicant did not specify the ground of traversal. The Examiner assumes that the applicant select claims 23-26 and 28 without traverse.

The requirement is still deemed proper and is therefore made FINAL.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 23, 25, 26, 28 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8, respectively of U.S. Patent No. 6,760,590. Although the conflicting claims are not

identical, they are not patentably distinct from each other because claims 1-8 of the U.S. Patent No. 6,760,590 encompass claims 23, 25, 26, 28 of the present application.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. **Claims 23, 25, 26, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tong (US 6,760,590) in view of Kumar (US 2001/0050926).**

As to claim 23, Tong teaches a communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality (figure 1 and paragraph 37-38), said communication terminal apparatus comprising:

a measurer device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information that indicates said downlink channel quality;

wherein said transmitter transmits a notification signal includes information made less susceptible to errors in a propagation path, the information, among information indicative of channel quality.

Tong fails to teach information is converted to a code word whose code-word minimum the distance is proportional to the degree of measuring. Kumar teaches information is converted to a code word whose code-word minimum the distance is proportional to the degree of measuring (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Tong in order to maximized the service level.

As to claim 25, Tong teaches a communication terminal apparatus (figure 1 and paragraph 37-38) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

each of a plurality of digits representing the information of the notification signal is converted power control bits prior to its transmission.

Tong fails to teach a code word whose code length is proportional the digit's degree of significant. Kumar teaches a code word whose code length is proportional the digit's degree of significant (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Tong in order to maximized the service level.

As to claim 26, Tong teaches a communication terminal apparatus (figure 1 and paragraph 37-38) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein the transmitter transmits report channel quality indications or maximum support data rate indication information of the notification signal using a transmission power.

Tong fail to teach each of a plurality of digits representing the information that is proportionate to the digit's degree of significance. Kumar teaches each of a plurality of digits representing the information that is proportionate to the digit's degree of significance (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Tong in order to maximized the service level.

As to claim 28, Tong teaches a communication terminal apparatus (figure 1 and paragraph 37-38) comprising:

a measuring device that measures reception quality of a pilot signal to output information having a plurality of bits that indicate the measured reception quality;

a transmitter that transmits the information to obtain report channel quality indications or maximum support data rate indication information of the notification signal.

Tong fails to teach a coding device that encodes code word, wherein the coding device encodes the information such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits. Kumar teaches a coding device that encodes code word, wherein the coding device encodes the information such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Tong in order to maximized the service level.

Response to Arguments

Applicant's arguments with respect to **new** claims 23, 25, 26, 28 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

Claim 24 is allowed.

As to claim 24, the teaching of above prior arts either alone or in combination fails to teach a table that indicates a correspondence between the notification signal and a code word, a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein the transmitter converts the notification signal, prior to its transmission, to a code word based on the contents of said table.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A. Kim et al (US 2005/0083901) teaches apparatus and method for encode/decode transports format combine indicator in CDMA communication system.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C. LE whose telephone number is 571-272-7868. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 571-272-7872. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Danh

October 20, 2005.

DANH CONG LE
PATENT EXAMINER

SHEET 1 OF 1

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

OIPE JC116 JUN 0 7 2004 PATENT & TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
L9289.02149B	10/321,623
APPLICANT	Kenichi MIYOSHI, et al.
FILING DATE December 18, 2002	GROUP 2683

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
DCL		6603980	08/2003	Kitagawa			

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Technology Center 2600

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DCL		0986282	03/2000	Europe				
		0986192	03/2000	Europe				
		0013325	03/2000	WO			Abstract	
		0802638	10/1997	Europe				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

European Search Report dated March 5, 2004

EXAMINER danh **DATE CONSIDERED** 10/18/05

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

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PATENT & TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
L9289.02149B	10/321,623
APPLICANT Kenichi MIYOSHI, et al.	
FILING DATE December 18, 2002	GROUP 2683

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER								DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
DCL			6	7	5	1	1	9	7	06/2004	Sadanaka			
|			6	6	5	1	2	1	1	11/2003	Abe et al.			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER								DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	NO
DCL	2000		1	2	4	9	1	4		04/2000	JP			Abstract	
|	2000		6	8	9	5	9			03/2000	JP			Abstract	
|	2000		4	1	7	1				01/2000	JP			Abstract	
|		1	1	3	3	1	1	3	1	11/1999	JP			Abstract	
|		0	9	5	9	5	8	1		11/1999	EP				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

Japanese Office Action dated December 21, 2004, with English translation.

EXAMINER Donh DATE CONSIDERED 10/18/05

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

Notice of References Cited	Application/Control No. 10/321,623	Applicant(s)/Patent Under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2683	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2005/0083901	04-2005	Kim et al.	370/342
*	B	US-2001/0050926	12-2001	Kumar, Derek D.	370/529
	C	US-			
	D	US-			
	E	US-			
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent under Reexamination
	10/321,623	MIYOSHI ET AL.
	Examiner	Art Unit
	DANH C. LE	2683

√	Rejected	—	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim Final	Claim Original	Date 10/28/05	Date	Date	Date	Date	Date	Date
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Search Notes	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2683	

SEARCHED

Class	Subclass	Date	Examiner
370	529	10/19/05	DCL

INTERFERENCE SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)

	DATE	EXMR
Update EAST Search (USP, USPGPUB)	10/19/05	DCL

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PATENT & TRADEMARK OFFICE

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al. Art Unit: 2683

Appln. No.: 10/321,623 Examiner: D. Le

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

REQUEST FOR IDENTIFICATION OF REFERENCE AND RESETTING OF RESPONSE PERIOD

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

The Final Rejection of October 25, 2005 incorrectly lists the Patent Number for Tong as US 6,760,590. This Patent Number belongs to the parent case of this application. It is respectfully requested that the reference be identified in a new Office Action and that the period for response be reset.

Respectfully submitted,

Date: November 4, 2005

James E. Ledbetter
Registration No. 28,732

JEL/ejw

ATTORNEY DOCKET NO. L9289.02149B

STEVENS DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, NW, Suite 850
P.O. BOX 34387
Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S346	135	@rlad<"20000901" and (downlink down-link forward) with quality and (codeword code-word code adj2 word)	US-PGPUB; USPAT	OR	ON	2005/12/09 12:51

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor: Kenichi MIYOSHI et al. Group Art Unit: 2683

Appln. No.: 10/321,623 Examiner: D.C. Le

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

RESPONSE UNDER 37 CFR § 1.116

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Final Rejection dated October 25, 2005, the Applicants respectfully request reconsideration and allowance in light of the following remarks.

Applicants acknowledge with appreciation the indication in the Final Rejection that claim 24 is allowed.

Claims 21, 22, 27, and 29 stand withdrawn from consideration as directed to non-elected subject matter.

A terminal disclaimer is filed herewith to obviate the obviousness-type double patenting rejection applied to claims 23, 25, 26, and 28.

Claims 23, 25, 26, and 28 stand rejected, under 35 USC §103(a), as being unpatentable over Tong et al. (US 2001/0038630) in view of Kumar (US 2001/0050926). The Applicants respectfully traverse these rejections based on the following points.

The Applicants respectfully submit that the applied references, considered alone or together, fail to teach or suggest the feature recited in claim 23 of converting information to a code word having a code-word minimum distance that is proportional to the measured quality of a downlink channel. The Final Rejection acknowledges that Tong does not disclose this feature, but proposes that Kumar discloses it in paragraph 82 (Final Rejection paragraph bring pages 3 and 4). The Applicants respectfully disagree and submit that this reference in no way discloses this subject matter.

Kumar discloses, in paragraph 82, a receiver that receives two code words that were identical when transmitted, but degraded by the effects of a propagation channel (see Kumar abstract, lines 7-12). The receiver decodes, presumably using error correction decoding, both of the received code words and then re-encodes estimates of the two decoded words to regenerate the expected pair of error-correction-coded (ECC) code words sent by the transmitter (¶82, lines 1-9). Thereafter, the receiver determines the Hamming distance between each of the regenerated ECC code words and the corresponding received code word. The determined Hamming distance is approximately proportional to the bit error rate (BER) for the received code word (¶82, lines 9-13). When the determined BER estimates for the two code word are substantially different, the receiver system selects the code word from the pair with the lower BER (i.e., smaller Hamming distance) for use in regenerating the communicated information (¶82, lines 14-18). Otherwise, the receiver may combine the two code words for use in regenerating the communicated information (¶82, lines 18-24).

In summary, the only conversion of information to a code word disclosed by Kumar is the conversion of previously decoded information back to coded information by an encoding operation. Presumably, the decoding operation is performed on the received code word to eliminate the detectable and correctable errors in the decoded information. Thereafter, the information obtained through decoding is re-encoded so as to regenerate the code word the receiver expects was transmitted by its communicating partner. This regenerated code word is compared to the received code word to determine the Hamming distance (i.e., bit position differences) between the two code words, which provides an indication of the expected BER for the communication.

However, Kumar's receiver does not make a determination about the communication channel quality until the expected code word is regenerated and compared to the received code word. As a result, it necessarily follows that Kumar cannot disclose regenerating the expected code word to have a Hamming distance proportional to the measured channel quality because the channel quality is not determined until after the expected code word is regenerated and compared to the received code word.

Moreover, the receiver must regenerate the code word using the same code used by the transmitter. Since the receiver cannot determine the channel quality until after the code word is regenerated, it necessarily follows that both the transmitter and receiver must use a fixed code having a Hamming distance that is invariant to the measured channel quality.

Accordingly, the Applicants respectfully submit that the applied references, considered singly or in combination, do not teach or suggest the subject matter defined by claim 23. More specifically, the applied references do not suggest a transmitter that converts information to a code word, having a code-word minimum distance that is proportional to the measured quality of a downlink channel, and then transmits the code word. Therefore, allowance of claim 23 is warranted.

Claim 25 recites the feature of converting each of a plurality of digits of information related to channel quality to a code word having a length proportional to the digit's degree of significance within the information. The Final Rejection acknowledges that Tong does not disclose this feature, but proposes that Kumar does in paragraph 82 (Final Rejection page 4, sixth paragraph). The Applicants respectfully disagree and submit that the reference in no way discloses such subject matter.

An examination of Kumar's paragraph 82 reveals that Kumar discloses nothing similar to generating multiple code words having variable lengths. As a result it necessarily follows that Kumar cannot disclose generating each of multiple code words having a length proportional to a digit's degree of significance in a value represented by multiple digits. Kumar also does not disclose anything similar to a digit's degree of significance.

Moreover, as discussed in connection with claim 23, Kumar's receiver does not make a determination about the communication channel quality until an expected code word is regenerated and compared to a received code word. As a result, it necessarily follows that Kumar cannot disclose regenerating expected code words representing information based on a measured channel quality because Kumar's receiver must regenerate the expected code words before the channel quality measurement can be made.

Claim 28 distinguishes over the applied references for reasons analogous to those provided for distinguishing claim 25. More specifically, Kumar discloses nothing in the cited paragraph, ¶82, that is similar to coding a most significant bit of information so that it is less susceptible to error, when transmitted through a propagation path, than other bits of the information. Also, claim 28 recites that the information indicates the measured reception quality of a pilot signal. Since Kumar's receiver cannot measure the quality of a received signal until an expected code word of the received signal is regenerated, it necessarily follows that Kumar cannot disclose generating an expected code word representing the measured quality of the received signal. The Final Rejection acknowledges that Tong does not supplement the teachings of Kumar in this regard (see Final Rejection page 5, last paragraph).

Accordingly, the Applicants respectfully submit that the applied references, taken alone or together, do not disclose or suggest the subject matter defined by claims 25 and 28. Therefore, allowance of claims 25 and 28 is warranted.

Claim 26 recites transmitting each of a plurality of informational digits using a transmission power proportionate to the digit's degree of significance in the information. The Final Rejection does not propose that either Tong or Kumar teach this feature. Instead, the Final Rejection parses the words of the claimed feature and proposes that: (1) Tong discloses in ¶¶37-38 a transmitter that reports measured channel quality indications using a transmission power (see Final Rejection page 4, last 5 lines, and page 5, lines 1-2) and (2) Kumar discloses in ¶82 representing each of a plurality of digits, providing information related to a measured channel quality, in a manner proportionate to the digit's degree of significance in the information (see Final Rejection page 5, second paragraph). The Applicants respectfully disagree that either reference discloses the proposed subject matter.

An examination of Tong's ¶¶37-38 reveals that Tong does not disclose varying a transmission power. Instead, Tong discloses selecting a transmission data rate based upon a reported channel quality. Since Tong does not disclose varying a transmission power, it necessarily follows that Tong cannot disclose varying a transmission power to provide an indication of a measured channel quality.

As discussed in connection with claim 25, Kumar does not disclose anything similar to a digit's degree of significance in paragraph 82. The previous discussion is incorporated herein by reference.

Accordingly, the Applicants respectfully submit that the applied references, whether considered individually or together, do not teach or suggest the subject matter defined by claim 26. Therefore, allowance of claim 26 is warranted.

To promote a better understanding of the differences between the claimed invention and the applied references, the Applicants provide the following additional remarks.

Claims 23, 25, 26 and 28 all recite a transmitter, and, accordingly, the invention defined by claims 23, 25, 26, and 28 relates to a communication terminal apparatus at the transmitting side of a communication.

By contrast to the claimed invention, Kumar discloses a receiver system that either: (1) combines two (i.e., upper and lower sideband signal) codeword estimates together to form one estimate, which is then decoded or (2) selects one of the two decoded estimates, thereby discarding the remaining decoded estimate, to determine the received decoded codeword estimate, which is less likely to be erroneous (see Kumar ¶81). In short, the portion of Kumar's disclosure cited in the Final Rejection (i.e., ¶82) discloses a communication receiver.

Accordingly, the invention defined by claims 23, 25, 26 and 28 relates to a transmitter, whereas the cited portion of Kumar relates to a receiver.

In addition, although Kumar's paragraph 82 may suggest that the BER of an upper sideband signal codeword and the BER of a lower sideband signal codeword differ, this difference is caused passively by noise, interference, or RF propagation channel distortion, such as multipath, and is not created actively by the transmitter (see Kumar ¶81).

Furthermore, Kumar's upper sideband signal and lower-sideband signal refer to a high frequency signal and a low frequency signal on the frequency axis, respectively. The upper and lower sideband regions are located around the conventional analog FM-band signal and occupy the frequency region from about a ±100 KHz frequency offset to about a ±200 KHz frequency offset from the analog FM-band channel's center frequency (see Kumar, ¶72). Thus, Kumar's upper sideband signal and lower sideband signal bear no relationship to the most significant bit and the other bits of information recited in claim 28. Kumar does not disclose or suggest making the BER of a most significant bit and the BER of other bits different at the transmitter and transmitting the information.

Moreover, Kumar does not disclose the coding device, recited in claim 28, which encodes information such that the most significant bit of a plurality of bits is less susceptible to errors in a propagation path than the other bits.

In view of the above, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: January 25, 2006
JEL/DWW/att

Attorney Docket No. L9289.02149B
STEVENS DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, N.W., Suite 850
P.O. Box 34387
Washington, D.C. 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

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Terminal Disclaimer To Obviate A Double Patenting Rejection Over A Prior Patent

Docket No. L9289.02149B

In Re Application Of: **Kenichi MIYOSHI, et al.**

Serial No.	Filing Date	Examiner	Group Art Unit
10/321,623	**December 18, 2002**	**D. LE**	**2683**

Invention: **COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD**

Owner of Record: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**

TO THE ASSISTANT COMMISSIONER FOR PATENTS:

The above-identified owner of record of a **100** percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application, which would extend beyond the expiration date of the full statutory term defined in 35 U.S.C. 154 to 156 and 173, as presently shortened by any terminal disclaimer, of prior Patent No. **6,760,590** . The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors and/or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 to 156 and 173 of the prior patent, as presently shortened by any terminal disclaimer, in the event that it later expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 C.F.R. 1.321, has all claims cancelled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of an organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☒ The undersigned is an attorney of record.

Signature

Dated: **January 25, 2006**

James E. Ledbetter, Reg. No. 28,732

Typed or Printed Name

01/26/2006 SZEWDIE1 00000014 10321623

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☐ Terminal disclaimer fee under 37 C.F.R. 1.20(d) included.

☐ PTO suggested wording for terminal disclaimer was unchanged.

☐ Certification under 37 C.F.R. 3.73(b) is required if terminal disclaimer is signed by the assignee.

 P32/REV01

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PATENT APPLICATION FEE DETERMINATION RECORD
Effective November 10, 1998

Application or Docket Number: 10321623

CLAIMS AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY TYPE: RATE	SMALL ENTITY TYPE: FEE	OR	OTHER THAN SMALL ENTITY: RATE	OTHER THAN SMALL ENTITY: FEE
BASIC FEE							
TOTAL CLAIMS	20 minus 20=	* —			OR		
INDEPENDENT CLAIMS	3 minus 3 =	* —			OR		
MULTIPLE DEPENDENT CLAIM PRESENT					OR		
			TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY: RATE	SMALL ENTITY: ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY: RATE	OTHER THAN SMALL ENTITY: ADDITIONAL FEE
Total	* 9	Minus	** 20	= —			OR		
Independent	* 9	Minus	*** 3	= 6			OR	88	528
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM							OR		
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	528

8/5/05

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY: RATE	SMALL ENTITY: ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY: RATE	OTHER THAN SMALL ENTITY: ADDITIONAL FEE
Total	* 9	Minus	** 20	= —			OR		
Independent	* 9	Minus	*** 9	= —			OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM							OR		
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

10/25/06	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY: RATE	SMALL ENTITY: ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY: RATE	OTHER THAN SMALL ENTITY: ADDITIONAL FEE
Total	* 9	Minus	** 20	= —			OR		
Independent	* 9	Minus	*** 9	= —			OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM							OR		
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 8/98)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	142	@rlad<"20000901" and (downlink down-link forward) with quality and (codeword code-word code adj2 word)	US-PGPUB; USPAT	OR	ON	2006/02/07 17:18

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
1032162 3	10/321,623	MIYOSHI ET AL.	

Document Code - DISQ	**Internal Document – DO NOT MAIL**

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 01-25-06	**This patent is subject to a Terminal Disclaimer**	

Approved/Disapproved by:

TERMINAL DISCLAIMER APPROVED SENT TO SCANNING ON 02-08-06 BY KAREN L. WARD

U.S. Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 02/23/2006

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 02/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/321,623	MIYOSHI ET AL.	
	Examiner	Art Unit	
	DANH C. LE	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _25 January 2006_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _21-29_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) _24_ is/are allowed.

6)☒ Claim(s) _23,25,26 and 28_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. **Claims 23, 25, 26, 28 are rejected under 35 U.S.C. 102(e) as being anticipated by Niemelia (US 6,452,914).**

As to claim 23, Niemelia teaches a communication terminal apparatus (figure 2, 3, 4 and col.4, lines 2- 65), comprising:

a measuring device (that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the information of the notification signal, prior to its transmission, is converted to a code word whose code-word minimum distance is proportional to the degree of measured downlink channel quality.

As to claim 25, Niemelia teaches a communication terminal apparatus (figure 1 and paragraph 37-38) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

each of a plurality of digits representing the information of the notification signal is converted, prior to its transmission, to a code word whose code length is proportional the digit's degree of significance.

As to claim 26, Niemelia inherently teaches a communication terminal apparatus (figure 2, 3A, B) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits each of a plurality of digits representing the information of the notification signal using a transmission power that is proportionate to the digit's degree of significance.

As to claim 28, Niemelia teaches a communication terminal apparatus (figure 2-5 and clo.4, line 2-col.5, line 23) comprising:

a measuring device that measures reception quality of a pilot signal to output information having a plurality of bits that indicate the measured reception quality;

a coding device that encodes code word; and

a transmitter that transmits the information to obtain a the code word, wherein:

the coding device encodes the information such that the most significance of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits.

Allowable Subject Matter

Claim 24 is allowed.

As to claim 24, the teaching of above prior arts either alone or in combination fails to teach a table that indicates a correspondence between the notification signal and a code word, a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein the transmitter converts the notification signal, prior to its transmission, to a code word based on the contents of said table.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C. LE whose telephone number is 571-272-7868. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 571-272-7872. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

February 7, 2006

DANH CONG LE
PRIMARY EXAMINER

Notice of References Cited	Application/Control No. 10/321,623	Applicant(s)/Patent Under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2683	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,452,914	09-2002	Niemela, Kari	370/337
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent under Reexamination
	10/321,623	MIYOSHI ET AL.
	Examiner	Art Unit
	DANH C. LE	2683

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	+	Restricted	I	Interference	O	Objected

Claim		Date								Claim		Date								Claim		Date							
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Search Notes	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2683	

SEARCHED

Class	Subclass	Date	Examiner
370	337	2/7/06	DCL
	476		

INTERFERENCE SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)

	DATE	EXMR
EAST Search updated (US, USPUB)	2/7/06	DCL

U.S. Patent and Trademark Office   Part of Paper No. 20060207

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 03/01/2006

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 03/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/321,623	MIYOSHI ET AL.	
	Examiner	Art Unit	
	DANH C. LE	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 04 November 2005.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *24* is/are allowed.

6)☒ Claim(s) *23,25,26 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

1. Claims 23, 25, 26, 28 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8, respectively of U.S. Patent No. 6,760,590. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims 1-8 of the U.S. Patent No. 6,760,590 encompass claims 23, 25, 26, 28 of the present application.

Response to Amendment

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 23, 25, 26, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Niemelia (US 6,452,914) in view of Kumar (US 2001/0050926).**

As to claim 23, Niemelia teaches a communication terminal apparatus (figure 2 and col.4, lines 2- 65), comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the information of the notification signal, prior to its transmission, is converted to a code word whose code-word minimum distance of measured downlink channel quality.

Niemelia fails to teach the distance is proportional to the degree of measuring. Kumar teaches information is converted to a code word whose code-word minimum the distance is proportional to the degree of measuring (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Niemelia in order to maximized the service level.

As to claim 25, Niemelia teaches a communication terminal apparatus (figure 1 and paragraph 37-38) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

each of a plurality of digits representing the information of the notification signal is converted, prior to its transmission, to a code word.

Niemelia fails to teach a code word length is proportional the digit's degree of significant. Kumar teaches a code word length is proportional the digit's degree of significant (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Niemelia in order to maximized the service level.

As to claim 28, Niemelia teaches a communication terminal apparatus (figure 2 and clo.4, line 2-col.5, line 23) comprising:

a measuring device that measures reception quality of a pilot signal to output information having a plurality of bits that indicate the measured reception quality;

a coding device that encodes code word; and

a transmitter that transmits the information to obtain a the code word, wherein:

the coding device encodes the information such that the plurality of bits is less susceptible to errors in a propagation path.

Niemelia fails to teach the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits. Kumar teaches the coding device encodes the information such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Niemelia in order to maximized the service level.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 26 is rejected under 35 U.S.C. 102(e) as being anticipated by xx (US 6,452,914).

As to claim 26, xx inherently teaches a communication terminal apparatus (figure 2, 3A, B) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits each of a plurality of digits representing the information of the notification signal using a transmission power that is proportionate to the digit's degree of significance.

Response to Arguments

Applicant's arguments with respect to **new** claims 23, 25, 26, 28 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

Claim 24 is allowed.

As to claim 24, the teaching of above prior arts either alone or in combination fails to teach a table that indicates a correspondence between the notification signal and a code word, a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein the transmitter converts the notification signal, prior to its transmission, to a code word based on the contents of said table.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A. Niemeda (US 2002/0136242) teaches signaling method and telecommunication system.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C. LE whose telephone number is 571-272-7868. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 571-272-7872. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

danh

December 09, 2005.

DANH C LE
PATENT EXAMINER

Notice of References Cited	Application/Control No. 10/321,623	Applicant(s)/Patent Under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2683	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2002/0136242	09-2002	Niemela, Kari	370/523
*	B	US-6,452,914	09-2002	Niemela, Kari	370/337
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Interview Summary	**Application No.** 10/321,623	**Applicant(s)** MIYOSHI ET AL.	
	Examiner DANH C. LE	**Art Unit** 2683	

All participants (applicant, applicant's representative, PTO personnel):

(1) *DANH C. LE*. (3)_____.

(2) *MR. LEDBETTER ASSISTANCE*. (4)_____.

Date of Interview: *07 December 2005*.

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *All*.

Identification of prior art discussed: *6,760,590*.

Agreement with respect to the claims f)☒ was reached. g)☐ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *The examiner withdrawn the final action on 10/25/05 and issued another Officice Action*.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)
In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Search Notes	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2683	

SEARCHED

Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)

	DATE	EXMR
Update EAST Search	12/7/05	DCL

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Kenichi MIYOSHI, et al. Art Unit: 2683

Appln. No.: 10/321,623 Examiner: D. Le

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

REQUEST FOR IDENTIFICATION OF REFERENCE AND RESETTING OF RESPONSE PERIOD

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

The Final Rejection of October 25, 2005 incorrectly lists the Patent Number for Tong as US 6,760,590. This Patent Number belongs to the parent case of this application. It is respectfully requested that the reference be identified in a new Office Action and that the period for response be reset.

Respectfully submitted,

Date: November 4, 2005

James E. Ledbetter
Registration No. 28,732

JEL/ejw

ATTORNEY DOCKET NO. L9289.02149B

STEVENS DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, NW, Suite 850
P.O. BOX 34387
Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

Index of Claims	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.
	Examiner DANH C. LE	Art Unit 2683

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor: Kenichi MIYOSHI et al. Group Art Unit: 2683

Appln. No.: 10/321,623 Examiner: D.C. Le

Filed: December 18, 2002

For: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

RESPONSE UNDER 37 CFR § 1.111

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated February 23, 2006, the Applicants respectfully request reconsideration and allowance of this application in light of the following remarks.

The Applicants acknowledge with appreciation the indication in the Office Action that claim 24 is allowed.

Claims 21, 22, 27, and 29 stand withdrawn from consideration as directed to non-elected subject matter.

Claims 23, 25, 26, and 28 stand rejected, under 35 USC §102(e), as being anticipated by US 6,452,914 to Niemelia. The Applicants respectfully traverse this rejection based on the following points.

US 6,452,914 was filed on June 11, 2001, and is a continuation of PCT/FI99/01065 filed December 21, 1999. Thus, US 6,452,914 has an effective date of June 11, 2001, based on its filing in the U.S. on June 11, 2001. See, MPEP 706.02(f)(1), page 700-400.

The present application claims priority based on two prior Japanese applications as follows:

JAPANESE PATENT APPLICATION NO. 2000-234420
FILED August 2, 2000; and
JAPANESE PATENT APPLICATION NO. 2000-285405
FILED September 20, 2000.

Submitted herewith are verified English translations of these priority applications.

It is submitted that these translations support the subject matter of claims 23, 25, 26, and 28.

Accordingly, given that the August 2, 2000 and September 20, 2000 dates of the priority applications antedate the effective date of June 11, 2001 of US 6,452,914 , Niemela is now overcome as a reference.

In view of the above, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

Date: April 26, 2006
JEL/DWW/att

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VERIFICATION OF A TRANSLATION

I, Tetsuo AKIYOSHI, of 5th Floor, Shintoshicenter Bldg., 24-1, Tsurumaki 1-chome, Tama-shi, Tokyo 206-0034 Japan, declare that I am well acquainted with both the Japanese and English languages, and that the attached is an accurate translation, to the best of my knowledge and ability, of the Japanese language Patent Application No. JP 2000-234420 filed on August 2, 2000.

Signature ______________ Date April 12, 2006

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Reference Number = 2900625218 Application Number 2000-234420

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[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

[WHAT IS CLAIMED IS:]

[Claim 1] A communication terminal apparatus comprising: measuring means for measuring downlink channel quality; generating means for generating a notification signal to notify the channel quality to a base station apparatus; and transmitting means for transmitting the notification signal indicating a good channel quality relatively less susceptible to errors in a propagation path.

[Claim 2] The communication terminal apparatus according to claim 1, wherein said transmitting means transmits with transmission power increased in proportion to a notification signal that indicates that channel quality is good.

[Claim 3] The communication terminal apparatus according to claim 2, further comprising controlling means for controlling transmission power of a pilot signal; wherein said transmitting means transmits with a notification signal that indicates channel quality better than a predetermined channel quality set to higher transmission power than the pilot signal transmission power, and a notification signal that indicates channel quality poorer than the predetermined channel quality set to lower transmission power than the pilot signal transmission power.

[Claim 4] The communication terminal apparatus according to claim 2 or 3, further comprising: a table that indicates a correspondence between a notification signal and transmission power; and a rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein transmitting means adjusts a notification signal to predetermined transmission power based on said table.

[Claim 5] The communication terminal apparatus according to claim 1, wherein transmitting means transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that channel quality is good.

[Claim 6] The communication terminal apparatus according to claim 5, further comprising: a table that indicates a correspondence between a notification signal and a code word; and a rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein transmitting means converts a notification signal to a predetermined code word based on said table.

[Claim 7] The communication terminal apparatus according to any of claims 1 through 6, further comprising a determining means for determining a communication mode indicated by a combination of modulation method and coding method based on channel quality; wherein generating means makes a notification signal a signal that indicates the communication mode.

[Claim 8] The communication terminal apparatus according to any of claims 1 through 6, wherein measuring means measures pilot signal reception quality; and generating means makes a notification signal a signal that indicates a pilot signal reception quality value.

[Claim 9] A base station apparatus comprising: receiving means for receiving a notification signal transmitted from the communication terminal apparatus according to any of claims 1 through 8; measuring means for measuring reception power of the notification signal; detecting means for detecting a notification signal whose reception power is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

[Claim 10] A base station apparatus comprising: receiving means for receiving a notification signal transmitted from the communication terminal apparatus according to any of claims 1 through 8; measuring means for measuring likelihood of the notification signal; detecting means for detecting a notification signal whose likelihood is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

[Claim 11] The base station apparatus according to claim 9 or 10, further comprising: calculating means for calculating a rate of detection by detecting means; and transmitting means for transmitting a control signal instructing the communication terminal apparatus according to claim 4 or 6 to rewrite said table based on a result of comparison of the rate of detection and a predetermined threshold value.

[Claim 12] A radio communication method, wherein a communication terminal apparatus measures downlink channel quality, generates a notification signal for notifying information indicating the channel quality to a base station apparatus, and transmits the notification signal indicating a good channel quality relatively less susceptible to errors in a propagation path, whereas the base station apparatus determines downlink communication resource allocation using the notification signal.

[DETAILED DESCRIPTION OF THE INVENTION]

【0001】

[TECHNICAL FIELD OF THE INVENTION]

The present invention relates to a communication terminal apparatus, base station apparatus, and radio communication method to be used in a cellular communication system.

【0002】

[PRIOR ART]

In a cellular communication system, one base station performs radio communication with a plurality of communication terminals simultaneously, and therefore, as demand has increased in recent years, so has the need for higher transmission efficiency.

【0003】

One technology that has been proposed for increasing the transmission efficiency of a downlink from a base station to a communication terminal is HDR (High Data Rate). HDR is a communication method whereby a base station performs scheduling for allocating communication resources to communication terminals by time division, and also sets a transmission rate for each communication terminal according to the downlink channel quality.

【0004】

The operations by which a base station and communication terminals perform radio communication with HDR are described below. First, the base station transmits a pilot signal to each communication terminal. Each communication terminal estimates the downlink channel quality using a CIR (desired carrier to interference ratio) based on the pilot signal, etc , and finds a transmission rate at which communication is possible. Then, based on the transmission rate at which communication is possible, each communication terminal selects a communication mode, which is a combination of packet length, coding method, and modulation method, and transmits a data rate control (hereinafter referred to as "DRC") signal indicating the communication mode to the base station.

【0005】

The type of modulation method that can be used in each system is predetermined as BPSK, QPSK, 16QAM, 64QAM, and so forth. Also, the type of coding that can be used in each system is predetermined as 1/2 turbo code, 1/3 turbo code, 3/4 turbo code, and so forth. Further, a plurality of transmission rates that can be used in each system are predetermined according to a combination of packet length, modulation method, and coding method. Each communication terminal selects a combination whereby communication can be performed most efficiently with the current downlink channel quality, and transmits a DRC signal indicating the selected communication mode to the base station. Generally, DRC signals are represented by numbers from 1 to N, with a higher number indicating a proportionally better downlink channel quality.

【0006】

Based on the DRC signal transmitted from each communication terminal, the base station sets a transmission rate for each communication terminal, and sends a signal to each communication terminal via a control channel indicating communication resource allocation to each communication terminal. Generally, taking improvement of system transmission efficiency into consideration, communication resources are allocated with priority to the communication terminal that has the best downlink channel quality—that is to say, the communication terminal that transmits the highest-numbered DRC signal.

【0007】

The base station then transmits data only to the relevant communication terminal in its allocated time. For example, if time t1 has been allocated to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

【0008】

In this way, data transmission efficiency has conventionally been increased for the overall system by setting a transmission rate for each communication terminal according to channel quality by means of HDR, and performing communication resource allocation with priority to a communication terminal with a high transmission rate at which communication is possible.

【0009】

[PROBLEMS TO BE SOLVED BY THE INVENTION]

However, if the communication mode determined by a communication terminal is received erroneously by the base station due to deterioration of the channel conditions on the uplink from the communication terminal to the base station, or the like, the base station will transmit data using that erroneous mode. As the determined communication mode and the communication mode of data transmitted to the communication terminal are different, the communication terminal cannot demodulate or decode the data.

【0010】

Also, when a base station such as that described above has allocated time t1 to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

【0011】

Due to the above, a problem arises in that, if the communication mode determined by a communication terminal is received erroneously by the base station, there will be an interval during which time-divided communication resources are not used, and downlink throughput falls.

【0012】

The present invention is carried out in view of the foregoing, and the object of the present invention is to provide a communication terminal apparatus, base station apparatus, and radio communication method that make it possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated in time division to communication terminals based on downlink channel quality.

【0013】

[MEANS FOR SOLVING THE PROBLEMS]

A communication terminal apparatus of the present invention comprises: measuring means for measuring downlink channel quality; generating means for generating a notification signal to notify the channel quality to a base station apparatus; and transmitting means for transmitting the notification signal indicating a good channel quality relatively less susceptible to errors in a propagation path.

【0014】

According to this constitution, because a notification signal indicating a good channel quality is made relatively less susceptible to errors in a propagation path and then transmitted, a base station is able to keep the error occurrence rate for a notification signal which is selected at a relatively greater number of occurrences in low. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous notification signal, and so to prevent a fall in downlink throughput.

【0015】

In a communication terminal apparatus of the present invention, transmitting means transmits with transmission power increased in proportion to a notification signal that indicates that channel quality is good.

【0016】

According to this constitution, because a notification signal indicating a good channel quality is transmitted with relatively higher transmission power, a notification signal indicating good downlink quality is transmitted with relatively less susceptibility to errors.

【0017】

A communication terminal apparatus of the present invention further comprises controlling means for controlling transmission power of a pilot signal; wherein said transmitting means transmits with a notification signal that indicates channel quality better than a predetermined channel quality set to higher transmission power than the pilot signal transmission power, and a notification signal that indicates channel quality poorer than the predetermined channel quality set to lower transmission power than the pilot signal transmission power.

【0018】

According to this constitution, in comparison with the transmission power for sending conventional notification signals, both of notification signals with higher transmission power and notification signals with lower transmission power are transmitted; therefore the average transmission power for sending notification signals are kept the same as for sending conventional notification signals, while at the same time notification signals indicating good channel quality are transmitted with less susceptibility to errors. That is to say, it is possible to proportionally reduce susceptibility to errors of notification signals indicating that downlink channel quality is good without reducing downlink capacity compared with a conventional system.

【0019】

A communication terminal apparatus under the present invention further comprises: a table that indicates a correspondence between a notification signal and transmission power; and rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein said transmitting means adjusts a notification signal to predetermined transmission power based on said table.

【0020】

According to this constitution, because the table is rewritten adaptively in response to changes in communication conditions, error occurrence rate on notification signals is kept low even if the communication conditions deteriorates.

【0021】

In a communication terminal apparatus of the present invention, transmitting means transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that channel quality is good.

【0022】

According to this constitution, because a notification signal indicating a good channel quality is transmitted after being subjected to conversion to a code word with a size of a code word minimum distance proportional to a notification signal, a notification signal indicating good downlink quality is transmitted with relatively less susceptibility to errors. Moreover, according to this constitution, it is possible to change the degree of insusceptibility to errors of code words corresponding to each of notification signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

【0023】

A communication terminal apparatus under the present invention further comprises: a table that indicates a correspondence between a notification signal and a code word; and rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein transmitting means converts a notification signal to a predetermined code word based on said table.

【0024】

According to this constitution, because the table is rewritten adaptively in response to changes in communication conditions, error occurrence rate on notification signals is kept low even if the communication conditions deteriorates.

【0025】

A communication terminal apparatus under the present invention further comprises determining means for determining a communication mode indicated by a combination of modulation method and coding method based on channel quality; wherein generating means makes a notification signal a signal that indicates said communication mode.

【0026】

According to this constitution, it is possible to represent a notification signal with very small number of bits, which heightens uplink channel utilization efficiency.

【0027】

In a communication terminal apparatus under the present invention, measuring means measures pilot signal reception quality; and generating means makes a notification signal a signal that indicates a pilot signal reception quality value.

【0028】

According to this constitution, there is no need to determine a communication mode at a communication terminal side, which offers the advantage of enabling communication terminal power consumption and apparatus size to be reduced.

【0029】

A base station apparatus under the present invention comprises: receiving means for receiving a notification signal transmitted from any of the above communication terminal apparatuses; measuring means for measuring reception power of the notification signal; detecting means for detecting a notification signal whose reception power is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

【0030】

A base station apparatus under the present invention comprises: receiving means for receiving a notification signal transmitted from any of the above communication terminal apparatuses; measuring means for measuring likelihood of the notification signal; detecting means for detecting a notification signal whose likelihood is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

【0031】

According to these constitutions, notification signals more susceptible to errors are excluded in determining communication resource allocation, it is possible to prevent communication resource allocation from being determined based on erroneous notification signals.

【0032】

A base station apparatus under the present invention further comprises: calculating means for calculating a rate of detection by detecting means; and transmitting means for transmitting a control signal instructing the above communication terminal apparatus to rewrite the table based on a result of comparison of the rate of detection and a predetermined threshold value.

【0033】

According to this constitution, because the communication terminal apparatus rewrites the table adaptively in response to changes in communication conditions, error occurrence rate on notification signals is kept low even if the communication conditions deteriorates.

【0034】

In a radio communication method of the present invention, a communication terminal apparatus measures downlink channel quality, generates a notification signal for notifying information indicating the channel quality to a base station apparatus, and transmits the notification signal indicating a good channel quality relatively less susceptible to errors in a propagation path, whereas the base station apparatus determines downlink communication resource allocation using the notification signal.

【0035】

According to this method, because a notification signal indicating a good channel quality is made relatively less susceptible to errors in a propagation path and then transmitted, a base station is able to keep the error occurrence rate for a notification signal which is selected at a relatively greater number of occurrences in low. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous notification signal, and so to prevent a fall in downlink throughput.

【0036】

[DESCRIPTION OF THE SPECIAL EMBODIMENTS]

As stated above, a base station allocates communication resources with priority to the communication terminal with the best downlink channel quality. In other words, a base station selects the highest-numbered DRC signal, and allocates communication resources with priority to the communication terminal that transmitted that selected DRC signal. Thus, DRC signal selection frequency is as shown in FIG 1. FIG 1 is a graph illustrating DRC signal selection frequency in a base station. In this figure, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better channel quality.

【0037】

As shown in FIG 1, the higher the number of a DRC signals, the greater is the frequency of its selection by the base station. That is to say, the better the downlink channel quality of a communication terminal, the higher is the frequency with which communication resources are allocated to that communication terminal. This kind of relationship arises from the fact that there are many communication terminals, and there is an increased probability of there being a communication terminal with good downlink channel quality.

【0038】

Thus, noting the fact that the selection frequency of each DRC signal differs according to channel quality, the inventors conceived the present invention. That is to say, the inventors arrive at the present invention by discovering the fact that downlink throughput will fall to a greater degree if a DRC signal indicating that downlink channel quality is good is received erroneously because a DRC signal indicating that downlink channel quality is good tends to be selected with greater frequency. Put another way, the inventors arrive at the present invention by discovering the fact that an impact to downlink throughput fall is relatively small even if a DRC signal indicating that downlink channel quality is poor is received erroneously because a DRC signal indicating that downlink channel quality is poor tends to be selected with lesser frequency.

【0039】

In short, the essence of the present invention lies in that a communication terminal transmits information indicating a good downlink channel quality to a base station, made less susceptible to errors in a propagation path, thereby to prevent a fall in downlink throughput

【0040】

With reference to the attached drawings, embodiments of the present invention will be explained in detail below.

(Embodiment 1)

A communication terminal according to Embodiment 1 of the present invention transmits at proportionally higher transmission power a DRC signal indicating that downlink channel quality is good. Also, a base station according to Embodiment 1 of the present invention excludes DRC signals with reception power lower than a predetermined threshold value in performing communication resource allocation.

【0041】

FIG 2 is a block diagram showing the configuration of a base station according to Embodiment 1 of the present invention;

In FIG 2, an allocation section 101 determines communication resource allocation to each communication terminal based on DRC signals excluding DRC signals detected by unused DRC detection sections 116 described later herein from among DRC signals extracted by demodulators 114 described later herein. Then, based on the determined communication resource allocation, the allocation section 101 notifies a buffer 102 for output of downlink transmit data, indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104.

【0042】

The buffer 102 holds downlink transmit data, and outputs downlink transmit data for a predetermined communication terminal to the adaptive coding section 103 in accordance with the directions of the allocation section 101. The adaptive coding section 103 codes the output signal from the buffer 102 in accordance with the directions of the allocation section 101, and outputs the resulting signal to the adaptive modulator 104. The adaptive modulator 104 modulates the output signal from the adaptive coding section 103 in accordance with the directions of the allocation section 101, and outputs the resulting signal to a spreading section 105. Spreading section 105 spreads the output signal from the adaptive modulator 104, and outputs the resulting signal to a multiplexer 108.

【0043】

A modulator 106 modulates the pilot signal and outputs the resulting signal to a spreading section 107. Spreading section 107 spreads the output signal from modulator 106 and outputs the resulting signal to a multiplexer 108.

【0044】

The multiplexer 108 performs time multiplexing of the spread pilot signal with the spread downlink transmit data at predetermined intervals, and outputs the resulting signal to a transmit RF section 109. The transmit RF section 109 converts the frequency of the output signal from the multiplexer 108 to radio frequency, and outputs the resulting signal to a duplexer 110.

【0045】

The duplexer 110 transmits the output signal from the transmit RF section 109 as a radio signal from an antenna 111 to a communication terminal. Moreover, the duplexer 110 outputs the signals transmitted from each communication terminal and received by antenna 111 to receive RF section 112.

【0046】

A receive RF section 112 converts the frequency of a radio frequency signal output from the duplexer 110 to base band, and outputs the resulting signal to a despreading section 113. The despreading section 113 despreads the base band signal using the spreading code used to spread the DRC signal, and outputs the resulting signal to the demodulator 114 and a reception power calculation section 115.

【0047】

The demodulator 114 demodulates the output signal from the despreading section 113 and extracts the DRC signal, and outputs this signal to the allocation section 101.

【0048】

The reception power calculation section 115 measures the reception power of the despread DRC signal, which is output to the unused DRC detection section 116. In the unused DRC detection section 116 is set a predetermined threshold value, as described later herein, and a DRC signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 101.

【0049】

A despreading section 113, demodulator 114, reception power calculation section 115, and unused DRC detection section 116 are provided for each communication terminal. From each demodulator 114 a DRC signal for the corresponding communication terminal is output, and from each unused DRC detection section 116 a detection result for the corresponding communication terminal is output.

【0050】

FIG 3 is a block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention. In FIG 3, a communication mode determination section 201 determines a communication mode indicating a combination of modulation method and coding method based on a CIR measured by a CIR measurement section 219 described later herein, and outputs the result to a DRC signal creation section 202. The communication mode determination section 201 also indicates the downlink receive data demodulation method to an adaptive demodulator 216, and indicates the downlink receive data decoding method to an adaptive decoding section 217, based on the determined communication mode.

【0051】

The DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode output from the communication mode determination section 201, and outputs this DRC signal to a modulator 203 and DRC power controller 205.

【0052】

Modulator 203 modulates the DRC signal and outputs the resulting signal to a spreading section 204. spreading section 204 spreads the output signal from modulator 203 and outputs the resulting signal to the DRC power controller 205. The DRC power controller 205 refers to a transmission power table 206 that shows the correspondence between DRC numbers and transmission power, controls the DRC signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209 described later herein, and outputs the DRC signal that has undergone transmission power control to a multiplexer 210. The actual method of controlling DRC signal transmission power will be described later herein.

【0053】

A modulator 207 modulates the pilot signal and outputs the resulting signal to a spreading section 208. Spreading section 208 spreads the output signal from modulator 207 and outputs the resulting signal to the pilot power controller 209. The pilot power controller 209 controls the transmission power of the pilot signal, and outputs the pilot signal that has undergone transmission power control to the multiplexer 210. The pilot power controller 209 also outputs the pilot signal transmission power to the DRC power controller 205.

【0054】

The multiplexer 210 performs time multiplexing of the DRC signal that has undergone transmission power control and the pilot signal that has undergone transmission power control at predetermined intervals, and outputs the resulting signal to a transmit RF section 211. The transmit RF section 211 converts the frequency of the output signal from the multiplexer 210 to radio frequency, and outputs the resulting signal to a duplexer 212.

【0055】

The duplexer 212 transmits the output signal from the transmit RF section 211 as a radio signal from an antenna 213 to the base station. Also, a signal transmitted as a radio signal by the base station and received as a radio signal by the antenna 213 is output by the duplexer 212 to a receive RF section 214.

【0056】

The receive RF section 214 converts the frequency of the radio frequency signal output from the duplexer 212 to base band, and outputs the resulting signal to a despreading section 215 and a despreading section 218.

【0057】

Despreading section 215 despreads the data component of the base band signal and outputs the resulting signal to the adaptive demodulator 216. The adaptive demodulator 216 demodulates the output signal from despreading section 215 in accordance with the directions of the communication mode determination section 201, and outputs the resulting signal to the adaptive decoding section 217. The adaptive decoding section 217 decodes the output signal from the adaptive demodulator 216 in accordance with the directions of the communication mode determination section 201, and obtains receive data.

【0058】

Despreading section 218 despreads the pilot signal component of the base band signal and outputs the resulting signal to a CIR measurement section 219. The CIR measurement section 219 measures the CIR of the pilot signal output from despreading section 218, and outputs the result to the communication mode determination section 201.

【0059】

Next, the procedure for transmission/reception of signals between the base station shown in FIG 2 and the communication terminal shown in FIG 3 will be described.

【0060】

First, at the start of communication, a pilot signal is modulated by the modulator 106 in the base station, is spread by spreading section 107, and is output to the multiplexer 108. Only the spread pilot signal is output from the multiplexer 108 to the transmit RF section 109. The spread pilot signal is frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

【0061】

A radio signal of only the pilot signal component transmitted as a radio signal from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to base band by the receive RF section 214. The pilot signal component of the base band signal is despread by despreading section 218, and output to the CIR measurement section 219.

【0062】

Next, in the CIR measurement section 219, the CIR of the pilot signal output from despreading section 218 is measured, and based on the CIR, the communication mode is determined by the communication mode determination section 201. Then a DRC signal with a number corresponding to the communication mode is created by the DRC signal creation section 202.

【0063】

The DRC signal is modulated by modulator 203, spread by spreading section 204, and output to the DRC power controller 205. In the DRC power controller 205, the DRC signal transmission power is controlled based on the transmission power of the pilot signal output from the pilot power controller 209, and the ratios of pilot signal transmission power to DRC signal transmission power set beforehand in the transmission power table 206.

【0064】

The contents set in the transmission power table 206 will be described below. FIG 4 is a drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention.

【0065】

The transmission power table 206 shows the correspondence between DRC numbers and DRC signal transmission power, set so that the higher the DRC number, the higher is the transmission power. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the transmission power table 206, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power.

【0066】

As explained above, the frequency of selection by the base station tends to be proportional to the downlink channel quality indicated by a DRC signal, and therefore in this embodiment, transmission power is higher, and susceptibility to errors lower, the better the downlink channel quality indicated by a DRC signal. As a result, the probability of a DRC signal that indicates that downlink channel quality is good being received erroneously can be made lower than the probability of a DRC signal that indicates that downlink channel quality is poor being received erroneously. In other words, the probability of a DRC signal with a high frequency of selection by the base station being received erroneously can be made lower than the probability of a DRC signal with a low frequency of selection by the base station being received erroneously.

【0067】

The DRC signal transmission power values set in the transmission power table 206 are expressed as a ratio to the pilot signal transmission power. Here, as shown in FIG 4, the settings are arranged so that DRC number 3 in the middle of DRC numbers 1 to 5 is taken as a reference, and DRC signals indicating a lower number than DRC number 3 are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a higher number than DRC number 3 are transmitted at higher transmission power than the pilot signal transmission power. That is to say, the settings are arranged so that DRC signals indicating a poorer channel quality than a predetermined channel quality (here, the channel quality corresponding to a DRC signal with DRC number 3) are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a better channel quality than the predetermined channel quality are transmitted at higher transmission power than the pilot signal transmission power.

【0068】

Thus, with this embodiment, by setting DRC signals for which transmission power is increased and DRC signals for which transmission power is decreased in comparison with conventional DRC signal transmission power (here, that is, pilot signal transmission power), and making the total of DRC signal transmission power increases and decreases ±0 dB, it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors while keeping average DRC signal transmission power constant compared with a conventional system. That is to say, it is possible to proportionally reduce susceptibility to errors of DRC signals indicating that downlink channel quality is good without reducing uplink capacity compared with a conventional system.

【0069】

Also, since, in this way, DRC signals indicating that downlink channel quality is poor (DRC signals with DRC numbers 1 and 2 in FIG 4) are transmitted at lower transmission power than in a conventional system, it is possible to reduce power consumption in a communication terminal that is located far from the base station and for which there is a high probability of transmitting a DRC signal indicating that downlink channel quality is poor. That is to say, in the case of a communication terminal that transmits a DRC signal indicating that downlink channel quality is poor, whereas the DRC signal was previously transmitted at transmission power that was high to begin with, according to this embodiment the DRC signal transmission power can be made lower than that high transmission power, enabling communication terminal power consumption to be greatly reduced.

【0070】

As the frequency of selection by a base station is low to begin with for a DRC signal indicating that downlink channel quality is poor, there is almost no effect of producing a fall in throughput due to transmitting a DRC signal indicating that downlink channel quality is poor at lower transmission power than previously in this way.

【0071】

Also, with this embodiment, DRC signals indicating that uplink channel quality is good (DRC signals with DRC numbers 4 and 5 in FIG 4) are transmitted at higher transmission power than in a conventional system. However, there is a high possibility of a DRC signal indicating that uplink channel quality is good being transmitted from a communication terminal located comparatively near the base station. Also, due to pilot signal transmission power control that is performed constantly on an uplink, the transmission power of a pilot signal transmitted from a communication terminal located comparatively near the base station (that is, the conventional DRC signal transmission power) is low to begin with. Therefore, in the case of a communication terminal that transmits a DRC signal indicating that uplink channel quality is good, DRC signal transmission power remains low and power consumption remains low even though the previously originally low DRC signal transmission power increases, and so there is almost no effect on power consumption.

【0072】

In the DRC power controller 205, the DRC signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 206. Then, in the DRC power controller 205, the transmission power of the DRC signal output from spreading section 204 is adjusted to this obtained transmission power, and a DRC signal that has been subjected to transmission power control is output to the multiplexer 210. To give a specific example, if the number of the DRC signal output from the DRC signal creation section 202 to the DRC power controller 205 is 5, the transmission power of the DRC signal output from spreading section 204 is adjusted to a transmission power 2 dB lower than the transmission power of the pilot signal output from the pilot power controller 209.

【0073】

The DRC signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by the transmit RF section 211, and transmitted to the base station as a radio signal from the antenna 213 via the duplexer 212.

【0074】

The radio signal transmitted from the communication terminal is received by the antenna 111 of the base station, and input to the receive RF section 112 via the duplexer 110. The signal input to the receive RF section 112 is frequency-converted to base band, despread by the despreading section 113 using the spreading code used to spread the DRC signal, and output to the demodulator 114 and reception power calculation section 115.

【0075】

In the demodulator 114 the output signal from the despreading section 113 is demodulated, and the DRC signal is extracted and output to the allocation section 101.

【0076】

Here, since a DRC signal indicating that downlink channel quality is poor is transmitted by a communication terminal at lower transmission power than in a conventional system, the probability of a DRC signal indicating that downlink channel quality is poor being received erroneously by the base station is increased. Also, as stated above, if communication resource allocation is performed based on an erroneously received DRC signal, downlink throughput will fall.

【0077】

Thus, in the reception power calculation section 115, the reception power of the despread DRC signal is measured, and is output to the unused DRC detection section 116. The lowest reception power at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest (a DRC signal with DRC number 1 in FIG 4) has been set beforehand in the unused DRC detection section 116 as a threshold value. Then, in the unused DRC detection section 116, a DRC signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 101. A DRC signal detected by the unused DRC detection section 116 is a DRC signal that is not used by the allocation section 101 in determining communication resource allocation.

【0078】

In the allocation section 101, communication resource allocation to each communication terminal is determined based on the DRC signals remaining after DRC signals detected by the unused DRC detection section 116 have been excluded from the DRC signals extracted by the demodulator 114.

【0079】

Thus, in a base station according to this embodiment, a DRC signal of reception power lower than the lowest reception power at which a DRC signal indicating that downlink channel quality is poorest is not received erroneously is excluded. That is to say, in a base station according to this embodiment, a notification signal susceptible to errors is excluded in determining downlink communication resource allocation. Therefore, according to a base station of this embodiment, even though a DRC signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on an erroneous DRC signal.

【0080】

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

【0081】

A base station according to this embodiment may also be configured as shown in FIG 5. FIG 5 is a block diagram showing another configuration of a base station according to Embodiment 1 of the present invention; That is to say, a base station may be configured in such a way that the reception power calculation section 115 and unused DRC detection section 116 shown in FIG 2 are replaced by a likelihood calculation section 301 and unused DRC detection section 302. In the following description, parts identical to those in FIG 2 are assigned the same reference numerals as in FIG 2 and their detailed explanations are omitted.

【0082】

In FIG 5, the likelihood calculation section 301 calculates a likelihood that indicates the probable degree of certainty of a DRC signal, and outputs the calculation result to the unused DRC detection section 302. The lowest likelihood at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest has been set beforehand in the unused DRC detection section 302 as a threshold value. Then, in the unused DRC detection section 302, a DRC signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 101.

【0083】

In this way the same effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG 5.

【0084】

(Embodiment 2)

In a communication terminal according to Embodiment 2 of the present invention, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted.

【0085】

FIG 6 is a block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 203, spreading section 204, DRC power controller 205, and transmission power table 206 shown in FIG 3 are replaced by a code word selector 401, code word table 402, modulator 403, and spreading section 404. In the following description, parts identical to those in FIG 3 are assigned the same reference numerals as in FIG 3 and their detailed explanations are omitted.

【0086】

The code word selector 401 refers to the code word table 402, converts a DRC signal created by the DRC signal creation section 202 to a predetermined code word, and outputs the code word to modulator 403. Modulator 403 modulates the code word and outputs it to spreading section 404. Spreading section 404 spreads the output signal from modulator 403 and outputs the resulting signal to a multiplexer 210.

【0087】

Next, the operation of a communication terminal according to this embodiment will be described.

First, the contents set in the code word table 402 will be described. FIG 7 is a drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention.

【0088】

The code word table 402 shows the correspondence between DRC numbers and code words after DRC signal conversion, set so that the higher the DRC number, the larger is the code word minimum distance of the code word to which the DRC signal is converted. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the code word table 402, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which the DRC signal is converted.

【0089】

Here, "code word distance" is the number of bits that differ between code words, and "code word minimum distance" is the minimum number of bits by which a particular code word differs with respect to all other code words. To be specific, the code word for a DRC signal with DRC number 5 is "111111111", and this code word "111111111" differs by a minimum of 6 bits when compared with any of the code words corresponding to DRC signals with DRC numbers 1 to 4.

Therefore, the code word minimum distance of the code word for a DRC signal with DRC number 5 is 6. Similarly, the code word minimum distance of the code word for a DRC signal with DRC number 4 is 3.

【0090】

Thus, the code word for a DRC signal with DRC number 5 is less likely to be mistaken for another code word than the code word for a DRC signal with DRC number 4. That is to say, the larger code word minimum distance of a code word, the less likely it is to be mistaken for another code word.

【0091】

In the code word selector 401, a DRC signal output from the DRC signal creation section 202 is converted to a code word set in the code word table 402, and output to modulator 403. To give a specific example, if the DRC signal output from the DRC signal creation section 202 is a number 5 DRC signal, it is converted to code word "111111111".

【0092】

Following conversion, the code word is modulated by modulator 403 and spread by spreading section 404. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

【0093】

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

【0094】

Also, according to this embodiment, it is possible to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high without increasing DRC signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal without increasing communication terminal power consumption.

【0095】

Moreover, according to this embodiment, it is possible to change the degree of insusceptibility to errors of code words corresponding to DRC signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

【0096】

(Embodiment 3)

A base station according to Embodiment 3 of the present invention transmits to a communication terminal a control signal for table rewriting based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined, and a communication terminal according to Embodiment 3 of the present invention rewrites the contents of a transmission power table or code word table based on a control signal transmitted from the base station.

【0097】

FIG 8 is a block diagram showing the configuration of a base station according to Embodiment 3 of the present invention; As shown in this figure, a base station according to this embodiment is configured by further providing the configuration shown in FIG 2 with a detection rate calculation section 501, control signal creation section 502, modulator 503, and spreading section 504. In the following description, parts identical to those in FIG 2 are assigned the same reference numerals as in FIG 2 and their detailed explanations are omitted.

【0098】

In FIG 8, the detection rate calculation section 501 calculates the rate of detection by the unused DRC detection section 116 and outputs the result to the control signal creation section 502. That is to say, the detection rate calculation section 501 calculates the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined.
Based on the detection rate, the control signal creation section 502 creates a control signal for table rewriting (hereinafter referred to as "table rewrite signal"), which is output to modulator 503. Modulator 503 modulates the table rewrite signal and outputs it to spreading section 504. Spreading section 504 spreads the output signal from modulator 503 and outputs the resulting signal to a multiplexer 108.

【0099】

FIG 9 is a block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured by further providing the configuration shown in FIG 3 with a despreading section 601, demodulator 602, and table rewriting section 603. In the following description, parts identical to those in FIG 3 are assigned the same reference numerals as in FIG 3 and their detailed explanations are omitted.

【0100】

In FIG 9, despreading section 601 despreads a base band signal using the spreading code used to spread the table rewrite signal, and outputs the resulting signal to the demodulator 602. The demodulator 602 demodulates the output signal from despreading section 601 and extracts the table rewrite signal, which is output to the table rewriting section 603. The table rewriting section 603 rewrites the contents of the transmission power table in accordance with the table rewrite signal.

【0101】

Next, the procedure for transmission/reception of signals between the base station shown in FIG 8 and the communication terminal shown in FIG 9 will be described.

【0102】

First, in the detection rate calculation section 501 of the base station, the detection rate of the unused DRC detection section 116 is calculated and is output to the control signal creation section 502. The detection rate can be calculated, for example, from the number of detections in a predetermined time.

【0103】

A predetermined threshold value for the detection rate has been set in the control signal creation section 502, and this threshold value is compared with the detection rate calculated by the detection rate calculation section 501. If the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be increased is created, and is output to modulator 503. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all DRC signal transmission power values to be increased simultaneously from their current values.

【0104】

The table rewrite signal is modulated by modulator 503, spread by spreading section 504, and output to the multiplexer 108. The spread table rewrite signal is multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

【0105】

The radio signal transmitted from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to base band by the receive RF section 214. The base band signal is despread by despreading section 601 and demodulated by the demodulator 602, and the table rewrite signal is extracted. The extracted table rewrite signal is output to the table rewriting section 603.

【0106】

The contents of the transmission power table 206 are then rewritten by the table rewriting section 603 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 increases all the transmission power values set in the transmission power table 206.

【0107】

In the above description, the configuration is such that the table rewriting section 603 rewrites the contents of the transmission power table 206, but this embodiment may also be applied to a communication terminal according to Embodiment 2, and a configuration may be used whereby the table rewriting section 603 rewrites the contents of the code word table 402 shown in FIG 6.

【0108】

In this case, if the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, the control signal creation section 502 of a base station according to this embodiment creates a table rewrite signal ordering all code word minimum distances set in the code word table 402 to be increased. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all code word minimum distances of code words corresponding to DRC signals to be increased simultaneously from their current values. Then the table rewriting section 603 rewrites the contents of the code word table 402 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 rewrites the code words set in the code word table 402 with code words all of whose code word minimum distances are larger than at present.

【0109】

Thus, according to this embodiment, the contents of the transmission power table or code word table are rewritten based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined. In other words, in this embodiment, transmission power table or code word table contents are rewritten adaptively in accordance with variations in the communication environment. That is to say, according to this embodiment, when the communication environment deteriorates and the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined reaches or exceeds a predetermined threshold value, the transmission power of each DRC signal is increased, or the code word minimum distance of the code word corresponding to each DRC signal is increased, thereby enabling the DRC signal error occurrence rate to be held down even when the communication environment deteriorates.

【0110】

In this embodiment, the predetermined detection rate threshold value is decided upon considering appropriately the environment in which the communication system is used.

【0111】

Moreover, with this embodiment, it is also possible to further set a second predetermined threshold value in the control signal creation section 502 to create a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be decreased when the detection rate calculated by the detection rate calculation section 501 falls below this second threshold value. By this means, it is possible to reduce DRC signal transmission power when DRC signal reception quality becomes excessive, thereby enabling communication terminal power consumption to be decreased.

【0112】

Furthermore, in this embodiment, table rewriting is performed based on the rate of detection by the unused DRC detection section 116, but it is also possible to rewrite a table based on the distribution of DRC signals used in determining communication resource allocation from among DRC signals transmitted from mobile stations, so that that distribution is optimized. In this case, the base station shown in FIG 8 is configured with the detection rate calculation section replaced by a used DRC distribution determination section, which determines the distribution of DRC signals used in communication resource allocation determination based on DRC signals output from the demodulator 114 and detection results output from the unused DRC detection section 116, and outputs a signal indicating that distribution to the control signal creation section 502. The control signal creation section 502 then creates a table rewrite signal based on the signal indicating the distribution output from the used DRC distribution determination section.

【0113】

(Embodiment 4)

A communication terminal according to Embodiment 4 of the present invention transmits at higher transmission power in proportion to CIR information that indicates that downlink channel quality is good. A base station according to Embodiment 4 of the present invention excludes CIR information for which the reception power is lower than a predetermined threshold value in performing communication resource allocation.

【0114】

In above-described Embodiment 1, a communication terminal determines the communication mode based on the CIR and transmits a DRC signal corresponding to that determined communication mode to the base station at predetermined transmission power, and the base station determines communication resource allocation to each communication terminal based on the DRC signals. DRC signal can be represented with far fewer bits than other information indicating downlink channel quality (such as a downlink CIR, for example), and therefore use of a DRC signal has the advantage of enabling the downlink channel utilization efficiency to be increased. On the other hand, since a communication terminal must be provided with a table for communication mode determination, a table for DRC signal creation, and so forth to determine the communication mode and create a DRC signal, there are the disadvantages of increased communication terminal power consumption and apparatus size.

【0115】

Thus, in this embodiment, a communication terminal transmits CIR information to the base station at predetermined transmission power, and the base station determines the communication mode based on the CIR information and then determines communication resource allocation to each communication terminal. As a result, although there is the disadvantage of a slight decrease in the uplink channel utilization efficiency, the fact that communication terminals do not have to determine the communication mode and create a DRC signal, and do not need to be provided with a communication mode determination table, DRC signal creation table, and so forth, offers the major advantage of enabling communication terminal power consumption and apparatus size to be reduced. Also, in this embodiment, it is possible for CIR information for a plurality of terminals to be compared in the base station, and the correct communication mode to be determined with certainty, making this embodiment particularly useful in cases such as those where it is not possible for the communication mode to be determined simply from the CIR in each communication terminal.

【0116】

A base station according to this embodiment and a communication terminal according to this embodiment will be described below. FIG 10 is a block diagram showing the configuration of a base station according to Embodiment 4 of the present invention; In the following description, parts identical to those in FIG 2 are assigned the same reference numerals as in FIG 2 and their detailed explanations are omitted.

【0117】

In FIG 10, a demodulator 701 demodulates the output signal from a despreading section 113, and extracts a signal that contains CIR information (hereinafter referred to as "CIR signal"), which is output to an allocation section 704.

【0118】

A reception power calculation section 702 measures the reception power of the despread CIR signal, which is output to an unused CIR detection section 703. In the unused CIR detection section 703 is set a predetermined threshold value in the same way as in Embodiment 1, and a CIR signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 704.

【0119】

A despreading section 113, demodulator 701, reception power calculation section 702, and unused CIR detection section 703 are provided for each communication terminal. From each demodulator 701 a CIR signal for the corresponding communication terminal is output, and from each unused CIR detection section 703 a detection result for the corresponding communication terminal is output.

【0120】

The allocation section 704 determines communication resource allocation to each communication terminal based on CIR information indicated by CIR signals excluding CIR signals detected by the unused CIR detection sections 703 from among the CIR signals extracted by the demodulators 701. Then, based on the determined communication resource allocation, the allocation section 704 notifies a buffer 102 for output of downlink transmit data, and outputs the CIR information to a communication mode determination section 705.

【0121】

Based on the CIR information output from the allocation section 704, the communication mode determination section 705 determines the communication mode, which indicates a combination of modulation method and coding method, and outputs a signal indicating this communication mode to a modulator 706. In addition, based on the determined communication mode, the communication mode determination section 705 indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104. Modulator 706 modulates the signal indicating the communication mode and outputs it to a spreading section 707. Spreading section 707 spreads the output signal from modulator 706 and outputs the resulting signal to a multiplexer 108.

【0122】

FIG 11 is a block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention. In the following description, parts identical to those in FIG 3 are assigned the same reference numerals as in FIG 3 and their detailed explanations are omitted.

【0123】

In FIG 11, a CIR information creation section 801 creates a CIR signal indicating a CIR measured by a CIR measurement section 219, and outputs it to a modulator 802 and CIR information power controller 804. The modulator 802 modulates the CIR signal and outputs it to the spreading section 803. Spreading section 803 spreads the output signal from modulator 802 and outputs the spread signal to the CIR information power controller 804. The CIR information power controller 804 refers to a transmission power table 805 that shows the correspondence between CIR level and transmission power, and controls the CIR signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209, and outputs the CIR signal that has undergone transmission power control to a multiplexer 210.

【0124】

A despreading section 807 despreads the base band signal using the spreading code used to spread the signal indicating the communication mode, and outputs the despread signal to a communication mode detection section 808. The communication mode detection section 808 demodulates the output signal from despreading section 807 and detects the communication mode. Then, based on the detected communication mode, the communication mode detection section 808 indicates the downlink receive data demodulation method to an adaptive demodulator 216 and indicates the downlink receive data decoding method to an adaptive decoding section 217.

【0125】

Next, the procedure for transmission/reception of signals between the base station shown in FIG 10 and the communication terminal shown in FIG 11 will be described.

【0126】

First, in the communication terminal shown in FIG 11, the CIR of the pilot signal output from despreading section 218 is measured by the CIR measurement section 219, and a CIR signal is created by the CIR information creation section 801.

【0127】

The CIR signal is modulated by modulator 802, spread by spreading section 803, and output to the CIR information power controller 804. In the transmission power table 805, the correspondence between CIR level and CIR signal transmission power is shown in the same way as in Embodiment 1, set so that the CIR signal transmission power increases in proportion to the level of the CIR. That is to say, in the settings in transmission power table 805, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power. Also, as in Embodiment 1, the CIR signal transmission power values set in the transmission power table 805 are expressed as a ratio to the pilot signal transmission power.

【0128】

In the CIR information power controller 804, the CIR signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 805. Then, in the CIR information power controller 804, the transmission power of the CIR signal output from spreading section 803 is adjusted to this obtained transmission power, and a CIR signal that has been subjected to transmission power control is output to the multiplexer 210.

【0129】

The CIR signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

【0130】

In the base station shown in FIG 10, the output signal from the despreading section 113 is demodulated by demodulator 701, and the demodulated CIR signal is extracted and output to the allocation section 704. In the reception power calculation section 702, the reception power of the despread CIR signal is measured, and is output to the unused CIR detection section 703. The lowest reception power at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 703 as a threshold value, as in Embodiment 1. Then, in the unused CIR detection section 703, a CIR signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 704. A CIR signal detected by the unused CIR detection section 703 is a CIR signal that is not used by the allocation section 704 in determining communication resource allocation.

【0131】

In the allocation section 704, communication resource allocation to each communication terminal is determined based on the CIR shown by CIR signals remaining after CIR signals detected by the unused CIR detection section 703 have been excluded from the CIR signals extracted by the demodulator 701, and CIR information is output to the communication mode determination section 705.

【0132】

In the communication mode determination section 705, the communication mode is determined based on CIR information output from the allocation section 704, and a signal indicating this communication mode is output to modulator 706. The signal indicating the communication mode is modulated by modulator 706, spread by spreading section 707, multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to the communication terminal as a radio signal from an antenna 111 via a duplexer 110.

【0133】

In the communication terminal shown in FIG 11, a base band signal is despread by despreading section 807, and the despread signal is output to the communication mode detection section 808. In the communication mode detection section 808, the output signal from despreading section 807 is demodulated and the communication mode is detected, and based on the detected communication mode, the downlink receive data demodulation method is indicated to the adaptive demodulator 216 and the downlink receive data decoding method is indicated to the adaptive decoding section 217.

【0134】

Thus, according to this embodiment, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

【0135】

Also, according to this embodiment, as in Embodiment 1, a CRI signal of reception power lower than the lowest reception power at which a CIR signal indicating that downlink channel quality is poorest is not received erroneously is excluded, and therefore, even though a CIR signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on erroneous CIR information.

【0136】

A base station according to this embodiment may also be configured as shown in FIG 12. FIG 12 is a block diagram showing another configuration of a base station according to Embodiment 4 of the present invention; That is to say, a base station may be configured in such a way that the reception power calculation section 702 and unused CIR detection section 703 shown in FIG 10 are replaced by a likelihood calculation section 901 and unused CIR detection section 902. In the following description, parts identical to those in FIG 10 are assigned the same reference numerals as in FIG 10 and their detailed explanations are omitted.

【0137】

In FIG 12, the likelihood calculation section 901 calculates a likelihood that indicates the probable degree of certainty of a CRI signal, and outputs the calculation result to the unused CIR detection section 902. The lowest likelihood at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 902 as a threshold value. Then, in the unused CIR detection section 902, a CIR signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 704.

【0138】

In this way the same effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG 12.

【0139】

(Embodiment 5)

In a communication terminal according to Embodiment 5 of the present invention, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted.

【0140】

FIG 13 is a block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 802, spreading section 803, CIR information power controller 804, and transmission power table 805 shown in FIG 11 are replaced by a code word selector 1001, code word table 1002, modulator 1003, and spreading section 1004. In the following description, parts identical to those in FIG 11 are assigned the same reference numerals as in FIG 11 and their detailed explanations are omitted.

【0141】

The code word selector 1001 refers to the code word table 1002, converts a CIR signal created by the CIR information creation section 801 to a predetermined code word, and outputs it to modulator 1003. Modulator 1003 modulates the code word and outputs it to spreading section 1004.

Spreading section 1004 spreads the output signal from modulator 1003 and outputs the resulting signal to a multiplexer 210.

【0142】

Next, the operation of a communication terminal according to this embodiment will be described.

In the same way as in above-described Embodiment 2, the code word table 1002 shows the correspondence between CIR level and code words after CIR signal conversion, set so that the higher the CIR level, the larger is the code word minimum distance of the code word to which the CIR signal is converted. That is to say, in the settings in the code word table 1002, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which the CIR signal is converted.

【0143】

In the code word selector 1001, a CIR signal output from the CIR information creation section 801 is converted to a code word set in the code word table 1002, and output to modulator 1003. Following conversion, the code word is modulated by modulator 1003 and spread by spreading section 1004. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

【0144】

Thus, according to this embodiment, as in Embodiment 2, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

【0145】

Also, according to this embodiment, as in Embodiment 2, it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high without increasing CIR signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information without increasing communication terminal power consumption.

【0146】

Moreover, according to this embodiment, as in Embodiment 2, it is possible to change the degree of insusceptibility to errors of code words corresponding to CIR signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

【0147】

It is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 1 and a communication terminal according to above-described Embodiment 2. Moreover, it is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 4 and a communication terminal according to above-described Embodiment 5. In addition, it is also possible for the transmission power table provided in a communication terminal according to above-described Embodiment 4 and the code word table provided in a communication terminal according to above-described Embodiment 5 to be rewritten as appropriate based on a control signal from the base station, in the same way as in above-described Embodiment 3.

【0148】

Also, in above-described Embodiments 1 to 5, a case has been described where a pilot signal is time-multiplexed, but above-described Embodiments 1 to

5 are not limited to this, and can also be applied to a case where a pilot signal is code-multiplexed.

【0149】

Moreover, in above-described Embodiments 1 to 5, a CIR has been used as a value that indicates pilot signal reception quality, but this is not a limitation, and any value may be used as long as it is a value that indicates reception quality.

【0150】

Furthermore, in above-described Embodiments 1 to 5, the predetermined threshold value set in the unused DRC detection section or the unused CIR detection section is assumed to be a fixed value, but a configuration may also be used whereby the threshold value is varied adaptively in accordance with the DRC signal error rate or CIR signal error rate. 【0151】

[EFFECT OF THE INVENTION]

As described above, according to the present invention it is possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated in time division to communication terminals based on downlink channel quality.

[BRIEF DESCRIPTION OF DRAWINGS]

[FIG 1]

A graph illustrating DRC signal selection frequency in a base station;

[FIG 2]

A block diagram showing a configuration of a base station according to Embodiment 1 of the present invention;

[FIG 3]

A block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention;

[FIG 4]

A drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention;

[FIG 5]

A block diagram showing another configuration of a base station according to Embodiment 1 of the present invention;

[FIG 6]

A block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention;

[FIG 7]

A drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention;

[FIG 8]

A block diagram showing a configuration of a base station according to Embodiment 3 of the present invention;

[FIG 9]

A block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention;

[FIG 10]

A block diagram showing a configuration of a base station according to Embodiment 4 of the present invention;

[FIG 11]

A block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention;

[FIG 12]

A block diagram showing another configuration of a base station according to Embodiment 4 of the present invention;

[FIG 13]

A block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention;

[EXPLANATIONS OF LETTERS OR NUMERALS]

101, 704 Allocation Section

102 Buffer

103 Adaptive Coding Section

104 Adaptive Modulator

105, 107, 204, 208, 404, 504, 707, 803, 1004 Spreading Section

106, 203, 207, 403, 503, 706, 802, 1003 Modulator

108, 210 Multiplexer

113, 215, 218, 601 Despreading Section

114, 602, 701 Demodulator

115, 702 Reception Power Calculation Section

116, 302 Unused DRC Detection Section

201, 705 Communication Mode Determination Section

202 DRC Signal Creation Section

205 DRC Power Control Section

206, 805 Transmission Power Table

209 Pilot Power Controller

216 Adaptive Demodulator

217 Adaptive Coding Section

219 CIR Measurement Section

301, 901 Likelihood Calculation Section

401, 1001 Code Word Selector

402, 1002 Code Word Table

501 Detection Rate Calculation Section

502 Control Signal Creation Section

603 Table Rewriting Section

703, 902 Unused CIR Detection Section

801 CIR Information Creation Section

804 CIR Information Power Controller

[NAME OF DOCUMENT] ABSTRACT

[ABSTRACT]

»[OBJECT]

«To prevent a fall in downlink throughput in a communication system in which communication resources are allocated in time division to communication terminals based on downlink channel quality.

[OVERCOMING MEANS]

A communication mode determination section 201 determines the communication mode based on the CIR measured by a CIR measurement section 219; a DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode; and a DRC power controller 205 refers to a transmission power table 206 showing the correspondence between DRC numbers and transmission power, and, based on the transmission power of the pilot signal output from a pilot power controller 209, increases transmission power in proportion as the DRC signal indicates that downlink channel quality is good.

[SELECTED DRAWINGS] FIG 3

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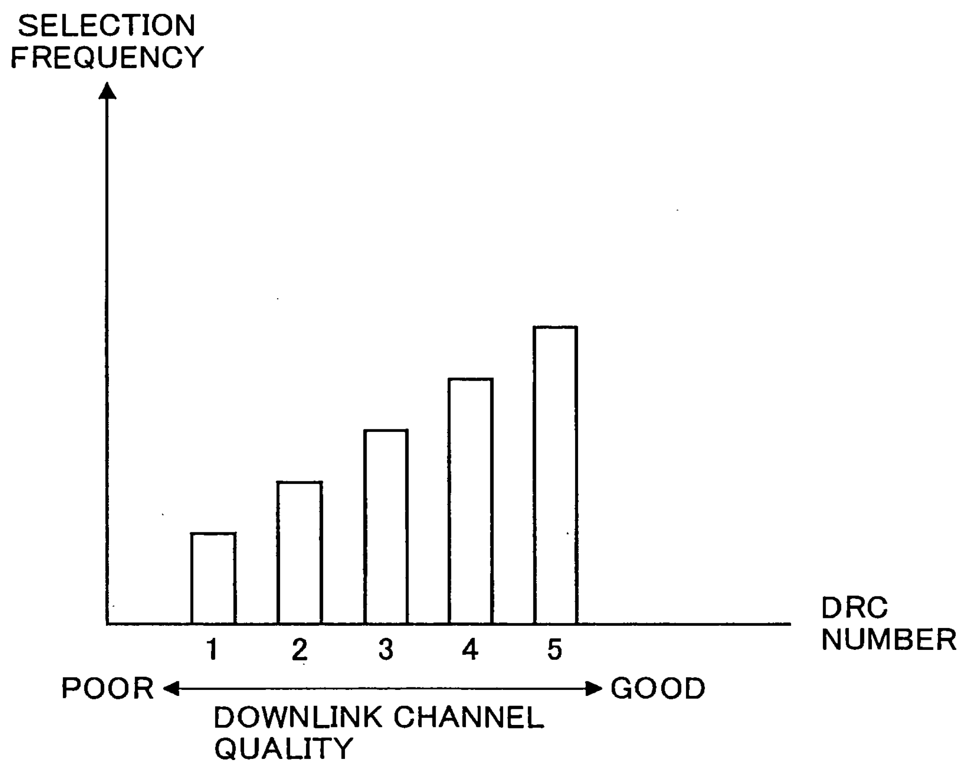
[NAME OF DOCUMENT] DRAWINGS

[FIG.1]



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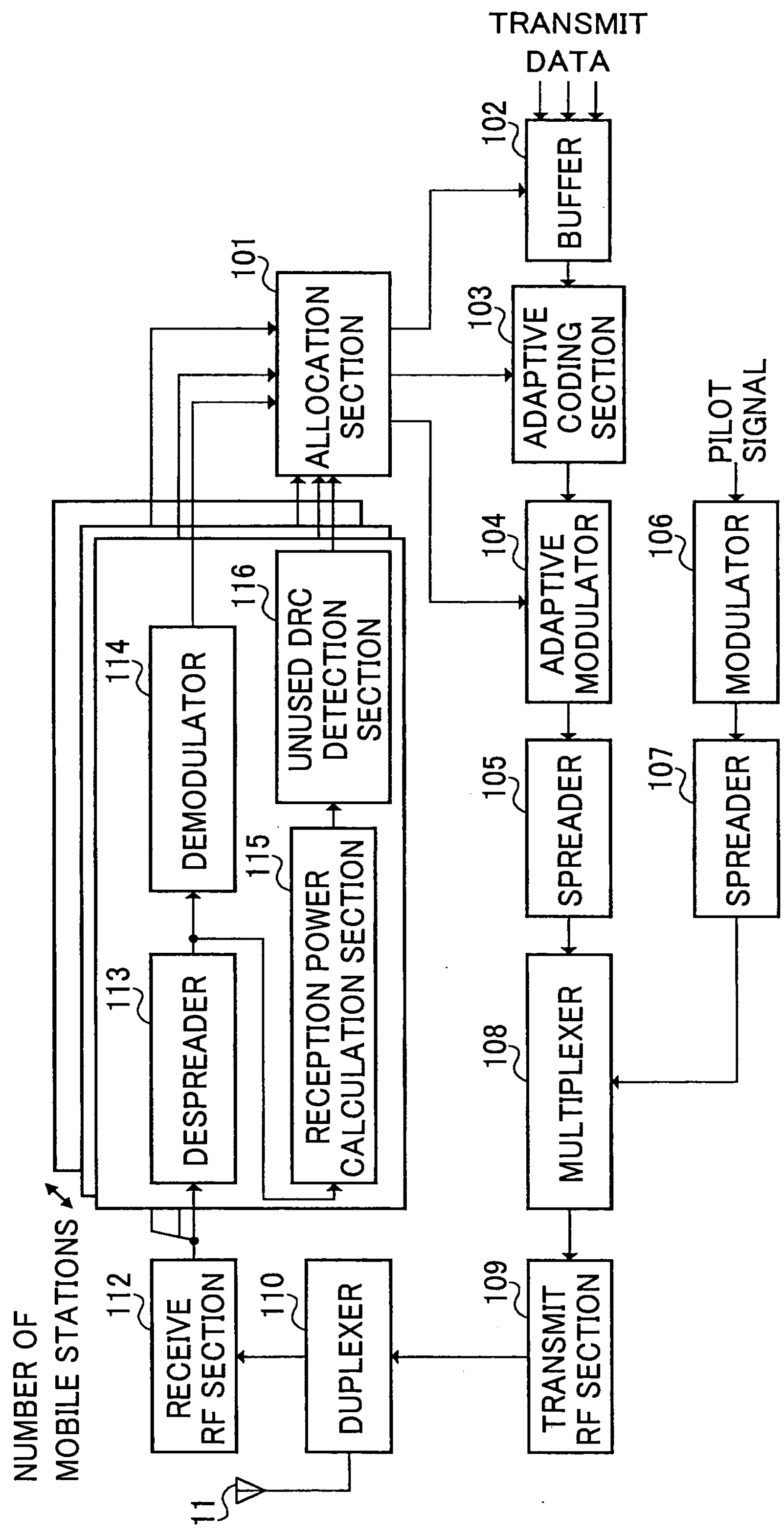
[FIG.2]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ADAPTIVE CODING SECTION
103
PILOT SIGNAL
ADAPTIVE MODULATOR
104
MODULATOR
106
UNUSED DRC DETECTION SECTION
116
DEMODULATOR
114
SPREADER
105
SPREADER
107
RECEPTION POWER CALCULATION SECTION
115
DESPREADER
113
MULTIPLEXER
108
NUMBER OF MOBILE STATIONS
RECEIVE RF SECTION
112
DUPLEXER
110
TRANSMIT RF SECTION
109
111

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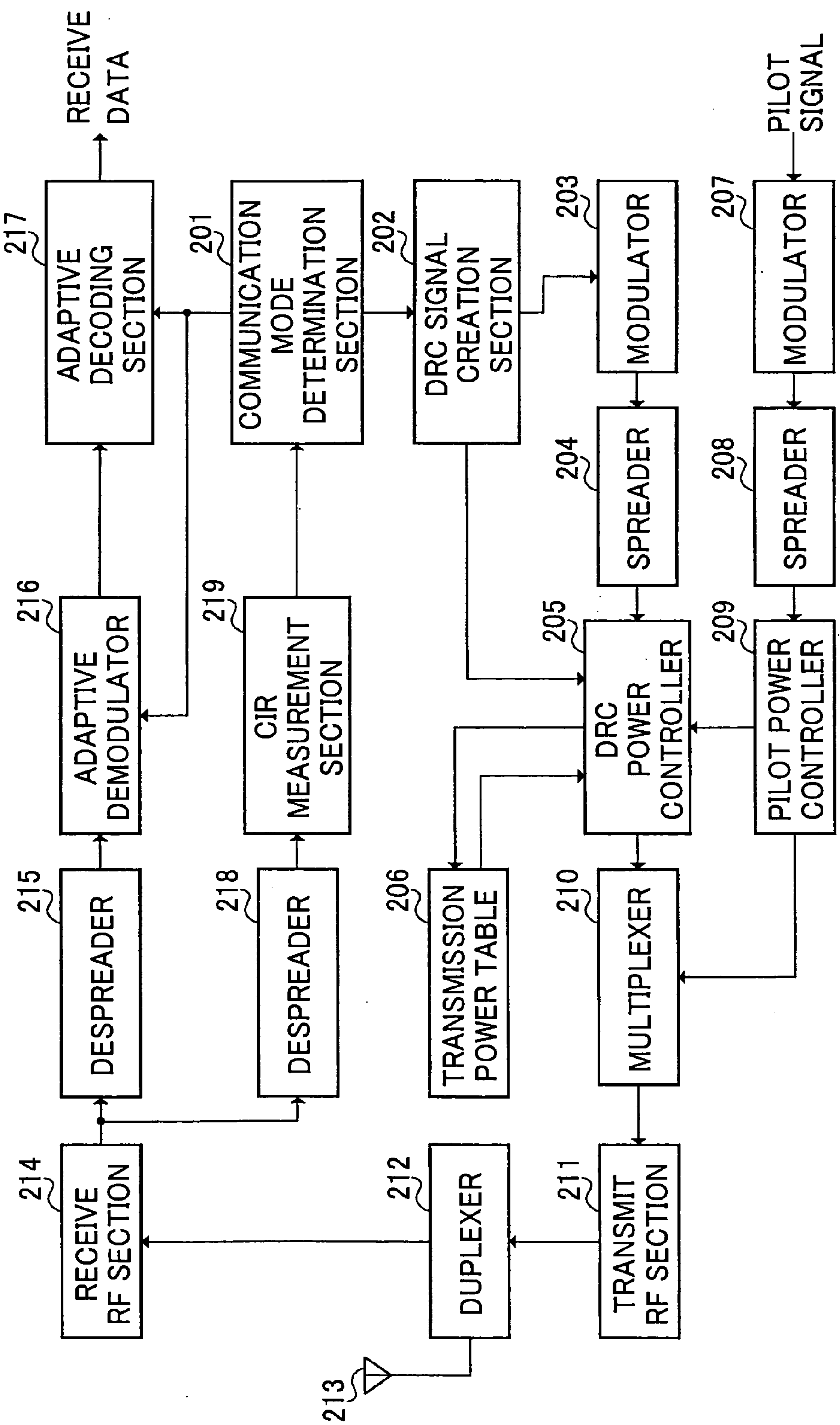
[FIG.3]



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201
COMMUNICATION MODE DETERMINATION SECTION
202
DRC SIGNAL CREATION SECTION
203
MODULATOR
207
MODULATOR
PILOT SIGNAL
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
204
SPREADER
208
SPREADER
205
DRC POWER CONTROLLER
209
PILOT POWER CONTROLLER
215
DESPREADER
218
DESPREADER
206
TRANSMISSION POWER TABLE
210
MULTIPLEXER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

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[FIG.4]

DRC NUMBER	TRANSMISSION POWER (RATIO TO PILOT SIGNAL TRANSMISSION POWER)
1	−2dB
2	−1dB
3	0dB
4	+1dB
5	+2dB

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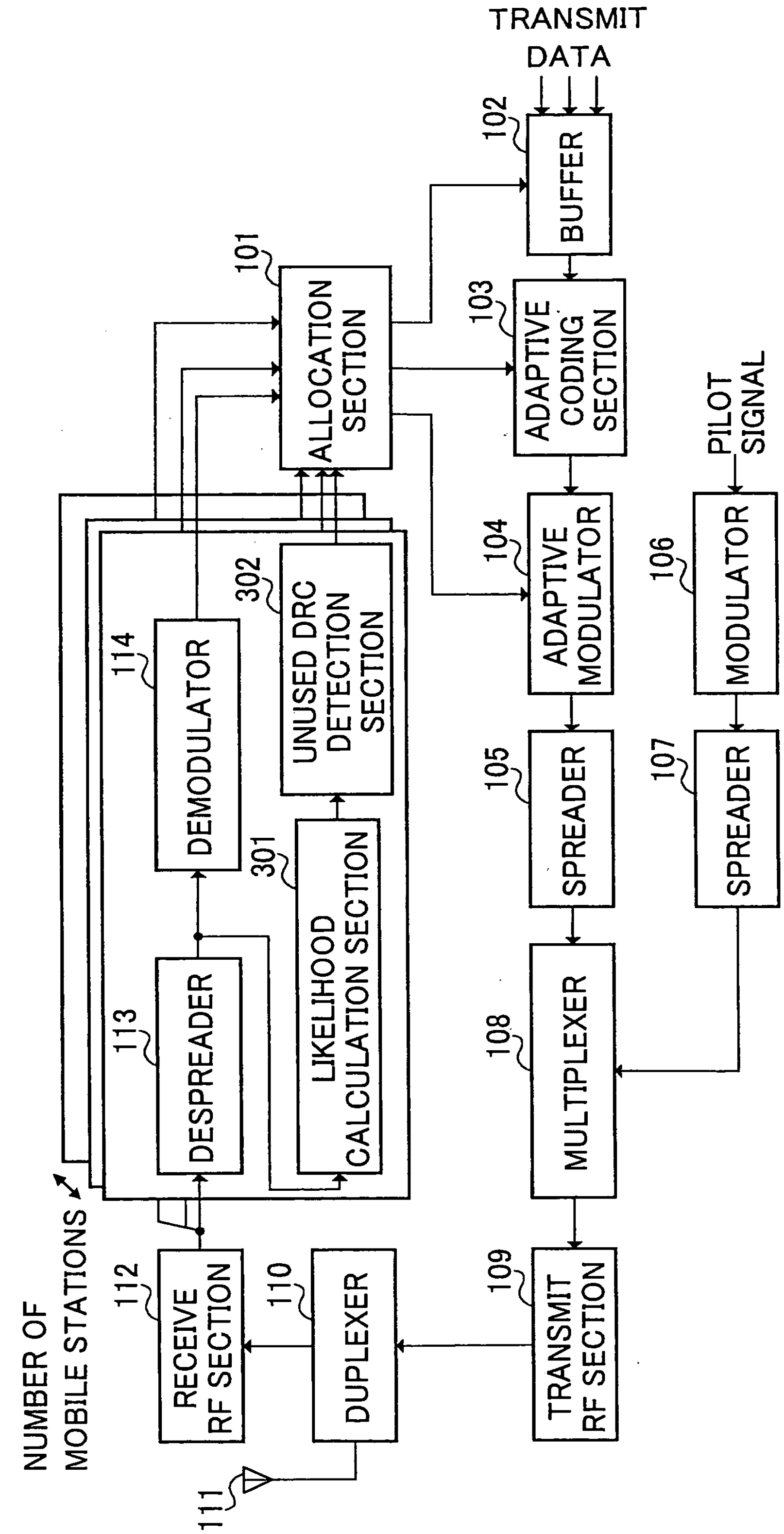
[FIG.5]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101
ALLOCATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
104
ADAPTIVE MODULATOR
106
MODULATOR
105
SPREADER
107
SPREADER
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
113
DESPREADER
114
DEMODULATOR
301
LIKELIHOOD CALCULATION SECTION
302
UNUSED DRC DETECTION SECTION
NUMBER OF MOBILE STATIONS

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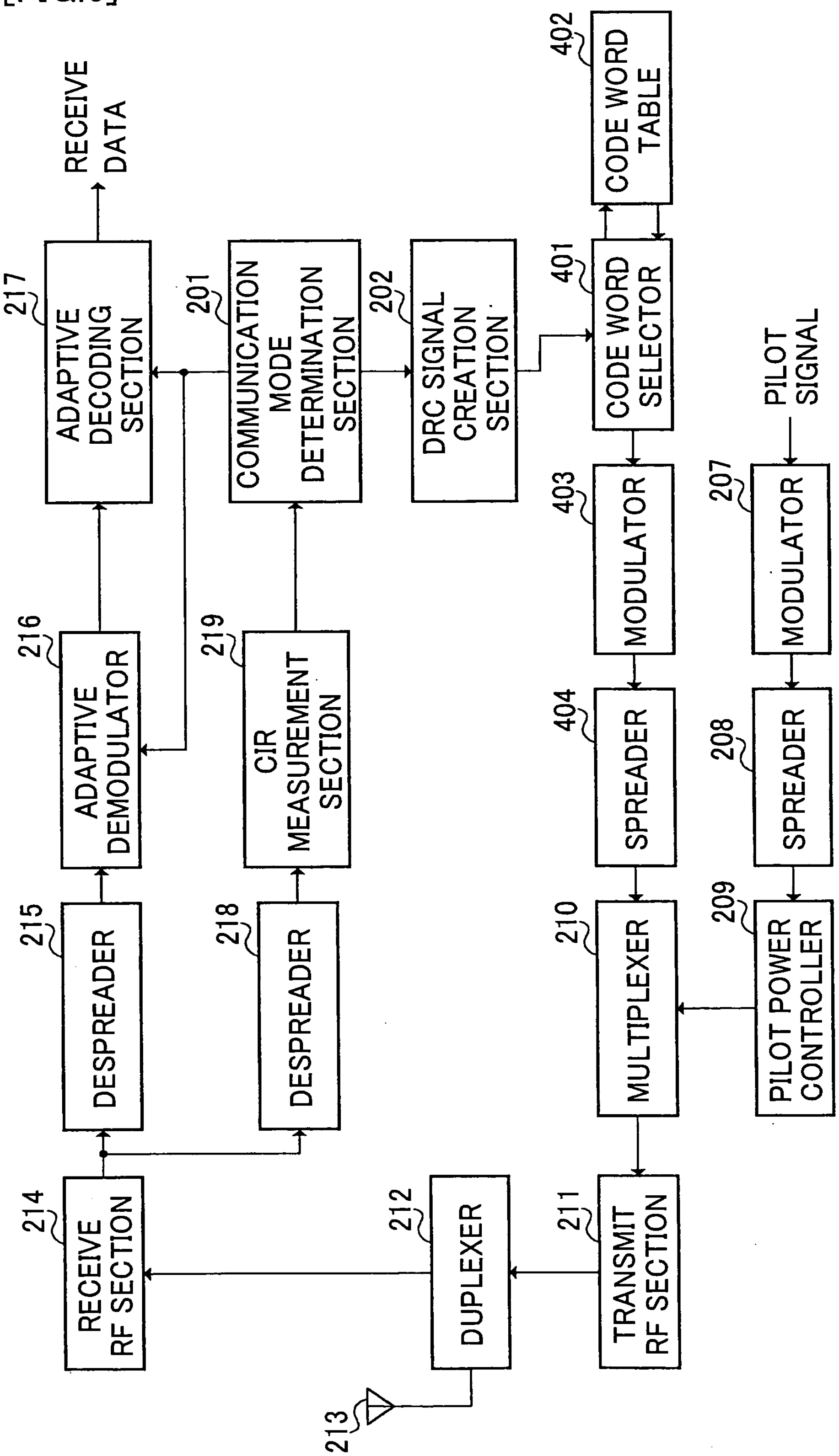
[FIG.6]



RECEIVE DATA
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201
COMMUNICATION MODE DETERMINATION SECTION
202
DRC SIGNAL CREATION SECTION
401
CODE WORD SELECTOR
402
CODE WORD TABLE
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
403
MODULATOR
207
MODULATOR
PILOT SIGNAL
215
DESPREADER
218
DESPREADER
404
SPREADER
208
SPREADER
210
MULTIPLEXER
209
PILOT POWER CONTROLLER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

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[FIG.7]

DRC NUMBER	CODE WORD	MINIMUM INTERSYMBOL DISTANCE
1	000000000	1
2	000000001	1
3	000000110	2
4	000111000	3
5	111111111	6

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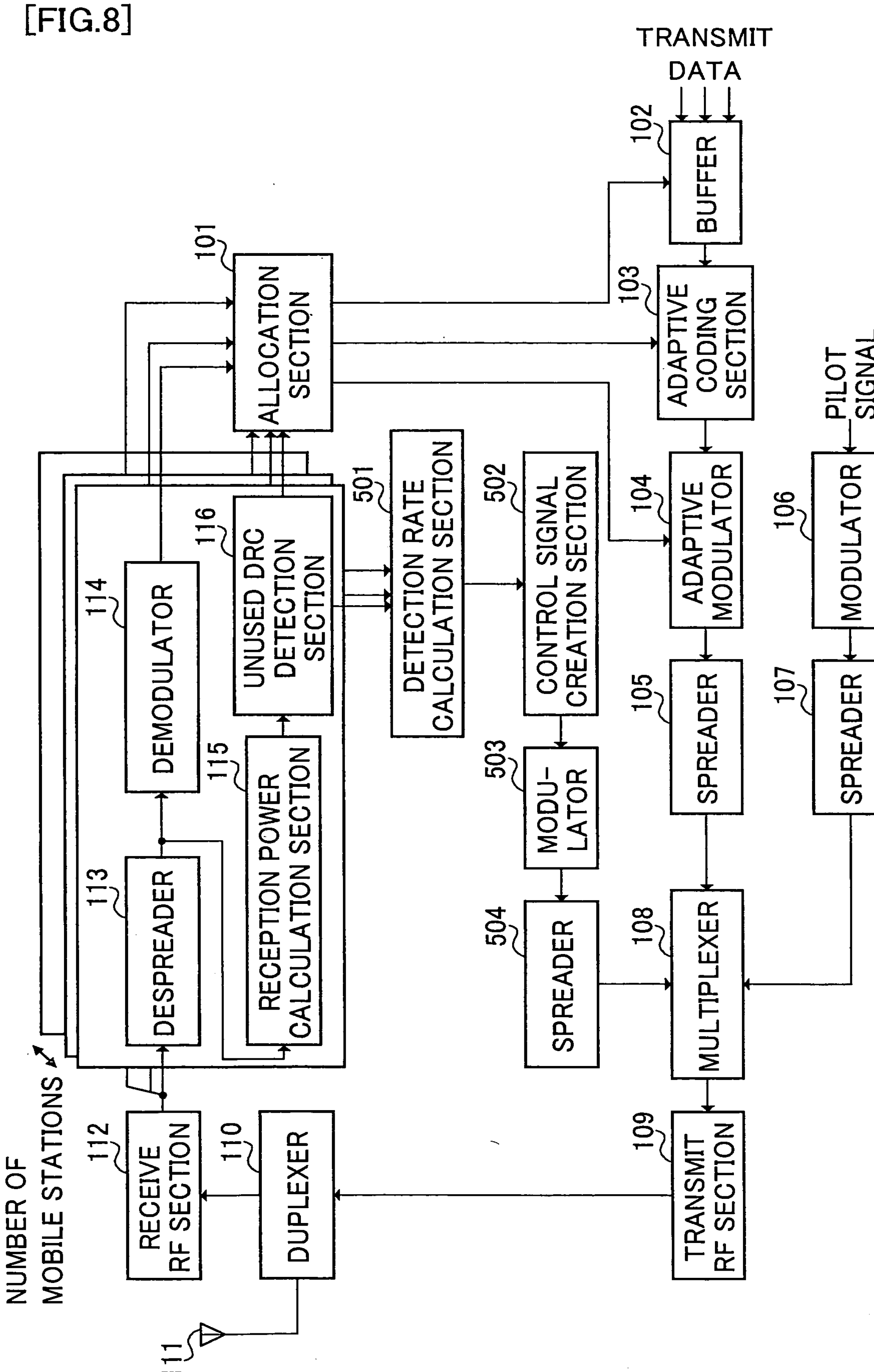
[FIG.8]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BUFFER
101
ALLOCATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
501
DETECTION RATE CALCULATION SECTION
502
CONTROL SIGNAL CREATION SECTION
104
ADAPTIVE MODULATOR
106
MODULATOR
116
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
115
RECEPTION POWER CALCULATION SECTION
503
MODU-LATOR
105
SPREADER
107
SPREADER
113
DESPREADER
504
SPREADER
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

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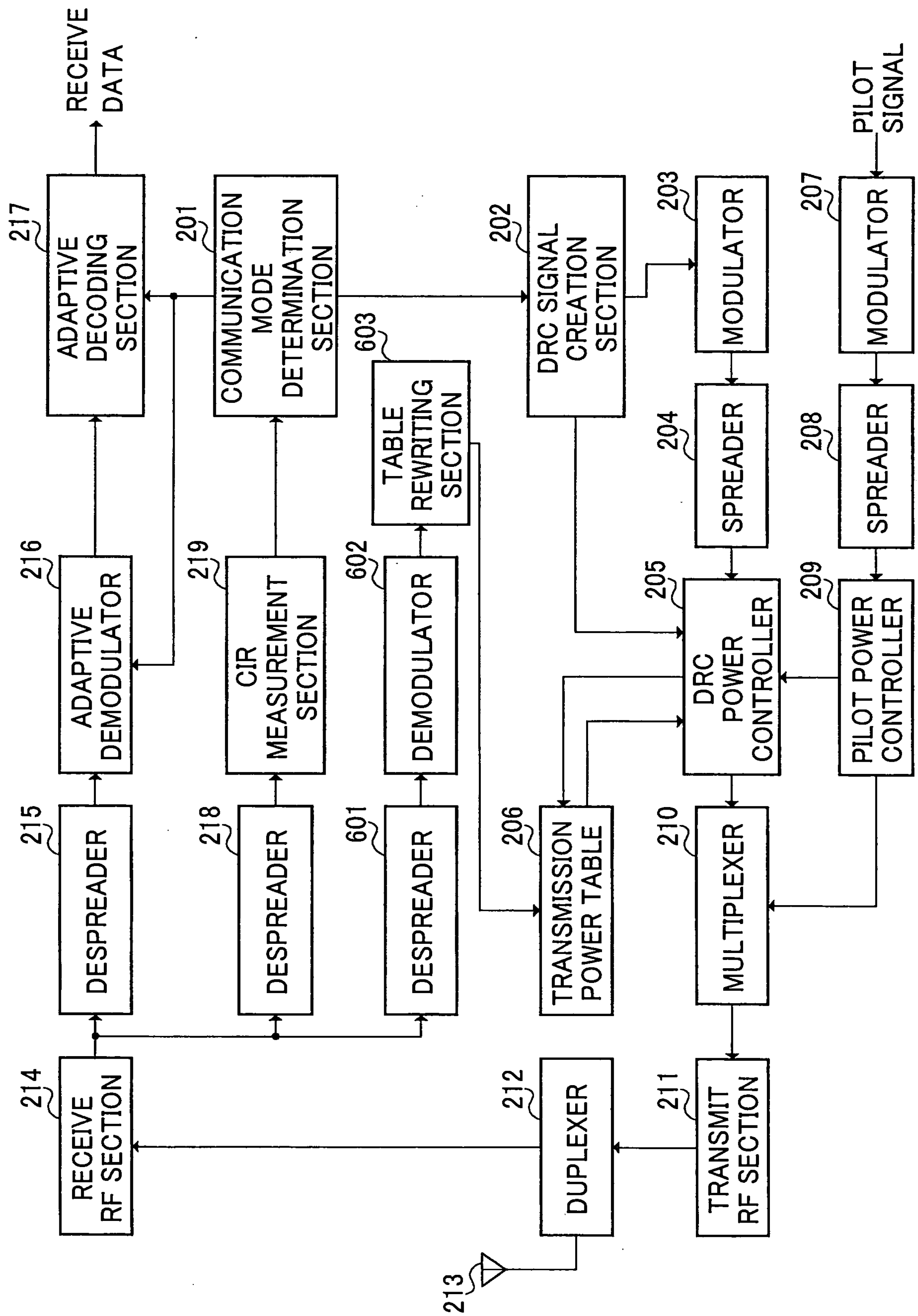
[FIG.9]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201 COMMUNICATION MODE DETERMINATION SECTION
603 TABLE REWRITING SECTION
202 DRC SIGNAL CREATION SECTION
203 MODULATOR
207 MODULATOR
PILOT SIGNAL
204 SPREADER
208 SPREADER
216 ADAPTIVE DEMODULATOR
219 CIR MEASUREMENT SECTION
602 DEMODULATOR
205 DRC POWER CONTROLLER
209 PILOT POWER CONTROLLER
215 DESPREADER
218 DESPREADER
601 DESPREADER
206 TRANSMISSION POWER TABLE
210 MULTIPLEXER
214 RECEIVE RF SECTION
212 DUPLEXER
211 TRANSMIT RF SECTION
213

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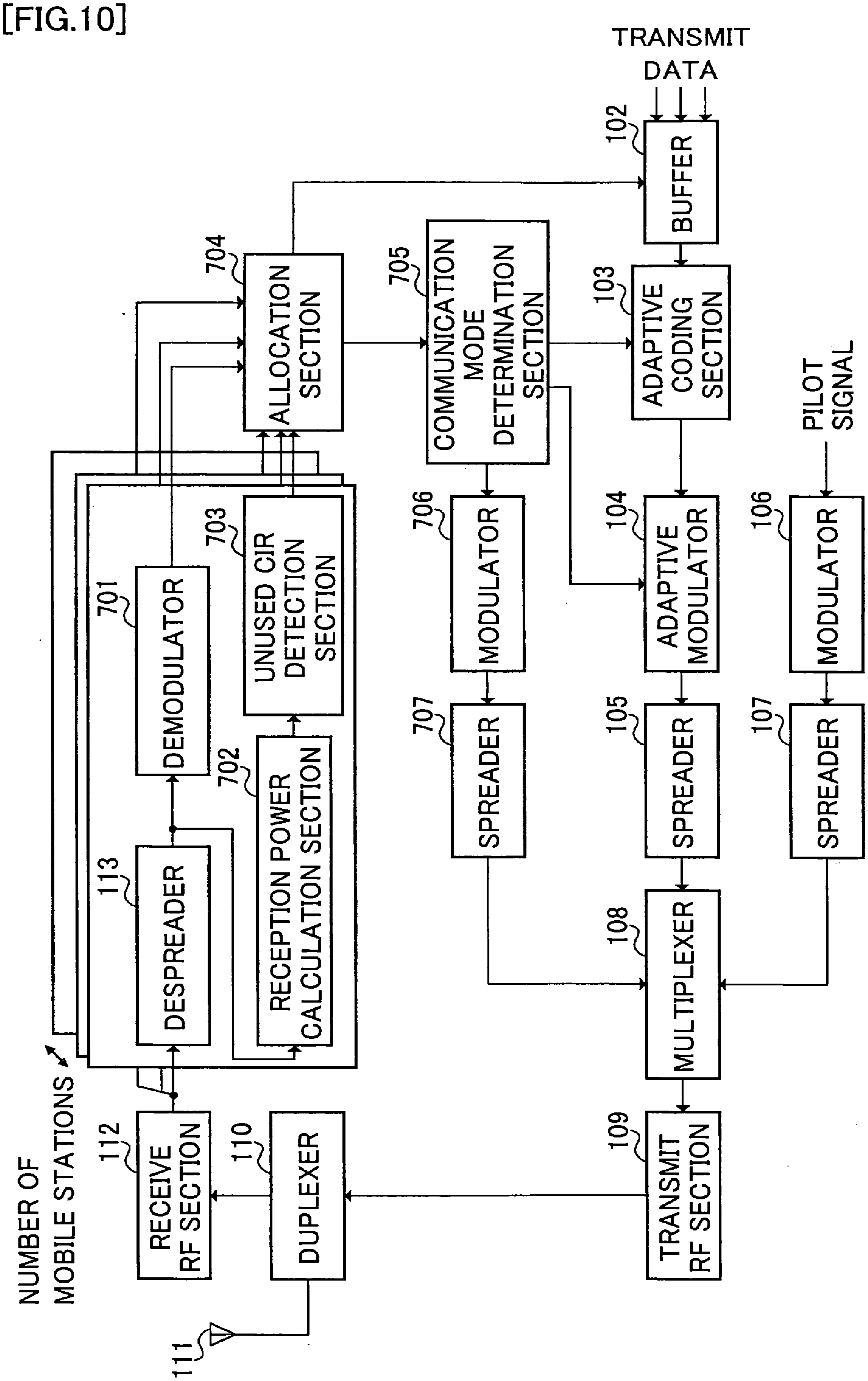
[FIG.10]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BUFFER
103
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ADAPTIVE MODULATOR
105
SPREADER
106
MODULATOR
PILOT SIGNAL
107
SPREADER
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
113
DESPREADER
701
DEMODULATOR
702
RECEPTION POWER CALCULATION SECTION
703
UNUSED CIR DETECTION SECTION
704
ALLOCATION SECTION
705
COMMUNICATION MODE DETERMINATION SECTION
706
MODULATOR
707
SPREADER
NUMBER OF MOBILE STATIONS

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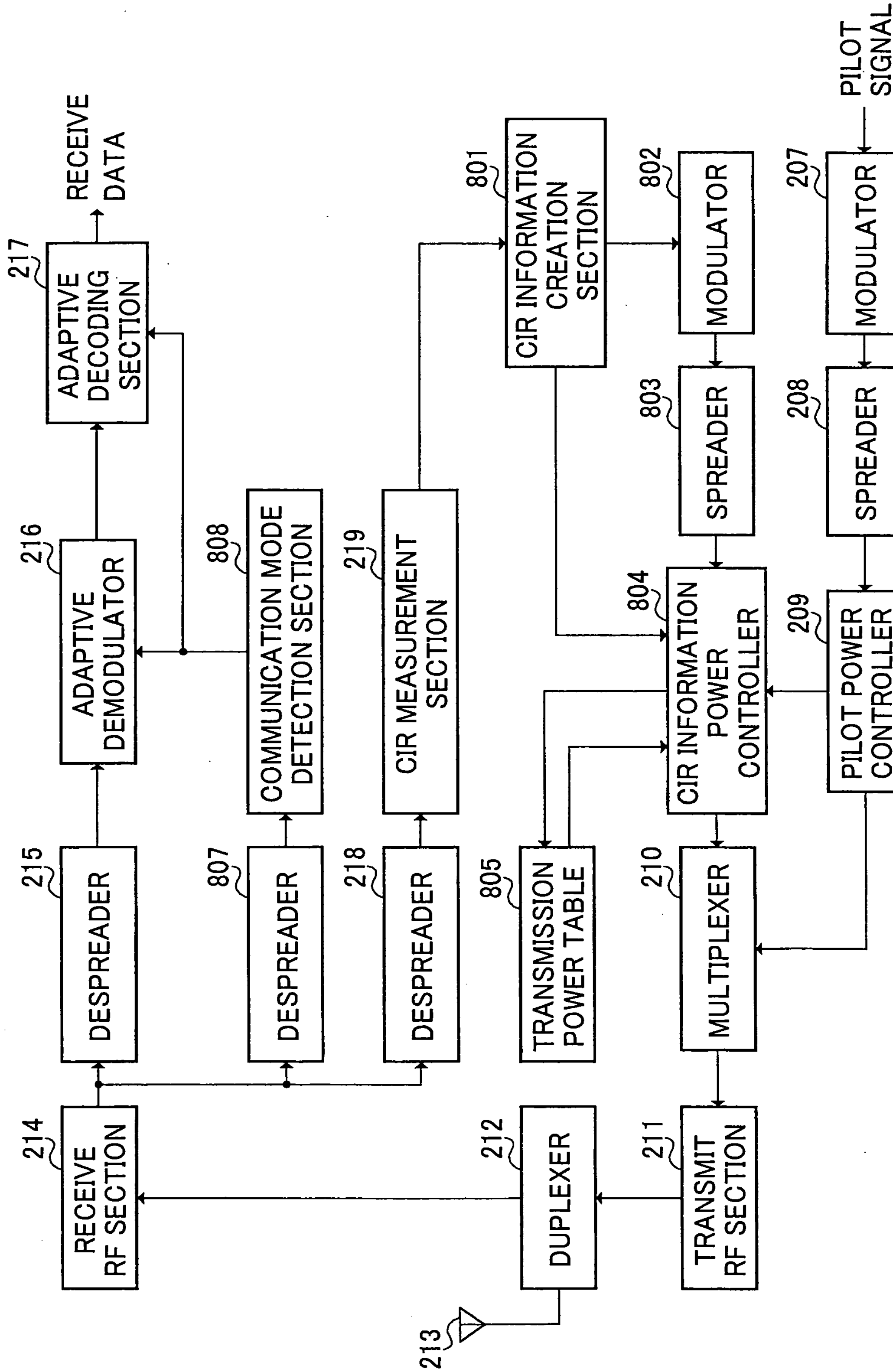
[FIG.11]



RECEIVE DATA
217
ADAPTIVE DECODING SECTION
216
ADAPTIVE DEMODULATOR
215
DESPREADER
214
RECEIVE RF SECTION
808
COMMUNICATION MODE DETECTION SECTION
807
DESPREADER
219
CIR MEASUREMENT SECTION
218
DESPREADER
801
CIR INFORMATION CREATION SECTION
805
TRANSMISSION POWER TABLE
212
DUPLEXER
213
802
MODULATOR
803
SPREADER
804
CIR INFORMATION POWER CONTROLLER
210
MULTIPLEXER
211
TRANSMIT RF SECTION
PILOT SIGNAL
207
MODULATOR
208
SPREADER
209
PILOT POWER CONTROLLER

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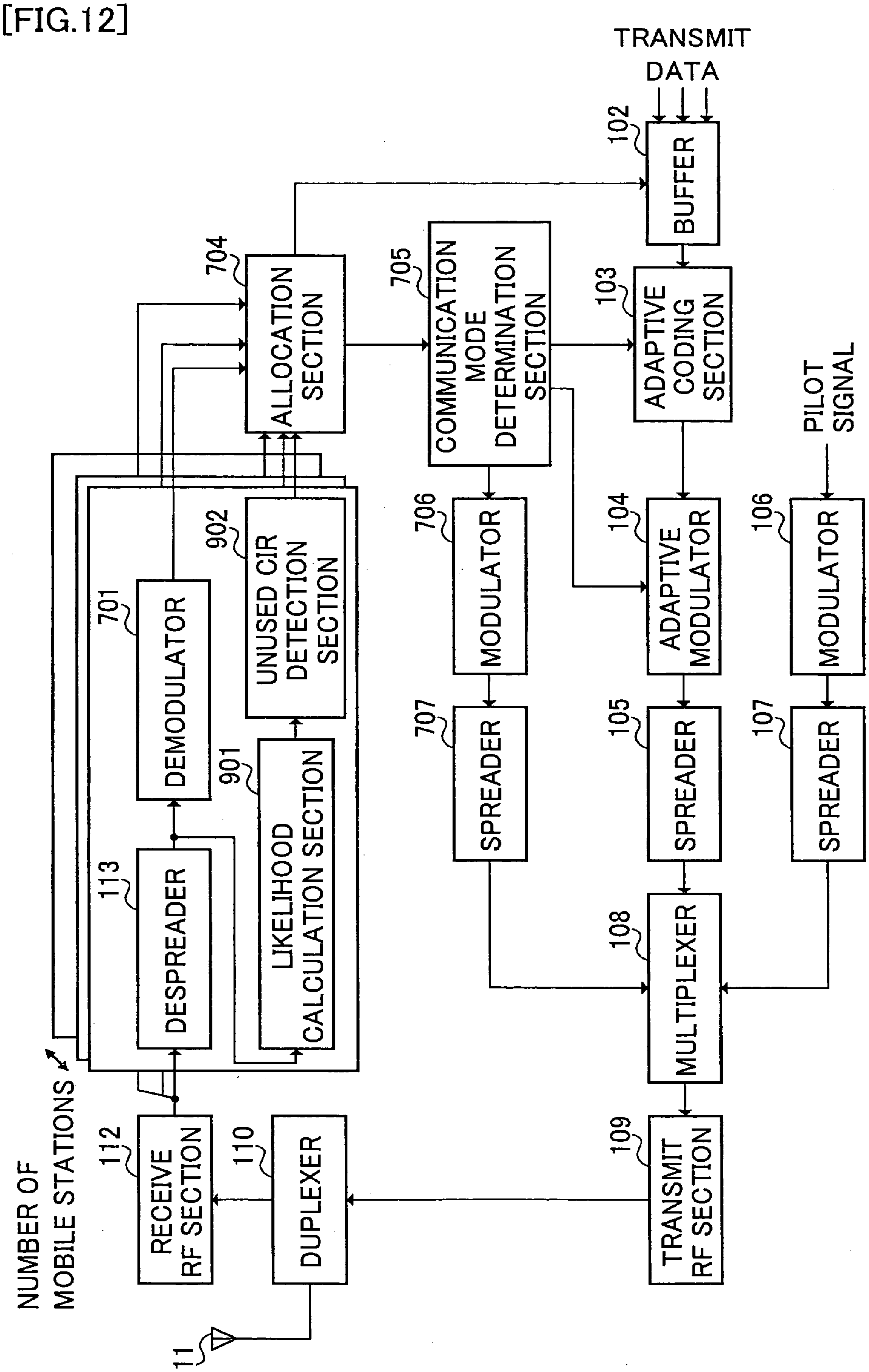
[FIG.12]



TRANSMIT DATA
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704
ALLOCATION SECTION
705
COMMUNICATION MODE DETERMINATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
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DEMODULATOR
902
UNUSED CIR DETECTION SECTION
706
MODULATOR
104
ADAPTIVE MODULATOR
106
MODULATOR
113
DESPREADER
901
LIKELIHOOD CALCULATION SECTION
707
SPREADER
105
SPREADER
107
SPREADER
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

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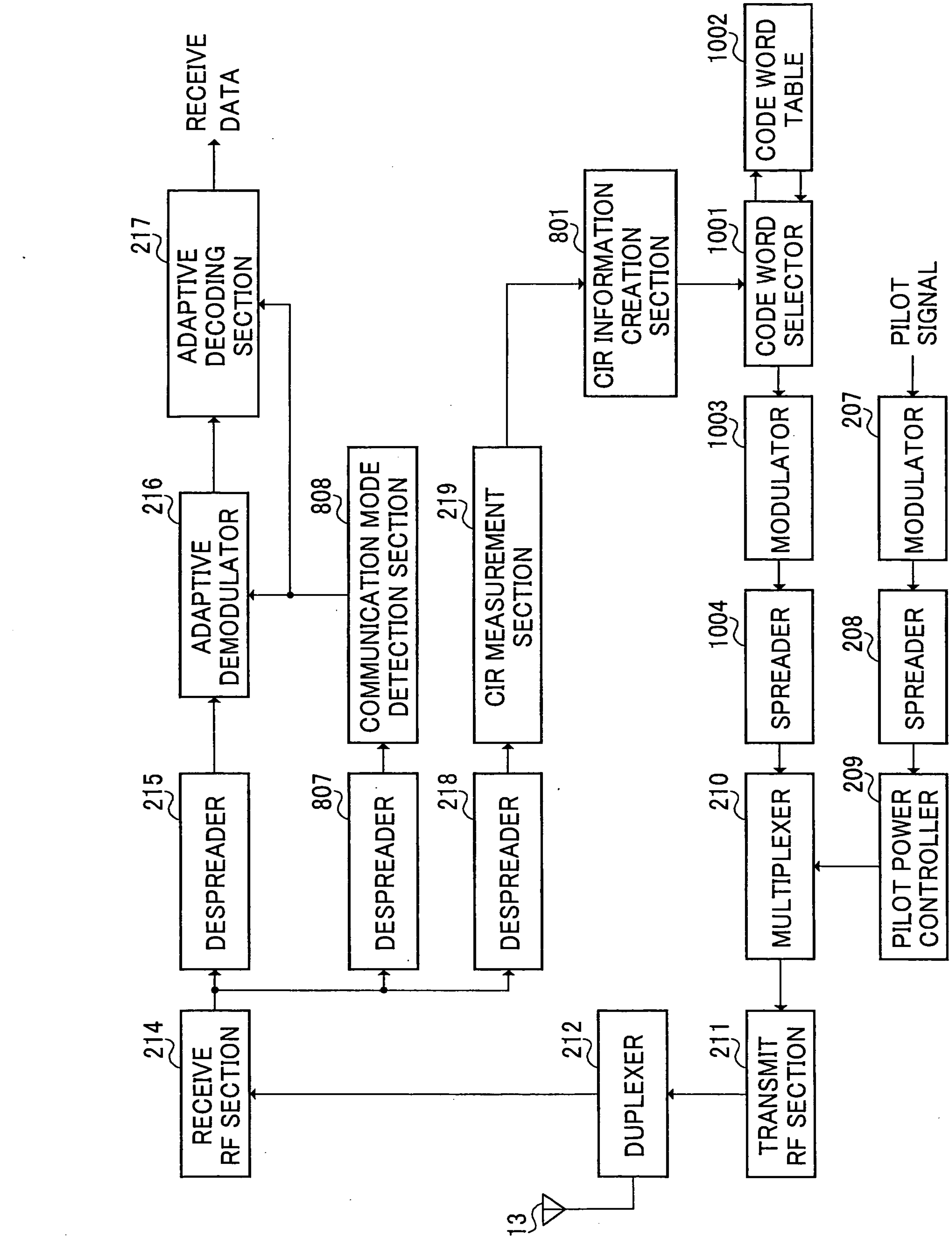
[FIG.13]



RECEIVE DATA
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216
ADAPTIVE DEMODULATOR
215
DESPREADER
214
RECEIVE RF SECTION
808
COMMUNICATION MODE DETECTION SECTION
807
DESPREADER
219
CIR MEASUREMENT SECTION
218
DESPREADER
801
CIR INFORMATION CREATION SECTION
212
DUPLEXER
213
1002
CODE WORD TABLE
1001
CODE WORD SELECTOR
1003
MODULATOR
1004
SPREADER
210
MULTIPLEXER
211
TRANSMIT RF SECTION
PILOT SIGNAL
207
MODULATOR
208
SPREADER
209
PILOT POWER CONTROLLER

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VERIFICATION OF A TRANSLATION

I, Tetsuo AKIYOSHI, of 5th Floor, Shintoshicenter Bldg., 24-1, Tsurumaki 1-chome, Tama-shi, Tokyo 206-0034 Japan, declare that I am well acquainted with both the Japanese and English languages, and that the attached is an accurate translation, to the best of my knowledge and ability, of the Japanese language Patent Application No. JP 2000-285405 filed on September 20, 2000.

Signature ______________ Date April 12, 2006

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[Name of Document]	PATENT APPLICATION
[Reference Number]	2900625200
[Filing Date]	September 20, 2000
[To]	Commissioner, Patent Office
[International Patent Classification]	H04B 7/26
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[Identification Number]	100105050
[Patent Attorney]	
[Name]	Kimihito WASHIDA
[Declaration of priority based on prior application]	
[Filing Number]	2000-234420
[Filing Date]	August 2, 2000
[Indication of Official Fee]	
[Prepayment Register Number]	041243
[Amount of Payment]	¥21,000
[List of Items Submitted]	
[Name of Item]	Specification 1

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[Name of Item]	Drawing	1
[Name of Item]	Abstract	1
[Number of General Power of Attorney]	9700376	

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[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

[WHAT IS CLAIMED IS:]

[Claim 1] A communication terminal apparatus used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality, said communication terminal apparatus comprising: measuring means for measuring downlink channel quality; and transmitting means for transmitting a notification signal to notify a base station apparatus of information that indicates the channel quality; wherein said transmitting means transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of the channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

[Claim 2] The communication terminal apparatus according to claim 1, wherein transmitting means transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

[Claim 3] The communication terminal apparatus according to claim 2, wherein said transmitting means transmits with transmission power increased in proportion to a notification signal that indicates that channel quality is good.

[Claim 4] The communication terminal apparatus according to claim 3, further comprising controlling means for controlling transmission power of a pilot signal; wherein said transmitting means transmits with a notification signal that indicates channel quality better than a predetermined channel quality set to higher transmission power than the pilot signal transmission power, and a notification signal that indicates channel quality poorer than the predetermined channel quality set to lower transmission power than the pilot signal transmission power.

[Claim 5] The communication terminal apparatus according to claim 3 or 4, further comprising: a table that indicates a correspondence between a notification signal and transmission power; and a rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein transmitting means adjusts a notification signal to predetermined transmission power based on said table.

[Claim 6] The communication terminal apparatus according to claim 2, wherein transmitting means transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that channel quality is good.

[Claim 7] The communication terminal apparatus according to claim 6, further comprising: a table that indicates a correspondence between a notification signal and a code word; and a rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein transmitting means converts a notification signal to a predetermined code word based on said table.

[Claim 8] The communication terminal apparatus according to any of claims 2 through 7, further comprising determining means for determining a communication mode indicated by a combination of modulation method and coding method based on channel quality; wherein transmitting means makes a notification signal a signal that indicates the communication mode.

[Claim 9] The communication terminal apparatus according to any of claims 2 through 7, wherein measuring means measures pilot signal reception quality; and transmitting means makes a notification signal a signal that indicates a pilot signal reception quality value.

[Claim 10] The communication terminal apparatus according to claim 1, wherein: said measuring means measures pilot signal reception quality; and transmitting means transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate the reception quality value.

[Claim 11] The communication terminal apparatus according to claim 10, wherein transmitting means transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

[Claim 12] The communication terminal apparatus according to claim 10, wherein transmitting means transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

[Claim 13] The communication terminal apparatus according to claim 10, wherein transmitting means transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

[Claim 14] A base station apparatus comprising: receiving means for receiving a notification signal transmitted from the communication terminal apparatus according to any of claims 1 through 13; measuring means for measuring reception power of the notification signal; detecting means for detecting a notification signal whose reception power is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

[Claim 15] A base station apparatus comprising: receiving means for receiving a notification signal transmitted from the communication terminal apparatus according to any of claims 1 through 13; measuring means for measuring likelihood of the notification signal; detecting means for detecting a notification signal whose likelihood is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

[Claim 16] The base station apparatus according to claim 14 or 15, further comprising: calculating means for calculating a rate of detection by detecting means; and transmitting means for transmitting a control signal instructing the communication terminal apparatus according to claim 5 or 7 to rewrite said table based on a result of comparison of the rate of detection and a predetermined threshold value.

[Claim 17] A radio communication method, wherein: a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of the channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and said base station determines downlink communication resource allocation in accordance with the notification signal.

[Claim 18] The radio communication method according to claim 17, wherein said communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

[Claim 19] The radio communication method according to claim 17, wherein said communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate the reception quality value.

[DETAILED DESCRIPTION OF THE INVENTION]

【0001】

[TECHNICAL FIELD OF THE INVENTION]

The present invention relates to a communication terminal apparatus, base station apparatus, and radio communication method to be used in a cellular communication system.

【0002】

[PRIOR ART]

In a cellular communication system, one base station performs radio communication with a plurality of communication terminals simultaneously, and therefore, as demand has increased in recent years, so has the need for higher transmission efficiency.

【0003】

One technology that has been proposed for increasing the transmission efficiency of a downlink from a base station to a communication terminal is HDR (High Data Rate). HDR is a communication method whereby a base station performs scheduling for allocating communication resources to communication terminals by time division, and also sets a transmission rate for each communication terminal according to the downlink channel quality.

【0004】

The operations by which a base station and communication terminals perform radio communication with HDR are described below. First, the base station transmits a pilot signal to each communication terminal. Each communication terminal estimates the downlink channel quality using a CIR (desired carrier to interference ratio) based on the pilot signal, etc , and finds a transmission rate at which communication is possible. Then, based on the transmission rate at which communication is possible, each communication terminal selects a communication mode, which is a combination of packet length, coding method, and modulation method, and transmits a data rate control (hereinafter referred to as "DRC") signal indicating the communication mode to the base station.

【0005】

The type of modulation method that can be used in each system is predetermined as BPSK, QPSK, 16QAM, 64QAM, and so forth. Also, the type of coding that can be used in each system is predetermined as 1/2 turbo code, 1/3 turbo code, 3/4 turbo code, and so forth. Further, a plurality of transmission rates that can be used in each system are predetermined according to a combination of packet length, modulation method, and coding method. Each communication terminal selects a combination whereby communication can be performed most efficiently with the current downlink channel quality, and transmits a DRC signal indicating the selected communication mode to the base station. Generally, DRC signals are represented by numbers from 1 to N, with a higher number indicating a proportionally better downlink channel quality.

【0006】

Based on the DRC signal transmitted from each communication terminal, the base station sets a transmission rate for each communication terminal, and sends a signal to each communication terminal via a control channel indicating communication resource allocation to each communication terminal. Generally, taking improvement of system transmission efficiency into consideration, communication resources are allocated with priority to the communication terminal that has the best downlink channel quality—that is to say, the communication terminal that transmits the highest-numbered DRC signal.

【0007】

The base station then transmits data only to the relevant communication terminal in its allocated time. For example, if time t1 has been allocated to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

【0008】

In this way, data transmission efficiency has conventionally been increased for the overall system by setting a transmission rate for each communication terminal according to channel quality by means of HDR, and performing communication resource allocation with priority to a communication terminal with a high transmission rate at which communication is possible.

【0009】

[PROBLEMS TO BE SOLVED BY THE INVENTION]

However, if the communication mode determined by a communication terminal is received erroneously by the base station due to deterioration of the channel conditions on the uplink from the communication terminal to the base station, or the like, the base station will transmit data using that erroneous mode. As the determined communication mode and the communication mode of data transmitted to the communication terminal are different, the communication terminal cannot demodulate or decode the data.

【0010】

Also, when a base station such as that described above has allocated time t1 to communication terminal A, in time t1 the base station transmits data only to communication terminal A, and does not transmit data to a communication terminal other than communication terminal A.

【0011】

Due to the above, a problem arises in that, if the communication mode determined by a communication terminal is received erroneously by the base station, there will be an interval during which time-divided communication resources are not used, and downlink throughput falls.

【0012】

The present invention is carried out in view of the foregoing, and the object of the present invention is to provide a communication terminal apparatus, base station apparatus, and radio communication method that make it possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

【0013】

[MEANS FOR SOLVING THE PROBLEMS]

A communication terminal apparatus under the present invention used in a communication system in which communication resources are allocated to each communication terminal apparatus based on downlink channel quality comprises: measuring means for measuring downlink channel quality; and transmitting means for transmitting a notification signal to notify a base station apparatus of information that indicates the channel quality; wherein said transmitting means transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of the channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus.

【0014】

According to this constitution, it is possible to prevent a fall in downlink throughput because, among information indicative of the channel quality, information which has a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus is made less susceptible to errors in a propagation path and then transmitted.

【0015】

In a communication terminal apparatus under the present invention, transmitting means transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

【0016】

According to this constitution, because a notification signal indicating a good channel quality is made relatively less susceptible to errors in a propagation path and then transmitted, a base station is able to keep the error occurrence rate for a notification signal which is selected at a relatively greater number of occurrences in low. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous notification signal.

【0017】

In a communication terminal apparatus of the present invention, transmitting means transmits with transmission power increased in proportion to a notification signal that indicates that channel quality is good.

【0018】

According to this constitution, because a notification signal indicating a good channel quality is transmitted with relatively higher transmission power, a notification signal indicating good downlink quality is transmitted with relatively less susceptibility to errors.

【0019】

A communication terminal apparatus of the present invention further comprises controlling means for controlling transmission power of a pilot signal; wherein said transmitting means transmits with a notification signal that indicates channel quality better than a predetermined channel quality set to higher transmission power than the pilot signal transmission power, and a notification signal that indicates channel quality poorer than the predetermined channel quality set to lower transmission power than the pilot signal transmission power.

【0020】

According to this constitution, in comparison with the transmission power for sending conventional notification signals, both of notification signals with higher transmission power and notification signals with lower transmission power are transmitted; therefore the average transmission power for sending notification signals are kept the same as for sending conventional notification signals, while at the same time notification signals indicating good channel quality are transmitted with less susceptibility to errors. That is to say, it is possible to proportionally reduce susceptibility to errors of notification signals indicating that downlink channel quality is good without reducing downlink capacity compared with a conventional system.

【0021】

A communication terminal apparatus under the present invention further comprises: a table that indicates a correspondence between a notification signal and transmission power; and rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein said transmitting means adjusts a notification signal to predetermined transmission power based on said table.

【0022】

According to this constitution, because the table is rewritten adaptively in response to changes in communication conditions, error occurrence rate on notification signals is kept low even if the communication conditions deteriorates.

【0023】

In a communication terminal apparatus of the present invention, transmitting means transmits after performing conversion to a code word with a size of a code word minimum distance proportional to a notification signal that indicates that channel quality is good.

【0024】

According to this constitution, because a notification signal indicating a good channel quality is transmitted after being subjected to conversion to a code word with a size of a code word minimum distance proportional to a notification signal, a notification signal indicating good downlink quality is transmitted with relatively less susceptibility to errors. Moreover, according to this constitution, it is possible to change the degree of insusceptibility to errors of code words corresponding to each of notification signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

【0025】

A communication terminal apparatus under the present invention further comprises: a table that indicates a correspondence between a notification signal and a code word; and rewriting means for rewriting contents of said table in accordance with a control signal from a base station apparatus; wherein transmitting means converts a notification signal to a predetermined code word based on said table.

【0026】

According to this constitution, because the table is rewritten adaptively in response to changes in communication conditions, error occurrence rate on notification signals is kept low even if the communication conditions deteriorates.

【0027】

A communication terminal apparatus under the present invention further comprises determining means for determining a communication mode indicated by a combination of modulation method and coding method based on channel quality; wherein transmitting means makes a notification signal a signal that indicates said communication mode.

【0028】

According to this constitution, it is possible to represent a notification signal with very small number of bits, which heightens uplink channel utilization efficiency.

【0029】

In a communication terminal apparatus under the present invention, measuring means measures pilot signal reception quality; and transmitting means makes a notification signal a signal that indicates a pilot signal reception quality value.

【0030】

According to this constitution, there is no need to determine a communication mode at a communication terminal side, which offers the advantage of enabling communication terminal power consumption and apparatus size to be reduced.

【0031】

In a communication terminal apparatus of the present invention, measuring means measures pilot signal reception quality; and transmitting means transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate the reception quality value.

【0032】

»According to this constitution, because information for which the amount of change is large is transmitted with proportionally greater insusceptibility to errors in the propagation path, the degree of error in reception quality values can be kept low.

By this means, it is possible to reduce the possibility of an erroneous determination of communication mode at the base station.

【0033】

In a communication terminal apparatus under the present invention, transmitting means transmits a notification signal converted to a code word whose code length is proportional to a value of an upper digit.

【0034】

According to this constitution, because a notification signal converted to a code word whose code length is proportional to a value of an upper digit is transmitted, it is possible to perform transmission with insusceptibility to errors made proportional to the value of the upper digit for which the amount of change is large.

【0035】

In a communication terminal apparatus under the present invention, transmitting means transmits a notification signal with transmission power increased in proportion to a value of an upper digit.

【0036】

According to this constitution, a notification signal is transmitted with higher transmission power for an upper digit value, so a notification signal is transmitted with proportionally greater insusceptibility to errors for the upper digit value, which has large amount of change.

【0037】

In a communication terminal apparatus under the present invention, transmitting means transmits a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit.

【0038】

According to this constitution, a notification signal spread with a spreading code whose spreading factor is higher in proportion to a value of an upper digit is transmitted, so a notification signal is transmitted with proportionally greater insusceptibility to errors for the upper digit value, which has large amount of change.

【0039】

A base station apparatus under the present invention comprises: receiving means for receiving a notification signal transmitted from any of the above communication terminal apparatuses; measuring means for measuring reception power of the notification signal; detecting means for detecting a notification signal whose reception power is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

【0040】

A base station apparatus under the present invention comprises: receiving means for receiving a notification signal transmitted from any of the above communication terminal apparatuses; measuring means for measuring likelihood of the notification signal; detecting means for detecting a notification signal whose likelihood is less than a predetermined threshold value; and determining means for determining downlink communication resource allocation using a notification signal excluding a detected notification signal from a received plurality of notification signals.

【0041】

According to these constitutions, notification signals more susceptible to errors are excluded in determining communication resource allocation, it is possible to prevent communication resource allocation from being determined based on erroneous notification signals.

【0042】

A base station apparatus under the present invention further comprises: calculating means for calculating a rate of detection by detecting means; and transmitting means for transmitting a control signal instructing the above communication terminal apparatus to rewrite the table based on a result of comparison of the rate of detection and a predetermined threshold value.

【0043】

According to this constitution, because the communication terminal apparatus rewrites the table adaptively in response to changes in communication conditions, error occurrence rate on notification signals is kept low even if the communication conditions deteriorates.

【0044】

In a radio communication method under the present invention, a communication terminal apparatus, when transmitting a notification signal to notify a base station apparatus of information that indicates downlink channel quality, transmits a notification signal having information made less susceptible to errors in a propagation path, the information, among information indicative of the channel quality, having a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus; and said base station determines downlink communication resource allocation in accordance with the notification signal.

【0045】

According to this method, it is possible to prevent a fall in downlink throughput because, among information indicative of the channel quality, information which has a possibility of decreasing the downlink throughput when the information is received erroneously in said base station apparatus is made less susceptible to errors in a propagation path and then transmitted.

【0046】

In a radio communication method under the present invention, a communication terminal apparatus transmits with less susceptibility to errors in a propagation path in proportion to a notification signal that indicates that channel quality is good.

【0047】

According to this method, because a notification signal indicating a good channel quality is made relatively less susceptible to errors in a propagation path and then transmitted, a base station is able to keep the error occurrence rate for a notification signal which is selected at a relatively greater number of occurrences in low. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous notification signal.

【0048】

In a radio communication method under the present invention, a communication terminal apparatus measures pilot signal reception quality, and transmits a notification signal made less susceptible to errors in a propagation path in proportion to information for which an amount of change is large within information used to indicate the reception quality value.

【0049】

According to this method, because information for which the amount of change is large is transmitted with proportionally greater insusceptibility to errors in the propagation path, the degree of error in reception quality values can be kept low. By this means, it is possible to reduce the possibility of an erroneous determination of communication mode at the base station.

【0050】

[DESCRIPTION OF THE SPECIAL EMBODIMENTS]

The essence of the present invention lies in that a communication terminal transmits, among information indicative of downlink channel quality, information which has a possibility of decreasing the downlink throughput when the information is received erroneously in a base station made less susceptible to errors in the propagation path, thereby to prevent a fall in downlink throughput.

【0051】

With reference to the attached drawings, embodiments of the present invention will be explained in detail below.

(Embodiment 1)

As stated above, a base station allocates communication resources with priority to the communication terminal with the best downlink channel quality. In other words, a base station selects the highest-numbered DRC signal, and allocates communication resources with priority to the communication terminal that transmitted that selected DRC signal. Thus, DRC signal selection frequency is as shown in FIG 1. FIG 1 is a graph illustrating DRC signal selection frequency in a base station. In this figure, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better channel quality.

【0052】

As shown in FIG 1, the higher the number of a DRC signal, the greater is the frequency of its selection by the base station. That is to say, the better the downlink channel quality of a communication terminal, the higher is the frequency with which communication resources are allocated to that communication terminal. This kind of relationship arises from the fact that there are many communication terminals, and there is an increased probability of there being a communication terminal with good downlink channel quality.

【0053】

Thus, the selection frequency of each DRC signal differs according to channel quality. That is to say, since a DRC signal indicating that downlink channel quality is good tends to be selected with greater frequency, there is a high probability that downlink throughput will fall if a DRC signal indicating that downlink channel quality is good is received erroneously. Also, since a DRC signal indicating that downlink channel quality is poor tends to be selected with lower frequency, there is little effect of producing a fall in downlink throughput if a DRC signal indicating that downlink channel quality is poor is received erroneously.

【0054】

Thus, a communication terminal according to Embodiment 1 of the present invention transmits at proportionally higher transmission power a DRC signal indicating that downlink channel quality is good. Also, a base station according to Embodiment 1 of the present invention excludes DRC signals with reception power lower than a predetermined threshold value in performing communication resource allocation.

【0055】

FIG 2 is a block diagram showing the configuration of a base station according to Embodiment 1 of the present invention;

In FIG 2, an allocation section 101 determines communication resource allocation to each communication terminal based on DRC signals excluding DRC signals detected by unused DRC detection sections 116 described later herein from among DRC signals extracted by demodulators 114 described later herein. Then, based on the determined communication resource allocation, the allocation section 101 notifies a buffer 102 for output of downlink transmit data, indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104.

【0056】

The buffer 102 holds downlink transmit data, and outputs downlink transmit data for a predetermined communication terminal to the adaptive coding section 103 in accordance with the directions of the allocation section 101. The adaptive coding section 103 codes the output signal from the buffer 102 in accordance with the directions of the allocation section 101, and outputs the resulting signal to the adaptive modulator 104. The adaptive modulator 104 modulates the output signal from the adaptive coding section 103 in accordance with the directions of the allocation section 101, and outputs the resulting signal to a spreading section 105. Spreading section 105 spreads the output signal from the adaptive modulator 104, and outputs the resulting signal to a multiplexer 108.

【0057】

A modulator 106 modulates the pilot signal and outputs the resulting signal to a spreading section 107. Spreading section 107 spreads the output signal from modulator 106 and outputs the resulting signal to a multiplexer 108.

【0058】

The multiplexer 108 performs time multiplexing of the spread pilot signal with the spread downlink transmit data at predetermined intervals, and outputs the resulting signal to a transmit RF section 109. The transmit RF section 109 converts the frequency of the output signal from the multiplexer 108 to radio frequency, and outputs the resulting signal to a duplexer 110.

【0059】

The duplexer 110 transmits the output signal from the transmit RF section 109 as a radio signal from an antenna 111 to a communication terminal. Moreover, the duplexer 110 outputs the signals transmitted from each communication terminal and received by antenna 111 to receive RF section 112.

【0060】

A receive RF section 112 converts the frequency of a radio frequency signal output from the duplexer 110 to base band, and outputs the resulting signal to a despreading section 113. The despreading section 113 despreads the base band signal using the spreading code used to spread the DRC signal, and outputs the resulting signal to the demodulator 114 and a reception power calculation section 115.

【0061】

The demodulator 114 demodulates the output signal from the despreading section 113 and extracts the DRC signal, and outputs this signal to the allocation section 101.

【0062】

The reception power calculation section 115 measures the reception power of the despread DRC signal, which is output to the unused DRC detection section 116. In the unused DRC detection section 116 is set a predetermined threshold value, as described later herein, and a DRC signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 101.

【0063】

A despreading section 113, demodulator 114, reception power calculation section 115, and unused DRC detection section 116 are provided for each communication terminal. From each demodulator 114 a DRC signal for the corresponding communication terminal is output, and from each unused DRC detection section 116 a detection result for the corresponding communication terminal is output.

【0064】

FIG 3 is a block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention. In FIG 3, a communication mode determination section 201 determines a communication mode indicating a combination of modulation method and coding method based on a CIR measured by a CIR measurement section 219 described later herein, and outputs the result to a DRC signal creation section 202. The communication mode determination section 201 also indicates the downlink receive data demodulation method to an adaptive demodulator 216, and indicates the downlink receive data decoding method to an adaptive decoding section 217, based on the determined communication mode.

【0065】

The DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode output from the communication mode determination section 201, and outputs this DRC signal to a modulator 203 and DRC power controller 205.

【0066】

Modulator 203 modulates the DRC signal and outputs the resulting signal to a spreading section 204. spreading section 204 spreads the output signal from modulator 203 and outputs the resulting signal to the DRC power controller 205. The DRC power controller 205 refers to a transmission power table 206 that shows the correspondence between DRC numbers and transmission power, controls the DRC signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209 described later herein, and outputs the DRC signal that has undergone transmission power control to a multiplexer 210. The actual method of controlling DRC signal transmission power will be described later herein.

【0067】

A modulator 207 modulates the pilot signal and outputs the resulting signal to a spreading section 208. Spreading section 208 spreads the output signal from modulator 207 and outputs the resulting signal to the pilot power controller 209. The pilot power controller 209 controls the transmission power of the pilot signal, and outputs the pilot signal that has undergone transmission power control to the multiplexer 210. The pilot power controller 209 also outputs the pilot signal transmission power to the DRC power controller 205.

【0068】

The multiplexer 210 performs time multiplexing of the DRC signal that has undergone transmission power control and the pilot signal that has undergone transmission power control at predetermined intervals, and outputs the resulting signal to a transmit RF section 211. The transmit RF section 211 converts the frequency of the output signal from the multiplexer 210 to radio frequency, and outputs the resulting signal to a duplexer 212.

【0069】

The duplexer 212 transmits the output signal from the transmit RF section 211 as a radio signal from an antenna 213 to the base station. Also, a signal transmitted as a radio signal by the base station and received as a radio signal by the antenna 213 is output by the duplexer 212 to a receive RF section 214.

【0070】

The receive RF section 214 converts the frequency of the radio frequency signal output from the duplexer 212 to base band, and outputs the resulting signal to a despreading section 215 and a despreading section 218.

【0071】

Despreading section 215 despreads the data component of the base band signal and outputs the resulting signal to the adaptive demodulator 216. The adaptive demodulator 216 demodulates the output signal from despreading section 215 in accordance with the directions of the communication mode determination section 201, and outputs the resulting signal to the adaptive decoding section 217. The adaptive decoding section 217 decodes the output signal from the adaptive demodulator 216 in accordance with the directions of the communication mode determination section 201, and obtains receive data.

【0072】

Despreading section 218 despreads the pilot signal component of the base band signal and outputs the resulting signal to a CIR measurement section 219. The CIR measurement section 219 measures the CIR of the pilot signal output from despreading section 218, and outputs the result to the communication mode determination section 201.

【0073】

Next, the procedure for transmission/reception of signals between the base station shown in FIG 2 and the communication terminal shown in FIG 3 will be described.

【0074】

First, at the start of communication, a pilot signal is modulated by the modulator 106 in the base station, is spread by spreading section 107, and is output to the multiplexer 108. Only the spread pilot signal is output from the multiplexer 108 to the transmit RF section 109. The spread pilot signal is frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

【0075】

A radio signal of only the pilot signal component transmitted as a radio signal from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to base band by the receive RF section 214. The pilot signal component of the base band signal is despread by despreading section 218, and output to the CIR measurement section 219.

【0076】

Next, in the CIR measurement section 219, the CIR of the pilot signal output from despreading section 218 is measured, and based on the CIR, the communication mode is determined by the communication mode determination section 201. Then a DRC signal with a number corresponding to the communication mode is created by the DRC signal creation section 202.

【0077】

The DRC signal is modulated by modulator 203, spread by spreading section 204, and output to the DRC power controller 205. In the DRC power controller 205, the DRC signal transmission power is controlled based on the transmission power of the pilot signal output from the pilot power controller 209, and the ratios of pilot signal transmission power to DRC signal transmission power set beforehand in the transmission power table 206.

【0078】

The contents set in the transmission power table 206 will be described below. FIG 4 is a drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention.

【0079】

The transmission power table 206 shows the correspondence between DRC numbers and DRC signal transmission power, set so that the higher the DRC number, the higher is the transmission power. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the transmission power table 206, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power.

【0080】

As explained above, the frequency of selection by the base station tends to be proportional to the downlink channel quality indicated by a DRC signal, and therefore in this embodiment, transmission power is higher, and susceptibility to errors lower, the better the downlink channel quality indicated by a DRC signal. As a result, the probability of a DRC signal that indicates that downlink channel quality is good being received erroneously can be made lower than the probability of a DRC signal that indicates that downlink channel quality is poor being received erroneously. In other words, the probability of a DRC signal with a high frequency of selection by the base station being received erroneously can be made lower than the probability of a DRC signal with a low frequency of selection by the base station being received erroneously.

【0081】

The DRC signal transmission power values set in the transmission power table 206 are expressed as a ratio to the pilot signal transmission power. Here, as shown in FIG 4, the settings are arranged so that DRC number 3 in the middle of DRC numbers 1 to 5 is taken as a reference, and DRC signals indicating a lower number than DRC number 3 are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a higher number than DRC number 3 are transmitted at higher transmission power than the pilot signal transmission power. That is to say, the settings are arranged so that DRC signals indicating a poorer channel quality than a predetermined channel quality (here, the channel quality corresponding to a DRC signal with DRC number 3) are transmitted at lower transmission power than the pilot signal transmission power, while DRC signals indicating a better channel quality than the predetermined channel quality are transmitted at higher transmission power than the pilot signal transmission power.

【0082】

Thus, with this embodiment, by setting DRC signals for which transmission power is increased and DRC signals for which transmission power is decreased in comparison with conventional DRC signal transmission power (here, that is, pilot signal transmission power), and making the total of DRC signal transmission power increases and decreases ±0 dB, it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors while keeping average DRC signal transmission power constant compared with a conventional system. That is to say, it is possible to proportionally reduce susceptibility to errors of DRC signals indicating that downlink channel quality is good without reducing uplink capacity compared with a conventional system.

【0083】

Also, since, in this way, DRC signals indicating that downlink channel quality is poor (DRC signals with DRC numbers 1 and 2 in FIG 4) are transmitted at lower transmission power than in a conventional system, it is possible to reduce power consumption in a communication terminal that is located far from the base station and for which there is a high probability of transmitting a DRC signal indicating that downlink channel quality is poor. That is to say, in the case of a communication terminal that transmits a DRC signal indicating that downlink channel quality is poor, whereas the DRC signal was previously transmitted at transmission power that was high to begin with, according to this embodiment the DRC signal transmission power can be made lower than that high transmission power, enabling communication terminal power consumption to be greatly reduced.

【0084】

As the frequency of selection by a base station is low to begin with for a DRC signal indicating that downlink channel quality is poor, there is almost no effect of producing a fall in throughput due to transmitting a DRC signal indicating that downlink channel quality is poor at lower transmission power than previously in this way.

【0085】

Also, with this embodiment, DRC signals indicating that uplink channel quality is good (DRC signals with DRC numbers 4 and 5 in FIG 4) are transmitted at higher transmission power than in a conventional system. However, there is a high possibility of a DRC signal indicating that uplink channel quality is good being transmitted from a communication terminal located comparatively near the base station. Also, due to pilot signal transmission power control that is performed constantly on an uplink, the transmission power of a pilot signal transmitted from a communication terminal located comparatively near the base station (that is, the conventional DRC signal transmission power) is low to begin with. Therefore, in the case of a communication terminal that transmits a DRC signal indicating that uplink channel quality is good, DRC signal transmission power remains low and power consumption remains low even though the previously originally low DRC signal transmission power increases, and so there is almost no effect on power consumption.

【0086】

In the DRC power controller 205, the DRC signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 206. Then, in the DRC power controller 205, the transmission power of the DRC signal output from spreading section 204 is adjusted to this obtained transmission power, and a DRC signal that has been subjected to transmission power control is output to the multiplexer 210. To give a specific example, if the number of the DRC signal output from the DRC signal creation section 202 to the DRC power controller 205 is 5, the transmission power of the DRC signal output from spreading section 204 is adjusted to a transmission power 2 dB lower than the transmission power of the pilot signal output from the pilot power controller 209.

【0087】

The DRC signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by the transmit RF section 211, and transmitted to the base station as a radio signal from the antenna 213 via the duplexer 212.

【0088】

The radio signal transmitted from the communication terminal is received by the antenna 111 of the base station, and input to the receive RF section 112 via the duplexer 110. The signal input to the receive RF section 112 is frequency-converted to base band, despread by the despreading section 113 using the spreading code used to spread the DRC signal, and output to the demodulator 114 and reception power calculation section 115.

【0089】

In the demodulator 114 the output signal from the despreading section 113 is demodulated, and the DRC signal is extracted and output to the allocation section 101.

【0090】

Here, since a DRC signal indicating that downlink channel quality is poor is transmitted by a communication terminal at lower transmission power than in a conventional system, the probability of a DRC signal indicating that downlink channel quality is poor being received erroneously by the base station is increased. Also, as stated above, if communication resource allocation is performed based on an erroneously received DRC signal, downlink throughput will fall.

【0091】

Thus, in the reception power calculation section 115, the reception power of the despread DRC signal is measured, and is output to the unused DRC detection section 116. The lowest reception power at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest (a DRC signal with DRC number 1 in FIG 4) has been set beforehand in the unused DRC detection section 116 as a threshold value. Then, in the unused DRC detection section 116, a DRC signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 101. A DRC signal detected by the unused DRC detection section 116 is a DRC signal that is not used by the allocation section 101 in determining communication resource allocation.

【0092】

In the allocation section 101, communication resource allocation to each communication terminal is determined based on the DRC signals remaining after DRC signals detected by the unused DRC detection section 116 have been excluded from the DRC signals extracted by the demodulator 114.

【0093】

Thus, in a base station according to this embodiment, a DRC signal of reception power lower than the lowest reception power at which a DRC signal indicating that downlink channel quality is poorest is not received erroneously is excluded. That is to say, in a base station according to this embodiment, a notification signal susceptible to errors is excluded in determining downlink communication resource allocation. Therefore, according to a base station of this embodiment, even though a DRC signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on an erroneous DRC signal.

【0094】

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

【0095】

A base station according to this embodiment may also be configured as shown in FIG 5. FIG 5 is a block diagram showing another configuration of a base station according to Embodiment 1 of the present invention; That is to say, a base station may be configured in such a way that the reception power calculation section 115 and unused DRC detection section 116 shown in FIG 2 are replaced by a likelihood calculation section 301 and unused DRC detection section 302. In the following description, parts identical to those in FIG 2 are assigned the same reference numerals as in FIG 2 and their detailed explanations are omitted.

【0096】

In FIG 5, the likelihood calculation section 301 calculates a likelihood that indicates the probable degree of certainty of a DRC signal, and outputs the calculation result to the unused DRC detection section 302. The lowest likelihood at which an error does not occur in a DRC signal indicating that downlink channel quality is poorest has been set beforehand in the unused DRC detection section 302 as a threshold value. Then, in the unused DRC detection section 302, a DRC signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 101.

【0097】

In this way the same effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG 5.

【0098】

(Embodiment 2)

In a communication terminal according to Embodiment 2 of the present invention, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted.

【0099】

FIG 6 is a block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 203, spreading section 204, DRC power controller 205, and transmission power table 206 shown in FIG 3 are replaced by a code word selector 401, code word table 402, modulator 403, and spreading section 404. In the following description, parts identical to those in FIG 3 are assigned the same reference numerals as in FIG 3 and their detailed explanations are omitted.

【0100】

The code word selector 401 refers to the code word table 402, converts a DRC signal created by the DRC signal creation section 202 to a predetermined code word, and outputs the code word to modulator 403. Modulator 403 modulates the code word and outputs it to spreading section 404. Spreading section 404 spreads the output signal from modulator 403 and outputs the resulting signal to a multiplexer 210.

【0101】

Next, the operation of a communication terminal according to this embodiment will be described.

First, the contents set in the code word table 402 will be described. FIG 7 is a drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention.

【0102】

The code word table 402 shows the correspondence between DRC numbers and code words after DRC signal conversion, set so that the higher the DRC number, the larger is the code word minimum distance of the code word to which the DRC signal is converted. Here, numbers 1 to 5 are used as DRC numbers, with a higher number representing a proportionally better downlink channel quality. That is to say, in the settings in the code word table 402, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which the DRC signal is converted.

【0103】

Here, "code word distance" is the number of bits that differ between code words, and "code word minimum distance" is the minimum number of bits by which a particular code word differs with respect to all other code words. To be specific, the code word for a DRC signal with DRC number 5 is "111111111", and this code word "111111111" differs by a minimum of 6 bits when compared with any of the code words corresponding to DRC signals with DRC numbers 1 to 4.

Therefore, the code word minimum distance of the code word for a DRC signal with DRC number 5 is 6. Similarly, the code word minimum distance of the code word for a DRC signal with DRC number 4 is 3.

【0104】

Thus, the code word for a DRC signal with DRC number 5 is less likely to be mistaken for another code word than the code word for a DRC signal with DRC number 4. That is to say, the larger code word minimum distance of a code word, the less likely it is to be mistaken for another code word.

【0105】

In the code word selector 401, a DRC signal output from the DRC signal creation section 202 is converted to a code word set in the code word table 402, and output to modulator 403. To give a specific example, if the DRC signal output from the DRC signal creation section 202 is a number 5 DRC signal, it is converted to code word "111111111".

【0106】

Following conversion, the code word is modulated by modulator 403 and spread by spreading section 404. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

【0107】

Thus, according to this embodiment, the better the downlink channel quality indicated by a DRC signal, the larger is the code word minimum distance of the code word to which that DRC signal is converted with respect to other DRC signal code words before being transmitted, and therefore it is possible to make DRC signals indicating that downlink channel quality is good proportionally less susceptible to errors, and to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal, and so to prevent a fall in downlink throughput.

【0108】

Also, according to this embodiment, it is possible to reduce the error occurrence rate of DRC signals for which the probability of selection by a base station is high without increasing DRC signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on an erroneous DRC signal without increasing communication terminal power consumption.

【0109】

Moreover, according to this embodiment, it is possible to change the degree of insusceptibility to errors of code words corresponding to DRC signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

【0110】

(Embodiment 3)

A base station according to Embodiment 3 of the present invention transmits to a communication terminal a control signal for table rewriting based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined, and a communication terminal according to Embodiment 3 of the present invention rewrites the contents of a transmission power table or code word table based on a control signal transmitted from the base station.

【0111】

FIG 8 is a block diagram showing the configuration of a base station according to Embodiment 3 of the present invention; As shown in this figure, a base station according to this embodiment is configured by further providing the configuration shown in FIG 2 with a detection rate calculation section 501, control signal creation section 502, modulator 503, and spreading section 504. In the following description, parts identical to those in FIG 2 are assigned the same reference numerals as in FIG 2 and their detailed explanations are omitted.

【0112】

In FIG 8, the detection rate calculation section 501 calculates the rate of detection by the unused DRC detection section 116 and outputs the result to the control signal creation section 502. That is to say, the detection rate calculation section 501 calculates the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined.
Based on the detection rate, the control signal creation section 502 creates a control signal for table rewriting (hereinafter referred to as "table rewrite signal"), which is output to modulator 503. Modulator 503 modulates the table rewrite signal and outputs it to spreading section 504. Spreading section 504 spreads the output signal from modulator 503 and outputs the resulting signal to a multiplexer 108.

【0113】

FIG 9 is a block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured by further providing the configuration shown in FIG 3 with a despreading section 601, demodulator 602, and table rewriting section 603. In the following description, parts identical to those in FIG 3 are assigned the same reference numerals as in FIG 3 and their detailed explanations are omitted.

【0114】

In FIG 9, despreading section 601 despreads a base band signal using the spreading code used to spread the table rewrite signal, and outputs the resulting signal to the demodulator 602. The demodulator 602 demodulates the output signal from despreading section 601 and extracts the table rewrite signal, which is output to the table rewriting section 603. The table rewriting section 603 rewrites the contents of the transmission power table in accordance with the table rewrite signal.

【0115】

Next, the procedure for transmission/reception of signals between the base station shown in FIG 8 and the communication terminal shown in FIG 9 will be described.

【0116】

First, in the detection rate calculation section 501 of the base station, the detection rate of the unused DRC detection section 116 is calculated and is output to the control signal creation section 502. The detection rate can be calculated, for example, from the number of detections in a predetermined time.

【0117】

A predetermined threshold value for the detection rate has been set in the control signal creation section 502, and this threshold value is compared with the detection rate calculated by the detection rate calculation section 501. If the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be increased is created, and is output to modulator 503. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all DRC signal transmission power values to be increased simultaneously from their current values.

【0118】

The table rewrite signal is modulated by modulator 503, spread by spreading section 504, and output to the multiplexer 108. The spread table rewrite signal is multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to communication terminals as a radio signal from the antenna 111 via the duplexer 110.

【0119】

The radio signal transmitted from the base station is received by the antenna 213 of the communication terminal, passes through the duplexer 212, and is frequency-converted to base band by the receive RF section 214. The base band signal is despread by despreading section 601 and demodulated by the demodulator 602, and the table rewrite signal is extracted. The extracted table rewrite signal is output to the table rewriting section 603.

【0120】

The contents of the transmission power table 206 are then rewritten by the table rewriting section 603 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 increases all the transmission power values set in the transmission power table 206.

【0121】

In the above description, the configuration is such that the table rewriting section 603 rewrites the contents of the transmission power table 206, but this embodiment may also be applied to a communication terminal according to Embodiment 2, and a configuration may be used whereby the table rewriting section 603 rewrites the contents of the code word table 402 shown in FIG 6.

【0122】

In this case, if the detection rate calculated by the detection rate calculation section 501 is greater than or equal to the threshold value, the control signal creation section 502 of a base station according to this embodiment creates a table rewrite signal ordering all code word minimum distances set in the code word table 402 to be increased. That is to say, if the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined is greater than or equal to the predetermined threshold value, the control signal creation section 502 creates a table rewrite signal that orders all code word minimum distances of code words corresponding to DRC signals to be increased simultaneously from their current values. Then the table rewriting section 603 rewrites the contents of the code word table 402 in accordance with the table rewrite signal. That is to say, the table rewriting section 603 rewrites the code words set in the code word table 402 with code words all of whose code word minimum distances are larger than at present.

【0123】

Thus, according to this embodiment, the contents of the transmission power table or code word table are rewritten based on the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined. In other words, in this embodiment, transmission power table or code word table contents are rewritten adaptively in accordance with variations in the communication environment. That is to say, according to this embodiment, when the communication environment deteriorates and the rate of occurrence of DRC signals that are excluded when communication resource allocation is determined reaches or exceeds a predetermined threshold value, the transmission power of each DRC signal is increased, or the code word minimum distance of the code word corresponding to each DRC signal is increased, thereby enabling the DRC signal error occurrence rate to be held down even when the communication environment deteriorates.

【0124】

In this embodiment, the predetermined detection rate threshold value is decided upon considering appropriately the environment in which the communication system is used.

【0125】

Moreover, with this embodiment, it is also possible to further set a second predetermined threshold value in the control signal creation section 502 to create a table rewrite signal ordering all transmission power values set in the transmission power table 206 to be decreased when the detection rate calculated by the detection rate calculation section 501 falls below this second threshold value. By this means, it is possible to reduce DRC signal transmission power when DRC signal reception quality becomes excessive, thereby enabling communication terminal power consumption to be decreased.

【0126】

Furthermore, in this embodiment, table rewriting is performed based on the rate of detection by the unused DRC detection section 116, but it is also possible to rewrite a table based on the distribution of DRC signals used in determining communication resource allocation from among DRC signals transmitted from mobile stations, so that that distribution is optimized. In this case, the base station shown in FIG 8 is configured with the detection rate calculation section replaced by a used DRC distribution determination section, which determines the distribution of DRC signals used in communication resource allocation determination based on DRC signals output from the demodulator 114 and detection results output from the unused DRC detection section 116, and outputs a signal indicating that distribution to the control signal creation section 502. The control signal creation section 502 then creates a table rewrite signal based on the signal indicating the distribution output from the used DRC distribution determination section.

【0127】

(Embodiment 4)

A communication terminal according to Embodiment 4 of the present invention transmits at higher transmission power in proportion to CIR information that indicates that downlink channel quality is good. A base station according to Embodiment 4 of the present invention excludes CIR information for which the reception power is lower than a predetermined threshold value in performing communication resource allocation.

【0128】

In above-described Embodiment 1, a communication terminal determines the communication mode based on the CIR and transmits a DRC signal corresponding to that determined communication mode to the base station at predetermined transmission power, and the base station determines communication resource allocation to each communication terminal based on the DRC signals. DRC signal can be represented with far fewer bits than other information indicating downlink channel quality (such as a downlink CIR, for example), and therefore use of a DRC signal has the advantage of enabling the downlink channel utilization efficiency to be increased. On the other hand, since a communication terminal must be provided with a table for communication mode determination, a table for DRC signal creation, and so forth to determine the communication mode and create a DRC signal, there are the disadvantages of increased communication terminal power consumption and apparatus size.

【0129】

Thus, in this embodiment, a communication terminal transmits CIR information to the base station at predetermined transmission power, and the base station determines the communication mode based on the CIR information and then determines communication resource allocation to each communication terminal. As a result, although there is the disadvantage of a slight decrease in the uplink channel utilization efficiency, the fact that communication terminals do not have to determine the communication mode and create a DRC signal, and do not need to be provided with a communication mode determination table, DRC signal creation table, and so forth, offers the major advantage of enabling communication terminal power consumption and apparatus size to be reduced. Also, in this embodiment, it is possible for CIR information for a plurality of terminals to be compared in the base station, and the correct communication mode to be determined with certainty, making this embodiment particularly useful in cases such as those where it is not possible for the communication mode to be determined simply from the CIR in each communication terminal.

【0130】

A base station according to this embodiment and a communication terminal according to this embodiment will be described below. FIG 10 is a block diagram showing the configuration of a base station according to Embodiment 4 of the present invention; In the following description, parts identical to those in FIG 2 are assigned the same reference numerals as in FIG 2 and their detailed explanations are omitted.

【0131】

In FIG 10, a demodulator 701 demodulates the output signal from a despreading section 113, and extracts a signal that contains CIR information (hereinafter referred to as "CIR signal"), which is output to an allocation section 704.

【0132】

A reception power calculation section 702 measures the reception power of the despread CIR signal, which is output to an unused CIR detection section 703. In the unused CIR detection section 703 is set a predetermined threshold value in the same way as in Embodiment 1, and a CIR signal of reception power lower than this threshold value is detected, and the result of the detection is output to the allocation section 704.

【0133】

A despreading section 113, demodulator 701, reception power calculation section 702, and unused CIR detection section 703 are provided for each communication terminal. From each demodulator 701 a CIR signal for the corresponding communication terminal is output, and from each unused CIR detection section 703 a detection result for the corresponding communication terminal is output.

【0134】

The allocation section 704 determines communication resource allocation to each communication terminal based on CIR information indicated by CIR signals excluding CIR signals detected by the unused CIR detection sections 703 from among the CIR signals extracted by the demodulators 701. Then, based on the determined communication resource allocation, the allocation section 704 notifies a buffer 102 for output of downlink transmit data, and outputs the CIR information to a communication mode determination section 705.

【0135】

Based on the CIR information output from the allocation section 704, the communication mode determination section 705 determines the communication mode, which indicates a combination of modulation method and coding method, and outputs a signal indicating this communication mode to a modulator 706. In addition, based on the determined communication mode, the communication mode determination section 705 indicates the downlink transmit data coding method to an adaptive coding section 103, and indicates the downlink transmit data modulation method to an adaptive modulator 104. Modulator 706 modulates the signal indicating the communication mode and outputs it to a spreading section 707. Spreading section 707 spreads the output signal from modulator 706 and outputs the resulting signal to a multiplexer 108.

【0136】

FIG 11 is a block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention. In the following description, parts identical to those in FIG 3 are assigned the same reference numerals as in FIG 3 and their detailed explanations are omitted.

【0137】

In FIG 11, a CIR information creation section 801 creates a CIR signal indicating a CIR measured by a CIR measurement section 219, and outputs it to a modulator 802 and CIR information power controller 804. The modulator 802 modulates the CIR signal and outputs it to the spreading section 803. Spreading section 803 spreads the output signal from modulator 802 and outputs the spread signal to the CIR information power controller 804. The CIR information power controller 804 refers to a transmission power table 805 that shows the correspondence between CIR level and transmission power, and controls the CIR signal transmission power based on the transmission power of a pilot signal output from a pilot power controller 209, and outputs the CIR signal that has undergone transmission power control to a multiplexer 210.

【0138】

A despreading section 807 despreads the base band signal using the spreading code used to spread the signal indicating the communication mode, and outputs the despread signal to a communication mode detection section 808. The communication mode detection section 808 demodulates the output signal from despreading section 807 and detects the communication mode. Then, based on the detected communication mode, the communication mode detection section 808 indicates the downlink receive data demodulation method to an adaptive demodulator 216 and indicates the downlink receive data decoding method to an adaptive decoding section 217.

【0139】

Next, the procedure for transmission/reception of signals between the base station shown in FIG 10 and the communication terminal shown in FIG 11 will be described.

【0140】

First, in the communication terminal shown in FIG 11, the CIR of the pilot signal output from despreading section 218 is measured by the CIR measurement section 219, and a CIR signal is created by the CIR information creation section 801.

【0141】

The CIR signal is modulated by modulator 802, spread by spreading section 803, and output to the CIR information power controller 804. In the transmission power table 805, the correspondence between CIR level and CIR signal transmission power is shown in the same way as in Embodiment 1, set so that the CIR signal transmission power increases in proportion to the level of the CIR. That is to say, in the settings in transmission power table 805, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power. Also, as in Embodiment 1, the CIR signal transmission power values set in the transmission power table 805 are expressed as a ratio to the pilot signal transmission power.

【0142】

In the CIR information power controller 804, the CIR signal transmission power is obtained by having the transmission power of the pilot signal output from the pilot power controller 209 adjusted in accordance with the ratios set in the transmission power table 805. Then, in the CIR information power controller 804, the transmission power of the CIR signal output from spreading section 803 is adjusted to this obtained transmission power, and a CIR signal that has been subjected to transmission power control is output to the multiplexer 210.

【0143】

The CIR signal that has undergone transmission power control is multiplexed with the pilot signal by the multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

【0144】

In the base station shown in FIG 10, the output signal from the despreading section 113 is demodulated by demodulator 701, and the demodulated CIR signal is extracted and output to the allocation section 704. In the reception power calculation section 702, the reception power of the despread CIR signal is measured, and is output to the unused CIR detection section 703. The lowest reception power at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 703 as a threshold value, as in Embodiment 1. Then, in the unused CIR detection section 703, a CIR signal of reception power lower than this threshold value is detected, and the detection result is output to the allocation section 704. A CIR signal detected by the unused CIR detection section 703 is a CIR signal that is not used by the allocation section 704 in determining communication resource allocation.

【0145】

In the allocation section 704, communication resource allocation to each communication terminal is determined based on the CIR shown by CIR signals remaining after CIR signals detected by the unused CIR detection section 703 have been excluded from the CIR signals extracted by the demodulator 701, and CIR information is output to the communication mode determination section 705.

【0146】

In the communication mode determination section 705, the communication mode is determined based on CIR information output from the allocation section 704, and a signal indicating this communication mode is output to modulator 706. The signal indicating the communication mode is modulated by modulator 706, spread by spreading section 707, multiplexed with transmit data and the pilot signal in the multiplexer 108, frequency-converted to radio frequency by the transmit RF section 109, and transmitted to the communication terminal as a radio signal from an antenna 111 via a duplexer 110.

【0147】

In the communication terminal shown in FIG 11, a base band signal is despread by despreading section 807, and the despread signal is output to the communication mode detection section 808. In the communication mode detection section 808, the output signal from despreading section 807 is demodulated and the communication mode is detected, and based on the detected communication mode, the downlink receive data demodulation method is indicated to the adaptive demodulator 216 and the downlink receive data decoding method is indicated to the adaptive decoding section 217.

【0148】

Thus, according to this embodiment, as in Embodiment 1, the better the downlink channel quality indicated by a CIR signal, the higher is the transmission power at which transmission is performed, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

【0149】

Also, according to this embodiment, as in Embodiment 1, a CRI signal of reception power lower than the lowest reception power at which a CIR signal indicating that downlink channel quality is poorest is not received erroneously is excluded, and therefore, even though a CIR signal indicating that downlink channel quality is poor is transmitted at lower transmission power than in a conventional system, it is possible to prevent communication resource allocation from being determined based on erroneous CIR information.

【0150】

A base station according to this embodiment may also be configured as shown in FIG 12. FIG 12 is a block diagram showing another configuration of a base station according to Embodiment 4 of the present invention; That is to say, a base station may be configured in such a way that the reception power calculation section 702 and unused CIR detection section 703 shown in FIG 10 are replaced by a likelihood calculation section 901 and unused CIR detection section 902. In the following description, parts identical to those in FIG 10 are assigned the same reference numerals as in FIG 10 and their detailed explanations are omitted.

【0151】

In FIG 12, the likelihood calculation section 901 calculates a likelihood that indicates the probable degree of certainty of a CRI signal, and outputs the calculation result to the unused CIR detection section 902. The lowest likelihood at which an error does not occur in a CIR signal indicating that downlink channel quality is poorest has been set beforehand in the unused CIR detection section 902 as a threshold value. Then, in the unused CIR detection section 902, a CIR signal with a likelihood lower than this threshold value is detected, and the detection result is output to the allocation section 704.

【0152】

In this way the same effect as described above is also obtained when a base station according to this embodiment is configured as shown in FIG 12.

【0153】

(Embodiment 5)

In a communication terminal according to Embodiment 5 of the present invention, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted.

【0154】

FIG 13 is a block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention. As shown in this figure, a communication terminal according to this embodiment is configured in such a way that the modulator 802, spreading section 803, CIR information power controller 804, and transmission power table 805 shown in FIG 11 are replaced by a code word selector 1001, code word table 1002, modulator 1003, and spreading section 1004. In the following description, parts identical to those in FIG 11 are assigned the same reference numerals as in FIG 11 and their detailed explanations are omitted.

【0155】

The code word selector 1001 refers to the code word table 1002, converts a CIR signal created by the CIR information creation section 801 to a predetermined code word, and outputs it to modulator 1003. Modulator 1003 modulates the code word and outputs it to spreading section 1004. Spreading section 1004 spreads the output signal from modulator 1003 and outputs the resulting signal to a multiplexer 210.

【0156】

Next, the operation of a communication terminal according to this embodiment will be described.

In the same way as in above-described Embodiment 2, the code word table 1002 shows the correspondence between CIR level and code words after CIR signal conversion, set so that the higher the CIR level, the larger is the code word minimum distance of the code word to which the CIR signal is converted. That is to say, in the settings in the code word table 1002, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which the CIR signal is converted.

【0157】

In the code word selector 1001, a CIR signal output from the CIR information creation section 801 is converted to a code word set in the code word table 1002, and output to modulator 1003. Following conversion, the code word is modulated by modulator 1003 and spread by spreading section 1004. The spread code word is multiplexed with a pilot signal by a multiplexer 210, frequency-converted to radio frequency by a transmit RF section 211, and transmitted to the base station as a radio signal from an antenna 213 via a duplexer 212.

【0158】

Thus, according to this embodiment, as in Embodiment 2, the better the downlink channel quality indicated by a CIR signal, the larger is the code word minimum distance of the code word to which that CIR signal is converted with respect to other CIR signal code words before being transmitted, and therefore it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high. By this means it is possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information, and so to prevent a fall in downlink throughput.

【0159】

Also, according to this embodiment, as in Embodiment 2, it is possible to reduce the error occurrence rate of CIR information for which the probability of use by a base station is high without increasing CIR signal transmission power, thereby making it possible to reduce the possibility of communication resource allocation being determined based on erroneous CIR information without increasing communication terminal power consumption.

【0160】

Moreover, according to this embodiment, as in Embodiment 2, it is possible to change the degree of insusceptibility to errors of code words corresponding to CIR signals while keeping the code length of code words constant, and therefore it is not necessary to provide a plurality of demodulation systems in accordance with different code lengths in a base station, thus enabling the apparatus configuration of a base station to be simplified.

【0161】

(Embodiment 6)

A communication terminal according to Embodiments 6 to 8 of the present invention transmits with less susceptibility to errors in the propagation path in proportion to information for which the amount of change is large within CIR information. In other words, a communication terminal according to Embodiments 6 to 8 of the present invention transmits with less susceptibility to errors in the propagation path in proportion to information that indicates a broad value within CIR information.

【0162】

The meaning of "information for which the amount of change is large" and "information that indicates a broad value" here can be illustrated by a specific example. If a CIR value is indicated by a value with a decimal fraction (such as 8.7 dB), then the above-mentioned information refers to the integer part (here, "8"). In this case, since the amount of change per unit of the integer part is 1 dB, while the amount of change per unit of the fractional part is 0.1 dB, the integer part is "information for which the amount of change is large". Therefore, if an integer part is received erroneously by a base station, the degree of error is large compared with the case where a fractional part is received erroneously, and the probability of an erroneous determination of communication mode is higher. That is to say, the probability of downlink throughput falling is higher.

【0163】

Also, CIR information is normally converted to a code word with a limited number of bits before being transmitted to a base station, and there are also limits on the transmission power and spreading code spreading factor that can be used in transmitting CIR information. There are thus limits to making CIR information overall insusceptible to errors, and it is difficult to do so.

【0164】

Thus, in Embodiments 6 to 8 of the present invention, within the above-described limitations on transmission of CIR information, transmission is performed with insusceptibility to errors in the propagation path made proportional to "information for which the amount of change is large" within the above limitations so that, at least "information for which the amount of change is large" (that is, "information that indicates a broad value") of CIR information is received correctly.

【0165】

A communication terminal according to Embodiment 6 of the present invention is described below. A communication terminal according to Embodiment 6 of the present invention performs conversion to, and transmits, a code word with a code length proportional to the value of the upper digit in a CIR value.

【0166】

FIG 14 is a block diagram showing the configuration of a communication terminal according to Embodiment 6 of the present invention. In the following description, parts identical to those in FIG 11 are assigned the same reference numerals as in FIG 11 and their detailed explanations are omitted.

【0167】

In FIG 14, a CIR signal creation section 1101 converts a CIR value measured by a CIR measurement section 219 to a code word and creates a CIR signal, and outputs the created CIR signal to a multiplexer 210. At this time, the CIR signal creation section 1101 creates a CIR signal by performing conversion to a code word with a code length proportional to the value of the upper digit in the CIR value.

【0168】

Next, the configuration of the CIR signal creation section 1101 will be described. FIG 15 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 6 of the present invention.

【0169】

In FIG 15, an upper digit information generation section 1201 outputs the value of the upper digit in the CIR value output from the CIR measurement section 219 to a 6-bit coding section 1203. A lower digit information generation section 1202 outputs the value of the lower digit in the CIR value output from the CIR measurement section 219 to a 4-bit coding section 1204. To give a specific example, if the CIR value output from the CIR measurement section 219 is 8.7 dB, the upper digit information generation section 1201 outputs the value of the integer part, "8", to the 6-bit coding section 1203, and the lower digit information generation section 1202 outputs the value of the fractional part, "7", to the 4-bit coding section 1204.

【0170】

The 6-bit coding section 1203 converts the value output from the upper digit information generation section 1201 (here, "8") to a 6-bit code word, and outputs the 6-bit code word to a time multiplexer 1205. The 4-bit coding section 1204 converts the value output from the lower digit information generation section 1202 (here, "7") to a 4-bit code word, and outputs the 4-bit code word to the time multiplexer 1205. It is herein assumed that the number of bits that can be used to indicate a CIR value is ten.

【0171】

The time multiplexer 1205, by storing the 6-bit code word in the first half of a slot and storing the 4-bit code word in the following latter half of the slot, performs time multiplexing of the code word for the integer part of the CIR value (that is, the code word corresponding to the value of the upper digit) and the code word for the fractional part of the CIR value (that is, the code word corresponding to the value of the lower digit). The time multiplexer 1205 then outputs the time-multiplexed 10-bit code word to a modulator 1206 as a CIR signal. It is herein assumed that one slot is composed of 10 bits, with the integer part of a CIR value represented by the preceding 6 bits and the fractional part of a CIR value represented by the succeeding 4 bits.

【0172】

The modulator 1206 modulates the CIR signal and outputs it to the spreading section 1207. Spreading section 1207 spreads the output signal from modulator 1206 and outputs the resulting signal to a multiplexer 210.

【0173】

Next, the operation of a communication terminal with the above configuration will be described. In the 6-bit coding section 1203, the value of the upper digit in the CIR value (here, "8") is converted to a 6-bit code word, and in the 4-bit coding section 1204, the value of the lower digit in the CIR value (here, "4") is converted to a 4-bit code word.

【0174】

As the number of different code words that can be represented by 6 bits is 2^6, and the number of different code words that can be represented by 4 bits is 2^4, the code word minimum distance between code words can be made larger for code words represented by 6 bits. Therefore, a code word represented by 6 bits is less susceptible to being mistaken for another code word than a code word represented by 4 bits.

That is to say, in this embodiment, the value of the upper digit of a CIR value is less susceptible to errors.

【0175】

Thus, with a communication terminal according to this embodiment, within the limitation of 10 bits available to indicate a CIR value, by performing conversion to a code word of a code length proportional to the value of the upper digit in a CIR value, it is possible to perform transmission with insusceptibility to errors made proportional to the value of the upper digit for which the amount of change is large. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

【0176】

In this embodiment, a case has been described where the upper digit value is converted to a 6-bit code word and the lower digit value is converted to a 4-bit code word. However, as long as the number of bits of the code word corresponding to the upper digit value is greater than the number of bits of the code word corresponding to the lower digit value, there are no particular limitations on these numbers of bits.

【0177】

(Embodiment 7)

A communication terminal according to Embodiment 7 of the present invention transmits with transmission power increased in proportion to the value of the upper digit in a CIR value.

【0178】

A communication terminal according to this embodiment differs from a communication terminal according to Embodiment 6 only in the internal configuration of the CIR signal creation section 1101, and therefore only the CIR signal creation section 1101 will be described in the following description.

【0179】

FIG 16 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 7 of the present invention. In the following description, parts identical to those in FIG 15 are assigned the same reference numerals as in FIG 15 and their detailed explanations are omitted.

【0180】

The CIR signal creation section 1101 shown in FIG 16 converts a CIR value measured by a CIR measurement section 219 to a code word, and then creates a CIR signal, increasing transmission power in proportion to the value of the upper digit.

【0181】

In FIG 16, the 5-bit coding section 1301 converts the value output from the upper digit information generation section 1201 to a 5-bit code word, and outputs the 5-bit code word to a modulator 1303. The 5-bit coding section 1302 converts the value output from the lower digit information generation section 1202 to a 5-bit code word, and outputs the 5-bit code word to a modulator 1304. Thus, in this embodiment, both the upper digit value and the lower digit value are converted to 5-bit code words, and therefore there is no difference between them in insusceptibility to errors from a code word standpoint.

【0182】

Modulator 1303 modulates the code word output from 5-bit coding section 1301, and outputs it to an upper digit spreading section 1305. Modulator 1304 modulates the code word output from 5-bit coding section 1302, and outputs it to a lower digit spreading section 1306.

【0183】

The upper digit spreading section 1305 spreads the output signal from modulator 1303, and outputs the spread signal to an upper digit power controller 1307. The lower digit spreading section 1306 spreads the output signal from modulator 1304, and outputs the spread signal to a lower digit power controller 1308. At this time, the upper digit spreading section 1305 and lower digit spreading section 1306 perform their respective spreading processing using different spreading codes of the same spreading factor. That is to say, the upper digit value of the CIR value and the lower digit value of the CIR value are spread using different spreading codes that have the same spreading factor.

【0184】

Based on the transmission power of a pilot signal output from a pilot power controller 209, the upper digit power controller 1307 controls the transmission power of the signal indicating the upper digit value of the CIR value, and outputs the signal that has undergone transmission power control to a code multiplexer 1309. Similarly, based on the transmission power of the pilot signal output from the pilot power controller 209, the lower digit power controller 1308 controls the transmission power of the signal indicating the lower digit value of the CIR value, and outputs the signal that has undergone transmission power control to the code multiplexer 1309. The actual transmission power control method will be described later herein.

【0185】

The code multiplexer 1309 multiplexes the signal indicating the upper digit value of the CIR value and the signal indicating the lower digit value of the CIR value in the same time slot. That is to say, the code multiplexer 1309 performs code multiplexing of the signal indicating the upper digit value and the signal indicating the lower digit value.

【0186】

Next, the operation of a communication terminal with the above configuration will be described.

In the upper digit power controller 1307, a signal indicating the upper digit value of a CIR value is adjusted to a transmission power whose only predetermined value is higher than the pilot signal transmission power. In the lower digit power controller 1308, a signal indicating the lower digit value of the CIR value is adjusted to a transmission power whose only predetermined value is lower than the pilot signal transmission power. That is to say, the transmission power is increased in proportion to the value of the upper digit in the CIR value.

【0187】

Thus, a communication terminal according to this embodiment can transmit with insusceptibility to errors made proportional to the upper digit value for which the amount of change is large by transmitting with transmission power increased in proportion to the upper digit value of a CIR value. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

【0188】

Also, in this embodiment, by increasing transmission power of the upper digit value compared with conventional CIR signal transmission power (here, the pilot signal transmission power), and decreasing transmission power of the lower digit value by the amount by which it is increased for the upper digit value, giving a total transmission power increase/decrease value of ±0 dB, the overall CIR signal transmission power is kept the same as conventional CIR signal transmission power. Thus, according to this embodiment, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value while keeping CIR signal transmission power the same as in a conventional system. That is to say, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value without reducing uplink capacity compared with a conventional system.

【0189】

(Embodiment 8)

A communication terminal according to Embodiment 8 of the present invention transmits with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit in a CIR value.

【0190】

A communication terminal according to this embodiment differs from a communication terminal according to Embodiment 6 or 7 only in the internal configuration of the CIR signal creation section 1101, and therefore only the CIR signal creation section 1101 will be described in the following description.

【0191】

FIG 17 is a block diagram showing the configuration of the CIR signal creation section of a communication terminal according to Embodiment 8 of the present invention. In the following description, parts identical to those in FIG 15 or FIG 16 are assigned the same reference numerals as in FIG 15 or FIG 16 and their detailed explanations are omitted.

【0192】

The CIR signal creation section 1101 shown in FIG 17 converts a CIR value measured by a CIR measurement section 219 to a code word, and then creates a CIR signal, with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit.

【0193】

In FIG 17, the upper digit spreading section 1401 spreads the output signal from modulator 1303 and outputs the resulting signal to a multiplexer 1205. The lower digit spreading section 1402 spreads the output signal from modulator 1304, and outputs the spread signal to a time multiplexer 1205. At this time, the upper digit spreading section 1401 performs spreading processing with a spreading code of the same kind as used by the lower digit spreading section 1402 and with a higher spreading factor than that of the lower digit spreading section 1402. That is to say, the upper digit value of the CIR value is spread with a higher spreading factor than the lower digit value. As a result, insusceptibility to errors in the propagation path is proportional to the upper digit value.

【0194】

Thus, a communication terminal according to this embodiment can transmit with insusceptibility to errors made proportional to the upper digit value for which the amount of change is large by transmitting with spreading performed using a spreading code with a higher spreading factor in proportion to the value of the upper digit in a CIR value. By this means, even if an error should occur in a CIR signal in the propagation path, the probability of being able to perform reception correctly at the base station is proportionally higher according to the value of the upper digit in a CIR value, and the degree of error in CIR values can be kept low. Thus, it is possible to reduce the possibility of an erroneous communication mode being determined in the base station.

【0195】

Also, in this embodiment, the spreading factor for the upper digit value is increased compared with a conventional CIR signal spreading factor, and the spreading factor for the lower digit value is decreased by the amount by which it is increased for the upper digit value. By this means, the amount of data sent in one slot is kept the same as for a conventional CIR signal. Thus, according to this embodiment, it is possible to perform transmission with insusceptibility to errors made proportional to the upper digit value without reducing the amount of data sent in one slot.

【0196】

It is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 1 and a communication terminal according to above-described Embodiment 2. Moreover, it is also possible to implement the present invention by combining a communication terminal according to above-described Embodiment 4 and a communication terminal according to above-described Embodiment 5. Furthermore, it is also possible to implement the present invention by combining the respective communication terminals according to above-described Embodiments 6 to 8. In addition, it is also possible for the transmission power table provided in a communication terminal according to above-described Embodiment 4 and the code word table provided in a communication terminal according to above-described Embodiment 5 to be rewritten as appropriate based on a control signal from the base station, in the same way as in above-described Embodiment 3.

【0197】

Also, in above-described Embodiments 1 to 8, a case has been described where a pilot signal is time-multiplexed, but above-described Embodiments 1 to 8 are not limited to this, and can also be applied to a case where a pilot signal is code-multiplexed.

【0198】

Moreover, in above-described Embodiments 1 to 8, a CIR has been used as a value that indicates pilot signal reception quality, but this is not a limitation, and any value may be used as long as it is a value that indicates reception quality.

【0199】

Furthermore, in above-described Embodiments 1 to 5, the predetermined threshold value set in the unused DRC detection section or the unused CIR detection section is assumed to be a fixed value, but a configuration may also be used whereby the threshold value is varied adaptively in accordance with the

DRC signal error rate or CIR signal error rate.

【0200】

In addition, in above-described Embodiments 6 to 8, either time multiplexing or code multiplexing may be used when multiplexing code words.

【0201】

Also, in above-described Embodiments 6 to 8, an example has been given in which a CIR value is represented by one integer-part digit and one fractional-part digit. However, this is not a limitation, and above-described Embodiments 6 to 8 may all be implemented for CIR values represented by a plurality of digits.

【0202】

Moreover, in above-described Embodiments 6 to 8, the value of the upper digit of a CIR value has been described as "information for which the amount of change is large". However, "information for which the amount of change is large" does not necessarily correspond to the size of a digit. For example, if a method is used whereby a CIR value is represented by an integer by first indicating a broad value of 0 db, 2 dB, 4 dB, 6 dB ... changing by 2 dB at a time, and adding information indicating the presence or absence of an increment of 1 dB for that broad value, a value changing by 2 dB at a time is "information for which the amount of change is large". With this method, to represent a CIR value of 7 dB, for example, CIR information that includes information indicating 6 dB and information indicating that there is an increment of 1 dB is transmitted to the base station. At this time, the communication terminal apparatus transmits the information indicating 6 dB with greater insusceptibility to errors than the information indicating that there is an increment of 1 dB, in the same way as in above-described Embodiments 6 to 8.

【0203】

[EFFECT OF THE INVENTION]

As described above, according to the present invention it is possible to prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

[BRIEF DESCRIPTION OF DRAWINGS]

[FIG 1]

A graph illustrating DRC signal selection frequency in a base station;

[FIG 2]

A block diagram showing a configuration of a base station according to Embodiment 1 of the present invention;

[FIG 3]

A block diagram showing the configuration of a communication terminal according to Embodiment 1 of the present invention;

[FIG 4]

A drawing showing the contents of the transmission power table provided in a communication terminal according to Embodiment 1 of the present invention;

[FIG 5]

A block diagram showing another configuration of a base station according to Embodiment 1 of the present invention;

[FIG 6]

A block diagram showing the configuration of a communication terminal according to Embodiment 2 of the present invention;

[FIG 7]

»A drawing showing the contents of the code word table provided in a communication terminal according to Embodiment 2 of the present invention;

[FIG 8]

« A block diagram showing another configuration of a base station according to Embodiment 3 of the present invention;

[FIG 9]

A block diagram showing the configuration of a communication terminal according to Embodiment 3 of the present invention;

[FIG 10]

A block diagram showing a configuration of a base station according to Embodiment 4 of the present invention;

[FIG 11]

A block diagram showing the configuration of a communication terminal according to Embodiment 4 of the present invention;

[FIG 12]

A block diagram showing another configuration of a base station according to Embodiment 4 of the present invention;

[FIG 13]

A block diagram showing the configuration of a communication terminal according to Embodiment 5 of the present invention;

[FIG 14]

A block diagram showing the configuration of a communication terminal according to Embodiment 6 of the present invention;

[FIG 15]

A block diagram showing the configuration of a CIR signal creation section of a communication terminal according to Embodiment 6 of the present invention;

[FIG 16]

A block diagram showing the configuration of a CIR signal creation section of a communication terminal according to Embodiment 7 of the present invention;

[FIG 17]

A block diagram showing the configuration of a CIR signal creation section of a communication terminal according to Embodiment 8 of the present invention;

[EXPLANATIONS OF LETTERS OR NUMERALS]

101, 704 Allocation Section

102 Buffer

103 Adaptive Coding Section

104 Adaptive Modulator

105, 107, 204, 208, 404, 504, 707, 803, 1004 Spreading Section

106, 203, 207, 403, 503, 706, 802, 1003 Modulator

108, 210 Multiplexer

113, 215, 218, 601 Despreading Section

114, 602, 701 Demodulator

115, 702 Reception Power Calculation Section

116, 302 Unused DRC Detection Section

201, 705 Communication Mode Determination Section

202 DRC Signal Creation Section

205 DRC Power Control Section

206, 805 Transmission Power Table

209 Pilot Power Controller

216 Adaptive Demodulator

217 Adaptive Coding Section

219 CIR Measurement Section

301, 901 Likelihood Calculation Section

401, 1001 Code Word Selector

402, 1002 Code Word Table

501 Detection Rate Calculation Section

502 Control Signal Creation Section

603 Table Rewriting Section

703, 902 Unused CIR Detection Section

801 CIR Information Creation Section

804 CIR Information Power Controller

1101 CIR Signal Creation Section

1201 Upper Digit Information Generation Section

1202 Lower Digit Information Generation Section

1203 6-bit Coding Section

1204 4-bit Coding Section

1305, 1401 Upper Digit Spreading Section

1306, 1402 Lower Digit Spreading Section

1307 Upper Digit Power Controller

1308 Lower Digit Power Controller

[NAME OF DOCUMENT] ABSTRACT

[ABSTRACT]

[OBJECT]

To prevent a fall in downlink throughput in a communication system in which communication resources are allocated to communication terminals based on downlink channel quality.

[OVERCOMING MEANS]

A communication mode determination section 201 determines the communication mode based on the CIR measured by a CIR measurement section 219; a DRC signal creation section 202 creates a DRC signal with a number corresponding to the communication mode; and a DRC power controller 205 refers to a transmission power table 206 showing the correspondence between DRC numbers and transmission power, and, based on the transmission power of the pilot signal output from a pilot power controller 209, increases transmission power in proportion as the DRC signal indicates that downlink channel quality is good.

[SELECTED DRAWINGS] FIG 3

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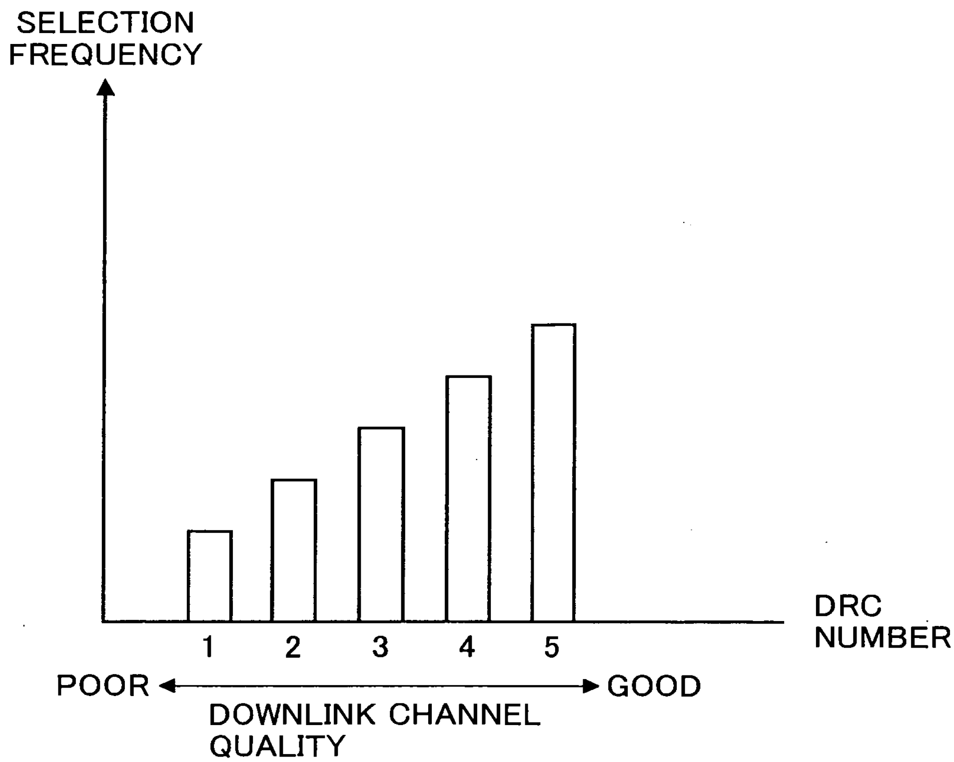
[NAME OF DOCUMENT] DRAWINGS

[FIG.1]



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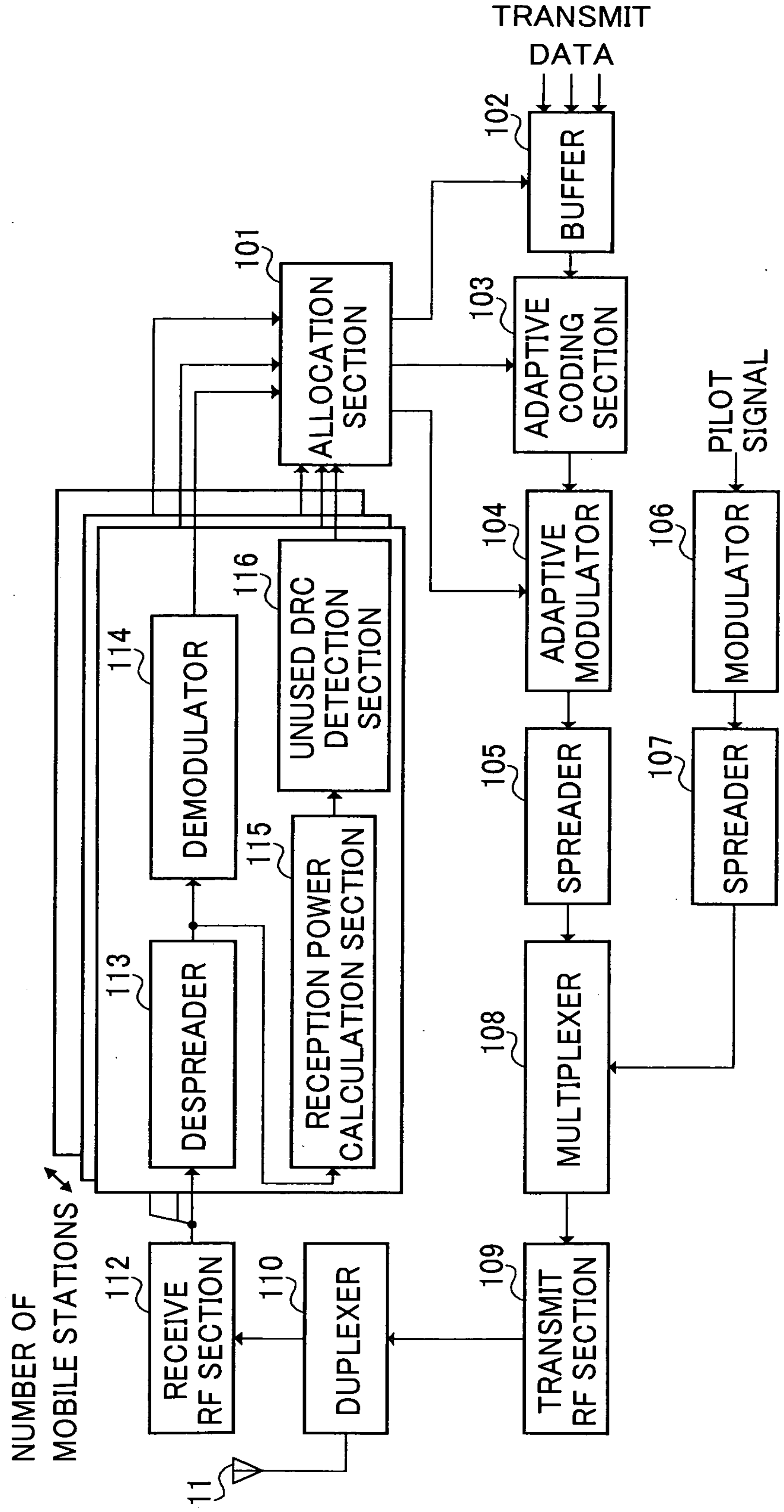
[FIG.2]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103
ADAPTIVE CODING SECTION
PILOT SIGNAL
104
ADAPTIVE MODULATOR
106
MODULATOR
116
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
105
SPREADER
107
SPREADER
115
RECEPTION POWER CALCULATION SECTION
113
DESPREADER
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

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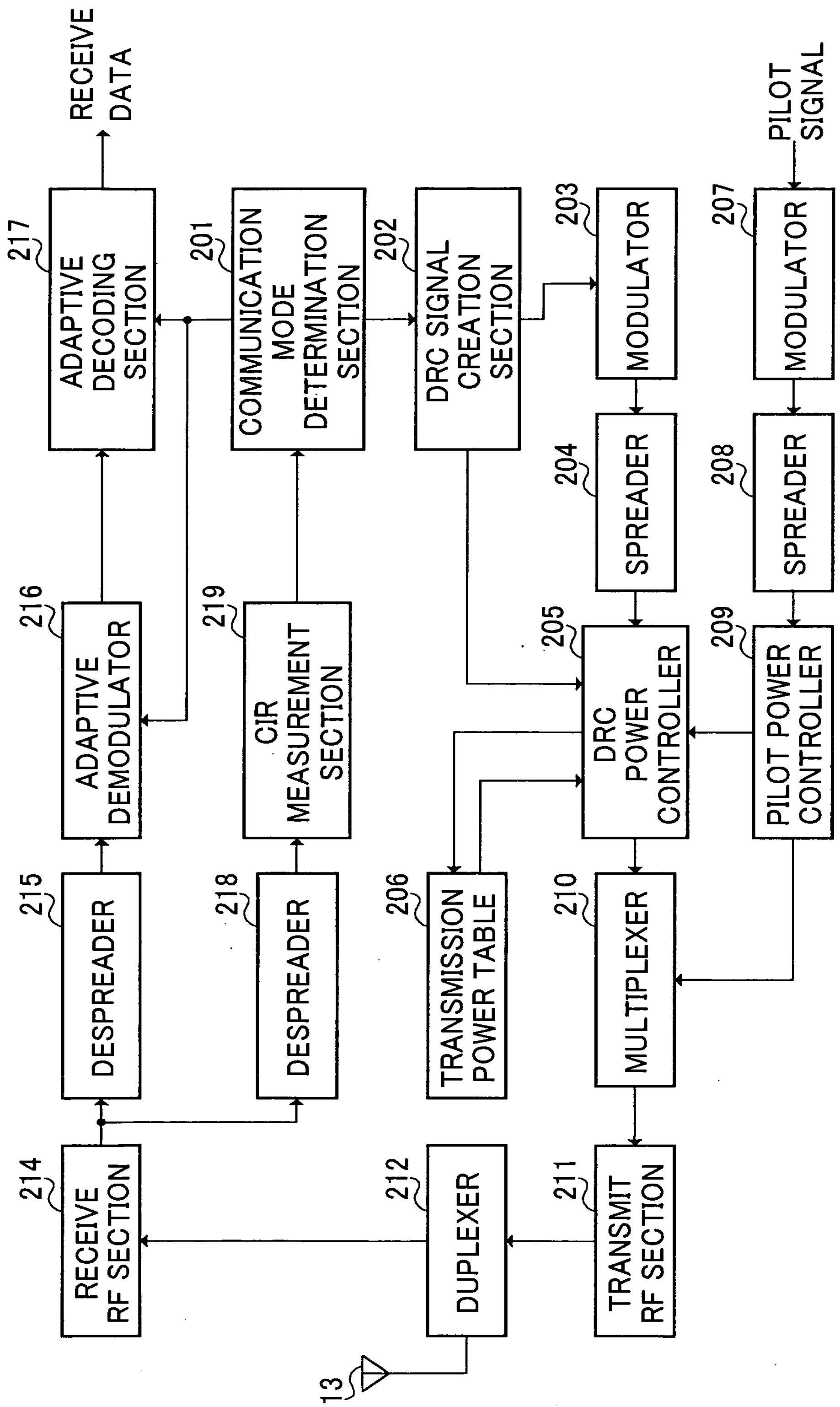
[FIG.3]



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COMMUNICATION MODE DETERMINATION SECTION
202
DRC SIGNAL CREATION SECTION
203
MODULATOR
207
MODULATOR
PILOT SIGNAL
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
204
SPREADER
208
SPREADER
205
DRC POWER CONTROLLER
209
PILOT POWER CONTROLLER
215
DESPREADER
218
DESPREADER
206
TRANSMISSION POWER TABLE
210
MULTIPLEXER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

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[FIG.4]

DRC NUMBER	TRANSMISSION POWER (RATIO TO PILOT SIGNAL TRANSMISSION POWER)
1	−2dB
2	−1dB
3	0dB
4	+1dB
5	+2dB

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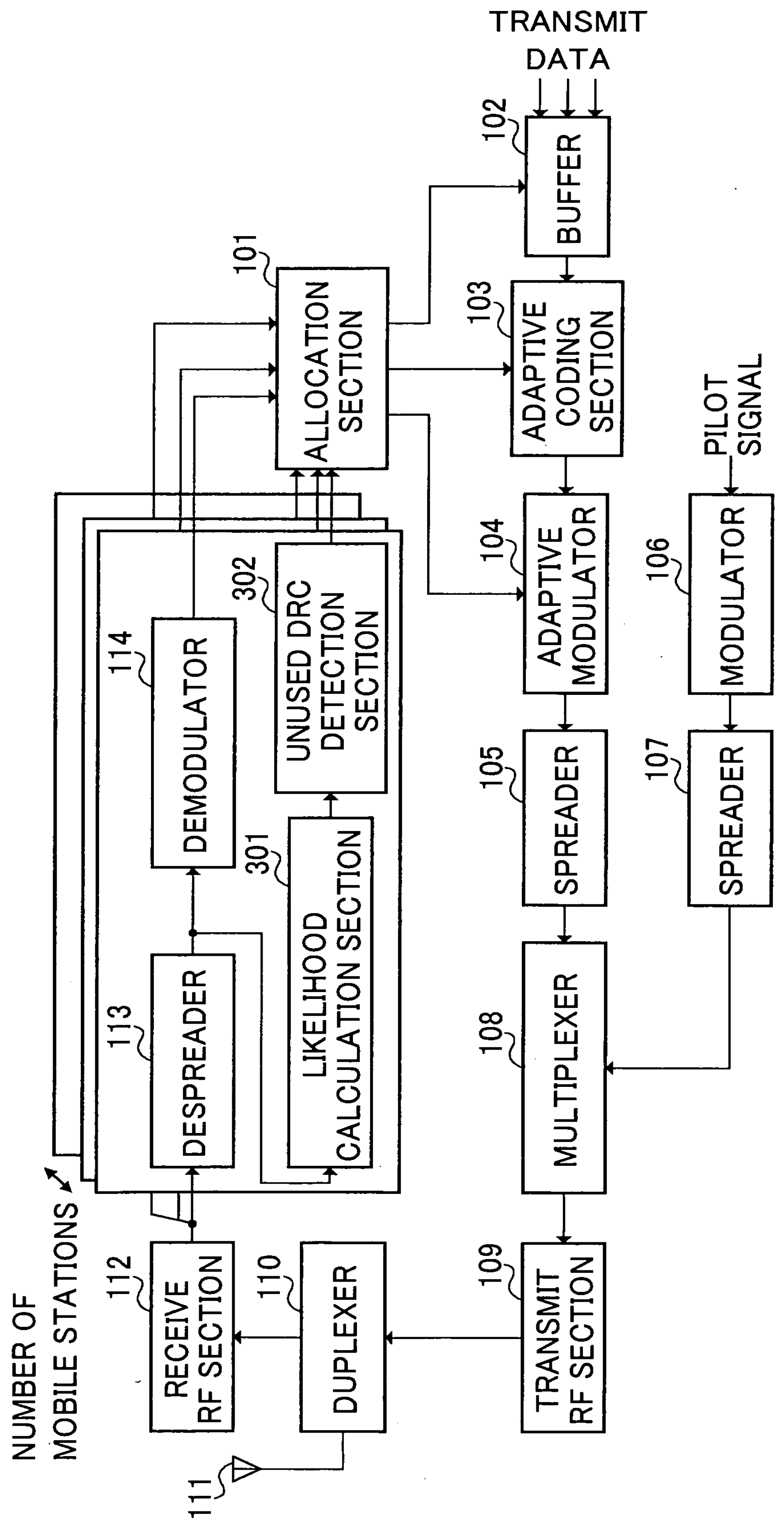
[FIG.5]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103
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PILOT SIGNAL
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ADAPTIVE MODULATOR
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MODULATOR
302
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
105
SPREADER
107
SPREADER
301
LIKELIHOOD CALCULATION SECTION
113
DESPREADER
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
112
RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

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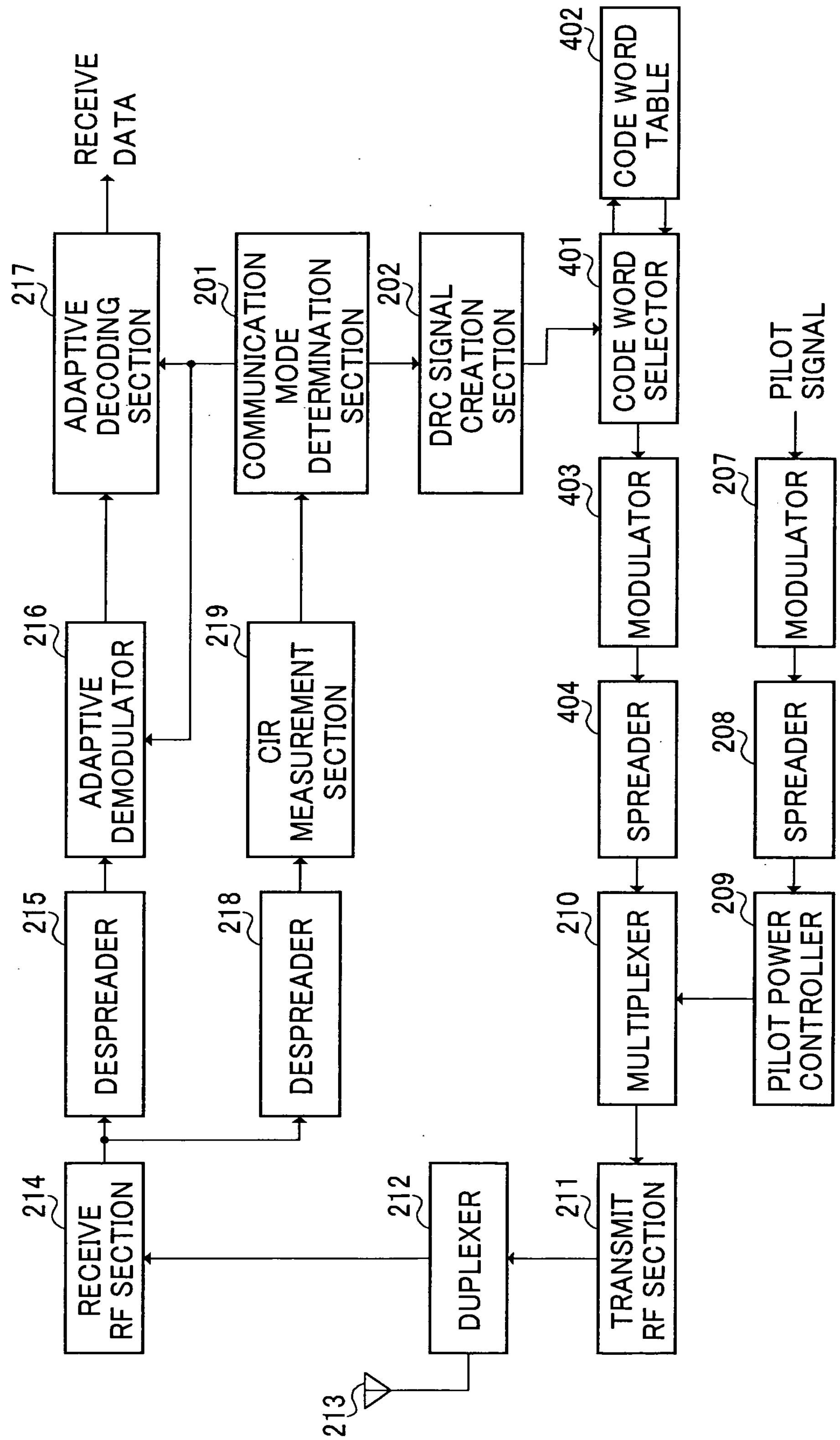
[FIG.6]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201
COMMUNICATION MODE DETERMINATION SECTION
202
DRC SIGNAL CREATION SECTION
401
CODE WORD SELECTOR
402
CODE WORD TABLE
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
403
MODULATOR
207
MODULATOR
PILOT SIGNAL
215
DESPREADER
218
DESPREADER
404
SPREADER
208
SPREADER
210
MULTIPLEXER
209
PILOT POWER CONTROLLER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

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[FIG.7]

DRC NUMBER	CODE WORD	MINIMUM INTERSYMBOL DISTANCE
1	000000000	1
2	000000001	1
3	000000110	2
4	000111000	3
5	111111111	6

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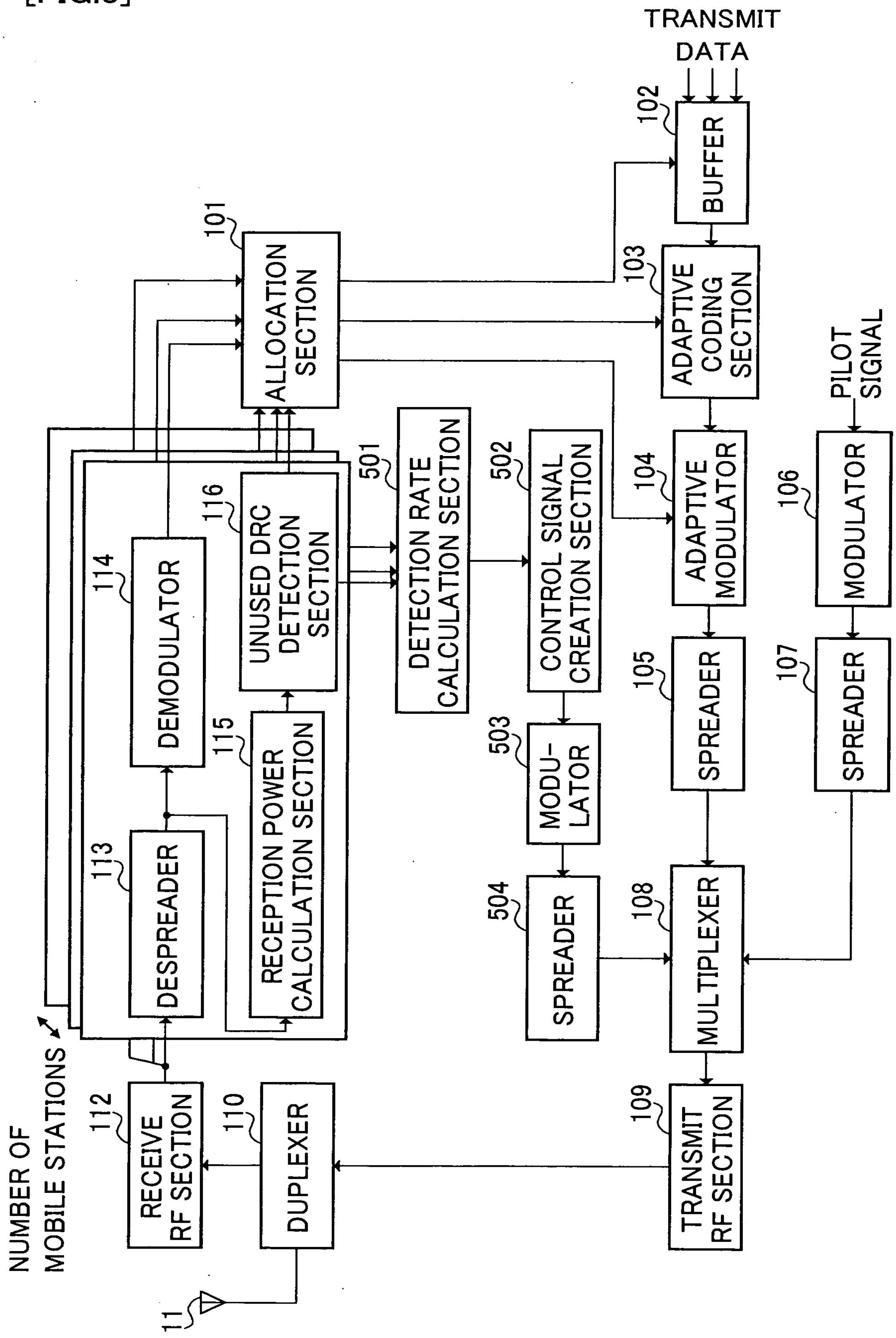
[FIG.8]



TRANSMIT DATA
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BUFFER
101
ALLOCATION SECTION
103
ADAPTIVE CODING SECTION
PILOT SIGNAL
501
DETECTION RATE CALCULATION SECTION
502
CONTROL SIGNAL CREATION SECTION
104
ADAPTIVE MODULATOR
106
MODULATOR
116
UNUSED DRC DETECTION SECTION
114
DEMODULATOR
105
SPREADER
107
SPREADER
115
RECEPTION POWER CALCULATION SECTION
503
MODU-LATOR
113
DESPREADER
504
SPREADER
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
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RECEIVE RF SECTION
110
DUPLEXER
109
TRANSMIT RF SECTION
111

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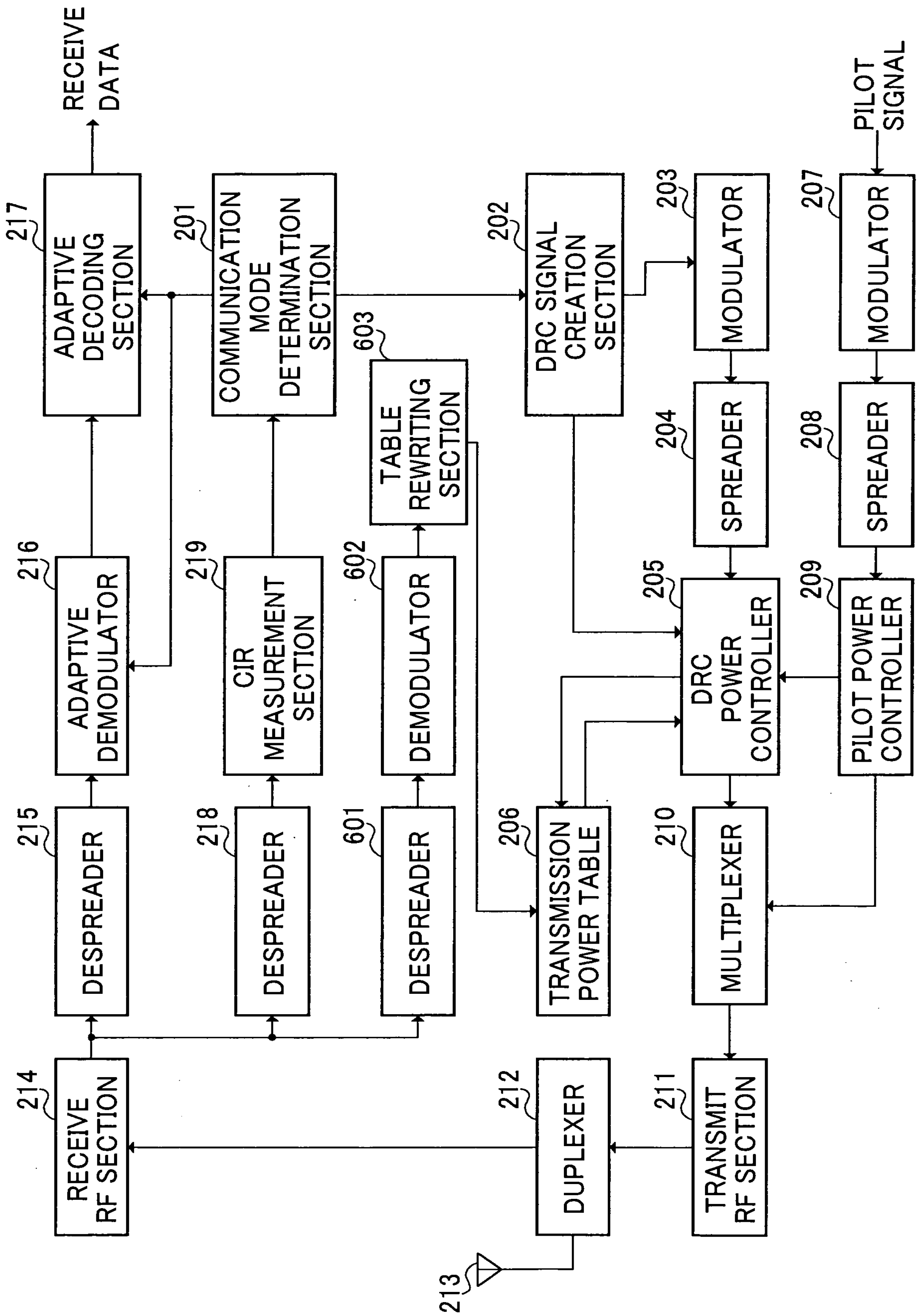
[FIG.9]



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COMMUNICATION MODE DETERMINATION SECTION
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DRC SIGNAL CREATION SECTION
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MODULATOR
207
MODULATOR
PILOT SIGNAL
603
TABLE REWRITING SECTION
204
SPREADER
208
SPREADER
216
ADAPTIVE DEMODULATOR
219
CIR MEASUREMENT SECTION
602
DEMODULATOR
205
DRC POWER CONTROLLER
209
PILOT POWER CONTROLLER
215
DESPREADER
218
DESPREADER
601
DESPREADER
206
TRANSMISSION POWER TABLE
210
MULTIPLEXER
214
RECEIVE RF SECTION
212
DUPLEXER
211
TRANSMIT RF SECTION
213

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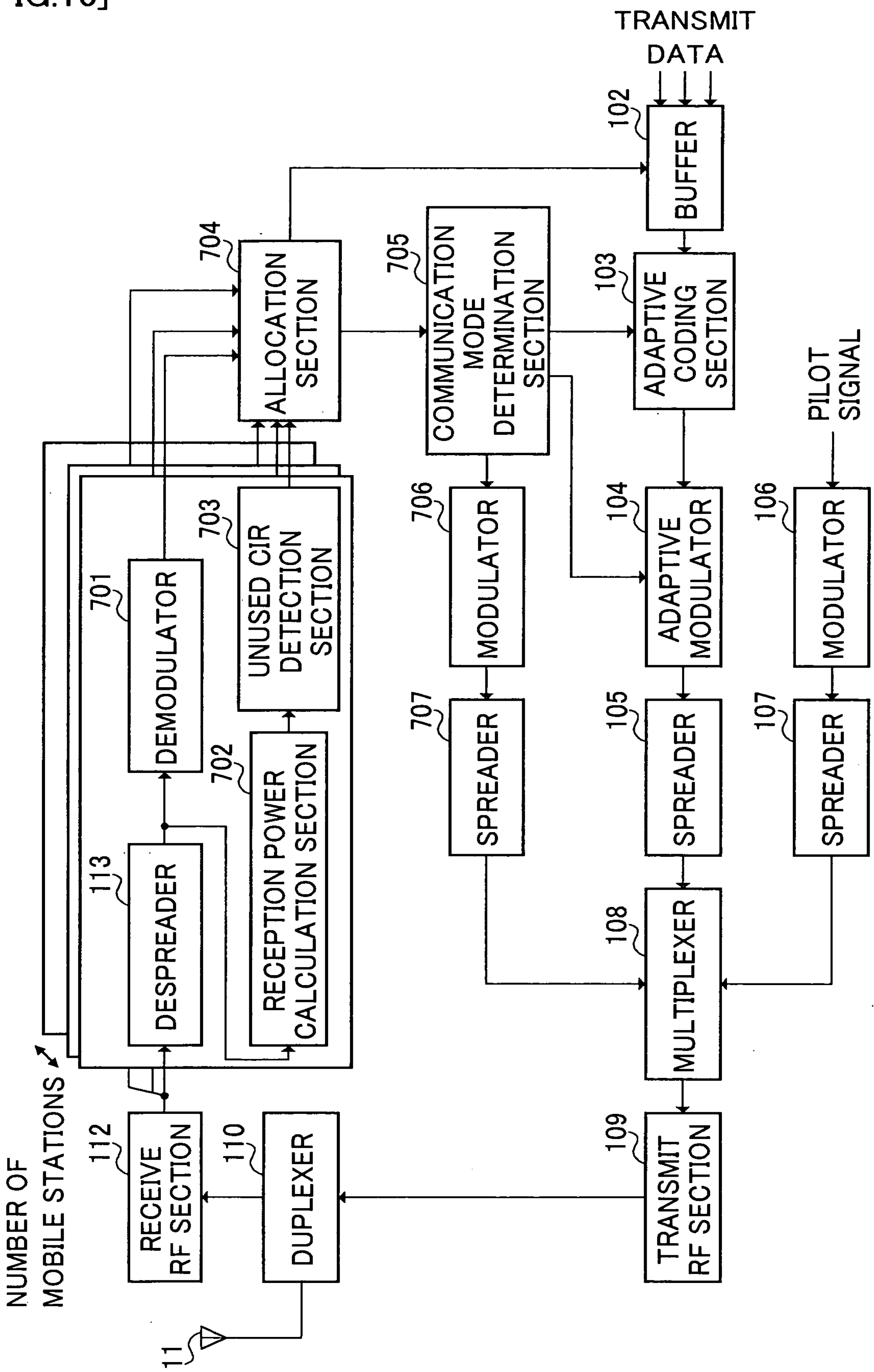
[FIG.10]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MODULATOR
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SPREADER
108
MULTIPLEXER
109
TRANSMIT RF SECTION
110
DUPLEXER
111
112
RECEIVE RF SECTION
113
DESPREADER
701
DEMODULATOR
702
RECEPTION POWER CALCULATION SECTION
703
UNUSED CIR DETECTION SECTION
704
ALLOCATION SECTION
705
COMMUNICATION MODE DETERMINATION SECTION
706
MODULATOR
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SPREADER
NUMBER OF MOBILE STATIONS

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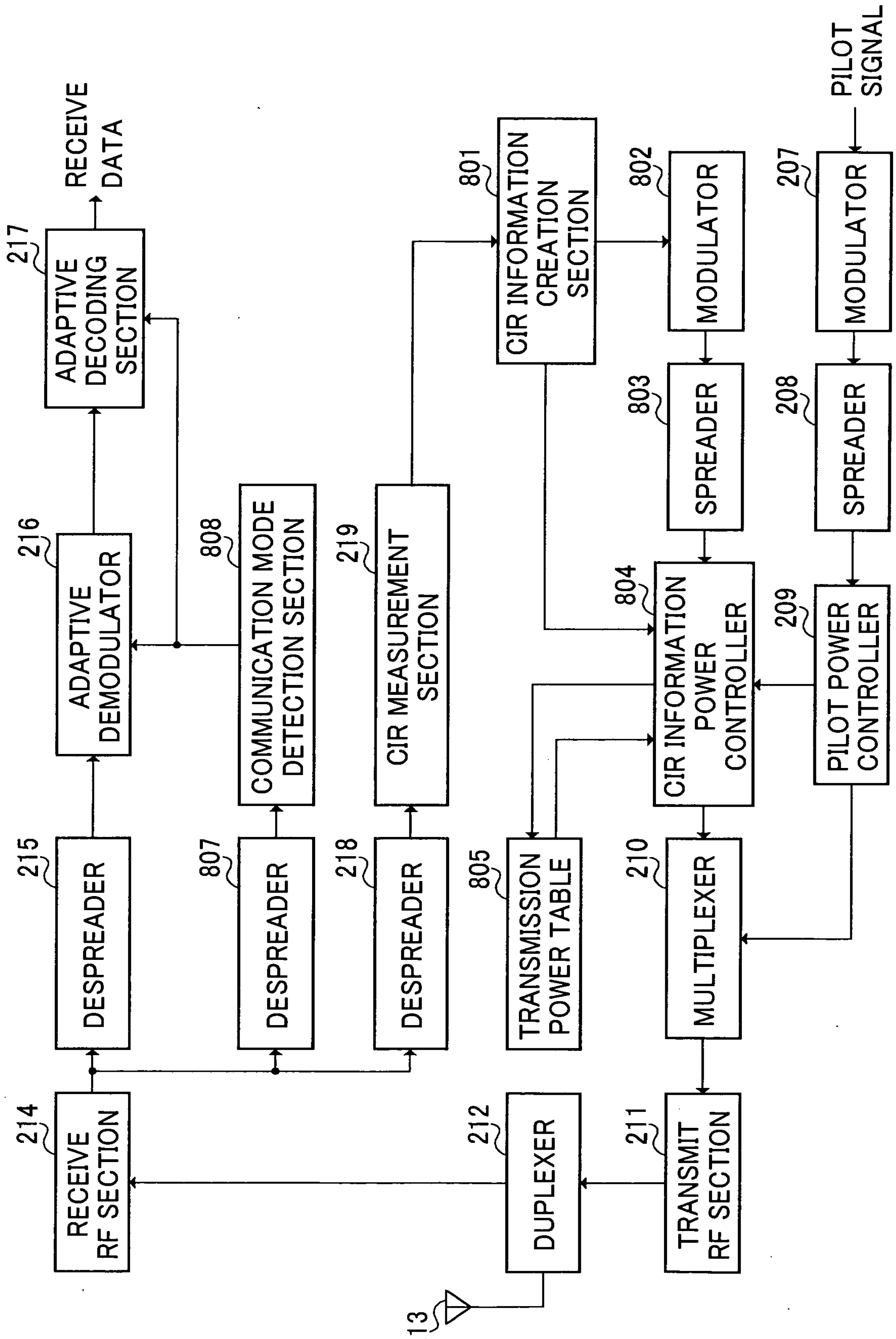
[FIG.11]



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DESPREADER
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807
DESPREADER
219
CIR MEASUREMENT SECTION
218
DESPREADER
801
CIR INFORMATION CREATION SECTION
805
TRANSMISSION POWER TABLE
212
DUPLEXER
213
802
MODULATOR
803
SPREADER
804
CIR INFORMATION POWER CONTROLLER
210
MULTIPLEXER
211
TRANSMIT RF SECTION
PILOT SIGNAL
207
MODULATOR
208
SPREADER
209
PILOT POWER CONTROLLER

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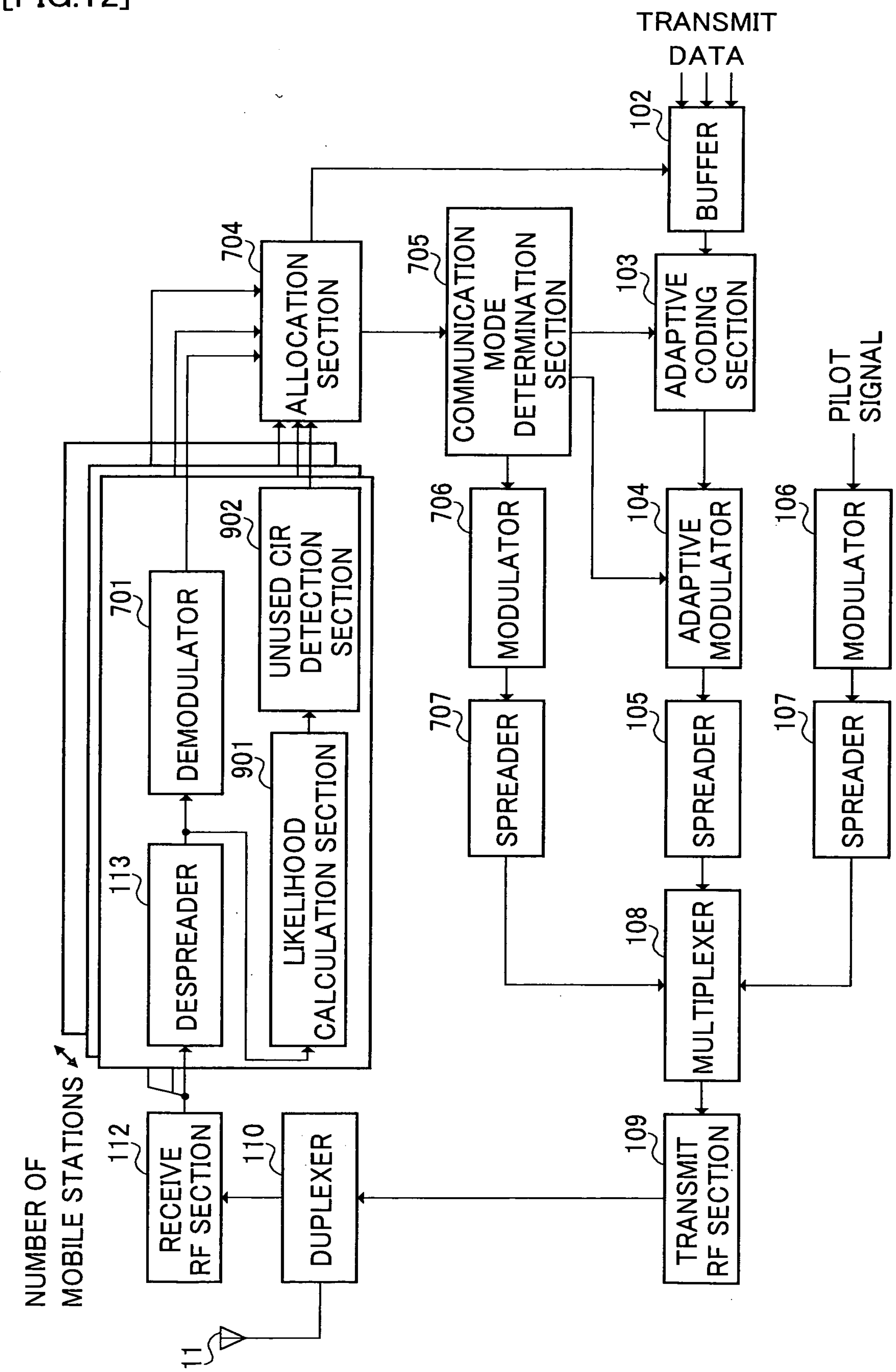
[FIG.12]



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BUFFER
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701
DEMODULATOR
706
MODULATOR
104
ADAPTIVE MODULATOR
106
MODULATOR
901
LIKELIHOOD CALCULATION SECTION
113
DESPREADER
707
SPREADER
105
SPREADER
107
SPREADER
108
MULTIPLEXER
NUMBER OF MOBILE STATIONS
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DUPLEXER
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TRANSMIT RF SECTION
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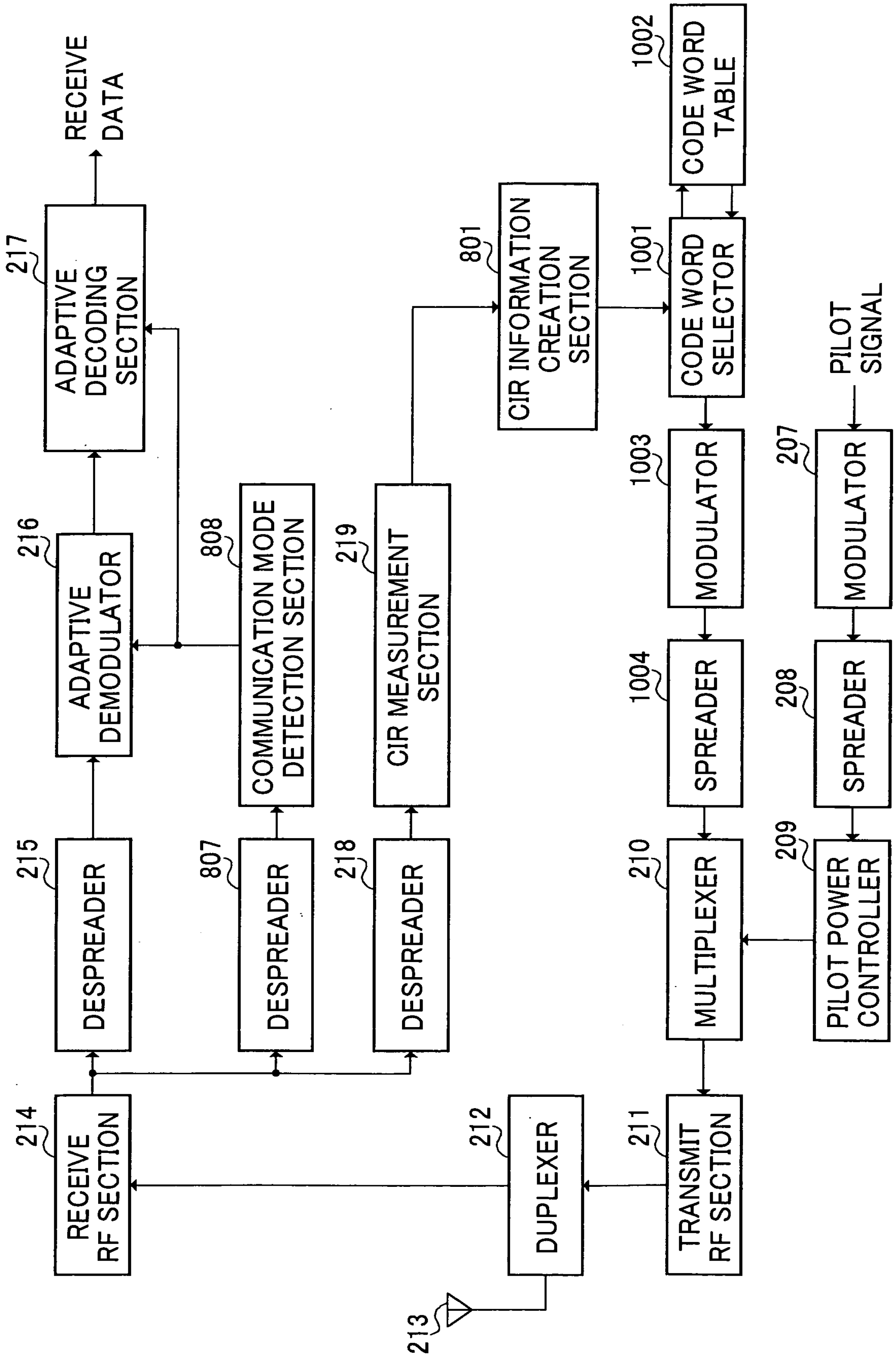
[FIG.13]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CIR INFORMATION CREATION SECTION
1002
CODE WORD TABLE
1001
CODE WORD SELECTOR
PILOT SIGNAL
1003
MODULATOR
207
MODULATOR
1004
SPREADER
208
SPREADER
215
DESPREADER
807
DESPREADER
218
DESPREADER
210
MULTIPLEXER
209
PILOT POWER CONTROLLER
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RECEIVE RF SECTION
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DUPLEXER
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TRANSMIT RF SECTION
213

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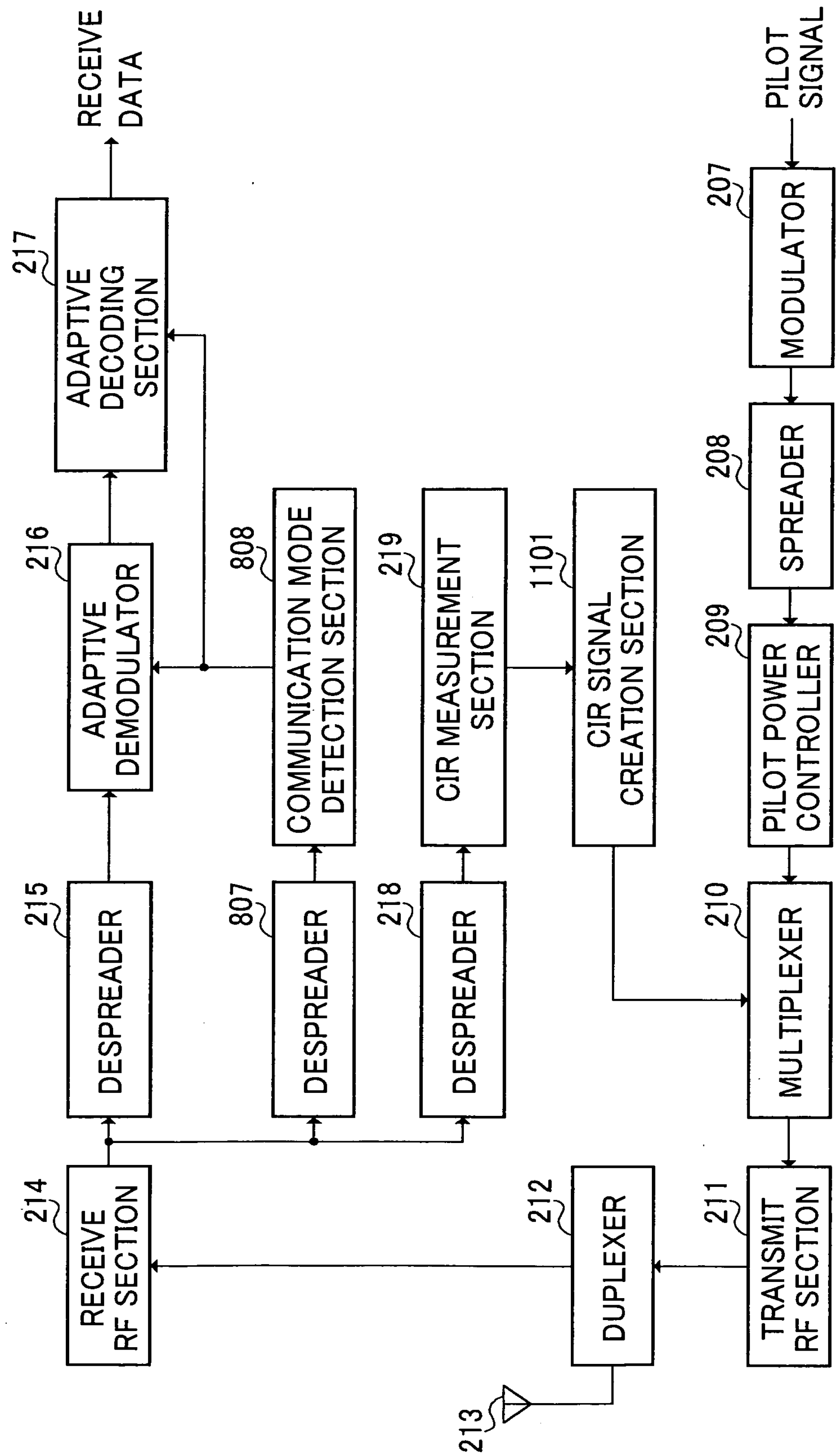
[FIG.14]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DESPREADER
219
CIR MEASUREMENT SECTION
218
DESPREADER
1101
CIR SIGNAL CREATION SECTION
212
DUPLEXER
213
PILOT SIGNAL
207
MODULATOR
208
SPREADER
209
PILOT POWER CONTROLLER
210
MULTIPLEXER
211
TRANSMIT RF SECTION

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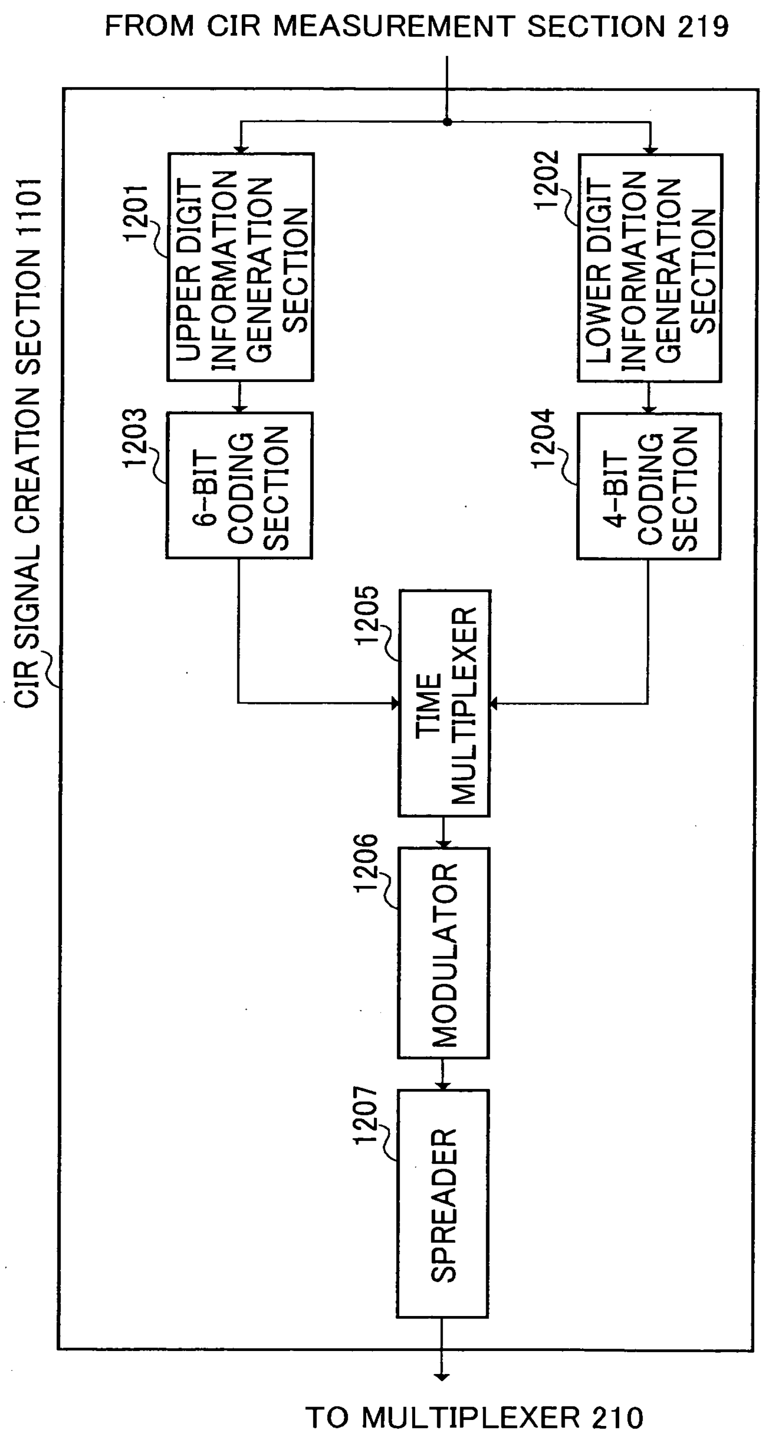
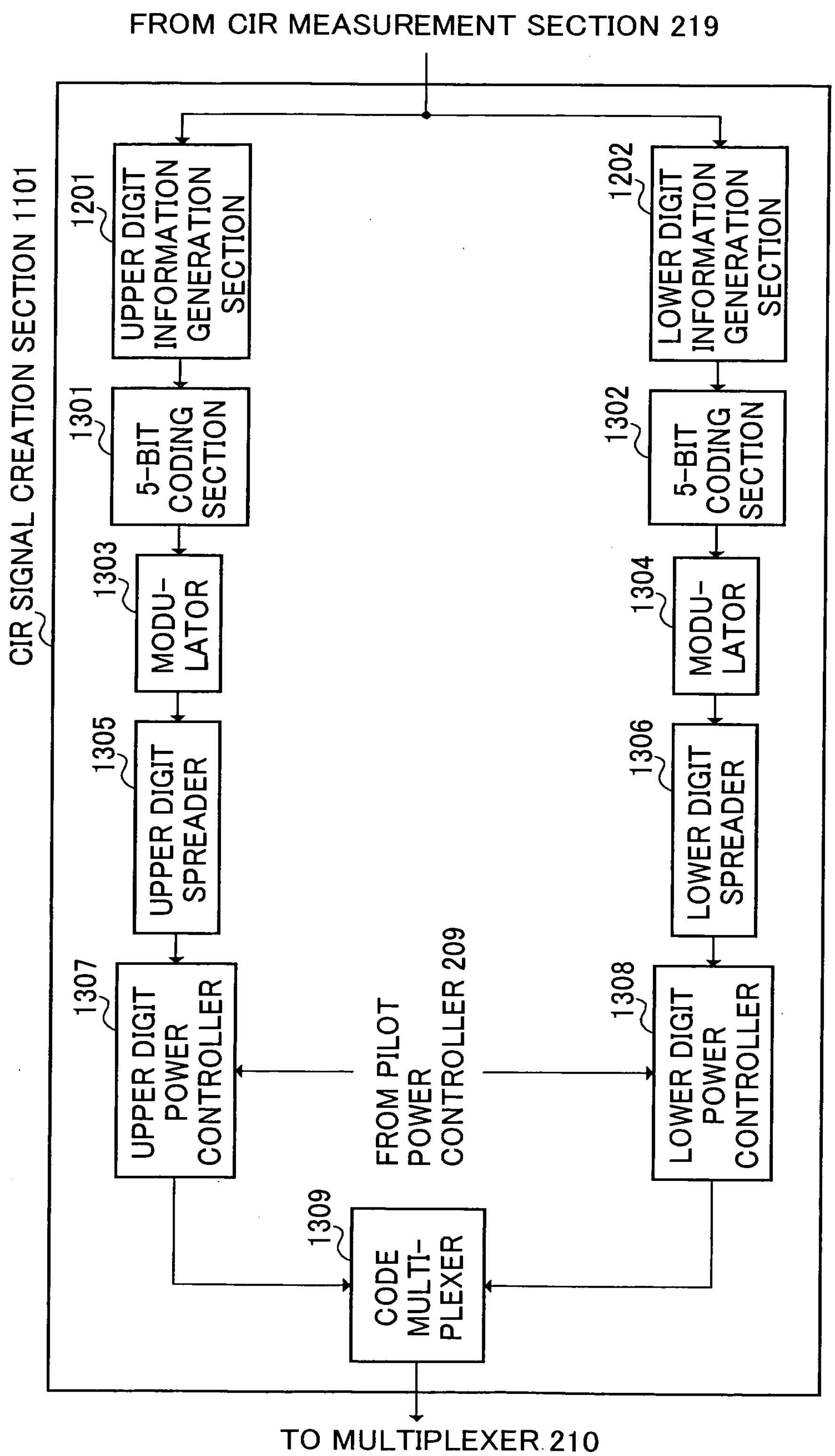
[FIG.15]


FROM CIR MEASUREMENT SECTION 219
CIR SIGNAL CREATION SECTION 1101
1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1203
6-BIT CODING SECTION
1204
4-BIT CODING SECTION
1205
TIME MULTIPLEXER
1206
MODULATOR
1207
SPREADER
TO MULTIPLEXER 210

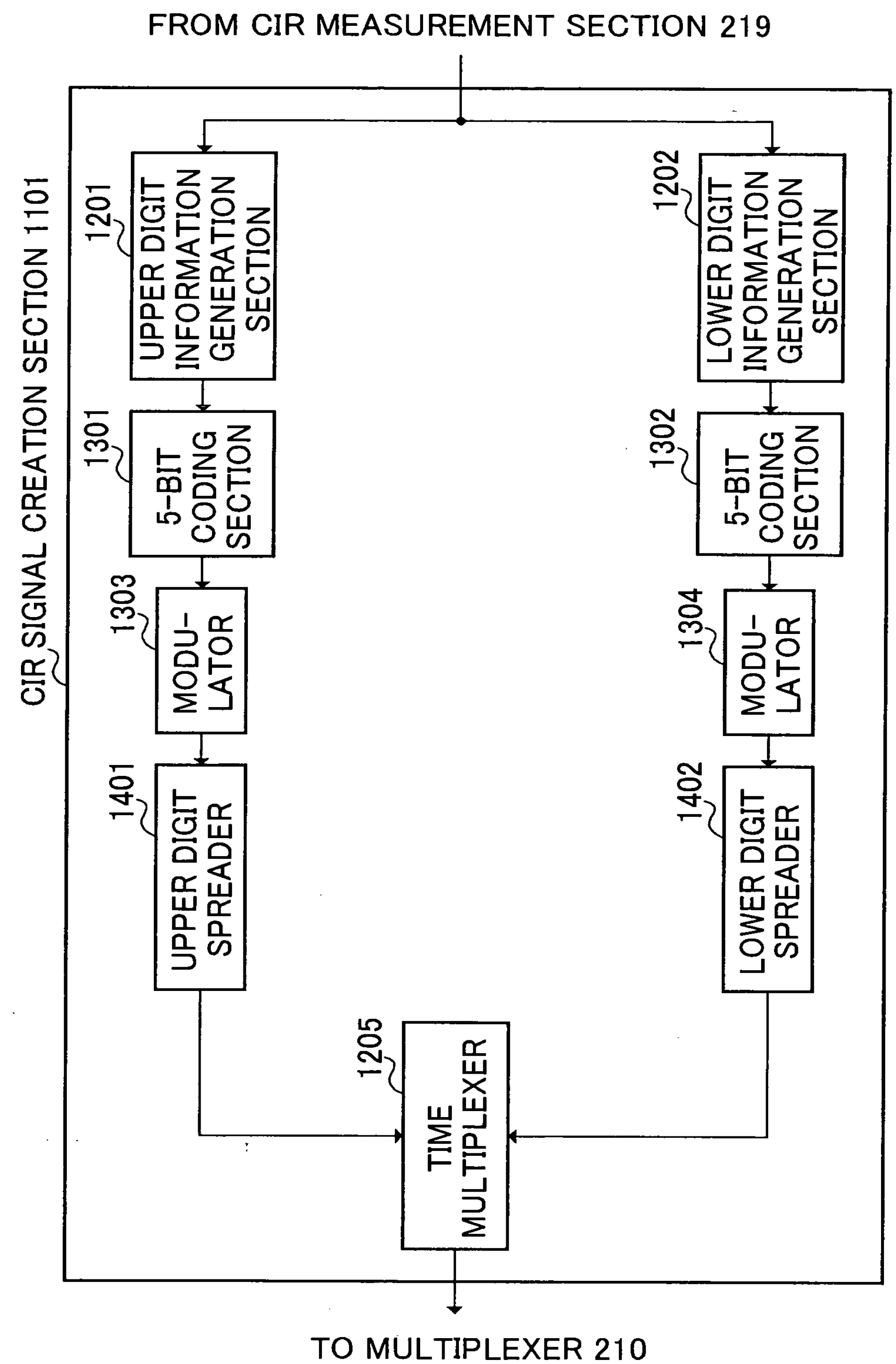
Th:• Page Blank (uspto)

[FIG.16]


FROM CIR MEASUREMENT SECTION 219
CIR SIGNAL CREATION SECTION 1101
1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1301
5-BIT CODING SECTION
1302
5-BIT CODING SECTION
1303
MODU-LATOR
1304
MODU-LATOR
1305
UPPER DIGIT SPREADER
1306
LOWER DIGIT SPREADER
1307
UPPER DIGIT POWER CONTROLLER
FROM PILOT POWER CONTROLLER 209
1308
LOWER DIGIT POWER CONTROLLER
1309
CODE MULTI-PLEXER
TO MULTIPLEXER 210

Th'~ Page Blank (uspto)

[FIG.17]


FROM CIR MEASUREMENT SECTION 219
CIR SIGNAL CREATION SECTION 1101
1201
UPPER DIGIT INFORMATION GENERATION SECTION
1202
LOWER DIGIT INFORMATION GENERATION SECTION
1301
5-BIT CODING SECTION
1302
5-BIT CODING SECTION
1303
MODU-LATOR
1304
MODU-LATOR
1401
UPPER DIGIT SPREADER
1402
LOWER DIGIT SPREADER
1205
TIME MULTIPLEXER
TO MULTIPLEXER 210

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EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S358	135	@ad<"20000801" and measur$4 with quality and (bit digit codeword code-word code adj word) with power with (ratio proportion$4)	US-PGPUB; USPAT	OR	ON	2006/07/19 16:24

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 08/01/2006

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	**PAPER NUMBER**
2617	

DATE MAILED: 08/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	10/321,623	MIYOSHI ET AL.
	Examiner	Art Unit
	DANH C. LE	2617

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *24* is/are allowed.

6)☒ Claim(s) *23,25,26 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *21,22,27 and 29* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. **Claim 26 is rejected under 35 U.S.C. 102(e) as being anticipated by Kitagawa US 6,603,980).**

As to claim 26, Kitagawa teach a communication terminal apparatus (figure 2 and its description) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits each of a plurality of digits representing the information of the notification signal using a transmission power that is proportionate to the digit's degree of significance (col.4, line 66-col.5, line 25).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. <u>Claims 23, 25 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagawa in view of Kuma (US 2001/0050926).</u>

As to claim 23, Kitagawa teach a communication terminal apparatus (figure 2 and its description) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the information of the notification signal, prior to its transmission, is converted to a TPC bit whose TPC bit minimum distance is proportional to the degree of measured downlink channel quality.

Kitagawa fails to teach TPC bit is a code word. Kumar teaches information is converted to a code word (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Kitagawa in order to maximized the service level.

As to claim 25, Kitagawa teach a communication terminal apparatus (figure 2 and its description) comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify apparatus of information generated based on said measured downlink channel quality, wherein:

each of a plurality of digits representing the information of the notification signal is a base station converted, prior to its transmission, to a TCP bit whose bit length is proportional the digit's degree of significance.

Kitagawa fails to teach TPC bit is a code word. Kumar teaches information is converted to a code word (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Kitagawa in order to maximized the service level.

As to claim 28, Kitagawa teach a communication terminal apparatus (figure 1 and its description) comprising:

a measuring device that measures reception quality of a pilot signal to output information having a plurality of bits that indicate the measured reception quality;

a coding device that encodes the information to obtain a TPC bit; and

a transmitter that transmits the TPC bit, wherein:

the coding device encodes the information such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits.

Kitagawa fails to teach TPC bit is a code word. Kumar teaches information is converted to a code word (paragraph 082). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kumar into the system of Kitagawa in order to maximized the service level.

Allowable Subject Matter

Claim 24 is allowed in the previous Office Action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C. LE whose telephone number is 571-272-7868. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 571-272-7872. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

danh

July 11, 2006

DANH CONG LE
PRIMARY EXAMINER

Notice of References Cited	Application/Control No. 10/321,623	Applicant(s)/Patent Under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,603,980	08-2003	Kitagawa et al.	455/522
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent under Reexamination
	10/321,623	MIYOSHI ET AL.
	Examiner	Art Unit
	DANH C. LE	2617

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date	Claim		Date	Claim		Date
Final	Original	7/20/07	Final	Original		Final	Original	
	1	÷		51			101	
	2			52			102	
	3			53			103	
	4			54			104	
	5			55			105	
	6			56			106	
	7			57			107	
	8			58			108	
	9			59			109	
	10			60			110	
	11			61			111	
	12			62			112	
	13			63			113	
	14			64			114	
	15			65			115	
	16			66			116	
	17			67			117	
	18			68			118	
	19			69			119	
	20	÷		70			120	
	21	–		71			121	
	22	–		72			122	
	23	√		73			123	
	24	=		74			124	
	25	√		75			125	
	26	√		76			126	
	27	–		77			127	
	28	√		78			128	
	29	–		79			129	
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	43			93			143	
	44			94			144	
	45			95			145	
	46			96			146	
	47			97			147	
	48			98			148	
	49			99			149	
	50			100			150	

Search Notes	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.
	Examiner DANH C. LE	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
455	522	7/20/06	DCL
	127		
370	318		
	310		

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST Search updated (US, USPUB)	7/20/06	DCL

TFW 2617

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): Kenichi MIYOSHI, et al.	Docket No. L9289.02149B

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/321,623	December 18, 2002	D. Le	52989	2617	5366

Invention: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

OIPE NOV 01 2006 PATENT & TRADEMARK OFFICE

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT		RATE	ADDITIONAL FEE
TOTAL CLAIMS	8	-	20	=	0	x	$50.00	$0.00
INDEP. CLAIMS	8	-	9	=	0	x	$200.00	$0.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$0.00

☒ No additional fee is required for amendment.

☐ Please charge Deposit Account No. in the amount of

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account 19-4375

- ☒ Any additional filing fees required under 37 C.F.R. 1.16.
- ☒ Any patent application processing fees under 37 CFR 1.17.

☐ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Signature

Dated: November 1, 2006

James E. Ledbetter, Esq.
Registration No. 28,732
Stevens, Davis, Miller & Mosher, LLP
1615 L Street, N.W., Suite 850
Washington, DC 20036
Tel: 202-785-0100
Fax: 202-408-5200

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

__________________ .
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

P11LARGE/REV10

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Kenichi MIYOSHI et al.	Group Art Unit: 2683
Appln. No.:	10/321,623	Examiner: D.C. Le
Filed:	December 18, 2002	Conf. No. 5366
For:	COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD	

AMENDMENT UNDER 37 CFR § 1.111

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated August 1, 2006, please amend the above-captioned application as follows:

IN THE CLAIMS

Please amend the claims to read as follows:

Listing of Claims

1-20. (Canceled).

21. (Withdrawn) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits the notification signal using a higher transmission power than a pilot signal transmission power, when said measured downlink channel quality is better than a predetermined channel quality, and

the transmitter transmits the notification signal using a lower transmission power than the pilot signal transmission power, when said measured downlink channel quality is poorer than the predetermined channel quality.

22. (Withdrawn) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality;

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality;

a table that indicates a correspondence between the notification signal and transmission power; and

a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein:

the transmitter adjusts the transmission power used to transmit the notification signal based on the contents of said table.

23. (Previously Presented) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the information of the notification signal, prior to its transmission, is converted to a code word whose code-word minimum distance is proportional to the degree of measured downlink channel quality.

24. (Previously Presented) A communication terminal apparatus, comprising:

a measuring device that measures downlink channel quality;

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality;

a table that indicates a correspondence between the notification signal and a code word; and

a rewriting device that rewrites contents of said table in accordance with a control signal from the base station apparatus, wherein:

the transmitter converts the notification signal, prior to its transmission, to a code word based on the contents of said table.

25. (Currently Amended) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

each of a plurality of digits representing the information of the notification signal is converted, prior to its transmission, to a code word whose code length is proportional to the digit's degree of significance.

26. (Canceled).

27. (Withdrawn) A communication terminal apparatus comprising:

a measuring device that measures downlink channel quality; and

a transmitter that transmits a notification signal to notify a base station apparatus of information generated based on said measured downlink channel quality, wherein:

the transmitter transmits each of a plurality of digits representing the information of the notification signal using a spreading code whose spreading factor is proportionate to the digit's degree of significance.

28. (Previously Presented) A communication terminal apparatus comprising:

a measuring device that measures reception quality of a pilot signal to output information having a plurality of bits that indicate the measured reception quality;

a coding device that encodes the information to obtain a code word; and

a transmitter that transmits the code word, wherein:

the coding device encodes the information such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits.

29. (Withdrawn) A base station apparatus comprising:

a receiver that receives a notification signal transmitted from a communication terminal apparatus;

a measurement device that measures reception power or the likelihood of having received the notification signal correctly;

a detector that detects whether the measured reception power or measured likelihood is less than a first threshold value;

a determination device that determines downlink communication resource allocation based on one or more received notification signals, while excluding from use a received notification signal whose measured reception power or measured likelihood is detected to be less than the first threshold value;

a calculator that calculates the ratio of excluded notification signals to received notification signals; and

a transmitter that transmits a control signal instructing the communication terminal apparatus to rewrite a table based on a result of comparison of the calculated ratio a second threshold value.

REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

The Applicants acknowledge with appreciation the indication in the Office Action that claim 24 is directed to allowable subject matter.

Claim 26 is hereby canceled.

Turning to the prior art rejections, claims 23, 25 and 28 stand rejected under 35 USC §103(a) as unpatentable over Kitagawa et al. (USPN 6,603,980) in view of Kumar (US 2001/0050926). These rejections are respectfully traversed in accordance with the discussion set forth below.

The Applicants note that Kitagawa et al. disclose in column 4, line 50 to column 5, line 25 the use of a TPC bit with a variable amplitude based on the received quality, with the variable amplitude of the TPC bit being different from the amplitude of other bits of the transmission signal. The transmission signal other than the TPC bit is sent with an amplitude instructed by the communicating party and the amplitude of the TPC bit is changed based on the correction value which is proportional to a difference between the received quality and the desired quality. Kitagawa et al. further disclose that in one slot, the amplitude of only the TPC bit is variable and the amplitude of transmission signals other than the TPC bit is fixed. That is, Kitagawa et al. disclose that, in one slot, the amplitude of the TPC bit is different from the amplitude of the bits other than the TPC bit.

The office action acknowledges that Kitagawa et al. teach the use of a TPC bit rather than the use of a code word wherein information of the notification signal, prior to its transmission, is converted to the code word. The office action cites Kumar for a teaching that information is converted to a code word, citing paragraph [0082] of Kumar.

The Applicants respectfully submit that Kitagawa et al. and Kumar have individual and collective deficiencies vis-a-vis claims 23, 25 and 28, given that both Kitagawa et al. and Kumar are completely silent with respect to at least the below-noted features of claims 23, 25 and 28:

Claim 23 recites that the information of the notification signal, prior to its transmission, is converted to a code word whose code-word minimum distance is proportional to the degree of measured downlink channel quality.

Claim 25 recites that each of a plurality of digits representing the information of the notification signal is converted, prior to its transmission, to a code word whose code length is proportional to the digit's degree of significance.

Claim 28 recites that a coding device encodes measured reception quality information comprising a plurality of bits such that the most significant bit of the plurality of bits is less susceptible to errors in a propagation path than other bits of the plurality of bits.

Due to the above-noted individual deficiencies of Kitagawa et al. and Kumar, it is submitted that the combined teachings of these references *per force* fail to achieve or render obvious the above-noted features of claims 23, 25 and 28.

Accordingly, Kitagawa et al. and Kumar, considered alone or together, fail to disclose or suggest the subject matter of claims 23, 25 and 28.

In view of the above, it is submitted that the obviousness rejections of claims 23, 25 and 28 are unwarranted and should be withdrawn.

Having resolved all pending objections and objections, The Applicants respectfully submit that this application is in condition for allowance, and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone

the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

Date: November 1, 2006
JEL/DWW/att

James E. Ledbetter
Registration No. 28,732

Attorney Docket No. L9289.02149B
STEVENS DAVIS, MILLER & MOSHER, L.L.P.
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P.O. Box 34387
Washington, D.C. 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

BEST AVAILABLE COPY

PATENT APPLICATION FEE DETERMINATION RECORD
Effective November 10, 1998

Application or Docket Number: 10321623

CLAIMS AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA
BASIC FEE		
TOTAL CLAIMS	20 minus 20=	* —
INDEPENDENT CLAIMS	3 minus 3 =	* —
MULTIPLE DEPENDENT CLAIM PRESENT		

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐ RATE	FEE	OR	OTHER THAN SMALL ENTITY RATE	FEE
		OR		
		OR		
		OR		
		OR		
TOTAL		OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 9	Minus	** 20	= —
Independent	* 9	Minus	*** 3	= 6
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

8/5/05

SMALL ENTITY RATE	ADDI-TIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDI-TIONAL FEE
		OR		
		OR	88	528
		OR		
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	528

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 9	Minus	** 20	= —
Independent	* 9	Minus	*** 9	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

RATE	ADDI-TIONAL FEE	OR	RATE	ADDI-TIONAL FEE
		OR		
		OR		
		OR		
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 8	Minus	** 20	= —
Independent	* 8	Minus	*** 9	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

(11/01/06)

RATE	ADDI-TIONAL FEE	OR	RATE	ADDI-TIONAL FEE
		OR		
		OR		
		OR		
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 6/98) 1998

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S37 3	26	@ad<"20000801" and measur$4 with quality and (bit digit codeword code-word code adj word) with (proportion$4) with quality	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2007/01/15 14:05
S37 6	5	@ad>"20000801" and (measur$4 with quality and (bit digit codeword code-word code adj word) with (proportion$4)).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2007/01/15 14:08
S37 9	200	@ad<"20000801" and (measur$4 with quality and (bit digit codeword code-word code adj word) with (proportion$4))	USPAT	OR	ON	2007/01/15 14:14

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

OIPE MAR 0 8 2005 PATENT & TRADEMARK OFFICE JC98

ATTY. DOCKET NO.	SERIAL NO.
L9289.02149B	10/321,623
APPLICANT	Kenichi MIYOSHI, et al.
FILING DATE December 18, 2002	GROUP 2683

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
DCL	6 7 5 1 1 9 7	06/2004	Sadanaka	—	—	
|	6 6 5 1 2 1 1	11/2003	Abe et al.	—	—	

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DCL	2000 1 2 4 9 1 4	04/2000	JP	—	—	Abstract	
|	2000 6 8 9 5 9	03/2000	JP	—	—	Abstract	
|	2000 4 1 7 1	01/2000	JP	—	—	Abstract	
|	1 1 3 3 1 1 3 1	11/1999	JP	—	—	Abstract	
|	0 9 5 9 5 8 1	11/1999	EP	—	—		

	OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)
|	Japanese Office Action dated December 21, 2004, with English translation.

EXAMINER [signature] DATE CONSIDERED 10/18/05

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 10/324623

APPLICATION AS FILED – PART I

~~FOR~~ 1/23/07	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))							
SEARCH FEE (37 CFR 1.16(k), (i), or (m))							
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))							
TOTAL CLAIMS (37 CFR 1.16(i))	4 minus 20 =	*	x =		OR	x =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	*	x =			x =	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 10/302,1623

Revised 1/22/07

APPLICATION AS FILED – PART I

12/18/02

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))							
SEARCH FEE (37 CFR 1.16(k), (i), or (m))							760
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))							
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	* /	X =		OR	X =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	* /	X =			X =	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	760

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A 12/18/02	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* same	Minus	** same	= /	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	= /	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

O/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

24257 7590 02/02/2007

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 02/02/2007

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

TITLE OF INVENTION: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$0	$1700	05/02/2007

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24257 7590 02/02/2007

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

TITLE OF INVENTION: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$0	$1700	05/02/2007

EXAMINER	ART UNIT	CLASS-SUBCLASS
LE, DANH C	2617	455-452100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 ____________
   2 ____________
   3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature ____________________ Date ____________________

Typed or printed name ____________________ Registration No. ____________________

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

24257 7590 02/02/2007

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

EXAMINER	
LE, DANH C	
ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 02/02/2007

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	10/321,623	MIYOSHI ET AL.	
	Examiner	Art Unit	
	DANH C. LE	2617	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address*--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *11/01/06*.

2. ☒ The allowed claim(s) is/are *23-25 and 28*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Ledbetter on 01/16/07.

Claims 21, 22, 27, 29 are cancelled.

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance:

Claims 23, 24, 25, 28 are allowed as stated in the Applicant's remarks on pages 8-11.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANH C. LE whose telephone number is 571-272-7868. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WILLIAM TROST can be reached on 571-272-7872. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Danh

January 15, 2007

DANH LE
PRIMARY EXAMINER

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO.	CONT. APPN. OF SERIAL NO.
L9289.02149B	10/089,605
APPLICANT: Kenichi MIYOSHI et al.	
FILING DATE: December 18, 2002	GROUP: 2684

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER								DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER								DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
DCL		2000	0	4	9	6	6	3		02/2000	JAPAN	—	—	Abstract	
DCL		11	3	3	1	0	5	7		11/1999	JAPAN	—	—	Abstract	

DCL **OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)**

~~"HDR Reverse Link Proposal", E. Esteves, et al., *Qualcomm Inc.*, pgs. 1-10~~. Not consider because no date DL

International Search Report dated November 13, 2001.

EXAMINER: [signature] DATE CONSIDERED: 4/7/04

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination
	10/321,623	MIYOSHI ET AL.
	Examiner	Art Unit
	DANH C. LE	2617

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)						
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
455	452.2	455	452.1	522				
INTERNATIONAL CLASSIFICATION		370	335	318				
H04Q	7/20							
	/							
	/							
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	/							

(Assistant Examiner) (Date)	danh 1/15/07	Total Claims Allowed: 4
Denise Hopkins 1/31/07 (Legal Instruments Examiner) (Date)	(Primary Examiner) (Date) DANH LE PRIMARY EXAMINER	O.G. Print Claim(s): 1 O.G. Print Fig.: 13

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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—	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Index of Claims	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.
	Examiner DANH C. LE	Art Unit 2617

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim Final	Claim Original	Date								
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 5366

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/321,623	12/18/2002 RULE	455	2617	L9289.02149B

APPLICANTS

Kenichi Miyoshi, Yokohama-shi, JAPAN;
Osamu Kato, Yokosuka-shi, JAPAN;
Junichi Aizawa, Yokohama-shi, JAPAN;

** CONTINUING DATA **************************

This application is a CON of 10/089,605 04/01/2002 PAT 6,760,590 YES

** FOREIGN APPLICATIONS *********************

JAPAN 2000-234420 08/02/2000
JAPAN 2000-285405 09/20/2000 YES

IF REQUIRED, FOREIGN FILING LICENSE GRANTED **
02/04/2003

	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☒ yes ☐ no 35 USC 119 (a-d) conditions met ☒ yes ☐ no ☐ Met after Allowance Verified and Acknowledged [signature] Examiner's Signature [initials] Initials	JAPAN	17	20	2

ADDRESS
24257

TITLE

COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

FILING FEE RECEIVED		
1268	FEES: Authority has been given in Paper No. _________ to charge/credit DEPOSIT ACCOUNT No. _________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ___________ ☐ Credit

Search Notes	Application/Control No. 10/321,623	Applicant(s)/Patent under Reexamination MIYOSHI ET AL.	
	Examiner DANH C. LE	Art Unit 2617	

SEARCHED

Class	Subclass	Date	Examiner
455	452.2	1/15/07	DL
	452.1		
	522		
370	335		
	318		

SEARCH NOTES (INCLUDING SEARCH STRATEGY)

	DATE	EXMR
EAST Search updated (US, USPUB, JPO, EPO, DERWENT)	1/15/07	DL

INTERFERENCE SEARCHED

Class	Subclass	Date	Examiner
Interference Search		1/15/07	DL

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

OIPE IAP44 MAR 05 2007 PATENT & TRADEMARK OFFICE

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24257 7590 02/02/2007

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	12/18/2002	Kenichi Miyoshi	L9289.02149B	5366

TITLE OF INVENTION: COMMUNICATION TERMINAL APPARATUS, BASE STATION APPARATUS, AND RADIO COMMUNICATION METHOD

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$0	$1700	05/02/2007

EXAMINER	ART UNIT	CLASS-SUBCLASS
LE, DANH C	2617	455-452100

03/06/2007 MAHMED2 00000135 10321623
01 FC:1501 1400.00 OP
02 FC:1504 300.00 OP

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 STEVENS, DAVIS, MILLER
2 & MOSHER, LLP
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Osaka, JAPAN

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual XX Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
XX Issue Fee
XX Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies ______

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
XX A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
XX The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 19-4375 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature James E. Ledbetter   Date March 5, 2007

Typed or printed name James E. Ledbetter   Registration No. 28,732

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/321,623	04/17/2007	7206587	L9289.02149B	5366

24257 7590 03/28/2007

STEVENS DAVIS MILLER & MOSHER, LLP
1615 L STREET, NW
SUITE 850
WASHINGTON, DC 20036

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 256 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Kenichi Miyoshi, Yokohama-shi, JAPAN;
Osamu Kato, Yokosuka-shi, JAPAN;
Junichi Aizawa, Yokohama-shi, JAPAN;

IR103 (Rev. 11/05)

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT2667260

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
PANASONIC CORPORATION	12/20/2013

RECEIVING PARTY DATA

Name:	INVENTERGY, INC.
Street Address:	19925 STEVENS CREEK BOULEVARD
Internal Address:	SUITE 100
City:	CUPERTINO
State/Country:	CALIFORNIA
Postal Code:	95014

PROPERTY NUMBERS Total: 115

Property Type	Number
Patent Number:	6726297
Patent Number:	8009549
Patent Number:	8416810
Patent Number:	7646702
Patent Number:	8238226
Patent Number:	7593317
Patent Number:	7929627
Patent Number:	7826557
Patent Number:	7792084
Patent Number:	8064393
Patent Number:	8270332
Patent Number:	8582573
Patent Number:	6400929
Patent Number:	6381445

Patent Number:	6366763
Patent Number:	6370359
Patent Number:	6487394
Patent Number:	6597894
Patent Number:	6505035
Patent Number:	6973289
Patent Number:	6611676
Patent Number:	7636551
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Patent Number:	6734810
Patent Number:	6940428
Patent Number:	6922159
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Patent Number:	6119004
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Patent Number:	6636723
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Patent Number:	8437316
Patent Number:	6839335
Patent Number:	7072416
Patent Number:	7760815
Patent Number:	6868056
Patent Number:	6944208
Patent Number:	6781973
Patent Number:	7145886
Patent Number:	6847828
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Patent Number:	6799053
Patent Number:	7206587
Patent Number:	RE37420
Patent Number:	RE39954
Patent Number:	RE41444
Application Number:	11575015
Application Number:	10901380
Application Number:	11134448
Application Number:	10419089
Application Number:	11859550
Application Number:	13478996
Application Number:	13532576
Application Number:	13554748
Application Number:	10235918
Application Number:	10322425
Application Number:	13590841
Patent Number:	6876870
Application Number:	11574636
Application Number:	12162592

CORRESPONDENCE DATA

Fax Number:
Phone: 4089737896
Email: wayne@inventergy.com

Correspondence will be sent via US Mail when the email attempt is unsuccessful.

Correspondent Name:	WAYNE P. SOBON
Address Line 1:	19925 STEVENS CREEK BOULEVARD
Address Line 2:	SUITE 100
Address Line 4:	CUPERTINO, CALIFORNIA 95014

NAME OF SUBMITTER:	WAYNE P. SOBON
Signature:	/Wayne P. Sobon/
Date:	01/03/2014
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 5
source=Panasonic Inventergy Appendix B - Transfer Documents 12-20-13#page1.tif
source=Panasonic Inventergy Appendix A - Appendix Patents#page1.tif
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source=Panasonic Inventergy Appendix A - Appendix Patents#page4.tif

Appendix B – Transfer Documents

Panasonic Corporation, a Japanese corporation having its principal place of business at 1006, Oaza Kadoma, Kadoma-shi, Osaka 571-8501, Japan ("**Assignor**"), hereby irrevocably assigns to Inventergy, Inc., a Delaware corporation with a business address at 19925 Stevens Creek Boulevard, Suite 100, Cupertino, California 95014, USA ("**Assignee**"), as of the date set forth below, the entire Assignor's right, title, and interest in and to (a) all US patents as listed in <u>Appendix A</u> (**"Appendix Patents"**), and (b) all of their related families, including all counterpart patents and applications in any geography or jurisdiction, pending applications and lapsed or otherwise abandoned patents or patent applications which: (i) claim priority to the Appendix Patents, (ii) to which the Appendix Patents claimed priority (**"Priority Patents"**), or (iii) which claim priority to the Priority Patents (collectively, (a) and (b) are the **"Patent Assets"**), and any patents or patent applications subject to any terminal disclaimer with regard to such patents and/or patent applications, and all causes of action, rights, and remedies arising under any such Patent Assets prior to, on or after the Effective Date of this Agreement and all claims for damages by reason of past, present or future infringement or other unauthorized use of such Patent Assets with the right to sue for and collect such damages.

Assignor also hereby authorizes the respective patent office of governmental agency in each jurisdiction to issue any and all patents or certificates of invention which may be granted upon any of the Patent Assets in the name of Assignee, as the assignee to the entire interest therein.

The terms and conditions of this assignment shall inure to the benefit of Assignee, its successors, assigns, and other legal representatives, and shall be binding upon Assignor, its successors, assigns, and other legal representatives.

IN WITNESS WHEREOF, Assignor have caused their duly authorized representatives to execute this Assignment.

ASSIGNOR

Panasonic Corporation

By: Ikuo Terauchi

Name: Ikuo Terauchi

Title: Authorized Signing Officer

Date: December 20, 2013

Appendix A - Appendix Patents

Subtotal	101	
Internal Family ID	Publication Number	Patent Status
Inv-01	US6726297	Granted
Inv-03	US8009549	Granted
Inv-04	US8416810	Granted
Inv-08	US7646702	Granted
Inv-08	US8238226	Granted
Inv-09	US7593317	Granted
Inv-15	US7929627	Granted
Inv-16	US7826557	Granted
Inv-21	US7792084	Granted
Inv-23	US8064393	Granted
Inv-26	US20120314645	Pending
Inv-26	US8270332	Granted
Pana-01	US6366763	Granted
Pana-01	US6370359	Granted
Pana-01	US6381445	Granted
Pana-01	US6400929	Granted
Pana-01	US6487394	Granted
Pana-01	US6505035	Granted
Pana-01	US6597894	Granted
Pana-01	US6611676	Granted
Pana-01	US6973289	Granted
Pana-01	US7636551	Granted
Pana-02	US6637001	Granted
Pana-02	US20050002477	lapsed
Pana-03	US6813323	Granted
Pana-03	US20050219071	lapsed
Pana-04	US6734810	Granted
Pana-04	US6922159	Granted
Pana-04	US6940428	Granted
Pana-05	US6069884	Granted
Pana-06	US6119004	Granted
Pana-07	US6069924	Granted
Pana-08	US20040048578	lapsed

Pana-08	US6636723	Granted
Pana-09	US6628630	Granted
Pana-10	US6404778	Granted
Pana-11	US6611509	Granted
Pana-11	US6807162	Granted
Pana-11	US6973065	Granted
Pana-11	US7778224	Granted
Pana-12	US6765894	Granted
Pana-12	US7656844	Granted
Pana-12	US8437316	Granted
Pana-13	US6839335	Granted
Pana-14	US7072416	Granted
Pana-14	US7760815	Granted
Pana-15	US6868056	Granted
Pana-16	US6944208	Granted
Pana-17	US6781973	Granted
Pana-18	US7145886	Granted
Pana-19	US6847828	Granted
Pana-19	US7386321	Granted
Pana-20	US7266118	Granted
Pana-21	US7133379	Granted
Pana-22	US6876870	Lapsed
Pana-22	US7392019	Granted
Pana-23	US7339949	Granted
Pana-24	US7702025	Granted
Pana-25	US7460502	Granted
Pana-26	US7269774	Granted
Pana-27	US7385934	Granted
Pana-28	US7114121	Granted
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Pana-30	US7746762	Granted
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Pana-33	US20120230257	lapsed

Pana-33	US20120263250	lapsed
Pana-33	US20120287775	lapsed
Pana-34	US7251469	lapsed
Pana-34	US7764711	Granted
Pana-35	US20070254715	Pending
Pana-35	US8086270	Granted
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Pana-37	US8175604	Granted
Pana-38	US7860184	Granted
Pana-39	US8073070	Granted
Pana-40	US8249132	Granted
Pana-41	US20090116434	Pending
Pana-42	US8218681	Granted
Pana-43	US8249178	Granted
Pana-44	US5583851	Granted
Pana-45	US5873027	Granted
Pana-45	US6336040	Granted
Pana-46	US5757870	Granted
Pana-46	US5818869	Granted
Pana-46	US7136367	lapsed
Pana-47	US6175558	Granted
Pana-47	US6301237	Granted
Pana-47	US6529492	Granted
Pana-47	US6370131	Granted
Pana-47	US6584088	Granted
Pana-47	US6549526	Granted
Pana-47	USRE41444	Granted
Pana-48	US6295301	Granted
Pana-48	US6697384	Granted
Pana-49	US20030007472	lapsed
Pana-49	US6466563	Granted
Pana-50	US7535864	Granted
Pana-50	US6370134	Granted
Pana-50	US7035233	Granted
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WCDMA (pool) 01	USRE37420	Granted

WCDMA (pool) 01	USRE39954	Granted
WCDMA (pool) 01	US20030087644	lapsed
WCDMA (pool) 01	US20060121930	lapsed
WCDMA (pool) 01	US20080261545	lapsed
WCDMA (pool) 07	US6738646	Granted
WCDMA (pool) 07	US7460880	Granted
WCDMA (pool) 07	US7761113	Granted
WCDMA (pool) 09	US6760590	Granted
WCDMA (pool) 09	US6799053	Granted
WCDMA (pool) 09	US7206587	Granted

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT2699760

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	SECURITY AGREEMENT

CONVEYING PARTY DATA

Name	Execution Date
INVENTERGY, INC.	12/19/2013

RECEIVING PARTY DATA

Name:	JOSEPH BEYERS
Street Address:	19925 STEVENS CREEK BOULEVARD
Internal Address:	SUITE 100
City:	CUPERTINO
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Postal Code:	95014

PROPERTY NUMBERS Total: 111

Property Type	Number
Patent Number:	6726297
Patent Number:	8009549
Patent Number:	8416810
Patent Number:	7646702
Patent Number:	8238226
Patent Number:	7593317
Patent Number:	7929627
Patent Number:	7826557
Patent Number:	7792084
Patent Number:	8064393
Patent Number:	8270332
Patent Number:	8582573
Patent Number:	6400929
Patent Number:	6381445

Patent Number:	6366763
Patent Number:	6370359
Patent Number:	6487394
Patent Number:	6597894
Patent Number:	6505035
Patent Number:	6973289
Patent Number:	6611676
Patent Number:	7636551
Patent Number:	6637001
Patent Number:	6813323
Patent Number:	6734810
Patent Number:	6940428
Patent Number:	6922159
Patent Number:	6069884
Patent Number:	6119004
Patent Number:	6069924
Patent Number:	6636723
Patent Number:	6628630
Patent Number:	6404778
Patent Number:	6611509
Patent Number:	6807162
Patent Number:	6973065
Patent Number:	7778224
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Patent Number:	8437316
Patent Number:	6839335
Patent Number:	7072416
Patent Number:	7760815
Patent Number:	6868056
Patent Number:	6944208
Patent Number:	6781973
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Patent Number:	7386321

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Patent Number:	7133379
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Patent Number:	7460502
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	7136367
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Patent Number:	RE39954
Patent Number:	6738646
Patent Number:	7460880
Patent Number:	7761113
Patent Number:	6760590
Patent Number:	6799053
Patent Number:	7206587
Application Number:	10901380
Application Number:	11134448
Application Number:	10419089
Application Number:	11859550
Application Number:	11575015
Application Number:	13478996
Application Number:	13532576
Application Number:	13554748
Application Number:	10235918
Application Number:	10322425

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Phone: 4089737896
Email: wayne@inventergy.com
Correspondence will be sent via US Mail when the email attempt is unsuccessful.
Correspondent Name: WAYNE P. SOBON
Address Line 1: 19925 STEVENS CREEK BOULEVARD
Address Line 2: SUITE 100
Address Line 4: CUPERTINO, CALIFORNIA 95014

	WAYNE P. SOBON
Signature:	/Wayne P. Sobon/
Date:	01/27/2014
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 18
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ASSIGNMENT FOR SECURITY
PATENTS

WHEREAS, **Inventergy, Inc.** (the "Assignor") holds all right, title and interest in the letter patents, design patents and utility patents listed on the annexed Schedule 1, which patents are issued or applied for (the "Patents");

WHEREAS, the Assignor has entered into a Secured Promissory Note, dated as of December 19, 2013 (as amended, restated or otherwise modified from time to time the "Secured Promissory Note"), in favor of **Joseph Beyers** (the "Assignee");

WHEREAS, pursuant to the Secured Promissory Note, the Assignor has assigned to the Assignee and granted to the Assignee a **first priority security interest** in all right, title and interest of the Assignor in, to and under the Patents and the applications and registrations thereof, and all proceeds thereof, including, without limitation, any and all causes of action which may exist by reason of infringement thereof and any and all damages arising from past, present and future violations thereof (the "Collateral"), to secure the payment, performance and observance of the "Obligations" (as defined in "Section 2. Secured Obligation" in the Secured Promissory Note);

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Assignor does hereby pledge, convey, sell, assign, transfer and set over unto the Assignee and grants to the Assignee a **first priority security interest** in the Collateral to secure the prompt payment, performance and for the benefit of the Buyers observance of the Obligations.

The Assignor does hereby further acknowledge and affirm that the rights and remedies of the Assignee with respect to the Collateral are more fully set forth in the Secured Promissory Note, the terms and provisions of which are hereby incorporated herein by reference as if fully set forth herein.

IN WITNESS WHEREOF, the Assignor has caused this Assignment to be duly executed by its officer thereunto duly authorized as of January 24, 2014.

Inventergy, Inc.

By: ______________________

Name: Wayne P. Sobon

Title: SVP and General Counsel

SCHEDULE 1 TO ASSIGNMENT FOR SECURITY

Patents and Patent Applications
Owned by: **Inventergy, Inc.**

Internal Family ID	Country	Inventergy Understood status 1/14/2014	Publication Number	Publication Date	Title	Application Number	File Date
Inv-01	USA	Granted	US6726297	4/27/2004	Ofdma signal transmission apparatus and method	US10/462491	1/20/2000
Inv-03	USA	Granted	US8009549	8/30/2011	Carrier allocation method in multi cell orthogonal frequency division multiple access system	US12/092950	11/16/2006
Inv-04	USA	Granted	US8416810	4/9/2013	Radio communication base station apparatus and pilot transmission method	US12/160872	1/18/2007
Inv-08	USA	Granted	US7646702	1/12/2010	Ofdm communication apparatus	US10/169716	7/9/2002
Inv-08	USA	Granted	US8238226	8/7/2012	Ofdm communication apparatus	US12/505420	7/17/2009
Inv-09	USA	Granted	US7593317	9/22/2009	Radio base station apparatus	US10/503010	7/29/2004
Inv-15	USA	Granted	US7929627	4/19/2011	Ofdm receiver, integrated circuit and receiving method	US11/885042	2/28/2006

Inv-16	USA	Granted	US7826557	11/2/2010	Retransmitting method and transmitting method in multi-antenna transmission	US11/721911	12/14/2005
Inv-21	USA	Granted	US7792084	9/7/2010	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	US11/892886	8/28/2007
Inv-23	USA	Granted	US8064393	11/22/2011	Wireless communication base station apparatus and wireless communication method in multicarrier communication	US11/997841	8/4/2006
Inv-26	USA	Granted	US8270332	9/18/2012	Wireless communication base station device and wireless communication method	US12/377373	10/12/2007
Inv-26	USA	Granted	US8582573	12/13/2012	Radio communication base station apparatus and radio communication method	US13/590841	8/21/2012
Pana-01	USA	Granted	US6400929	6/4/2002	Radio communication device and method of controlling transmission rate	US09/424843	12/6/1999

Pana-01	USA	Granted	US6381445	4/30/2002	Radio communication device and method of controlling transmission rate	US09/648742	8/28/2000
Pana-01	USA	Granted	US6366763	4/2/2002	Radio communication device and method of controlling transmission rate	US09/648756	8/28/2000
Pana-01	USA	Granted	US6370359	4/9/2002	Radio communication device and method of controlling transmission rate	US09/648757	8/28/2000
Pana-01	USA	Granted	US6487394	11/26/2002	Radio communication device and method of controlling transmission rate	US09/649003	8/28/2000
Pana-01	USA	Granted	US6597894	7/22/2003	Radio communication device and method of controlling transmission rate	US09/649006	8/28/2000
Pana-01	USA	Granted	US6505035	1/7/2003	Radio communication apparatus and transmission rate control method	US10/052261	1/23/2002
Pana-01	USA	Granted	US6973289	12/6/2005	Radio communication device and method of controlling transmission rate	US10/057897	1/29/2002

Pana-01	USA	Granted	US6611676	8/26/2003	Radio communication apparatus and transmission rate control method	US10/083553	2/27/2002
Pana-01	USA	Granted	US7636551	12/22/2009	Radio communication device and method of controlling transmission rate	US11/228339	9/19/2005
Pana-02	USA	Granted	US6637001	10/21/2003	Apparatus and method for image/voice transmission	US09/650743	8/30/2000
Pana-03	USA	Granted	US6813323	11/2/2004	Decoding method and communication terminal apparatus	US10/182270	7/25/2002
Pana-03	USA	Lapsed	US20050002477	1/6/2005	Decoding apparatus and decoding method	10901380	7/29/2004
Pana-04	USA	Granted	US6734810	5/11/2004	Apparatus and method for decoding	US10/221267	9/10/2002
Pana-04	USA	Granted	US6940428	9/6/2005	Apparatus and method for decoding	US10/793737	3/8/2004
Pana-04	USA	Granted	US6922159	7/26/2005	Apparatus and method for decoding	US10/793766	3/8/2004
Pana-04	USA	Lapsed	US20050219071	10/6/2005	Apparatus and method for decoding	11134448	5/23/2005

Pana-05	USA	Granted	US6069884	5/30/2000	Method of communication between a base station and a plurality of mobile unit communication apparatus, a base station, and mobile unit communication apparatus	US08/937005	9/24/1997
Pana-06	USA	Granted	US6119004	9/12/2000	Base station equipment for mobile communication	US09/068541	5/13/1998
Pana-07	USA	Granted	US6069924	5/30/2000	Differential detector with error correcting function	US09/027510	2/20/1998
Pana-08	USA	Granted	US6636723	10/21/2003	Cdma radio communication system using chip interleaving	US09/359020	7/22/1999
Pana-08	USA	Lapsed	US20040048578	3/11/2004	Cdma radio transmission apparatus, cdma radio reception apparatus, and cdma radio communication method	10419089	4/21/2003
Pana-09	USA	Granted	US6628630	9/30/2003	Spread spectrum communication method	US09/058881	4/13/1998
Pana-10	USA	Granted	US6404778	6/11/2002	Radio communication apparatus	US09/159602	9/24/1998

Pana-11	USA	Granted	US6611509	8/26/2003	Cdma/tdd mobile communication system and method	US09/264826	3/9/1999
Pana-11	USA	Granted	US6807162	10/19/2004	Cdma/tdd mobile communication system and method	US10/166268	6/11/2002
Pana-11	USA	Granted	US6973065	12/6/2005	Cdma/tdd mobile communication system and method	US10/419733	4/22/2003
Pana-11	USA	Granted	US7778224	8/17/2010	Cdma/tdd mobile communication system and method	US10/885684	7/8/2004
Pana-12	USA	Granted	US6765894	7/20/2004	Communication terminal apparatus and base station apparatus	US09/606906	6/30/2000
Pana-12	USA	Granted	US7656844	2/2/2010	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US10/868029	6/16/2004
Pana-12	USA	Granted	US8437316	5/7/2013	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US12/641177	12/17/2009

Pana-13	USA	Granted	US6839335	1/4/2005	Radio communication apparatus and radio communication method	US09/605862	6/29/2000
Pana-14	USA	Granted	US7072416	7/4/2006	Transmitting/receiving device and transmitting/receiving method	US09/582558	6/29/2000
Pana-14	USA	Granted	US7760815	7/20/2010	Apparatus and method for transmission/reception	US11/431606	5/11/2006
Pana-15	USA	Granted	US6868056	3/15/2005	Apparatus and method for ofdm communication	US09/635096	8/9/2000
Pana-16	USA	Granted	US6944208	9/13/2005	Interference signal canceling apparatus and interference signal canceling method	US09/936727	9/17/2001
Pana-17	USA	Granted	US6781973	8/24/2004	Combined signaling and sir inner-loop power control	US09/538888	3/30/2000
Pana-18	USA	Granted	US7145886	12/5/2006	Communication terminal, base station system, and method of controlling transmission power	US09/889919	7/25/2001
Pana-19	USA	Granted	US6847828	1/25/2005	Base station apparatus and radio communication method	US10/069484	2/27/2002

Pana-19	USA	Granted	US7386321	6/10/2008	Base station apparatus and radio communication method	US10/793738	3/8/2004
Pana-20	USA	Granted	US7266118	9/4/2007	Packet receiving apparatus and packet transmission method	US10/143989	5/14/2002
Pana-21	USA	Granted	US7133379	11/7/2006	Wireless communication system, and base station apparatus and communication terminal apparatus accommodated in the system	US10/181349	7/17/2002
Pana-22	USA	Granted	US7392019	6/24/2008	Wireless base station apparatus and wireless communication method	US11/053837	2/10/2005
Pana-23	USA	Granted	US7339949	3/4/2008	Arq transmission and reception methods and apparatus	US10/222989	8/19/2002
Pana-24	USA	Granted	US7702025	4/20/2010	Transmission/reception apparatus and transmission/reception method	US10/487574	2/25/2004
Pana-25	USA	Granted	US7460502	12/2/2008	Scheduling creation apparatus, base station apparatus, and radio communication method	US10/250487	7/3/2003

Pana-26	USA	Granted	US7269774	9/11/2007	Data receiving apparatus, data transmitting apparatus and retransmission request method	US10/484951	1/28/2004
Pana-27	USA	Granted	US7385934	6/10/2008	Radio communication apparatus and transfer rate decision method	US10/476845	11/6/2003
Pana-28	USA	Granted	US7114121	9/26/2006	Rate matching device and rate matching method	US10/478139	11/20/2003
Pana-29	USA	Granted	US7162206	1/9/2007	Test apparatus, mobile terminal apparatus, test method	US10/612289	7/3/2003
Pana-30	USA	Granted	US7746762	6/29/2010	Transmitting apparatus and transmitting method	US10/534987	5/16/2005
Pana-31	USA	Granted	US7693140	4/6/2010	Cdma transmitting apparatus and cdma receiving apparatus	US10/527199	3/10/2005
Pana-32	USA	Granted	US7299027	11/20/2007	Mimo receiver and mimo reception method for selection of mimo separation and channel variation compensation	US10/536010	5/23/2005
Pana-32	USA	Lapsed	US20080020802	1/24/2008	Wireless receiver and wireless reception method	11859550	9/21/2007

Pana-33	USA	Pending	US20070255993	11/1/2007	Automatic retransmission request control system and retransmission method in memo-ofdm system	11575015	3/30/2007
Pana-33	USA	Lapsed	US20120230257	9/13/2012	Retransmission method and transmitter	13478996	5/23/2012
Pana-33	USA	Lapsed	US20120263250	10/18/2012	Retransmission method, transmitter, and communication system	13532576	6/25/2012
Pana-33	USA	Lapsed	US20120287775	11/15/2012	Automatic retransmission request control system and retransmission method in mimo-ofdm system	13554748	7/20/2012
Pana-34	USA	Granted	US7251469	7/31/2007	Cdma transmitting apparatus and cdma transmitting method	US10/522980	2/2/2005
Pana-34	USA	Granted	US7764711	7/27/2010	Cdma transmission apparatus and cdma transmission method	US11/767124	6/22/2007
Pana-35	USA	Granted	US8086270	12/27/2011	Classifying-synthesizing transmission method of multi-user feedback information at base station	US11/574636	9/5/2005

Pana-36	USA	Granted	US7848439	12/7/2010	Communication apparatus, communication system, and communication method	US11/719611	11/18/2005
Pana-37	USA	Granted	US8175604	5/8/2012	Efficient rise over thermal (rot) control during soft handover	US10/588073	8/31/2005
Pana-38	USA	Granted	US7860184	12/28/2010	Multi-antenna communication method and multi-antenna communicaton apparatus	US11/813650	1/10/2006
Pana-39	USA	Granted	US8073070	12/6/2011	Multi-pilot generation method and detection method in multi-antenna communication system	US12/092944	11/22/2006
Pana-40	USA	Granted	US8249132	8/21/2012	Communication terminal and receiving method	US11/909425	3/3/2006
Pana-41	USA	Granted	US8576784	5/7/2009	Uplink resource allocation in a mobile communication system	US12/162592	11/2/2006
Pana-42	USA	Granted	US8218681	7/10/2012	Ofdm transmitter and ofdm receiver	US12/440894	3/11/2009
Pana-43	USA	Granted	US8249178	8/21/2012	Multicarrier transmitter and multicarrier receiver	US12/601804	5/25/2007

Pana-44	USA	Granted	US5583851	12/10/1996	Mobile communication apparatus having multi-codes allocating function	US08/272158	7/8/1994
Pana-45	USA	Granted	US5873027	2/16/1999	Mobile radio system with control over radio wave output if a malfunction is detected	US08/761552	12/6/1996
Pana-45	USA	Granted	US6336040	1/1/2002	Mobile radio system with control over radio wave output if a malfunction is detected	US09/207662	12/9/1998
Pana-46	USA	Granted	US5757870	5/26/1998	Spread spectrum communication synchronizing method and its circuit	US08/517408	8/21/1995
Pana-46	USA	Granted	US5818869	10/6/1998	Spread spectrum communication synchronizing method and its circuit	US08/858146	5/15/1997
Pana-47	USA	Granted	US6175558	1/16/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/000947	12/30/1997

Pana-47	USA	Granted	US6301237	10/9/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562921	5/2/2000
Pana-47	USA	Granted	US6529492	3/4/2003	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562922	5/2/2000
Pana-47	USA	Granted	US6370131	4/9/2002	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/576250	5/24/2000
Pana-47	USA	Granted	US6584088	6/24/2003	Cdma radio multiplex transmitting device and cdma radio multiplex receiving device	US09/825998	4/5/2001
Pana-47	USA	Granted	US6549526	4/15/2003	Cdma radio multiplex transmitting device and a cdma multiplex receiving device	US09/826005	4/5/2001
Pana-47	USA	Granted	US7136367	11/14/2006	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US10/335916	1/3/2003

Pana-47	USA	Granted	USRE41444	7/20/2010	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US12/270499	11/13/2008
Pana-48	USA	Granted	US6295301	9/25/2001	Pn code generating apparatus and mobile radio communication system	US09/139325	8/25/1998
Pana-48	USA	Granted	US6697384	2/24/2004	Method and apparatus for calculating a state of starting a pn code generating operation	US09/916284	7/30/2001
Pana-49	USA	Granted	US6466563	10/15/2002	Cdma mobile station and cdma transmission method	US10/147831	3/16/1999
Pana-49	USA	Lapsed	US20030007472	1/9/2003	Cdma mobile station apparatus and cdma transmission method	10235918	9/6/2002
Pana-50	USA	Granted	US6370134	4/9/2002	Cdma radio communication apparatus	US09/115502	7/15/1998
Pana-50	USA	Granted	US7035233	4/25/2006	Radio communication terminal apparatus and radio communication base station apparatus	US10/014352	12/14/2001

Pana-50	USA	Granted	US7535864	5/19/2009	Radio communication terminal apparatus and radio communication base station apparatus	US11/372152	3/10/2006
WCDMA (pool) 01	USA	Granted	US5677929	10/14/1997	Automobile on-board and/or portable telephone system	US08/272156	7/8/1994
WCDMA (pool) 01	USA	Granted	USRE37420	10/23/2001	Automobile on-board and/or portable telephone system	US09/337403	6/21/1999
WCDMA (pool) 01	USA	Granted	USRE39954	12/25/2007	Automobile on-board and/or portable telephone system	US09/887042	6/25/2001
WCDMA (pool) 07	USA	Granted	US6738646	5/18/2004	Base station device and method for communication	US10/069267	2/25/2002
WCDMA (pool) 07	USA	Lapsed	US20030087644	5/8/2003	Communication terminal apparatus and base station apparatus	10322425	12/19/2002
WCDMA (pool) 07	USA	Granted	US7460880	12/2/2008	Communication terminal apparatus and base station apparatus	US11/341430	1/30/2006
WCDMA (pool) 07	USA	Granted	US7761113	7/20/2010	Communication terminal apparatus and base station apparatus	US12/132992	6/4/2008

WCDMA (pool) 09	USA	Granted	US6760590	7/6/2004	Communication terminal apparatus, base station apparatus, and radio communication method	US10/089605	4/1/2002
WCDMA (pool) 09	USA	Granted	US6799053	9/28/2004	Communication terminal apparatus	US10/321500	12/18/2002
WCDMA (pool) 09	USA	Granted	US7206587	4/17/2007	Communication terminal apparatus, base station apparatus, and radio communication method	US10/321623	12/18/2002

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT2704390

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	SECURITY AGREEMENT

CONVEYING PARTY DATA

Name	Execution Date
INVENTERGY, INC.	01/28/2014

RECEIVING PARTY DATA

Name:	HUDSON BAY IP OPPORTUNITIES MASTER FUND, LP, AS COLLATERAL AGENT
Street Address:	777 THIRD AVENUE
Internal Address:	30TH FLOOR
City:	NEW YORK
State/Country:	NEW YORK
Postal Code:	10017

PROPERTY NUMBERS Total: 111

Property Type	Number
Patent Number:	6726297
Patent Number:	8009549
Patent Number:	8416810
Patent Number:	7646702
Patent Number:	8238226
Patent Number:	7593317
Patent Number:	7929627
Patent Number:	7826557
Patent Number:	7792084
Patent Number:	8064393
Patent Number:	8270332
Patent Number:	8582573
Patent Number:	6400929
Patent Number:	6381445

Patent Number:	6366763
Patent Number:	6370359
Patent Number:	6487394
Patent Number:	6597894
Patent Number:	6505035
Patent Number:	6973289
Patent Number:	6611676
Patent Number:	7636551
Patent Number:	6637001
Patent Number:	6813323
Patent Number:	6734810
Patent Number:	6940428
Patent Number:	6922159
Patent Number:	6069884
Patent Number:	6119004
Patent Number:	6069924
Patent Number:	6636723
Patent Number:	6628630
Patent Number:	6404778
Patent Number:	6611509
Patent Number:	6807162
Patent Number:	6973065
Patent Number:	7778224
Patent Number:	6765894
Patent Number:	7656844
Patent Number:	8437316
Patent Number:	6839335
Patent Number:	7072416
Patent Number:	7760815
Patent Number:	6868056
Patent Number:	6944208
Patent Number:	6781973
Patent Number:	7145886
Patent Number:	6847828
Patent Number:	7386321

	7266118
Patent Number:	7133379
Patent Number:	7392019
Patent Number:	7339949
Patent Number:	7702025
Patent Number:	7460502
Patent Number:	7269774
Patent Number:	7385934
Patent Number:	7114121
Patent Number:	7162206
Patent Number:	7746762
Patent Number:	7693140
Patent Number:	7299027
Patent Number:	7251469
Patent Number:	7764711
Patent Number:	8086270
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Patent Number:	7860184
Patent Number:	8073070
Patent Number:	8249132
Patent Number:	8576784
Patent Number:	8218681
Patent Number:	8249178
Patent Number:	5583851
Patent Number:	5873027
Patent Number:	6336040
Patent Number:	5757870
Patent Number:	5818869
Patent Number:	6175558
Patent Number:	6301237
Patent Number:	6529492
Patent Number:	6370131
Patent Number:	6584088
Patent Number:	6549526

	7136367
Patent Number:	RE41444
Patent Number:	6295301
Patent Number:	6697384
Patent Number:	6466563
Patent Number:	6370134
Patent Number:	7035233
Patent Number:	7535864
Patent Number:	5677929
Patent Number:	RE37420
Patent Number:	RE39954
Patent Number:	6738646
Patent Number:	7460880
Patent Number:	7761113
Patent Number:	6760590
Patent Number:	6799053
Patent Number:	7206587
Application Number:	10901380
Application Number:	11134448
Application Number:	10419089
Application Number:	11859550
Application Number:	11575015
Application Number:	13478996
Application Number:	13532576
Application Number:	13554748
Application Number:	10235918
Application Number:	10322425

CORRESPONDENCE DATA

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	WAYNE P. SOBON
Signature:	/Wayne P. Sobon/
Date:	01/29/2014
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 18
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ASSIGNMENT FOR SECURITY
PATENTS

WHEREAS, **Inventergy, Inc.** (the "Assignor") holds all right, title and interest in the letter patents, design patents and utility patents listed on the annexed Schedule 1, which patents are issued or applied for in the United States Patent and Trademark Office (the "Patents");

WHEREAS, the Assignor has entered into a Pledge and Security Agreement, dated as of May 10, 2013 (as amended, restated or otherwise modified from time to time the "Security Agreement"), in favor of **Hudson Bay IP Opportunities Master Fund, LP**, as collateral agent for certain buyers (the "Assignee");

WHEREAS, the Assignor has entered into a Secured Promissory Note, dated as of December 19, 2013 (as amended, restated or otherwise modified from time to time the "Secured Promissory Note"), in favor of **Joseph Beyers** ("Beyers"), as Permitted Indebtedness under the Security Agreement for the purchase of the Patents;

WHEREAS, the Assignor has assigned a continuing first priority security interest in favor of Beyers as a Permitted Lien under the Security Agreement; and

WHEREAS, pursuant to the Security Agreement, the Assignor has assigned to the Assignee and granted to the Assignee for the benefit of the Buyers (as defined in the Security Agreement) a **continuing second priority security interest,** expressly subject to that first priority security interest in favor of Beyers, in all right, title and interest of the Assignor in, to and under the Patents and the applications and registrations thereof, and all proceeds thereof, including, without limitation, any and all causes of action which may exist by reason of infringement thereof and any and all damages arising from past, present and future violations thereof (the "Collateral"), to secure the payment, performance and observance of the "Obligations" (as defined in the Security Agreement).

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Assignor does hereby pledge, convey, sell, assign, transfer and set over unto the Assignee and grants to the Assignee for the benefit of the Buyers a **continuing second priority security interest,** expressly subject to a first priority security interest in favor of Joseph Beyers, in the Collateral to secure the prompt payment, performance and for the benefit of the Buyers observance of the Obligations.

The Assignor does hereby further acknowledge and affirm that the rights and remedies of the Assignee with respect to the Collateral are more fully set forth in the Security Agreement, the terms and provisions of which are hereby incorporated herein by reference as if fully set forth herein.

IN WITNESS WHEREOF, the Assignor has caused this Assignment to be duly executed by its officer thereunto duly authorized as of January 28, 2014.

Inventergy, Inc.

By: ______________________
Name: Wayne P. Sobon
Title: SVP and General Counsel

SCHEDULE 1 TO ASSIGNMENT FOR SECURITY

Patents and Patent Applications
Owned by: **Inventergy, Inc.**

Internal Family ID	Country	Inventergy Understood status 1/14/2014	Publication Number	Publication Date	Title	Application Number	File Date
Inv-01	USA	Granted	US6726297	4/27/2004	Ofdma signal transmission apparatus and method	US10/462491	1/20/2000
Inv-03	USA	Granted	US8009549	8/30/2011	Carrier allocation method in multi cell orthogonal frequency division multiple access system	US12/092950	11/16/2006
Inv-04	USA	Granted	US8416810	4/9/2013	Radio communication base station apparatus and pilot transmission method	US12/160872	1/18/2007
Inv-08	USA	Granted	US7646702	1/12/2010	Ofdm communication apparatus	US10/169716	7/9/2002
Inv-08	USA	Granted	US8238226	8/7/2012	Ofdm communication apparatus	US12/505420	7/17/2009
Inv-09	USA	Granted	US7593317	9/22/2009	Radio base station apparatus	US10/503010	7/29/2004
Inv-15	USA	Granted	US7929627	4/19/2011	Ofdm receiver, integrated circuit and receiving method	US11/885042	2/28/2006

Inv-16	USA	Granted	US7826557	11/2/2010	Retransmitting method and transmitting method in multi-antenna transmission	US11/721911	12/14/2005
Inv-21	USA	Granted	US7792084	9/7/2010	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	US11/892886	8/28/2007
Inv-23	USA	Granted	US8064393	11/22/2011	Wireless communication base station apparatus and wireless communication method in multicarrier communication	US11/997841	8/4/2006
Inv-26	USA	Granted	US8270332	9/18/2012	Wireless communication base station device and wireless communication method	US12/377373	10/12/2007
Inv-26	USA	Granted	US8582573	12/13/2012	Radio communication base station apparatus and radio communication method	US13/590841	8/21/2012
Pana-01	USA	Granted	US6400929	6/4/2002	Radio communication device and method of controlling transmission rate	US09/424843	12/6/1999

Pana-01	USA	Granted	US6381445	4/30/2002	Radio communication device and method of controlling transmission rate	US09/648742	8/28/2000
Pana-01	USA	Granted	US6366763	4/2/2002	Radio communication device and method of controlling transmission rate	US09/648756	8/28/2000
Pana-01	USA	Granted	US6370359	4/9/2002	Radio communication device and method of controlling transmission rate	US09/648757	8/28/2000
Pana-01	USA	Granted	US6487394	11/26/2002	Radio communication device and method of controlling transmission rate	US09/649003	8/28/2000
Pana-01	USA	Granted	US6597894	7/22/2003	Radio communication device and method of controlling transmission rate	US09/649006	8/28/2000
Pana-01	USA	Granted	US6505035	1/7/2003	Radio communication apparatus and transmission rate control method	US10/052261	1/23/2002
Pana-01	USA	Granted	US6973289	12/6/2005	Radio communication device and method of controlling transmission rate	US10/057897	1/29/2002

Pana-01	USA	Granted	US6611676	8/26/2003	Radio communication apparatus and transmission rate control method	US10/083553	2/27/2002
Pana-01	USA	Granted	US7636551	12/22/2009	Radio communication device and method of controlling transmission rate	US11/228339	9/19/2005
Pana-02	USA	Granted	US6637001	10/21/2003	Apparatus and method for image/voice transmission	US09/650743	8/30/2000
Pana-03	USA	Granted	US6813323	11/2/2004	Decoding method and communication terminal apparatus	US10/182270	7/25/2002
Pana-03	USA	Lapsed	US20050002477	1/6/2005	Decoding apparatus and decoding method	10901380	7/29/2004
Pana-04	USA	Granted	US6734810	5/11/2004	Apparatus and method for decoding	US10/221267	9/10/2002
Pana-04	USA	Granted	US6940428	9/6/2005	Apparatus and method for decoding	US10/793737	3/8/2004
Pana-04	USA	Granted	US6922159	7/26/2005	Apparatus and method for decoding	US10/793766	3/8/2004
Pana-04	USA	Lapsed	US20050219071	10/6/2005	Apparatus and method for decoding	11134448	5/23/2005

Pana-05	USA	Granted	US6069884	5/30/2000	Method of communication between a base station and a plurality of mobile unit communication apparatus, a base station, and mobile unit communication apparatus	US08/937005	9/24/1997
Pana-06	USA	Granted	US6119004	9/12/2000	Base station equipment for mobile communication	US09/068541	5/13/1998
Pana-07	USA	Granted	US6069924	5/30/2000	Differential detector with error correcting function	US09/027510	2/20/1998
Pana-08	USA	Granted	US6636723	10/21/2003	Cdma radio communication system using chip interleaving	US09/359020	7/22/1999
Pana-08	USA	Lapsed	US20040048578	3/11/2004	Cdma radio transmission apparatus, cdma radio reception apparatus, and cdma radio communication method	10419089	4/21/2003
Pana-09	USA	Granted	US6628630	9/30/2003	Spread spectrum communication method	US09/058881	4/13/1998
Pana-10	USA	Granted	US6404778	6/11/2002	Radio communication apparatus	US09/159602	9/24/1998

Pana-11	USA	Granted	US6611509	8/26/2003	Cdma/tdd mobile communication system and method	US09/264826	3/9/1999
Pana-11	USA	Granted	US6807162	10/19/2004	Cdma/tdd mobile communication system and method	US10/166268	6/11/2002
Pana-11	USA	Granted	US6973065	12/6/2005	Cdma/tdd mobile communication system and method	US10/419733	4/22/2003
Pana-11	USA	Granted	US7778224	8/17/2010	Cdma/tdd mobile communication system and method	US10/885684	7/8/2004
Pana-12	USA	Granted	US6765894	7/20/2004	Communication terminal apparatus and base station apparatus	US09/606906	6/30/2000
Pana-12	USA	Granted	US7656844	2/2/2010	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US10/868029	6/16/2004
Pana-12	USA	Granted	US8437316	5/7/2013	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US12/641177	12/17/2009

Pana-13	USA	Granted	US6839335	1/4/2005	Radio communication apparatus and radio communication method	US09/605862	6/29/2000
Pana-14	USA	Granted	US7072416	7/4/2006	Transmitting/receiving device and transmitting/receiving method	US09/582558	6/29/2000
Pana-14	USA	Granted	US7760815	7/20/2010	Apparatus and method for transmission/reception	US11/431606	5/11/2006
Pana-15	USA	Granted	US6868056	3/15/2005	Apparatus and method for ofdm communication	US09/635096	8/9/2000
Pana-16	USA	Granted	US6944208	9/13/2005	Interference signal canceling apparatus and interference signal canceling method	US09/936727	9/17/2001
Pana-17	USA	Granted	US6781973	8/24/2004	Combined signaling and sir inner-loop power control	US09/538888	3/30/2000
Pana-18	USA	Granted	US7145886	12/5/2006	Communication terminal, base station system, and method of controlling transmission power	US09/889919	7/25/2001
Pana-19	USA	Granted	US6847828	1/25/2005	Base station apparatus and radio communication method	US10/069484	2/27/2002

Pana-19	USA	Granted	US7386321	6/10/2008	Base station apparatus and radio communication method	US10/793738	3/8/2004
Pana-20	USA	Granted	US7266118	9/4/2007	Packet receiving apparatus and packet transmission method	US10/143989	5/14/2002
Pana-21	USA	Granted	US7133379	11/7/2006	Wireless communication system, and base station apparatus and communication terminal apparatus accommodated in the system	US10/181349	7/17/2002
Pana-22	USA	Granted	US7392019	6/24/2008	Wireless base station apparatus and wireless communication method	US11/053837	2/10/2005
Pana-23	USA	Granted	US7339949	3/4/2008	Arq transmission and reception methods and apparatus	US10/222989	8/19/2002
Pana-24	USA	Granted	US7702025	4/20/2010	Transmission/reception apparatus and transmission/reception method	US10/487574	2/25/2004
Pana-25	USA	Granted	US7460502	12/2/2008	Scheduling creation apparatus, base station apparatus, and radio communication method	US10/250487	7/3/2003

Pana-26	USA	Granted	US7269774	9/11/2007	Data receiving apparatus, data transmitting apparatus and retransmission request method	US10/484951	1/28/2004
Pana-27	USA	Granted	US7385934	6/10/2008	Radio communication apparatus and transfer rate decision method	US10/476845	11/6/2003
Pana-28	USA	Granted	US7114121	9/26/2006	Rate matching device and rate matching method	US10/478139	11/20/2003
Pana-29	USA	Granted	US7162206	1/9/2007	Test apparatus, mobile terminal apparatus, test method	US10/612289	7/3/2003
Pana-30	USA	Granted	US7746762	6/29/2010	Transmitting apparatus and transmitting method	US10/534987	5/16/2005
Pana-31	USA	Granted	US7693140	4/6/2010	Cdma transmitting apparatus and cdma receiving apparatus	US10/527199	3/10/2005
Pana-32	USA	Granted	US7299027	11/20/2007	Mimo receiver and mimo reception method for selection of mimo separation and channel variation compensation	US10/536010	5/23/2005
Pana-32	USA	Lapsed	US20080020802	1/24/2008	Wireless receiver and wireless reception method	11859550	9/21/2007

Pana-33	USA	Pending	US20070255993	11/1/2007	Automatic retransmission request control system and retransmission method in memo-ofdm system	11575015	3/30/2007
Pana-33	USA	Lapsed	US20120230257	9/13/2012	Retransmission method and transmitter	13478996	5/23/2012
Pana-33	USA	Lapsed	US20120263250	10/18/2012	Retransmission method, transmitter, and communication system	13532576	6/25/2012
Pana-33	USA	Lapsed	US20120287775	11/15/2012	Automatic retransmission request control system and retransmission method in mimo-ofdm system	13554748	7/20/2012
Pana-34	USA	Granted	US7251469	7/31/2007	Cdma transmitting apparatus and cdma transmitting method	US10/522980	2/2/2005
Pana-34	USA	Granted	US7764711	7/27/2010	Cdma transmission apparatus and cdma transmission method	US11/767124	6/22/2007
Pana-35	USA	Granted	US8086270	12/27/2011	Classifying-synthesizing transmission method of multi-user feedback information at base station	US11/574636	9/5/2005

Pana-36	USA	Granted	US7848439	12/7/2010	Communication apparatus, communication system, and communication method	US11/719611	11/18/2005
Pana-37	USA	Granted	US8175604	5/8/2012	Efficient rise over thermal (rot) control during soft handover	US10/588073	8/31/2005
Pana-38	USA	Granted	US7860184	12/28/2010	Multi-antenna communication method and multi-antenna communicaton apparatus	US11/813650	1/10/2006
Pana-39	USA	Granted	US8073070	12/6/2011	Multi-pilot generation method and detection method in multi-antenna communication system	US12/092944	11/22/2006
Pana-40	USA	Granted	US8249132	8/21/2012	Communication terminal and receiving method	US11/909425	3/3/2006
Pana-41	USA	Granted	US8576784	5/7/2009	Uplink resource allocation in a mobile communication system	US12/162592	11/2/2006
Pana-42	USA	Granted	US8218681	7/10/2012	Ofdm transmitter and ofdm receiver	US12/440894	3/11/2009
Pana-43	USA	Granted	US8249178	8/21/2012	Multicarrier transmitter and multicarrier receiver	US12/601804	5/25/2007

Pana-44	USA	Granted	US5583851	12/10/1996	Mobile communication apparatus having multi-codes allocating function	US08/272158	7/8/1994
Pana-45	USA	Granted	US5873027	2/16/1999	Mobile radio system with control over radio wave output if a malfunction is detected	US08/761552	12/6/1996
Pana-45	USA	Granted	US6336040	1/1/2002	Mobile radio system with control over radio wave output if a malfunction is detected	US09/207662	12/9/1998
Pana-46	USA	Granted	US5757870	5/26/1998	Spread spectrum communication synchronizing method and its circuit	US08/517408	8/21/1995
Pana-46	USA	Granted	US5818869	10/6/1998	Spread spectrum communication synchronizing method and its circuit	US08/858146	5/15/1997
Pana-47	USA	Granted	US6175558	1/16/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/000947	12/30/1997

Pana-47	USA	Granted	US6301237	10/9/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562921	5/2/2000
Pana-47	USA	Granted	US6529492	3/4/2003	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562922	5/2/2000
Pana-47	USA	Granted	US6370131	4/9/2002	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/576250	5/24/2000
Pana-47	USA	Granted	US6584088	6/24/2003	Cdma radio multiplex transmitting device and cdma radio multiplex receiving device	US09/825998	4/5/2001
Pana-47	USA	Granted	US6549526	4/15/2003	Cdma radio multiplex transmitting device and a cdma multiplex receiving device	US09/826005	4/5/2001
Pana-47	USA	Granted	US7136367	11/14/2006	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US10/335916	1/3/2003

Pana-47	USA	Granted	USRE41444	7/20/2010	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US12/270499	11/13/2008
Pana-48	USA	Granted	US6295301	9/25/2001	Pn code generating apparatus and mobile radio communication system	US09/139325	8/25/1998
Pana-48	USA	Granted	US6697384	2/24/2004	Method and apparatus for calculating a state of starting a pn code generating operation	US09/916284	7/30/2001
Pana-49	USA	Granted	US6466563	10/15/2002	Cdma mobile station and cdma transmission method	US10/147831	3/16/1999
Pana-49	USA	Lapsed	US20030007472	1/9/2003	Cdma mobile station apparatus and cdma transmission method	10235918	9/6/2002
Pana-50	USA	Granted	US6370134	4/9/2002	Cdma radio communication apparatus	US09/115502	7/15/1998
Pana-50	USA	Granted	US7035233	4/25/2006	Radio communication terminal apparatus and radio communication base station apparatus	US10/014352	12/14/2001

Pana-50	USA	Granted	US7535864	5/19/2009	Radio communication terminal apparatus and radio communication base station apparatus	US11/372152	3/10/2006
WCDMA (pool) 01	USA	Granted	US5677929	10/14/1997	Automobile on-board and/or portable telephone system	US08/272156	7/8/1994
WCDMA (pool) 01	USA	Granted	USRE37420	10/23/2001	Automobile on-board and/or portable telephone system	US09/337403	6/21/1999
WCDMA (pool) 01	USA	Granted	USRE39954	12/25/2007	Automobile on-board and/or portable telephone system	US09/887042	6/25/2001
WCDMA (pool) 07	USA	Granted	US6738646	5/18/2004	Base station device and method for communication	US10/069267	2/25/2002
WCDMA (pool) 07	USA	Lapsed	US20030087644	5/8/2003	Communication terminal apparatus and base station apparatus	10322425	12/19/2002
WCDMA (pool) 07	USA	Granted	US7460880	12/2/2008	Communication terminal apparatus and base station apparatus	US11/341430	1/30/2006
WCDMA (pool) 07	USA	Granted	US7761113	7/20/2010	Communication terminal apparatus and base station apparatus	US12/132992	6/4/2008

WCDMA (pool) 09	USA	Granted	US6760590	7/6/2004	Communication terminal apparatus, base station apparatus, and radio communication method	US10/089605	4/1/2002
WCDMA (pool) 09	USA	Granted	US6799053	9/28/2004	Communication terminal apparatus	US10/321500	12/18/2002
WCDMA (pool) 09	USA	Granted	US7206587	4/17/2007	Communication terminal apparatus, base station apparatus, and radio communication method	US10/321623	12/18/2002

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
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EPAS ID: PAT2782882

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	RELEASE BY SECURED PARTY

CONVEYING PARTY DATA

Name	Execution Date
JOSEPH BEYERS	03/24/2014

RECEIVING PARTY DATA

Name:	INVENTERGY, INC.
Street Address:	19925 STEVENS CREEK BOULEVARD
City:	CUPERTINO
State/Country:	CALIFORNIA
Postal Code:	95014

PROPERTY NUMBERS Total: 111

Property Type	Number
Patent Number:	6726297
Patent Number:	8009549
Patent Number:	8416810
Patent Number:	7646702
Patent Number:	8238226
Patent Number:	7593317
Patent Number:	7929627
Patent Number:	7826557
Patent Number:	7792084
Patent Number:	8064393
Patent Number:	8270332
Patent Number:	8582573
Patent Number:	6400929
Patent Number:	6381445
Patent Number:	6366763
Patent Number:	6370359
Patent Number:	6487394
Patent Number:	6597894
Patent Number:	6505035
Patent Number:	6973289
Patent Number:	6611676

Property Type	Number
Patent Number:	7636551
Patent Number:	6637001
Patent Number:	6813323
Patent Number:	6734810
Patent Number:	6940428
Patent Number:	6922159
Patent Number:	6069884
Patent Number:	6119004
Patent Number:	6069924
Patent Number:	6636723
Patent Number:	6628630
Patent Number:	6404778
Patent Number:	6611509
Patent Number:	6807162
Patent Number:	6973065
Patent Number:	7778224
Patent Number:	6765894
Patent Number:	7656844
Patent Number:	8437316
Patent Number:	6839335
Patent Number:	7072416
Patent Number:	7760815
Patent Number:	6868056
Patent Number:	6944208
Patent Number:	6781973
Patent Number:	7145886
Patent Number:	6847828
Patent Number:	7386321
Patent Number:	7266118
Patent Number:	7133379
Patent Number:	7392019
Patent Number:	7339949
Patent Number:	7702025
Patent Number:	7460502
Patent Number:	7269774
Patent Number:	7385934
Patent Number:	7114121
Patent Number:	7162206
Patent Number:	7746762

Property Type	Number
Patent Number:	7693140
Patent Number:	7299027
Patent Number:	7251469
Patent Number:	7764711
Patent Number:	8086270
Patent Number:	7848439
Patent Number:	8175604
Patent Number:	7860184
Patent Number:	8073070
Patent Number:	8249132
Patent Number:	8576784
Patent Number:	8218681
Patent Number:	8249178
Patent Number:	5583851
Patent Number:	5873027
Patent Number:	6336040
Patent Number:	5757870
Patent Number:	5818869
Patent Number:	6175558
Patent Number:	6301237
Patent Number:	6529492
Patent Number:	6370131
Patent Number:	6584088
Patent Number:	6549526
Patent Number:	7136367
Patent Number:	RE41444
Patent Number:	6295301
Patent Number:	6697384
Patent Number:	6466563
Patent Number:	6370134
Patent Number:	7035233
Patent Number:	7535864
Patent Number:	5677929
Patent Number:	RE37420
Patent Number:	RE39954
Patent Number:	6738646
Patent Number:	7460880
Patent Number:	7761113
Patent Number:	6760590

Property Type	Number
Patent Number:	6799053
Patent Number:	7206587
Application Number:	10901380
Application Number:	11134448
Application Number:	10419089
Application Number:	11859550
Application Number:	11575015
Application Number:	13478996
Application Number:	13532576
Application Number:	13554748
Application Number:	10235918
Application Number:	10322425

CORRESPONDENCE DATA

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Address Line 2:	SUITE 100
Address Line 4:	CUPERTINO, CALIFORNIA 95014

NAME OF SUBMITTER:	PAUL A. ROBERTS
SIGNATURE:	/Paul A. Roberts/
DATE SIGNED:	03/25/2014
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 18

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TERMINATION AND RELEASE OF SECURITY INTEREST IN PATENTS

This **TERMINATION AND RELEASE OF SECURITY INTEREST IN PATENTS** (this "**Release**"), dated as of March 24, 2014, is made by Joseph Beyers, in its capacity as Assignee for Security.

Reference is made to (a) that certain promissory note dated December 19, 2013 as amended on February 6, 2014 by Inventergy, Inc., a Delaware corporation in favor Joseph Beyers, and (b) that Assignment for Security-Patents made by Inventergy, Inc. in favor of Joseph Beyers dated January 24, 2014;

WHEREAS, the Assignment for Security-Patents was recorded in the U.S. Patent and Trademark Office on January 27, 2014 at Reel/Frame No.032127/0234 ; and

NOW THEREFORE, Joseph Beyers does hereby **RELEASE** his security interest in, to and under the collateral covered by the Assignment for Security-Patents, and Joseph Beyers hereby reassigns, without representation, recourse or warranty whatsoever, such collateral to Inventergy, Inc. Joseph Beyers agrees to make appropriate filings with the U.S. Patent and Trademark Office and other necessary filings, in each case reasonably requested by Inventergy, Inc. at the expense of Inventergy, Inc., to evidence the release and termination of such security interests covering the collateral.

IN WITNESS WHEREOF, the Joseph Beyers has executed this Release, to take effect as of the date first set forth above.

Jos. W. Beyers

Joseph Beyers

ANNEX I

RELEASE TO ASSIGNMENT FOR SECURITY

Internal Family ID	Country	Inventergy Understood status 1/14/2014	Publication Number	Publication Date	Title	Application Number	File Date
Inv-01	USA	Granted	US6726297	4/27/2004	Ofdma signal transmission apparatus and method	US10/462491	1/20/2000
Inv-03	USA	Granted	US8009549	8/30/2011	Carrier allocation method in multi cell orthogonal frequency division multiple access system	US12/092950	11/16/2006
Inv-04	USA	Granted	US8416810	4/9/2013	Radio communication base station apparatus and pilot transmission method	US12/160872	1/18/2007
Inv-08	USA	Granted	US7646702	1/12/2010	Ofdm communication apparatus	US10/169716	7/9/2002
Inv-08	USA	Granted	US8238226	8/7/2012	Ofdm communication apparatus	US12/505420	7/17/2009
Inv-09	USA	Granted	US7593317	9/22/2009	Radio base station apparatus	US10/503010	7/29/2004
Inv-15	USA	Granted	US7929627	4/19/2011	Ofdm receiver, integrated circuit and receiving method	US11/885042	2/28/2006

Inv-16	USA	Granted	US7826557	11/2/2010	Retransmitting method and transmitting method in multi-antenna transmission	US11/721911	12/14/2005
Inv-21	USA	Granted	US7792084	9/7/2010	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	US11/892886	8/28/2007
Inv-23	USA	Granted	US8064393	11/22/2011	Wireless communication base station apparatus and wireless communication method in multicarrier communication	US11/997841	8/4/2006
Inv-26	USA	Granted	US8270332	9/18/2012	Wireless communication base station device and wireless communication method	US12/377373	10/12/2007
Inv-26	USA	Granted	US8582573	12/13/2012	Radio communication base station apparatus and radio communication method	US13/590841	8/21/2012
Pana-01	USA	Granted	US6400929	6/4/2002	Radio communication device and method of controlling transmission rate	US09/424843	12/6/1999

Pana-01	USA	Granted	US6381445	4/30/2002	Radio communication device and method of controlling transmission rate	US09/648742	8/28/2000
Pana-01	USA	Granted	US6366763	4/2/2002	Radio communication device and method of controlling transmission rate	US09/648756	8/28/2000
Pana-01	USA	Granted	US6370359	4/9/2002	Radio communication device and method of controlling transmission rate	US09/648757	8/28/2000
Pana-01	USA	Granted	US6487394	11/26/2002	Radio communication device and method of controlling transmission rate	US09/649003	8/28/2000
Pana-01	USA	Granted	US6597894	7/22/2003	Radio communication device and method of controlling transmission rate	US09/649006	8/28/2000
Pana-01	USA	Granted	US6505035	1/7/2003	Radio communication apparatus and transmission rate control method	US10/052261	1/23/2002
Pana-01	USA	Granted	US6973289	12/6/2005	Radio communication device and method of controlling transmission rate	US10/057897	1/29/2002

Pana-01	USA	Granted	US6611676	8/26/2003	Radio communication apparatus and transmission rate control method	US10/083553	2/27/2002
Pana-01	USA	Granted	US7636551	12/22/2009	Radio communication device and method of controlling transmission rate	US11/228339	9/19/2005
Pana-02	USA	Granted	US6637001	10/21/2003	Apparatus and method for image/voice transmission	US09/650743	8/30/2000
Pana-03	USA	Granted	US6813323	11/2/2004	Decoding method and communication terminal apparatus	US10/182270	7/25/2002
Pana-03	USA	Lapsed	US20050002477	1/6/2005	Decoding apparatus and decoding method	10901380	7/29/2004
Pana-04	USA	Granted	US6734810	5/11/2004	Apparatus and method for decoding	US10/221267	9/10/2002
Pana-04	USA	Granted	US6940428	9/6/2005	Apparatus and method for decoding	US10/793737	3/8/2004
Pana-04	USA	Granted	US6922159	7/26/2005	Apparatus and method for decoding	US10/793766	3/8/2004
Pana-04	USA	Lapsed	US20050219071	10/6/2005	Apparatus and method for decoding	11134448	5/23/2005

Pana-05	USA	Granted	US6069884	5/30/2000	Method of communication between a base station and a plurality of mobile unit communication apparatus, a base station, and mobile unit communication apparatus	US08/937005	9/24/1997
Pana-06	USA	Granted	US6119004	9/12/2000	Base station equipment for mobile communication	US09/068541	5/13/1998
Pana-07	USA	Granted	US6069924	5/30/2000	Differential detector with error correcting function	US09/027510	2/20/1998
Pana-08	USA	Granted	US6636723	10/21/2003	Cdma radio communication system using chip interleaving	US09/359020	7/22/1999
Pana-08	USA	Lapsed	US20040048578	3/11/2004	Cdma radio transmission apparatus, cdma radio reception apparatus, and cdma radio communication method	10419089	4/21/2003
Pana-09	USA	Granted	US6628630	9/30/2003	Spread spectrum communication method	US09/058881	4/13/1998
Pana-10	USA	Granted	US6404778	6/11/2002	Radio communication apparatus	US09/159602	9/24/1998

Pana-11	USA	Granted	US6611509	8/26/2003	Cdma/tdd mobile communication system and method	US09/264826	3/9/1999
Pana-11	USA	Granted	US6807162	10/19/2004	Cdma/tdd mobile communication system and method	US10/166268	6/11/2002
Pana-11	USA	Granted	US6973065	12/6/2005	Cdma/tdd mobile communication system and method	US10/419733	4/22/2003
Pana-11	USA	Granted	US7778224	8/17/2010	Cdma/tdd mobile communication system and method	US10/885684	7/8/2004
Pana-12	USA	Granted	US6765894	7/20/2004	Communication terminal apparatus and base station apparatus	US09/606906	6/30/2000
Pana-12	USA	Granted	US7656844	2/2/2010	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US10/868029	6/16/2004
Pana-12	USA	Granted	US8437316	5/7/2013	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US12/641177	12/17/2009

Pana-13	USA	Granted	US6839335	1/4/2005	Radio communication apparatus and radio communication method	US09/605862	6/29/2000
Pana-14	USA	Granted	US7072416	7/4/2006	Transmitting/receiving device and transmitting/receiving method	US09/582558	6/29/2000
Pana-14	USA	Granted	US7760815	7/20/2010	Apparatus and method for transmission/reception	US11/431606	5/11/2006
Pana-15	USA	Granted	US6868056	3/15/2005	Apparatus and method for ofdm communication	US09/635096	8/9/2000
Pana-16	USA	Granted	US6944208	9/13/2005	Interference signal canceling apparatus and interference signal canceling method	US09/936727	9/17/2001
Pana-17	USA	Granted	US6781973	8/24/2004	Combined signaling and sir inner-loop power control	US09/538888	3/30/2000
Pana-18	USA	Granted	US7145886	12/5/2006	Communication terminal, base station system, and method of controlling transmission power	US09/889919	7/25/2001
Pana-19	USA	Granted	US6847828	1/25/2005	Base station apparatus and radio communication method	US10/069484	2/27/2002

Pana-19	USA	Granted	US7386321	6/10/2008	Base station apparatus and radio communication method	US10/793738	3/8/2004
Pana-20	USA	Granted	US7266118	9/4/2007	Packet receiving apparatus and packet transmission method	US10/143989	5/14/2002
Pana-21	USA	Granted	US7133379	11/7/2006	Wireless communication system, and base station apparatus and communication terminal apparatus accommodated in the system	US10/181349	7/17/2002
Pana-22	USA	Granted	US7392019	6/24/2008	Wireless base station apparatus and wireless communication method	US11/053837	2/10/2005
Pana-23	USA	Granted	US7339949	3/4/2008	Arq transmission and reception methods and apparatus	US10/222989	8/19/2002
Pana-24	USA	Granted	US7702025	4/20/2010	Transmission/reception apparatus and transmission/reception method	US10/487574	2/25/2004
Pana-25	USA	Granted	US7460502	12/2/2008	Scheduling creation apparatus, base station apparatus, and radio communication method	US10/250487	7/3/2003

Pana-26	USA	Granted	US7269774	9/11/2007	Data receiving apparatus, data transmitting apparatus and retransmission request method	US10/484951	1/28/2004
Pana-27	USA	Granted	US7385934	6/10/2008	Radio communication apparatus and transfer rate decision method	US10/476845	11/6/2003
Pana-28	USA	Granted	US7114121	9/26/2006	Rate matching device and rate matching method	US10/478139	11/20/2003
Pana-29	USA	Granted	US7162206	1/9/2007	Test apparatus, mobile terminal apparatus, test method	US10/612289	7/3/2003
Pana-30	USA	Granted	US7746762	6/29/2010	Transmitting apparatus and transmitting method	US10/534987	5/16/2005
Pana-31	USA	Granted	US7693140	4/6/2010	Cdma transmitting apparatus and cdma receiving apparatus	US10/527199	3/10/2005
Pana-32	USA	Granted	US7299027	11/20/2007	Mimo receiver and mimo reception method for selection of mimo separation and channel variation compensation	US10/536010	5/23/2005
Pana-32	USA	Lapsed	US20080020802	1/24/2008	Wireless receiver and wireless reception method	11859550	9/21/2007

Pana-33	USA	Pending	US20070255993	11/1/2007	Automatic retransmission request control system and retransmission method in memo-ofdm system	11575015	3/30/2007
Pana-33	USA	Lapsed	US20120230257	9/13/2012	Retransmission method and transmitter	13478996	5/23/2012
Pana-33	USA	Lapsed	US20120263250	10/18/2012	Retransmission method, transmitter, and communication system	13532576	6/25/2012
Pana-33	USA	Lapsed	US20120287775	11/15/2012	Automatic retransmission request control system and retransmission method in mimo-ofdm system	13554748	7/20/2012
Pana-34	USA	Granted	US7251469	7/31/2007	Cdma transmitting apparatus and cdma transmitting method	US10/522980	2/2/2005
Pana-34	USA	Granted	US7764711	7/27/2010	Cdma transmission apparatus and cdma transmission method	US11/767124	6/22/2007
Pana-35	USA	Granted	US8086270	12/27/2011	Classifying-synthesizing transmission method of multi-user feedback information at base station	US11/574636	9/5/2005

Pana-36	USA	Granted	US7848439	12/7/2010	Communication apparatus, communication system, and communication method	US11/719611	11/18/2005
Pana-37	USA	Granted	US8175604	5/8/2012	Efficient rise over thermal (rot) control during soft handover	US10/588073	8/31/2005
Pana-38	USA	Granted	US7860184	12/28/2010	Multi-antenna communication method and multi-antenna communicaton apparatus	US11/813650	1/10/2006
Pana-39	USA	Granted	US8073070	12/6/2011	Multi-pilot generation method and detection method in multi-antenna communication system	US12/092944	11/22/2006
Pana-40	USA	Granted	US8249132	8/21/2012	Communication terminal and receiving method	US11/909425	3/3/2006
Pana-41	USA	Granted	US8576784	5/7/2009	Uplink resource allocation in a mobile communication system	US12/162592	11/2/2006
Pana-42	USA	Granted	US8218681	7/10/2012	Ofdm transmitter and ofdm receiver	US12/440894	3/11/2009
Pana-43	USA	Granted	US8249178	8/21/2012	Multicarrier transmitter and multicarrier receiver	US12/601804	5/25/2007

Pana-44	USA	Granted	US5583851	12/10/1996	Mobile communication apparatus having multi-codes allocating function	US08/272158	7/8/1994
Pana-45	USA	Granted	US5873027	2/16/1999	Mobile radio system with control over radio wave output if a malfunction is detected	US08/761552	12/6/1996
Pana-45	USA	Granted	US6336040	1/1/2002	Mobile radio system with control over radio wave output if a malfunction is detected	US09/207662	12/9/1998
Pana-46	USA	Granted	US5757870	5/26/1998	Spread spectrum communication synchronizing method and its circuit	US08/517408	8/21/1995
Pana-46	USA	Granted	US5818869	10/6/1998	Spread spectrum communication synchronizing method and its circuit	US08/858146	5/15/1997
Pana-47	USA	Granted	US6175558	1/16/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/000947	12/30/1997

Pana-47	USA	Granted	US6301237	10/9/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562921	5/2/2000
Pana-47	USA	Granted	US6529492	3/4/2003	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562922	5/2/2000
Pana-47	USA	Granted	US6370131	4/9/2002	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/576250	5/24/2000
Pana-47	USA	Granted	US6584088	6/24/2003	Cdma radio multiplex transmitting device and cdma radio multiplex receiving device	US09/825998	4/5/2001
Pana-47	USA	Granted	US6549526	4/15/2003	Cdma radio multiplex transmitting device and a cdma multiplex receiving device	US09/826005	4/5/2001
Pana-47	USA	Granted	US7136367	11/14/2006	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US10/335916	1/3/2003

Pana-47	USA	Granted	USRE41444	7/20/2010	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US12/270499	11/13/2008
Pana-48	USA	Granted	US6295301	9/25/2001	Pn code generating apparatus and mobile radio communication system	US09/139325	8/25/1998
Pana-48	USA	Granted	US6697384	2/24/2004	Method and apparatus for calculating a state of starting a pn code generating operation	US09/916284	7/30/2001
Pana-49	USA	Granted	US6466563	10/15/2002	Cdma mobile station and cdma transmission method	US10/147831	3/16/1999
Pana-49	USA	Lapsed	US20030007472	1/9/2003	Cdma mobile station apparatus and cdma transmission method	10235918	9/6/2002
Pana-50	USA	Granted	US6370134	4/9/2002	Cdma radio communication apparatus	US09/115502	7/15/1998
Pana-50	USA	Granted	US7035233	4/25/2006	Radio communication terminal apparatus and radio communication base station apparatus	US10/014352	12/14/2001

Pana-50	USA	Granted	US7535864	5/19/2009	Radio communication terminal apparatus and radio communication base station apparatus	US11/372152	3/10/2006
WCDMA (pool) 01	USA	Granted	US5677929	10/14/1997	Automobile on-board and/or portable telephone system	US08/272156	7/8/1994
WCDMA (pool) 01	USA	Granted	USRE37420	10/23/2001	Automobile on-board and/or portable telephone system	US09/337403	6/21/1999
WCDMA (pool) 01	USA	Granted	USRE39954	12/25/2007	Automobile on-board and/or portable telephone system	US09/887042	6/25/2001
WCDMA (pool) 07	USA	Granted	US6738646	5/18/2004	Base station device and method for communication	US10/069267	2/25/2002
WCDMA (pool) 07	USA	Lapsed	US20030087644	5/8/2003	Communication terminal apparatus and base station apparatus	10322425	12/19/2002
WCDMA (pool) 07	USA	Granted	US7460880	12/2/2008	Communication terminal apparatus and base station apparatus	US11/341430	1/30/2006
WCDMA (pool) 07	USA	Granted	US7761113	7/20/2010	Communication terminal apparatus and base station apparatus	US12/132992	6/4/2008

WCDMA (pool) 09	USA	Granted	US6760590	7/6/2004	Communication terminal apparatus, base station apparatus, and radio communication method	US10/089605	4/1/2002
WCDMA (pool) 09	USA	Granted	US6799053	9/28/2004	Communication terminal apparatus	US10/321500	12/18/2002
WCDMA (pool) 09	USA	Granted	US7206587	4/17/2007	Communication terminal apparatus, base station apparatus, and radio communication method	US10/321623	12/18/2002

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
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EPAS ID: PAT2785017

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	SECURITY AGREEMENT

CONVEYING PARTY DATA

Name	Execution Date
INVENTERGY, INC.	03/25/2014

RECEIVING PARTY DATA

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City:	NEW YORK
State/Country:	NEW YORK
Postal Code:	10017

PROPERTY NUMBERS Total: 111

Property Type	Number
Application Number:	10901380
Application Number:	11134448
Application Number:	10419089
Application Number:	11859550
Application Number:	11575015
Application Number:	13478996
Application Number:	13532576
Application Number:	13554748
Application Number:	10235918
Application Number:	10322425
Patent Number:	6726297
Patent Number:	8009549
Patent Number:	8416810
Patent Number:	7646702
Patent Number:	8238226
Patent Number:	7593317
Patent Number:	7929627
Patent Number:	7826557
Patent Number:	7792084

Property Type	Number
Patent Number:	8064393
Patent Number:	8270332
Patent Number:	8582573
Patent Number:	6400929
Patent Number:	6381445
Patent Number:	6366763
Patent Number:	6370359
Patent Number:	6487394
Patent Number:	6597894
Patent Number:	6505035
Patent Number:	6973289
Patent Number:	6611676
Patent Number:	7636551
Patent Number:	6637001
Patent Number:	6813323
Patent Number:	6734810
Patent Number:	6940428
Patent Number:	6922159
Patent Number:	6069884
Patent Number:	6119004
Patent Number:	6069924
Patent Number:	6636723
Patent Number:	6628630
Patent Number:	6404778
Patent Number:	6611509
Patent Number:	6807162
Patent Number:	6973065
Patent Number:	7778224
Patent Number:	6765894
Patent Number:	7656844
Patent Number:	8437316
Patent Number:	6839335
Patent Number:	7072416
Patent Number:	7760815
Patent Number:	6868056
Patent Number:	6944208
Patent Number:	6781973
Patent Number:	7145886
Patent Number:	6847828

Property Type	Number
Patent Number:	7386321
Patent Number:	7266118
Patent Number:	7133379
Patent Number:	7392019
Patent Number:	7339949
Patent Number:	7702025
Patent Number:	7460502
Patent Number:	7269774
Patent Number:	7385934
Patent Number:	7114121
Patent Number:	7162206
Patent Number:	7746762
Patent Number:	7693140
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Patent Number:	7764711
Patent Number:	8086270
Patent Number:	7848439
Patent Number:	8175604
Patent Number:	7860184
Patent Number:	8073070
Patent Number:	8249132
Patent Number:	8576784
Patent Number:	8218681
Patent Number:	8249178
Patent Number:	5583851
Patent Number:	5873027
Patent Number:	6336040
Patent Number:	5757870
Patent Number:	5818869
Patent Number:	6175558
Patent Number:	6301237
Patent Number:	6529492
Patent Number:	6370131
Patent Number:	6584088
Patent Number:	6549526
Patent Number:	7136367
Patent Number:	RE41444
Patent Number:	6295301

Property Type	Number
Patent Number:	6697384
Patent Number:	6466563
Patent Number:	6370134
Patent Number:	7035233
Patent Number:	7535864
Patent Number:	5677929
Patent Number:	RE37420
Patent Number:	RE39954
Patent Number:	6738646
Patent Number:	7460880
Patent Number:	7761113
Patent Number:	6760590
Patent Number:	6799053
Patent Number:	7206587

CORRESPONDENCE DATA

Fax Number:

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NAME OF SUBMITTER:	PAUL A. ROBERTS
SIGNATURE:	/Paul A. Roberts/
DATE SIGNED:	03/25/2014
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 18

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source=Inventergy Assignment for Security Patents - Hudson First on Mobile Broadband 03-25-14#page18.tif

ASSIGNMENT FOR SECURITY
PATENTS

WHEREAS, **Inventergy, Inc.** (the "Assignor") holds all right, title and interest in the letter patents, design patents and utility patents listed on the annexed Schedule 1, which patents are issued or applied for in the United States Patent and Trademark Office (the "Patents");

WHEREAS, the Assignor has entered into a Pledge and Security Agreement, dated as of May 10, 2013 (as amended, restated or otherwise modified from time to time the "Security Agreement"), in favor of **Hudson Bay IP Opportunities Master Fund, LP**, as collateral agent for certain buyers (the "Assignee");

WHEREAS, pursuant to the Security Agreement, the Assignor has assigned to the Assignee and granted to the Assignee for the benefit of the Buyers (as defined in the Security Agreement) a continuing security interest in all right, title and interest of the Assignor in, to and under the Patents and the applications and registrations thereof, and all proceeds thereof, including, without limitation, any and all causes of action which may exist by reason of infringement thereof and any and all damages arising from past, present and future violations thereof (the "Collateral"), to secure the payment, performance and observance of the "Obligations" (as defined in the Security Agreement);

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Assignor does hereby pledge, convey, sell, assign, transfer and set over unto the Assignee and grants to the Assignee for the benefit of the Buyers a continuing security interest in the Collateral to secure the prompt payment, performance and for the benefit of the Buyers observance of the Obligations.

The Assignor does hereby further acknowledge and affirm that the rights and remedies of the Assignee with respect to the Collateral are more fully set forth in the Security Agreement, the terms and provisions of which are hereby incorporated herein by reference as if fully set forth herein.

IN WITNESS WHEREOF, the Assignor has caused this Assignment to be duly executed by its officer thereunto duly authorized as of March 25, 2014.

Inventergy, Inc.

By: Joseph W. Beyers
Name: Joseph W. Beyers
Title: Chairman and CEO

State of California
County of Santa Clara

On March 25, 2014 before me, Sheila Meinecke Notary Public (insert name and title of the officer) personally appeared **Joseph W. Beyers**, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature (Seal)

SHEILA MEINECKE
COMM. #1998839
Notary Public - California
Santa Clara County
My Comm. Expires Dec. 19, 2016

SCHEDULE 1 TO ASSIGNMENT FOR SECURITY

Patents and Patent Applications
Owned by: **Inventergy, Inc.**

Internal Family ID	Country	Inventergy Understood status 1/14/2014	Publication Number	Publication Date	Title	Application Number	File Date
Inv-01	USA	Granted	US6726297	4/27/2004	Ofdma signal transmission apparatus and method	US10/462491	1/20/2000
Inv-03	USA	Granted	US8009549	8/30/2011	Carrier allocation method in multi cell orthogonal frequency division multiple access system	US12/092950	11/16/2006
Inv-04	USA	Granted	US8416810	4/9/2013	Radio communication base station apparatus and pilot transmission method	US12/160872	1/18/2007
Inv-08	USA	Granted	US7646702	1/12/2010	Ofdm communication apparatus	US10/169716	7/9/2002
Inv-08	USA	Granted	US8238226	8/7/2012	Ofdm communication apparatus	US12/505420	7/17/2009
Inv-09	USA	Granted	US7593317	9/22/2009	Radio base station apparatus	US10/503010	7/29/2004
Inv-15	USA	Granted	US7929627	4/19/2011	Ofdm receiver, integrated circuit and receiving method	US11/885042	2/28/2006

Inv-16	USA	Granted	US7826557	11/2/2010	Retransmitting method and transmitting method in multi-antenna transmission	US11/721911	12/14/2005
Inv-21	USA	Granted	US7792084	9/7/2010	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	US11/892886	8/28/2007
Inv-23	USA	Granted	US8064393	11/22/2011	Wireless communication base station apparatus and wireless communication method in multicarrier communication	US11/997841	8/4/2006
Inv-26	USA	Granted	US8270332	9/18/2012	Wireless communication base station device and wireless communication method	US12/377373	10/12/2007
Inv-26	USA	Granted	US8582573	12/13/2012	Radio communication base station apparatus and radio communication method	US13/590841	8/21/2012
Pana-01	USA	Granted	US6400929	6/4/2002	Radio communication device and method of controlling transmission rate	US09/424843	12/6/1999

Pana-01	USA	Granted	US6381445	4/30/2002	Radio communication device and method of controlling transmission rate	US09/648742	8/28/2000
Pana-01	USA	Granted	US6366763	4/2/2002	Radio communication device and method of controlling transmission rate	US09/648756	8/28/2000
Pana-01	USA	Granted	US6370359	4/9/2002	Radio communication device and method of controlling transmission rate	US09/648757	8/28/2000
Pana-01	USA	Granted	US6487394	11/26/2002	Radio communication device and method of controlling transmission rate	US09/649003	8/28/2000
Pana-01	USA	Granted	US6597894	7/22/2003	Radio communication device and method of controlling transmission rate	US09/649006	8/28/2000
Pana-01	USA	Granted	US6505035	1/7/2003	Radio communication apparatus and transmission rate control method	US10/052261	1/23/2002
Pana-01	USA	Granted	US6973289	12/6/2005	Radio communication device and method of controlling transmission rate	US10/057897	1/29/2002

Pana-01	USA	Granted	US6611676	8/26/2003	Radio communication apparatus and transmission rate control method	US10/083553	2/27/2002
Pana-01	USA	Granted	US7636551	12/22/2009	Radio communication device and method of controlling transmission rate	US11/228339	9/19/2005
Pana-02	USA	Granted	US6637001	10/21/2003	Apparatus and method for image/voice transmission	US09/650743	8/30/2000
Pana-03	USA	Granted	US6813323	11/2/2004	Decoding method and communication terminal apparatus	US10/182270	7/25/2002
Pana-03	USA	Lapsed	US20050002477	1/6/2005	Decoding apparatus and decoding method	10901380	7/29/2004
Pana-04	USA	Granted	US6734810	5/11/2004	Apparatus and method for decoding	US10/221267	9/10/2002
Pana-04	USA	Granted	US6940428	9/6/2005	Apparatus and method for decoding	US10/793737	3/8/2004
Pana-04	USA	Granted	US6922159	7/26/2005	Apparatus and method for decoding	US10/793766	3/8/2004
Pana-04	USA	Lapsed	US20050219071	10/6/2005	Apparatus and method for decoding	11134448	5/23/2005

Pana-05	USA	Granted	US6069884	5/30/2000	Method of communication between a base station and a plurality of mobile unit communication apparatus, a base station, and mobile unit communication apparatus	US08/937005	9/24/1997
Pana-06	USA	Granted	US6119004	9/12/2000	Base station equipment for mobile communication	US09/068541	5/13/1998
Pana-07	USA	Granted	US6069924	5/30/2000	Differential detector with error correcting function	US09/027510	2/20/1998
Pana-08	USA	Granted	US6636723	10/21/2003	Cdma radio communication system using chip interleaving	US09/359020	7/22/1999
Pana-08	USA	Lapsed	US20040048578	3/11/2004	Cdma radio transmission apparatus, cdma radio reception apparatus, and cdma radio communication method	10419089	4/21/2003
Pana-09	USA	Granted	US6628630	9/30/2003	Spread spectrum communication method	US09/058881	4/13/1998
Pana-10	USA	Granted	US6404778	6/11/2002	Radio communication apparatus	US09/159602	9/24/1998

Pana-11	USA	Granted	US6611509	8/26/2003	Cdma/tdd mobile communication system and method	US09/264826	3/9/1999
Pana-11	USA	Granted	US6807162	10/19/2004	Cdma/tdd mobile communication system and method	US10/166268	6/11/2002
Pana-11	USA	Granted	US6973065	12/6/2005	Cdma/tdd mobile communication system and method	US10/419733	4/22/2003
Pana-11	USA	Granted	US7778224	8/17/2010	Cdma/tdd mobile communication system and method	US10/885684	7/8/2004
Pana-12	USA	Granted	US6765894	7/20/2004	Communication terminal apparatus and base station apparatus	US09/606906	6/30/2000
Pana-12	USA	Granted	US7656844	2/2/2010	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US10/868029	6/16/2004
Pana-12	USA	Granted	US8437316	5/7/2013	Radio transmission apparatus and radio reception apparatus in a cdma communication system	US12/641177	12/17/2009

Pana-13	USA	Granted	US6839335	1/4/2005	Radio communication apparatus and radio communication method	US09/605862	6/29/2000
Pana-14	USA	Granted	US7072416	7/4/2006	Transmitting/receiving device and transmitting/receiving method	US09/582558	6/29/2000
Pana-14	USA	Granted	US7760815	7/20/2010	Apparatus and method for transmission/reception	US11/431606	5/11/2006
Pana-15	USA	Granted	US6868056	3/15/2005	Apparatus and method for ofdm communication	US09/635096	8/9/2000
Pana-16	USA	Granted	US6944208	9/13/2005	Interference signal canceling apparatus and interference signal canceling method	US09/936727	9/17/2001
Pana-17	USA	Granted	US6781973	8/24/2004	Combined signaling and sir inner-loop power control	US09/538888	3/30/2000
Pana-18	USA	Granted	US7145886	12/5/2006	Communication terminal, base station system, and method of controlling transmission power	US09/889919	7/25/2001
Pana-19	USA	Granted	US6847828	1/25/2005	Base station apparatus and radio communication method	US10/069484	2/27/2002

Pana-19	USA	Granted	US7386321	6/10/2008	Base station apparatus and radio communication method	US10/793738	3/8/2004
Pana-20	USA	Granted	US7266118	9/4/2007	Packet receiving apparatus and packet transmission method	US10/143989	5/14/2002
Pana-21	USA	Granted	US7133379	11/7/2006	Wireless communication system, and base station apparatus and communication terminal apparatus accommodated in the system	US10/181349	7/17/2002
Pana-22	USA	Granted	US7392019	6/24/2008	Wireless base station apparatus and wireless communication method	US11/053837	2/10/2005
Pana-23	USA	Granted	US7339949	3/4/2008	Arq transmission and reception methods and apparatus	US10/222989	8/19/2002
Pana-24	USA	Granted	US7702025	4/20/2010	Transmission/reception apparatus and transmission/reception method	US10/487574	2/25/2004
Pana-25	USA	Granted	US7460502	12/2/2008	Scheduling creation apparatus, base station apparatus, and radio communication method	US10/250487	7/3/2003

Pana-26	USA	Granted	US7269774	9/11/2007	Data receiving apparatus, data transmitting apparatus and retransmission request method	US10/484951	1/28/2004
Pana-27	USA	Granted	US7385934	6/10/2008	Radio communication apparatus and transfer rate decision method	US10/476845	11/6/2003
Pana-28	USA	Granted	US7114121	9/26/2006	Rate matching device and rate matching method	US10/478139	11/20/2003
Pana-29	USA	Granted	US7162206	1/9/2007	Test apparatus, mobile terminal apparatus, test method	US10/612289	7/3/2003
Pana-30	USA	Granted	US7746762	6/29/2010	Transmitting apparatus and transmitting method	US10/534987	5/16/2005
Pana-31	USA	Granted	US7693140	4/6/2010	Cdma transmitting apparatus and cdma receiving apparatus	US10/527199	3/10/2005
Pana-32	USA	Granted	US7299027	11/20/2007	Mimo receiver and mimo reception method for selection of mimo separation and channel variation compensation	US10/536010	5/23/2005
Pana-32	USA	Lapsed	US20080020802	1/24/2008	Wireless receiver and wireless reception method	11859550	9/21/2007

Pana-33	USA	Pending	US20070255993	11/1/2007	Automatic retransmission request control system and retransmission method in memo-ofdm system	11575015	3/30/2007
Pana-33	USA	Lapsed	US20120230257	9/13/2012	Retransmission method and transmitter	13478996	5/23/2012
Pana-33	USA	Lapsed	US20120263250	10/18/2012	Retransmission method, transmitter, and communication system	13532576	6/25/2012
Pana-33	USA	Lapsed	US20120287775	11/15/2012	Automatic retransmission request control system and retransmission method in mimo-ofdm system	13554748	7/20/2012
Pana-34	USA	Granted	US7251469	7/31/2007	Cdma transmitting apparatus and cdma transmitting method	US10/522980	2/2/2005
Pana-34	USA	Granted	US7764711	7/27/2010	Cdma transmission apparatus and cdma transmission method	US11/767124	6/22/2007
Pana-35	USA	Granted	US8086270	12/27/2011	Classifying-synthesizing transmission method of multi-user feedback information at base station	US11/574636	9/5/2005

Pana-36	USA	Granted	US7848439	12/7/2010	Communication apparatus, communication system, and communication method	US11/719611	11/18/2005
Pana-37	USA	Granted	US8175604	5/8/2012	Efficient rise over thermal (rot) control during soft handover	US10/588073	8/31/2005
Pana-38	USA	Granted	US7860184	12/28/2010	Multi-antenna communication method and multi-antenna communicaton apparatus	US11/813650	1/10/2006
Pana-39	USA	Granted	US8073070	12/6/2011	Multi-pilot generation method and detection method in multi-antenna communication system	US12/092944	11/22/2006
Pana-40	USA	Granted	US8249132	8/21/2012	Communication terminal and receiving method	US11/909425	3/3/2006
Pana-41	USA	Granted	US8576784	5/7/2009	Uplink resource allocation in a mobile communication system	US12/162592	11/2/2006
Pana-42	USA	Granted	US8218681	7/10/2012	Ofdm transmitter and ofdm receiver	US12/440894	3/11/2009
Pana-43	USA	Granted	US8249178	8/21/2012	Multicarrier transmitter and multicarrier receiver	US12/601804	5/25/2007

Pana-44	USA	Granted	US5583851	12/10/1996	Mobile communication apparatus having multi-codes allocating function	US08/272158	7/8/1994
Pana-45	USA	Granted	US5873027	2/16/1999	Mobile radio system with control over radio wave output if a malfunction is detected	US08/761552	12/6/1996
Pana-45	USA	Granted	US6336040	1/1/2002	Mobile radio system with control over radio wave output if a malfunction is detected	US09/207662	12/9/1998
Pana-46	USA	Granted	US5757870	5/26/1998	Spread spectrum communication synchronizing method and its circuit	US08/517408	8/21/1995
Pana-46	USA	Granted	US5818869	10/6/1998	Spread spectrum communication synchronizing method and its circuit	US08/858146	5/15/1997
Pana-47	USA	Granted	US6175558	1/16/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/000947	12/30/1997

Pana-47	USA	Granted	US6301237	10/9/2001	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562921	5/2/2000
Pana-47	USA	Granted	US6529492	3/4/2003	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/562922	5/2/2000
Pana-47	USA	Granted	US6370131	4/9/2002	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US09/576250	5/24/2000
Pana-47	USA	Granted	US6584088	6/24/2003	Cdma radio multiplex transmitting device and cdma radio multiplex receiving device	US09/825998	4/5/2001
Pana-47	USA	Granted	US6549526	4/15/2003	Cdma radio multiplex transmitting device and a cdma multiplex receiving device	US09/826005	4/5/2001
Pana-47	USA	Granted	US7136367	11/14/2006	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US10/335916	1/3/2003

Pana-47	USA	Granted	USRE41444	7/20/2010	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	US12/270499	11/13/2008
Pana-48	USA	Granted	US6295301	9/25/2001	Pn code generating apparatus and mobile radio communication system	US09/139325	8/25/1998
Pana-48	USA	Granted	US6697384	2/24/2004	Method and apparatus for calculating a state of starting a pn code generating operation	US09/916284	7/30/2001
Pana-49	USA	Granted	US6466563	10/15/2002	Cdma mobile station and cdma transmission method	US10/147831	3/16/1999
Pana-49	USA	Lapsed	US20030007472	1/9/2003	Cdma mobile station apparatus and cdma transmission method	10235918	9/6/2002
Pana-50	USA	Granted	US6370134	4/9/2002	Cdma radio communication apparatus	US09/115502	7/15/1998
Pana-50	USA	Granted	US7035233	4/25/2006	Radio communication terminal apparatus and radio communication base station apparatus	US10/014352	12/14/2001

Pana-50	USA	Granted	US7535864	5/19/2009	Radio communication terminal apparatus and radio communication base station apparatus	US11/372152	3/10/2006
WCDMA (pool) 01	USA	Granted	US5677929	10/14/1997	Automobile on-board and/or portable telephone system	US08/272156	7/8/1994
WCDMA (pool) 01	USA	Granted	USRE37420	10/23/2001	Automobile on-board and/or portable telephone system	US09/337403	6/21/1999
WCDMA (pool) 01	USA	Granted	USRE39954	12/25/2007	Automobile on-board and/or portable telephone system	US09/887042	6/25/2001
WCDMA (pool) 07	USA	Granted	US6738646	5/18/2004	Base station device and method for communication	US10/069267	2/25/2002
WCDMA (pool) 07	USA	Lapsed	US20030087644	5/8/2003	Communication terminal apparatus and base station apparatus	10322425	12/19/2002
WCDMA (pool) 07	USA	Granted	US7460880	12/2/2008	Communication terminal apparatus and base station apparatus	US11/341430	1/30/2006
WCDMA (pool) 07	USA	Granted	US7761113	7/20/2010	Communication terminal apparatus and base station apparatus	US12/132992	6/4/2008

WCDMA (pool) 09	USA	Granted	US6760590	7/6/2004	Communication terminal apparatus, base station apparatus, and radio communication method	US10/089605	4/1/2002
WCDMA (pool) 09	USA	Granted	US6799053	9/28/2004	Communication terminal apparatus	US10/321500	12/18/2002
WCDMA (pool) 09	USA	Granted	US7206587	4/17/2007	Communication terminal apparatus, base station apparatus, and radio communication method	US10/321623	12/18/2002

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT3092617

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	RELEASE OF SECURITY INTEREST

CONVEYING PARTY DATA

Name	Execution Date
HUDSON BAY IP OPPORTUNITIES MASTER FUND, LP, FOR ITSELF AND AS COLLATERAL AGENT FOR CERTAIN BUYERS	09/30/2014

RECEIVING PARTY DATA

Name:	INVENTERGY, INC.
Street Address:	900 E. HAMILTON AVE.
Internal Address:	SUITE 180
City:	CAMPBELL
State/Country:	CALIFORNIA
Postal Code:	95008

PROPERTY NUMBERS Total: 156

Property Type	Number
Patent Number:	7925762
Patent Number:	7623529
Patent Number:	7065339
Patent Number:	7991894
Patent Number:	7304966
Patent Number:	6885828
Patent Number:	6801542
Patent Number:	8681751
Patent Number:	6904035
Patent Number:	7900242
Patent Number:	7917620
Patent Number:	7560102
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Patent Number:	7822035
Patent Number:	6726297
Patent Number:	8009549
Patent Number:	8416810
Patent Number:	7646702
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Patent Number:	7593317
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Patent Number:	7392019
Patent Number:	7339949
Patent Number:	7702025
Patent Number:	7460502
Patent Number:	7269774
Patent Number:	7385934
Patent Number:	7114121
Patent Number:	7162206
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Patent Number:	6370131

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Application Number:	10419089
Application Number:	11859550
Application Number:	13478996
Application Number:	13532576
Application Number:	13554748
Application Number:	10235918
Application Number:	10322425
Application Number:	11698891

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NAME OF SUBMITTER:	PAUL A. ROBERTS
SIGNATURE:	/Paul A. Roberts/
DATE SIGNED:	11/03/2014
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 61

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RELEASE

This Release of Security Interest is dated as of September 30, 2014, is by Hudson Bay IP Opportunities Master Fund, LP for itself and as collateral agent for certain buyers ("**Lender**").

A Several Security Agreements have been filed in the United States Patent and Trademark Office (the "**Security Agreements**").

B. In connection with the Security Agreements, Inventergy, Inc. ("**Grantor**") granted to Lender a security interest (the "Security Interest") in certain of its now existing or hereafter acquired intellectual property (collectively, the "**Collateral**").

C. Grantor has requested Lender to release the Security Interest in and to the Collateral, including the Patent Rights (as defined below) and Lender wishes to release the Security Interest

NOW, THEREFORE, FOR VALUE RECEIVED, Lender does hereby irrevocably and unconditionally release the Security Interest in and to the following intellectual property held as Collateral and all rights therein of any type or description including, without limitation: (a) the patents and patent applications listed on **<u>Exhibit A</u>** attached hereto (the "**Patents**"); (b) all patents and patent applications (i) to which any of the Patents directly or indirectly claims priority, (ii) for which any of the Patents directly or indirectly forms a basis for priority, or (iii) that were co-owned applications that incorporate by reference, or are incorporated by reference into, the Patents; (c) all reissues, reexaminations, extensions, continuations, continuations in part, continuing prosecution applications, requests for continuing examinations, divisions, registrations of any item in any of the foregoing categories (a) and (b); (d) all foreign patents, patent applications, and counterparts relating to any item in any of the foregoing categories (a) through (c), including, without limitation, certificates of invention, utility models, industrial design protection, design patent protection, and other governmental grants or issuances; (e) all items in any of the foregoing in categories (b) through (d), whether or not expressly listed as Patents above and whether or not claims in any of the foregoing have been rejected, withdrawn, cancelled, or the like; (f) inventions, invention disclosures, and discoveries described in any of the Patents or any item in the foregoing categories (b) through (e) that (i) are included in any claim in the Patents or any item in the foregoing categories (b) through (e), (ii) are subject matter capable of being reduced to a patent claim in a reissue or reexamination proceeding brought on any of the Patents or any item in the foregoing categories (b) through (e), or (iii) could have been included as a claim in any of the Patents or any item in the foregoing categories (b) through (e); (g) all rights to apply in any or all countries of the world for patents, certificates of invention, utility models, industrial design protections, design patent protections, or other governmental grants or issuances of any type related to any item in any of the foregoing categories (a) through (f), including, without limitation, under the Paris Convention for the Protection of Industrial Property, the International Patent Cooperation Treaty, or any other convention, treaty, agreement, or understanding; (h) all causes of action (whether known or unknown or whether currently pending, filed, or otherwise) and other enforcement rights under, or on account of, any of the Patents or any item in any of the foregoing categories (b) through (g), including, without limitation, all causes of action and other enforcement rights for (1) damages, (2) injunctive relief, and (3) any other remedies of any kind for past, current, and future infringement; and (i) all rights to collect royalties and other payments under or on account of any of the Patents or any item in any of the foregoing categories (b) through (h) (the "**Patent Rights**").

Lender hereby authorizes Grantor or Grantor's authorized representative to (i) record this Release with the United States Patent and Trademark Office, and in other patent offices in the world, (ii) file UCC Financing Statement Amendments with the applicable filing office in order to terminate UCC financing statements filed on behalf of Lender against the Grantor and/or (iii) otherwise file this Release.

This Release is governed by and in accordance with the laws of the State of New York without regard to its rules of conflict of law, except Section 5-1401 of the New York General Obligations Law. This Release will be binding upon Lender and its successors and assigns and inures to the benefit of Grantor, any acquirer of the Patents and their respective successors and assigns.

To the extent a court of competent jurisdiction would apply the law of the State of California notwithstanding the express selection of the laws of New York, Lender acknowledges that it is aware that it may hereafter discover facts different from or in addition to what it now knows, believes or suspects to be true with respect to the matters herein released, and the releases in this Release will be and remain in effect in all respects as complete, general releases, notwithstanding any such different or additional facts. Lender acknowledges that it has been informed of Section 1542 of the Civil Code of the State of California, and does hereby expressly waive and relinquish all rights and benefits, if any, which it has or may have under said Section 1542, which reads as follows:

> A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which if known by him must have materially affected his settlement with the debtor.

IN WITNESS WHEREOF, Lender has caused this Release to be executed as of the date set forth above.

Hudson Bay Master Fund Ltd

By:____________________________

Name: George Antonopoulos

Title: Authorized Signatory

EXHIBIT A

Unique ID	Patent Number	Country	Portfolio Status	Title	Issue / Publication Date	Application Number	Filing Date
13HU01-001-01	BRPI0614848	BR	Pending	Method, system and equipment for processing sip requests in IMS network	2011/04/19	BRPI614848A	2006/07/26
13HU01-001-02	CN100502402	CN	Granted	Method and device for processing session message in IMS network	2009/06/17	CN200510119756.9	2005/11/04
13HU01-001-03	CN101189850	CN	Granted	Method, system and device in IMS network processing SIP message	2012/02/22	CN200680011706.1	2006/07/26
13HU01-001-04	EP1755310	DE	Granted	Methods and apparatuses for processing SIP requests in an IMS network comprising an AS	2011/06/08	EP2006254341A	2006/08/18
13HU01-001-05	EP1755310	EP	PreCursor(EP)	Methods and apparatuses for processing SIP requests in an IMS network comprising an AS	2011/06/08	EP2006254341A	2006/08/18
13HU01-001-06	EP1755310	ES	Granted	Methods and apparatuses for processing SIP requests in an IMS network comprising an AS	2011/06/08	EP2006254341A	2006/08/18
13HU01-001-07	EP1755310	FR	Granted	Methods and apparatuses for processing SIP requests in an IMS network comprising an AS	2011/06/08	EP2006254341A	2006/08/18
13HU01-001-08	EP1755310	GB	Granted	Methods and apparatuses for processing SIP requests in an IMS network comprising an AS	2011/06/08	EP2006254341A	2006/08/18
13HU01-001-10	EP1755310	IT	Granted	Methods and apparatuses for processing SIP requests in an IMS network comprising an AS	2011/06/08	EP2006254341A	2006/08/18
13HU01-001-09	IN254557	IN	Granted	Method, system and equipment for processing sip requests in IMS network	2012/11/23	IN2008CN454A	2008/01/28
13HU01-001-11	US7835352	US	Granted	Method, system and equipment for processing sip requests in IMS network	2010/11/16	US2006506581A 11/506,581	2006/08/18
13HU01-002-01	CN100551148	CN	Granted	Method for realizing system switch in encryption mode	2007/03/07	CN200510093678.X	2005/09/01
13HU01-002-02	CN101156498	CN	Granted	Method for implementing inter-system switch-over	2011/10/26	CN200680011893.3	2006/09/01
13HU01-002-03	EP1871134	DE	Granted	METHOD FOR HANDOVER BETWEEN SYSTEMS	2009/12/16	EP2006775581A	2006/09/01
13HU01-002-04	EP1871134	EP	PreCursor(EP)	METHOD FOR HANDOVER BETWEEN SYSTEMS	2009/12/16	EP2006775581A	2006/09/01
13HU01-002-05	EP1871134	FR	Granted	METHOD FOR HANDOVER BETWEEN SYSTEMS	2009/12/16	EP2006775581A	2006/09/01
13HU01-002-06	EP1871134	GB	Granted	METHOD FOR HANDOVER BETWEEN SYSTEMS	2009/12/16	EP2006775581A	2006/09/01
13HU01-002-07	WO2007025487	WO	Lapsed	A METHOD FOR REALIZING HANDOVER BETWEEN SYSTEMS	2007/03/08	WO2006CN2264A	2006/09/01

13HU01-003-01	CN101031004	CN	Granted	Method for realizing on-hook triggering service	2010/05/12	CN200610058041.1	2006/02/28
13HU01-003-02	CN101160940	CN	Granted	Method for implementing service triggered by off-hook	2010/08/11	CN200680012256.8	2006/10/31
13HU01-003-03	EP1993274	EP	Lapsed	METHOD FOR REALIZING SERVICE TRIGGERING WHEN PICKED-UP	2008/11/19	EP2006805125A	2006/10/31
13HU01-003-04	US8149824	US	Granted	Method and system for implementing service triggered by off-hook	2012/04/03	US2007668532A 11/668,523	2007/01/30
13HU01-003-05	WO2007098654	WO	Lapsed	METHOD FOR REALIZING SERVICE TRIGGERING WHEN PICKED-UP	2007/09/07	WO2006CN2924A	2006/10/31
13HU01-004-02	CN101156398	CN	Granted	Method and system for switching terminal state of media gateway	2010/10/27	CN200680011910.3	2006/10/24
13HU01-004-01	CN1964365	CN	Granted	Method for switching terminal status in media gateway	2011/06/22	CN200510101368.8	2005/11/11
13HU01-004-03	EP1786216	DE	Granted	Method and system for switching the state of a termination in a media gateway	2009/12/30	EP2006023462A	2006/11/10
13HU01-004-04	EP1786216	EP	PreCursor(EP)	Method and system for switching the state of a termination in a media gateway	2009/12/30	EP2006023462A	2006/11/10
13HU01-004-05	EP1786216	FR	Granted	Method and system for switching the state of a termination in a media gateway	2009/12/30	EP2006023462A	2006/11/10
13HU01-004-06	US7693141	US	Granted	Method and system for switching the state of a termination in a media gateway	2010/04/06	US2006595768A 11/595,768	2006/11/10
13HU01-004-07	WO2007054011	WO	Lapsed	A METHOD FOR SWITCHING THE TERMINATION STATE IN THE MEDIA GATEWAY	2007/05/18	WO2006CN2841A	2006/10/24
13HU01-005-02	CN1901550	CN	Granted	Subscribing method based on conversation start protocol and its system and device	2011/08/10	CN200610106654.8	2006/07/21
13HU01-005-01	CN200510028074.7	CN	Lapsed	Subscribing Method Based On Conversation Start Protocol and Its System and Device		CN200510028074.7	2005/07/22
13HU01-005-03	EP1909434	EP	Lapsed	SUBSCRIBING METHOD AND DEVICE	2008/04/09	EP20060761541A	2006/07/21
13HU01-005-04	EP2086203	EP	Lapsed	Subscribing method and device	2009/10/28	EP2009160916A	2006/07/21
13HU01-005-05	US7948955	US	Granted	Subscription method and device	2011/05/24	US200817423A [08/0113,669] 12/017,423	2008/01/22
13HU01-005-06	WO2007009396	WO	Lapsed	SUBSCRIBING METHOD AND DEVICE	2007/01/25	WO2006CN1806A	2006/07/21

13HU01-006-02	CN1764140	CN	Granted	Method for realizing application server communication	2007/03/07	CN200510103571.9	2005/09/21
13HU01-006-01	CN200410078266.4	CN	Lapsed	Method for realizing application server communication		CN200410078266.4	2005/09/21
13HU01-006-03	EP1796326	DE	Granted	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-04	EP1796326	EP	PreCursor(EP)	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-05	EP1796326	FR	Granted	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-06	EP1796326	GB	Granted	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-07	EP1796326	IT	Granted	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-08	EP1796326	NL	Granted	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-09	EP1796326	SE	Granted	A METHOD FOR ENABLING COMMUNICATION IN APPLICATION SERVERS	2012/01/18	EP2005791501A	2005/09/21
13HU01-006-10	WO2006032204	WO	Lapsed	A METHOD FOR ENABLING COMMUNICATION IN THE APPLICATION SERVERS	2006/03/30	WO2005CN1523A	2005/09/21
13HU01-007-01	CN1929627	CN	Granted	A kind of realizing public user identification in IMS network of method that decreases pneumococcus nasal carriage and system	2012/02/01	CN200510098402.0	2005/09/06
13HU01-007-03	CN1941739	CN	Granted	Method and system for allocating and using user mark	2010/06/23	CN200510108129.5	2005/09/29
13HU01-007-02	CN1941774	CN	Granted	Method and system for realizing public user mark carrier	2012/07/04	CN200510108128.0	2005/09/29
13HU01-007-04	EP1761077	DE	Granted	Method and system for enabling number portability in IMS networks	2008/08/27	EP2006018705A	2006/09/06
13HU01-007-05	EP1761077	EP	PreCursor(EP)	Method and system for enabling number portability in IMS networks	2008/08/27	EP2006018705A	2006/09/06
13HU01-007-06	EP1761077	FR	Granted	Method and system for enabling number portability in IMS networks	2008/08/27	EP2006018705A	2006/09/06
13HU01-007-07	EP1761077	SE	Granted	Method and system for enabling number portability in IMS networks	2008/08/27	EP2006018705A	2006/09/06

13HU01-007-08	US7787878	US	Granted	Method and system for enabling number portability in IMS networks	2010/08/31	US2006516946A 11/516,946	2006/09/06
13HU01-007-09	WO2007028332	WO	Lapsed	METHOD AND SYSTEM FOR ENABLING NUMBER PORTABILITY IN IMS NETWORKS	2007/03/15	WO2006CN2299A	2006/09/06
13HU01-008-01	CN1758649	CN	Lapsed	Method of interconnected protocol network communicating between different edition network	2010/04/28	CN200410079321.1	2004/10/05
13HU01-008-02	CN200710167705.2	CN	Lapsed	Inter-network interconnection protocol network intercommunicating method of different version		CN200710167705.2	2004/10/05
13HU01-008-03	EP1798918	EP	Lapsed	A METHOD FOR INTERCOMMUNICATION BETWEEN NETWORKS HAVING DIFFERENT VERSION OF INTERNET PROTOCOL	2007/06/20	EP2005795754A	2005/10/08
13HU01-008-04	US7792116	US	Granted	Method and device for interworking between internet protocol networks	2010/09/07	US2007703709A 11/703,709	2007/02/08
13HU01-008-05	WO2006037276	WO	Lapsed	A METHOD FOR INTERCOMMUNICATION BETWEEN NETWORKS HAVING DIFFERENT VERSION OF INTERNET PROTOCOL	2006/04/13	WO2005CN1640A	2005/10/08
13HU01-009-07r	US14/323165	US	Reissuing	Interworking network element, interworking system between the CSI terminal and the IMS terminal and the method thereof		14/323165	2014/07/03
13HU01-009-01	CN100563235	CN	Granted	Network element with interconnecting function, CSI terminal, IMS terminal interconnecting system and method	2009/11/25	CN200610077923.2	2006/04/26
13HU01-009-02	CN101313543	CN	Granted	Exchange functional network element, CSI terminal, IMS terminal exchange system and method	2011/07/20	CN200780000211.3	2007/01/09
13HU01-009-03	EP1973283	DE	Granted	INTERWORKING NETWORK ELEMENT, INTERWORKING SYSTEM BETWEEN THE CSI TERMINAL AND THE IMS TERMINAL AND THE METHOD THEREOF	2010/09/29	EP2007702010A	2007/01/09
13HU01-009-04	EP1973283	EP	PreCursor(EP)	INTERWORKING NETWORK ELEMENT, INTERWORKING SYSTEM BETWEEN THE CSI TERMINAL AND THE IMS	2010/09/29	EP2007702010A	2007/01/09

				TERMINAL AND THE METHOD THEREOF			
13HU01-009-05	EP1973283	FR	Granted	INTERWORKING NETWORK ELEMENT, INTERWORKING SYSTEM BETWEEN THE CSI TERMINAL AND THE IMS TERMINAL AND THE METHOD THEREOF	2010/09/29	EP2007702010A	2007/01/09
13HU01-009-06	EP1973283	GB	Granted	INTERWORKING NETWORK ELEMENT, INTERWORKING SYSTEM BETWEEN THE CSI TERMINAL AND THE IMS TERMINAL AND THE METHOD THEREOF	2010/09/29	EP2007702010A	2007/01/09
13HU01-009-07	US8213419	US	Granted	Interworking network element, interworking system between the CSI terminal and the IMS terminal and the method thereof	2012/07/03	US2008170227A '12/170,227	2008/07/09
13HU01-009-08	WO2007079679	WO	Lapsed	INTERWORKING NETWORK ELEMENT, INTERWORKING SYSTEM BETWEEN THE CSI TERMINAL AND THE IMS TERMINAL AND THE METHOD THEREOF	2007/07/19	WO2007CN78A	2007/01/09
13HU01-010-01	CN100411398	CN	Granted	Edge or packet gateway controlling method in next generation network and its system	2006/12/20	CN200510026714.0	2005/06/13
13HU01-010-02	CN100426805	CN	Granted	Edge or packet gateway control system in next generation network and its method	2006/12/20	CN200510026736.7	2005/06/14
13HU01-010-03	CN100438515	CN	Granted	Edge or packet gateway controlling method in next generation network and its system	2006/12/20	CN200510026737.1	2005/06/14
13HU01-010-04	CN101160799	CN	Granted	Fringe or packet gateway control system and control method thereof	2011/04/20	CN200680012195.5	2006/05/25
13HU01-010-05	EP1796312	EP	Lapsed	AN EDGE/PACKET GATEWAY CONTROL SYSTEM AND A METHOD FOR ACHIEVING THE CONTROL BY THE EDGE/PACKET GATEWAY	2007/06/13	EP20060741982	2006/05/26
13HU01-010-06	US7881317	US	Granted	Border/packet gateway control system and control method	2011/02/01	US2007680234A 11/680,234	2007/02/28
13HU01-010-07	WO2006133622	WO	Lapsed	AN EDGE/PACKET GATEWAY CONTROL SYSTEM AND A METHOD FOR ACHIEVING THE CONTROL BY THE EDGE/PACKET GATEWAY	2006/12/21	WO2006CN1094A	2006/05/25
13HU01-	CN100563282	CN	Lapsed	Method for listening dailed	2009/11/25	CN200510034992.0	2005/05/29

011-01				signal sound at dail line terminal when network communicating			
13HU01-011-02	EP1786162	DE	Granted	METHOD FOR THE CALLING USER TERMINAL LISTENING TO THE SIGNAL TONE OF THE CALLED USER TERMINAL WHEN INTER-NETWORKING	2009/09/30	EP2006741937A	2006/05/22
13HU01-011-03	EP1786162	EP	PreCursor(EP)	METHOD FOR THE CALLING USER TERMINAL LISTENING TO THE SIGNAL TONE OF THE CALLED USER TERMINAL WHEN INTER-NETWORKING	2009/09/30	EP2006741937A	2006/05/22
13HU01-011-04	EP1786162	GB	Granted	METHOD FOR THE CALLING USER TERMINAL LISTENING TO THE SIGNAL TONE OF THE CALLED USER TERMINAL WHEN INTER-NETWORKING	2009/09/30	EP2006741937A	2006/05/22
13HU01-011-05	US8335221	US	Granted	Method for listening to signal tone from a called party by a calling party during network interworking	2012/12/18	US2007707759A 11/707,759	2007/02/16
13HU01-011-06	WO2006128356	WO	Lapsed	METHOD FOR THE CALLING USER TERMINAL LISTENING TO THE SIGNAL TONE OF THE CALLED USER TERMINAL WHEN INTER-NETWORKING	2006/12/07	WO2006CN1049A	2006/05/22
13HU01-012-01	BRPI0613589	BR	Lapsed	método e sistema para implementação de roteamento de sinalização dinámica	2011/01/18	BRPI0613589A2	2006/08/10
13HU01-012-03	CN101161011	CN	Lapsed	Method and system of improving network reliability through implementing dynamic routing of signaling	2011/08/10	CN200680012205.5	2006/08/10
13HU01-012-02	CN1921459	CN	Lapsed	Method for improving reliability of network by realizing dynamic route of signal	2007/02/28	CN200510093052.9	2005/08/25
13HU01-012-04	EP1816887	DE	Granted	METHOD AND SYSTEM FOR IMPROVING NETWORK RELIABILITY BY REALIZING DYMANIC ROUTE OF SIGNALING	2010/05/05	EP2006775336A	2006/08/10
13HU01-012-05	EP1816887	EP	PreCursor(EP)	METHOD AND SYSTEM FOR IMPROVING NETWORK RELIABILITY BY REALIZING DYMANIC ROUTE OF SIGNALING	2010/05/05	EP2006775336A	2006/08/10
13HU01-012-06	EP1816887	FR	Granted	METHOD AND SYSTEM FOR IMPROVING NETWORK RELIABILITY BY REALIZING DYMANIC ROUTE OF	2010/05/05	EP2006775336A	2006/08/10

				SIGNALING			
13HU01-012-07	IN200704950	IN	Lapsed	METHOD AND SYSTEM FOR IMPROVING NETWORK RELIABILITY BY REALIZING DYMANIC ROUTE OF SIGNALING	2008/08/01	IN2007KN4950A	2007/12/20
13HU01-012-08	JP04619441	JP	Granted	The method and system which implement	2011/01/26	JP2008527289A	2006/08/10
13HU01-012-09	RU2408154	RU	Granted	METHOD AND SYSTEM FOR REALISATION OF DYNAMIC ROUTING OF CALL SIGNALS	2010/12/27	RU2008101969A	2006/08/10
13HU01-012-10	US8125995	US	Granted	Method and system for implementing dynamic signaling routing	2012/02/28	US2007821113A 11/821,113	2007/06/21
13HU01-012-11	WO2007022692	WO	Lapsed	METHOD AND SYSTEM FOR IMPROVING NETWORK RELIABILITY BY REALIZING DYMANIC ROUTE OF SIGNALING	2007/03/01	WO2006CN2018A	2006/08/10
13HU01-013-01	CN100459569	CN	Granted	Quick route switching method and apparatus for network node devices	2009/02/04	CN200510032840.7	2005/01/14
13HU01-013-02	EP1718014	EP	PreCursor(EP)	A ROUTE SWITCHING METHOD AND A NETWORK NODE DEVICE	2008/10/15	EP2006705441A	2006/01/09
13HU01-013-03	EP1718014	FR	Granted	A ROUTE SWITCHING METHOD AND A NETWORK NODE DEVICE	2008/10/15	EP2006705441A	2006/01/09
13HU01-013-04	EP1718014	SE	Granted	A ROUTE SWITCHING METHOD AND A NETWORK NODE DEVICE	2008/10/15	EP2006705441A	2006/01/09
13HU01-013-05	US7898943	US	Granted	Method for switching route and network device thereof	2011/03/01	US2003591218A 10/591,218	2007/11/21
13HU01-013-06	WO2006074596	WO	Lapsed	A ROUTE SWITCHING METHOD AND A NETWORK NODE DEVICE	2006/07/20	WO2006CN18A	2006/01/09
13HU01-014-01	CN100479417	CN	Granted	Communication method preventing circumbendibus of media-flow	2009/04/15	CN200510098546.6	2005/09/02
13HU01-014-02	CN101164290	CN	Lapsed	Communication method and equipment for preventing media stream circuity	2008/04/16	CN200680013147.8	2006/06/14
13HU01-014-03	EP1760986	DE	EP-Designated	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31
13HU01-014-11	EP1760986	EP	EP-Pending	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31
13HU01-014-04	EP1760986	EP	PreCursor(EP)	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31

13HU01-014-05	EP1760986	FI	EP-Designated	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31
13HU01-014-06	EP1760986	FR	EP-Designated	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31
13HU01-014-07	EP1760986	GB	EP-Designated	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31
13HU01-014-08	EP1760986	SE	EP-Designated	Communication method and device for preventing media stream circuity (tromboning)	2007/03/07	EP2006119909A	2006/08/31
13HU01-014-09	US8108526	US	Granted	Communication method and device for preventing media stream circuitry	2012/01/31	US2006469796A 11/469,796	2006/09/01
13HU01-014-10	WO2007025429	WO	Lapsed	A METHOD FOR PREVENTING THE MEDIA STREAM FROM BYPASSING AND THE DEVICE THEREOF	2007/03/08	WO2006CN1325A	2006/06/14
13HU01-015-01	CN101212309	CN	Granted	Method for controlling time stamp of reported event	2011/06/15	CN200610170447.9	2006/12/30
13HU01-015-02	EP2037627	DE	Granted	METHOD AND DEVICE FOR CONTROLLING REPORTING TIMESTAMP OF EVENT	2012/03/14	EP2007846226A	2007/12/29
13HU01-015-03	EP2037627	EP	PreCursor(EP)	METHOD AND DEVICE FOR CONTROLLING REPORTING TIMESTAMP OF EVENT	2012/03/14	EP2007846226A	2007/12/29
13HU01-015-04	EP2037627	FR	Granted	METHOD AND DEVICE FOR CONTROLLING REPORTING TIMESTAMP OF EVENT	2012/03/14	EP2007846226A	2007/12/29
13HU01-015-05	EP2037627	IT	Granted	METHOD AND DEVICE FOR CONTROLLING REPORTING TIMESTAMP OF EVENT	2012/03/14	EP2007846226A	2007/12/29
13HU01-015-06	US8116322	US	Granted	Method and apparatus for controlling reporting of an event timestamp	2012/02/14	US2009354289A 12/354289	2009/01/15
13HU01-015-07	WO2008083606	WO	Lapsed	METHOD AND DEVICE FOR CONTROLLING REPORTING TIMESTAMP OF EVENT	2008/07/17	WO2007CN71400A	2007/12/29
13HU01-016-01	CN1996968	CN	Granted	Decision method for the media gateway controller to distribute the resource	2010/04/14	CN200610093956.6	2006/06/26
13HU01-016-02	CN200810189659.0	CN	Lapsed	Method for down distributing resource and providing decision for medium gateway by medium gateway controller	1900/01/00	CN200810189659.0	2006/06/26
13HU01-016-03	EP2034670	DE	Granted	METHOD, APPARATUS, AND SYSTEM FOR THE MGC DISTRIBUTING A RESOURCE PROVISION DECISION TO THE MG	2012/06/15	EP2007721793A	2007/06/25
13HU01-	EP2034670	EP	PreCursor(EP)	METHOD, APPARATUS, AND	2012/06/13	EP2007721793A	2007/06/25

016-04				SYSTEM FOR THE MGC DISTRIBUTING A RESOURCE PROVISION DECISION TO THE MG			
13HU01-016-05	EP2034670	FR	Granted	METHOD, APPARATUS, AND SYSTEM FOR THE MGC DISTRIBUTING A RESOURCE PROVISION DECISION TO THE MG	2012/06/14	EP2007721793A	2007/06/25
13HU01-016-06	EP2034670	IT	Granted	METHOD, APPARATUS, AND SYSTEM FOR THE MGC DISTRIBUTING A RESOURCE PROVISION DECISION TO THE MG	2012/06/16	EP2007721793A	2007/06/25
13HU01-016-07	US7899065	US	Granted	Method, apparatus and system for a media gateway controller to deliver a resource provision decision to a media gateway	2011/03/01	US2008342546A 12/342,546	2008/12/23
13HU01-016-08	WO2008003252	WO	Lapsed	METHOD, APPARATUS, AND SYSTEM FOR THE MGC DISTRIBUTING A RESOURCE PROVISION DECISION TO THE MG	2008/01/10	WO2007CN70177A	2007/06/25
13HU01-017-01	CN100442930	CN	Granted	Mobile exchanging center and called parner processing method	1900/01/00	CN200510110891.7	2005/11/29
13HU01-017-02	CN101161019	CN	Lapsed	Mobile switching centre and called process method thereof	2008/04/09	CN200680012331.0	2006/08/22
13HU01-017-03	EP1898658	DE	Granted	MSC AND CALLED PROCESS METHOD THEREOF	2009/12/02	EP2006775455A	2006/08/22
13HU01-017-04	EP1898658	EP	PreCursor(EP)	MSC AND CALLED PROCESS METHOD THEREOF	2009/12/02	EP2006775455A	2006/08/22
13HU01-017-05	WO2007062560	WO	Lapsed	MSC AND CALLED PROCESS METHOD THEREOF	2007/06/07	WO2006CN2137A	2006/08/22
13HU01-018-01	CN100471140	CN	Granted	Method for detecting QoS	2009/03/18	CN200610062951.7	2006/09/29
13HU01-018-02	CN101001208	CN	Granted	Method for detecting QoS	2007/07/18	CN200610165838.1	2006/12/13
13HU01-018-03	CN101052014	CN	Granted	Method for detecting QoS	2007/10/10	CN200710107595.0	2007/05/21
13HU01-018-05	EP07871768.3	EP	Lapsed	Method for detecting QoS		EP07871768.3	2007/12/12
13HU01-018-04	EP1983688	DE	Granted	METHOD FOR DETECTING QOS	2012/04/25	EP2007817016A	2007/09/29
13HU01-018-06	EP1983688	EP	PreCursor(EP)	METHOD FOR DETECTING QOS	2012/04/25	EP2007817016A	2007/09/29
13HU01-018-07	EP1983688	FR	Granted	METHOD FOR DETECTING QOS	2012/04/25	EP2007817016A	2007/09/29
13HU01-018-08	EP1983688	GB	Granted	METHOD FOR DETECTING QOS	2012/04/25	EP2007817016A	2007/09/29
13HU01-018-09	US20090016233	US	Lapsed	Method for detecting QoS	2009/01/15	US2008211555A 12/211555	2008/09/16

13HU01-018-10	WO2008/086720	WO	Lapsed	Method for detecting QoS		PCT/CN2007/071220	2007/12/12
13HU01-018-11	WO2008/141580	WO	Lapsed	Method for detecting QoS		PCT/CN2008/071008	2008/05/19
13HU01-018-12	WO2008043304	WO	Lapsed	METHOD FOR DETECTING QOS	2008/04/17	WO2007CN70825A	2007/09/29
13HU01-019-01	CN1905472	CN	Granted	Method for implementing IMS network reliability	2010/05/05	CN200510085400.8	2005/07/27
13HU01-019-02	EP1914937	DE	Granted	METHOD AND SYSTEM FOR REALIZING IMS NETWORK RELIABILITY	2013/01/26	EP2006761564A	2006/07/28
13HU01-019-03	EP1914937	EP	PreCursor(EP)	METHOD AND SYSTEM FOR REALIZING IMS NETWORK RELIABILITY	2013/01/23	EP2006761564A	2006/07/25
13HU01-019-04	EP1914937	FR	Granted	METHOD AND SYSTEM FOR REALIZING IMS NETWORK RELIABILITY	2013/01/23	EP2006761564A	2006/07/25
13HU01-019-05	EP1914937	GB	Granted	METHOD AND SYSTEM FOR REALIZING IMS NETWORK RELIABILITY	2013/01/23	EP2006761564A	2006/07/25
13HU01-019-06	WO2007012270	WO	Lapsed	A METHOD FOR REALIZING THE IMS NETWORK RELIABILITY	2007/02/01	WO2006CN1834A	2006/07/25
13HU01-020-01	CN100546308	CN	Granted	Gateway control protocol message transmission method	2009/09/30	CN200510034409.6	2005/04/22
13HU01-020-02	US7653076	US	Granted	Method and apparatus for gateway control protocol message transmission	2010/01/26	US2007856152A 11/856,152	2007/09/17
13HU01-020-03	WO2006111104	WO	Lapsed	A GATEWAY CONTROL PROTOCOL MESSAGE TRANSFERRING METHOD AND THE APPARATUS THEREOF	2006/10/26	WO2006CN780A	2006/04/24
13HU01-021-02	CN100349411	CN	Granted	Medium flow service quality reporting method	2007/11/14	CN200410062978.7	2004/06/30
13HU01-021-01	CN100493069	CN	Lapsed	Method for detecting medium flow service quality	2006/01/04	CN200410062977.2	2004/06/30
13HU01-021-03	EP1739900	EP	PreCursor(EP)	A METHOD FOR ACQUIRING THE QOS OF THE MULTIMEDIA STREAM PERIODICALLY	2008/10/29	EP2005759437A	2005/06/30
13HU01-021-04	EP1739900	ES	Lapsed	A METHOD FOR ACQUIRING THE QOS OF THE MULTIMEDIA STREAM PERIODICALLY	2008/10/29	EP2005759437A	2005/06/30
13HU01-021-05	EP1739900	FR	Lapsed	A METHOD FOR ACQUIRING THE QOS OF THE MULTIMEDIA STREAM PERIODICALLY	2008/10/29	EP2005759437A	2005/06/30
13HU01-021-06	EP1739900	PT	Granted	A METHOD FOR ACQUIRING THE QOS OF THE MULTIMEDIA STREAM PERIODICALLY	2008/10/29	EP2005759437A	2005/06/30
13HU01-021-07	EP1739900	SE	Lapsed	A METHOD FOR ACQUIRING THE QOS OF THE MULTIMEDIA STREAM PERIODICALLY	2008/10/29	EP2005759437A	2005/06/30
13HU01-021-08	US7583612	US	Granted	Method for periodically acquiring the QoS of media	2009/09/01	US2006558619A	2006/11/10

				stream and system thereof			
13HU01-021-09	WO2006002597	WO	Lapsed	A METHOD FOR ACQUIRING THE QOS OF THE MULTIMEDIA STREAM PERIODICALLY	2006/01/12	WO2005CN958A	2005/06/30
13HU01-022-01	CN100499656	CN	Granted	Method for implementing medium gateway function, wireless access controlling apparatus and access system	2009/06/10	CN200510051044.8	2005/02/25
13HU01-022-02	US8085712	US	Granted	Method for implementing media gateway function,radio access control device and access system	2011/12/27	US20080049705A1 US2007844481A	2006/02/27
13HU01-022-03	WO2006089491	WO	Lapsed	METHOD FOR REALIZING MEDIA-GATEWAY FUNCTION, EQUIPMENT FOR WIRELESS ACCESS CONTROL AND ACCESS SYSTEM	2006/08/31	WO2006CN281A	2006/02/27
13HU01-023-01	CN100583918	CN	Granted	Safety protection method for service interruption of exchange network and its device	2010/01/20	CN200610065066.4	2006/03/16
13HU01-023-02	CN101160869	CN	Lapsed	Method and apparatus for security protection of service interruption in switch network	2008/04/09	CN200680012823.X	2006/11/22
13HU01-023-03	US7710880	US	Granted	Method and apparatus for security protection of service interruption in switch network	2010/05/04	US2006618597A	2006/12/29
13HU01-023-04	WO2007104199	WO	Lapsed	A SECURITY PROTECTING METOD USED FOR SERVICE INTERRUPTION IN THE SWITCHING NETWORK AND A SYSTEM THEREOF	2007/09/20	WO2006CN3144A	2006/11/22
13HU01-024-01	CN101841888	CN	Granted	Resource control method, related equipment and related system	2012/06/27	CN200910118794.0	2009/03/16
13HU01-024-02	EP2439979	DE	EP-Designated	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND SYSTEM	2012/04/11	EP2010753112A EP10753112.1	2010/03/16
13HU01-024-03	EP2439979	EP	EP-Pending	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND SYSTEM	2012/04/11	EP2010753112A EP10753112.1	2010/03/16
13HU01-024-04	EP2439979	FI	EP-Designated	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND SYSTEM	2012/04/11	EP2010753112A EP10753112.1	2010/03/16
13HU01-024-05	EP2439979	FR	EP-Designated	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND SYSTEM	2012/04/11	EP2010753112A EP10753112.1	2010/03/16
13HU01-024-06	EP2439979	GB	EP-Designated	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND SYSTEM	2012/04/11	EP2010753112A EP10753112.1	2010/03/16
13HU01-024-07	EP2439979	SE	EP-Designated	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND	2012/04/11	EP2010753112A EP10753112.1	2010/03/16

				SYSTEM			
13HU01-024-08	US8224325	US	Granted	Resource control method, relevant device, and system	2012/07/17	US13235062A	2011/09/16
13HU01-024-09	WO2010105545	WO	Lapsed	RESOURCE CONTROL METHOD, RELEVANT DEVIDE AND SYSTEM	2010/09/23	WO2010CN71057A	2010/03/16
13HU01-025-01	AU2003271027	AU	Lapsed	A network security authentication method	2007/08/09	AU2003271027A	2003/09/22
13HU01-025-02	CN1275419	CN	Lapsed	Network safety authentication method	2006/09/13	CN2002144191A	2002/10/18
13HU01-025-03	US8195942	US	Granted	Network security authentication method	2012/06/05	US2003531569A	2005/04/18
13HU01-025-04	WO2004036828	WO	Lapsed	A NETWORK SECURITY AUTHENTICATION METHOD	2004/04/29	WO2003CN801A	2003/09/22
13HU01-026-01	CN100574185	CN	Granted	Method for ensuring media stream safety in IP multimedia service subsystem network	2009/12/23	CN200510000097.7	2005/01/07
13HU01-026-02	EP1835652	DE	Granted	A METHOD FOR ENSURING THE SAFETY OF THE MEDIA-FLOW IN IP MULTIMEDIA SUB-SYSTEM	2010/06/16	EP2005848163A	2005/12/31
13HU01-026-03	EP1835652	EP	PreCursor(EP)	A METHOD FOR ENSURING THE SAFETY OF THE MEDIA-FLOW IN IP MULTIMEDIA SUB-SYSTEM	2010/06/16	EP2005848163A	2005/12/31
13HU01-026-04	EP1835652	GB	Granted	A METHOD FOR ENSURING THE SAFETY OF THE MEDIA-FLOW IN IP MULTIMEDIA SUB-SYSTEM	2010/06/16	EP2005848163A	2005/12/31
13HU01-026-05	US20140169563	US	Pending	METHOD FOR ENSURING MEDIA STREAM SECURITY IN IP MULTIMEDIA SUB-SYSTEM	2007/12/20	14/050,768	2013/10/10
13HU01-026-06	US8582766	US	Granted	METHOD FOR ENSURING MEDIA STREAM SECURITY IN IP MULTIMEDIA SUB-SYSTEM	2007/12/20	US2007774271A 11774271	2007/07/06
13HU01-026-07	WO2006072212	WO	Lapsed	A METHOD FOR ENSURING THE SAFETY OF THE MEDIA-FLOW IN IP MULTIMEDIA SUB-SYSTEM	2006/07/13	WO2005CN2429A	2005/12/31
13HU01-027.1-01	AR053615	AR	Granted	Method for Implementing Access Domain Security of IP Multimedia Subsystem	2007/05/07	ARP20060102194A	2006/05/26
13HU01-027.1-02	CN100461942	CN	Granted	Method for selecting safety mechanism of IP multimedia subsystem acess field	2009/02/11	CN200510071538.2	2005/05/27
13HU01-027.1-03	DE602006007648.7	DE	Granted	VERFAHREN ZUR IMPLEMENTIERUNG DER ZUGRIFFSBEREICHS	2009/08/20	DE602006007648T	2006/04/03
13HU01-027.1-04	EP1755311	DE	Duplicate	A METHOD FOR IMPLEMENTING THE ACCESS DOMAIN SECURITY OF AN IP MULTIMEDIA SUBSYSTEM	2009/07/08	EP2006722247A	2006/04/03

13HU01-027.1-05	EP1755311	EP	PreCursor(EP)	A METHOD FOR IMPLEMENTING THE ACCESS DOMAIN SECURITY OF AN IP MULTIMEDIA SUBSYSTEM	2009/07/08	EP2006722247A	2006/04/03
13HU01-027.1-06	EP1755311	FR	Granted	A METHOD FOR IMPLEMENTING THE ACCESS DOMAIN SECURITY OF AN IP MULTIMEDIA SUBSYSTEM	2009/07/08	EP2006722247A	2006/04/03
13HU01-027.1-07	EP1755311	GB	Granted	A METHOD FOR IMPLEMENTING THE ACCESS DOMAIN SECURITY OF AN IP MULTIMEDIA SUBSYSTEM	2009/07/08	EP2006722247A	2006/04/03
13HU01-027.1-08	TWI314414	TW	Granted	A METHOD FOR IMPLEMENTING THE ACCESS DOMAIN SECURITY OF AN IP MULTIMEDIA SUBSYSTEM	2009/09/01	TW2006118609A	2006/05/25
13HU01-027.1-09	US20080209532	US	Lapsed	Method for Implementing Access Domain Security of IP Multimedia Subsystem	2008/08/28	US2006629346A 11/629,346	2007/05/07
13HU01-027.1-10	WO2006125359	WO	Lapsed	A METHOD FOR IMPLEMENTING THE ACCESS DOMAIN SECURITY OF AN IP MULTIMEDIA SUBSYSTEM	2006/11/30	WO2006CN595A	2006/04/03
13HU01-027.2-01	CN100571134	CN	Granted	Method for verifying user terminal in IP multimedia subsystem	2009/12/16	CN200510070351.0	2005/04/30
13HU01-027.2-02	EP1879324	DE	Granted	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2012/08/01	EP2006741743A	2006/04/27
13HU01-027.2-03	EP1879324	EP	PreCursor(EP)	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2012/08/01	EP2006741743A	2006/04/27
13HU01-027.2-04	EP1879324	ES	Granted	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2012/08/01	EP2006741743A	2006/04/27
13HU01-027.2-05	EP1879324	FR	Granted	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2012/08/01	EP2006741743A	2006/04/27
13HU01-027.2-06	EP1879324	GB	Granted	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2012/08/01	EP2006741743A	2006/04/27
13HU01-027.2-07	EP1879324	IT	Granted	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2012/08/01	EP2006741743A	2006/04/27
13HU01-027.2-08	US8335487	US	Granted	Method for authenticating user terminal in IP multimedia sub-	2012/12/18	US11/896389	2007/08/31

				system			
13HU01-027.2-09	WO2006116921	WO	Lapsed	A METHOD FOR AUTHENTICATING USER TERMINAL IN IP MULTIMEDIA SUB-SYSTEM	2006/11/09	WO2006CN822A	2006/04/27
13HU01-028-02	CN101128049	CN	Granted	Method and system for providing circuit domain service and service control node SCP	2012/07/04	CN200610141030.X	2006/09/28
13HU01-028-01	CN200610111254.6	CN	Lapsed	Method and system for providing circuit domain service and service control node SCP		CN200610111254.6	2006/08/17
13HU01-028-03	EP2056536	DE	Granted	A METHOD, A SYSTEM AND A SERVICE CONTROL POINT FOR PROVIDING CIRCUIT DOMAIN SERVICE	2012/01/25	EP2007785297A	2007/08/09
13HU01-028-04	EP2056536	EP	PreCursor(EP)	A METHOD, A SYSTEM AND A SERVICE CONTROL POINT FOR PROVIDING CIRCUIT DOMAIN SERVICE	2012/01/25	EP2007785297A	2007/08/09
13HU01-028-05	EP2056536	FR	Granted	A METHOD, A SYSTEM AND A SERVICE CONTROL POINT FOR PROVIDING CIRCUIT DOMAIN SERVICE	2012/01/25	EP2007785297A	2007/08/09
13HU01-028-06	EP2056536	GB	Granted	A METHOD, A SYSTEM AND A SERVICE CONTROL POINT FOR PROVIDING CIRCUIT DOMAIN SERVICE	2012/01/25	EP2007785297A	2007/08/09
13HU01-028-07	WO2008022536	WO	Lapsed	A METHOD, A SYSTEM AND A SERVICE CONTROL POINT FOR PROVIDING CIRCUIT DOMAIN SERVICE	2008/02/28	WO2007CN2390A	2007/08/09
13HU01-029-01	AR50123	AR	Lapsed	SISTEMA DE RED DE COMUNICACIONES PARA IMPLEMENTAR SERVICIOS COMBINADOS Y SUS METODOS.	2006/09/27	ARP20050103360A	2005/08/11
13HU01-029-02	BR200507677	BR	Lapsed	sistema de rede de comunicações para implementação de serviços mistos e seu método	2007/07/17	BRPI507677A	2005/08/11
13HU01-029-04	CN100349473	CN	Lapsed	Method and system for realizing short message intercommunication based on mixed telephone number		CN200410059165.2	2004/08/11
13HU01-029-03	CN1735268	CN	Lapsed	Method for realizing mixed telephone number and communications network system	2006/02/15	CN200410059164.8	2004/08/11
13HU01-029-05	EP1713241	EP	Lapsed	A COMMUNICATION NETWORK SYSTEM AND	2006/10/18	EP2005774458A	2005/08/11

				METHOD OF ACHIEVING MIXED SERVICE			
13HU01-029-06	ID0024111	ID	Lapsed	Method and system for realizing short message intercommunication based on mixed telephone number		IDW-00200602090	2005/08/11
13HU01-029-07	IN246930	IN	Lapsed	Method and system for realizing short message intercommunication based on mixed telephone number	2011/03/25	IN2006CN4422A	2006/12/01
13HU01-029-08	RU2370904	RU	Granted	TELECOMMUNICATION NETWORK SYSTEM FOR IMPLEMENTING VARIOUS SERVICES AND METHOD OF IMPLEMENTING THEREOF	2009/10/20	RU2006130835A	2005/08/11
13HU01-029-09	US7787608	US	Granted	Communications network system for implementing mixed services and method thereof	2010/08/31	US11/489208	2006/07/19
13HU01-029-10	WO2006015551	WO	Lapsed	A COMMUNICATION NETWORK SYSTEM AND METHOD OF ACHIEVING MIXED SERVICE	2006/02/16	WO2005CN1241A	2005/08/11
13HU01-030-01	CN101247632	CN	Granted	Method, system and device for using IMS communication service identification in communication system	2008/08/20	CN200710079246.2	2007/02/13
13HU01-030-02	CN101517960	CN	Lapsed	Method, system and device for application IMS communication service identification in communication system	2009/08/26	CN200780000599.7	2007/11/19
13HU01-030-03	EP1959632	DE	EP-Designated	Method, system and apparatus for using IMS communication service identifier	2008/08/20	EP2008101535A	2008/02/12
13HU01-030-04	EP1959632	EP	EP-Pending	Method, system and apparatus for using IMS communication service identifier	2008/08/20	EP2008101535A	2008/02/12
13HU01-030-05	EP1959632	FI	EP-Designated	Method, system and apparatus for using IMS communication service identifier	2008/08/20	EP2008101535A	2008/02/12
13HU01-030-06	EP1959632	FR	EP-Designated	Method, system and apparatus for using IMS communication service identifier	2008/08/20	EP2008101535A	2008/02/12
13HU01-030-07	EP1959632	GB	EP-Designated	Method, system and apparatus for using IMS communication service identifier	2008/08/20	EP2008101535A	2008/02/12
13HU01-030-10	EP1959632	SE	EP-Designated	Method, system and apparatus for using IMS communication service identifier	2008/08/20	EP2008101535A	2008/02/12
13HU01-030-08	IN5391/DELNP/2009	IN	Pending	Method, System and Apparatus for Using IMS	1900/01/00	IN5391/DELNP/2009	2007/11/19

				Communication Service Identifiers in a Communication System			
13HU01-030-09	RU2434351	RU	Granted	METHOD, SYSTEM AND APPARATUS FOR USING IMS COMMUNICATION SERVICE IDENTIFIER IN COMMUNICATION SYSTEM	2011/11/20	RU2009134133A	2007/11/19
13HU01-030-12	US8185105	US	Granted	METHOD, SYSTEM AND APPARATUS FOR USING IMS COMMUNICATION SERVICE IDENTIFIER	2012/05/22	US12/539890	2009/08/12
13HU01-030-11	US8417240	US	Granted	METHOD, SYSTEM AND APPARATUS FOR USING IMS COMMUNICATION SERVICE IDENTIFIER	2013/04/09	US13/414770	2012/03/08
13HU01-030-11r	US14/285524	US	Reissuing	METHOD, SYSTEM AND APPARATUS FOR USING IMS COMMUNICATION SERVICE IDENTIFIER		US14/285524	2014/05/22
13HU01-030-13	WO2008098459	WO	Lapsed	METHOD, SYSTEM AND MEANS FOR APPLYING IMS COMMUNICATION SERVICE IDENTIFIERS IN A COMMUNICATION SYSTEM	2008/08/21	WO2007CN71090A	2007/11/19
13HU01-031-02	CN101064661	CN	Granted	Method and apparatus for notifying user to complement service	2011/08/24	CN200610099533.5	2006/07/28
13HU01-031-03	CN101317438	CN	Granted	Method and device for perceiving supplementary service executed by user	2012/04/25	CN200780000297.X	2007/02/08
13HU01-031-01	CN200610079107.5	CN	Lapsed	Method and apparatus for notifying user to complement service	1900/01/00	CN200610079107.5	2006/04/29
13HU01-031-04	EP1881689	DE	Granted	A METHOD AND DEVICE FOR PERCEIVING THE USER TRIGGERING A SUPPLEMENTARY SERVICE	2010/06/02	EP2007702308A	2007/02/08
13HU01-031-05	EP1881689	EP	PreCursor(EP)	A METHOD AND DEVICE FOR PERCEIVING THE USER TRIGGERING A SUPPLEMENTARY SERVICE	2010/06/02	EP2007702308A	2007/02/08
13HU01-031-06	EP1881689	FR	Granted	A METHOD AND DEVICE FOR PERCEIVING THE USER TRIGGERING A SUPPLEMENTARY SERVICE	2010/06/02	EP2007702308A	2007/02/08
13HU01-031-07	EP1881689	GB	Granted	A METHOD AND DEVICE FOR PERCEIVING THE USER TRIGGERING A SUPPLEMENTARY SERVICE	2010/06/02	EP2007702308A	2007/02/08
13HU01-031-08	US20080032686	US	Lapsed	Method and device for making awareness of occurence of a	2008/02/07	US2007881806A	2007/07/27

				supplementary service			
13HU01-031-09	WO2007124641	WO	Lapsed	A METHOD AND DEVICE FOR PERCEIVING THE USER TRIGGERING A SUPPLEMENTARY SERVICE	2007/11/08	WO2007CN435A	2007/02/08
13HU01-032-01	CN101056452	CN	Granted	Method and system for negotiating the voice encoding and decoding format in the communication system	2010/05/12	CN200610035050.9	2006/04/18
13HU01-032-02	CN101167374	CN	Granted	Method, system and device for negotiating voice coding/decoding in communication system	2011/02/09	CN200680013004.7	2006/11/29
13HU01-032-03	EP1848190	DE	EP-Designated	Method, system and device for speech codec negotiation in communication system	2007/10/24	EP20077802A	2007/04/17
13HU01-032-04	EP1848190	EP	EP-Pending	Method, system and device for speech codec negotiation in communication system	2007/10/24	EP20077802A	2007/04/17
13HU01-032-05	EP1848190	FI	EP-Designated	Method, system and device for speech codec negotiation in communication system	2007/10/24	EP20077802A	2007/04/17
13HU01-032-06	EP1848190	FR	EP-Designated	Method, system and device for speech codec negotiation in communication system	2007/10/24	EP20077802A	2007/04/17
13HU01-032-07	EP1848190	GB	EP-Designated	Method, system and device for speech codec negotiation in communication system	2007/10/24	EP20077802A	2007/04/17
13HU01-032-08	EP1848190	SE	EP-Designated	Method, system and device for speech codec negotiation in communication system	2007/10/24	EP20077802A	2007/04/17
13HU01-032-09	US7764953	US	Granted	Method, system and device for speech Codec negotiation in communication system	2010/07/27	US2007787527A	2007/04/17
13HU01-032-10	WO2007118380	WO	Lapsed	METHOD, SYSTEM AND DEVICE FOR NEGOTIATING VOICE CODING/DECODING IN COMMUNICATION SYSTEM	2007/10/25	WO2006CN3214A	2006/11/29
13HU01-033-01	CN101026653	CN	Granted	System and method for realizing colour image business	2011/08/24	CN200610057699.0	2006/02/24
13HU01-033-02	CN101156426	CN	Granted	System and method for implementing polychrome service	2011/02/16	CN200680011755.5	2006/11/01
13HU01-033-03	CN102394863	CN	Pending	System and method for realizing colour image business	2012/03/28	CN201110266055.3	2006/02/24
13HU01-033-04	EP1826985	DE	Granted	System and method for implementing multimedia calling line identification presentation service	2009/10/28	EP2007101173A	2007/01/25
13HU01-033-05	EP1826985	EP	PreCursor(EP)	System and method for implementing multimedia calling line identification	2009/10/28	EP2007101173A	2007/01/25

				presentation service			
13HU01-033-06	EP1826985	FR	Granted	System and method for implementing multimedia calling line identification presentation service	2009/10/28	EP2007101173A	2007/01/25
13HU01-033-07	EP1826985	GB	Granted	System and method for implementing multimedia calling line identification presentation service	2009/10/28	EP2007101173A	2007/01/25
13HU01-033-08	US20070201635	US	Pending	System and method for implementing multimedia calling line identification presentation service	2007/08/30	US11/698891	2007/01/29
13HU01-033-09	WO2007095802	WO	Lapsed	SYSTEM AND METHOD FOR REALIZING COLOR-IMAGE SERVICE	2007/08/30	WO2006CN2933A	2006/11/01
13HU01-034-01	CN100487788	CN	Granted	A method to realize the function of text-to-speech convert	2009/05/13	CN200510114277.8	2005/10/21
13HU01-034-02	EP1950737	DE	Granted	A METHOD, DEVICE AND SYSTEM FOR ACCOMPLISHING THE FUNCTION OF TEXT-TO-SPEECH CONVERSION	2010/05/26	EP2006805015A	2006/10/20
13HU01-034-03	EP1950737	EP	PreCursor(EP)	A METHOD, DEVICE AND SYSTEM FOR ACCOMPLISHING THE FUNCTION OF TEXT-TO-SPEECH CONVERSION	2010/05/26	EP2006805015A	2006/10/20
13HU01-034-04	EP1950737	GB	Granted	A METHOD, DEVICE AND SYSTEM FOR ACCOMPLISHING THE FUNCTION OF TEXT-TO-SPEECH CONVERSION	2010/05/26	EP2006805015A	2006/10/20
13HU01-034-05	US20080205279	US	Lapsed	Method, Apparatus and System for Accomplishing the Function of Text-to-Speech Conversion	2008/08/28	US2008106693A	2008/04/21
13HU01-034-06	WO2007045187	WO	Lapsed	A METHOD, APPARATUS AND SYSTEM FOR ACCOMPLISHING THE FUNCTION OF TEXT-TO-SPEECH CONVERSION	2007/04/26	WO2006CN2806A	2006/10/20
13HU01-035-01	CN101155148	CN	Granted	Media gateway issuing receiving multicast data to method, system and device	2012/02/22	CN200610140147.6	2006/09/30
13HU01-035-02	EP2068513	DE	Granted	METHOD, SYSTEM AND DEVICE FOR DISTRUBUTING AND RECEIVING THE MULTICAST DATA IN THE MEDIA GATEWAY	2010/11/24	EP2007816481A	2007/09/29
13HU01-035-03	EP2068513	EP	PreCursor(EP)	METHOD, SYSTEM AND DEVICE FOR DISTRUBUTING AND RECEIVING THE MULTICAST DATA IN THE MEDIA GATEWAY	2010/11/24	EP2007816481A	2007/09/29
13HU01-035-04	EP2068513	IT	Granted	METHOD, SYSTEM AND DEVICE FOR DISTRUBUTING AND	2010/11/24	EP2007816481A	2007/09/29

				RECEIVING THE MULTICAST DATA IN THE MEDIA GATEWAY			
13HU01-035-05	US7920579	US	Granted	Method, system and apparatus for media gateway to transmit and receive multicast data	2011/04/05	US2009413015A 12/413,015	2009/03/27
13HU01-035-06	WO2008040191	WO	Lapsed	METHOD, SYSTEM AND DEVICE FOR DISTRUBUTING AND RECEIVING THE MULTICAST DATA IN THE MEDIA GATEWAY	2008/04/10	WO2007CN2867A	2007/09/29
13HU01-036-01	CN101277343	CN	Granted	Method, terminal and system for implementing video binding in voice communication network	2012/01/04	CN200710095931.4	2007/03/30
13HU01-036-02	EP2120440	DE	Granted	A METHOD, TERMINAL AND SYSTEM FOR IMPLEMENTING VIDEO BINDING IN A VOICE COMMUNICATION NETWORK	2011/10/19	EP2008706632A	2008/02/03
13HU01-036-03	EP2120440	EP	PreCursor(EP)	A METHOD, TERMINAL AND SYSTEM FOR IMPLEMENTING VIDEO BINDING IN A VOICE COMMUNICATION NETWORK	2011/10/19	EP2008706632A	2008/02/03
13HU01-036-04	EP2120440	FR	Granted	A METHOD, TERMINAL AND SYSTEM FOR IMPLEMENTING VIDEO BINDING IN A VOICE COMMUNICATION NETWORK	2011/10/19	EP2008706632A	2008/02/03
13HU01-036-05	EP2120440	GB	Granted	A METHOD, TERMINAL AND SYSTEM FOR IMPLEMENTING VIDEO BINDING IN A VOICE COMMUNICATION NETWORK	2011/10/19	EP2008706632A	2008/02/03
13HU01-036-06	WO2008119272	WO	Lapsed	A METHOD, TERMINAL AND SYSTEM FOR IMPLEMENTING VIDEO BINDING IN A VOICE COMMUNICATION NETWORK	2008/10/09	WO2008CN70257A	2008/02/03
13HU01-037-01	CN101064680	CN	Granted	Method, system and apparatus for realizing multimedia calling service	2010/04/21	CN200610079110.7	2006/04/29
13HU01-037-02	EP2015592	DE	Granted	REALIZING A MULTIMEDIA CALL SERVICE	2012/07/11	EP2007720936A	2007/04/24
13HU01-037-03	EP2015592	EP	PreCursor(EP)	REALIZING A MULTIMEDIA CALL SERVICE	2012/07/11	EP2007720936A	2007/04/24
13HU01-037-04	EP2015592	GB	Granted	REALIZING A MULTIMEDIA CALL SERVICE	2012/07/11	EP2007720936A	2007/04/24
13HU01-037-05	WO2007124684	WO	Lapsed	A METHOD, SYSTEM AND APPARATUS FOR REALIZING MULTIMEDIA CALLING SERVICE	2007/11/08	WO2007CN1363A	2007/04/24
13HU01-038-01	CN100531267	CN	Granted	Method for realizing echo in communication system	2009/08/19	CN200510034345.X	2005/04/21
13HU01-038-02	EP1874016	EP	Lapsed	A METHOD FOR REALIZING RING BACK TONE IN COMMUNICATION SYSTEM	2008/01/02	EP2006741698A	2006/04/21
13HU01-038-03	US7986775	US	Granted	Method for realizing ring back tone in communication system	2011/07/26	US11/875195	2007/10/19

13HU01-038-04	WO2006111100	WO	Lapsed	A METHOD FOR REALIZING RING BACK TONE IN COMMUNICATION SYSTEM	2006/10/26	WO2006CN754A	2006/04/21
13HU01-039-01	CN1177508	CN	Granted	Method for implementing long-distance intelligent user roam calling	2004/11/24	CN2001123948A	2001/08/07
13HU01-039-02	CN1400843	CN	Lapsed	Method for implementing long-distance intelligent user roam calling	2003/03/05	CN2001123948A	2001/08/07
13HU01-039-03	EP1420605	EP	Lapsed	Implementing roaming call to foreign intelligent client	2007/11/28	EP2002719621A	2002/03/29
13HU01-039-04	RU2267865	RU	Lapsed	METHOD FOR CALLING EXTERNAL CLIENT OF INTELLECTUAL NETWORK IN ROAMING MODE	2006/01/10	RU2004104321A	2002/03/29
13HU01-039-05	US7349693	US	Granted	Method for implementing a call connection between a non-local calling subscriber and a local called subscriber who is an intelligent network subscriber	2008/03/25	US2003486322A 10486322	2002/03/29
13HU01-039-06	WO2003015437	WO	Lapsed	METHOD FOR ROAMING CALL IMPLEMENT TO FOREIGN INTELLIGENT CLIENT	2003/02/20	WO2002CN219A	2002/03/29

Unique ID	Patent Number	Country	Portfolio Status	Title	Issue / Publication Date	Application Number	Filing Date
13PA01-001-01	CN1173499	CN	Granted	Ofdma signal transmitting apparatus and method	2004/10/27	CN99800972	1999/05/28
13PA01-001-03	EP1001566	DE	EP-Designated	Ofdma signal transmitting apparatus and method	2000/05/17	EP99922578	1999/05/28
13PA01-001-02	EP1001566	EP	EP-Pending	Ofdma signal transmitting apparatus and method	2000/05/17	EP99922578	1999/05/28
13PA01-001-04	EP1001566	FR	EP-Designated	Ofdma signal transmitting apparatus and method	2000/05/17	EP99922578	1999/05/28
13PA01-001-05	EP1001566	GB	EP-Designated	Ofdma signal transmitting apparatus and method	2000/05/17	EP99922578	1999/05/28
13PA01-001-06	EP1001566	IT	EP-Designated	Ofdma signal transmitting apparatus and method	2000/05/17	EP99922578	1999/05/28
13PA01-001-07	EP1001566	NL	EP-Designated	Ofdma signal transmitting apparatus and method	2000/05/17	EP99922578	1999/05/28
13PA01-001-08	JP3515690	JP	Granted	Ofdma signal transmitter and its method	2004/04/05	JP15321498	1998/06/02
13PA01-001-09	US6726297	US	Granted	Ofdma signal transmission apparatus and method	2004/04/27	US09/462491	2000/01/20
13PA01-002-01	JP4864008	JP	Granted	Method of the carrier allotment in the multiple cell orthogonal frequency division multiple access system	2012/01/25	JP2007545294	2006/11/16
13PA01-002-02	US8009549	US	Granted	Carrier allocation method in multi cell orthogonal frequency division multiple access system	2011/08/30	US12/092950	2006/11/16
13PA01-003-01	EP1968335	DE	Granted	Radio communication base station device and pilot transmission method	2011/10/05	EP07706996	2007/01/18
13PA01-003-02	EP1968335	FR	Granted	Radio communication base station device and pilot transmission method	2011/10/05	EP07706996	2007/01/18
13PA01-003-03	EP1968335	GB	Granted	Radio communication base station device and pilot transmission method	2011/10/05	EP07706996	2007/01/18
13PA01-003-04	JP4832450	JP	Granted	Radio communication base station device and pilot transmission method	2011/12/07	JP2007554946	2007/01/18
13PA01-003-05	US8416810	US	Granted	Radio communication base station apparatus and pilot transmission method	2013/04/09	US12/160872	2007/01/18
13PA01-004-01	CN100440762	CN	Granted	Ofdm communication device	2008/12/03	CN01803504	2001/11/14
13PA01-004-02	DE60143934	DE	Granted	Ofdm nachrichtenÃƒÅ“bertragungsvorrichtung	2011/03/10	DE60143934	2001/11/14
13PA01-004-03	DE60143978	DE	Granted	Ofdm-kommunikationsvorrichtung	2011/03/10	DE60143978	2001/11/14
13PA01-004-05	EP1249955	FR	Granted	Ofdm communication device	2011/01/26	EP01982773	2001/11/14

13PA01-004-04	EP1249955	GB	Granted	Ofdm communication device	2011/01/26	EP01982773	2001/11/14
13PA01-004-07	EP2161867	FR	Granted	Ofdm communication device	2010/03/10	EP09178209	2001/11/14
13PA01-004-06	EP2161867	GB	Granted	Ofdm communication device	2010/03/10	EP09178209	2001/11/14
13PA01-004-08	JP4000057	JP	Granted	Ofdm communication device	2007/10/31	JP2002543837	2001/11/14
13PA01-004-09	US7646702	US	Granted	Ofdm communication apparatus	2010/01/12	US10/169716	2002/07/09
13PA01-004-10	US8238226	US	Granted	Ofdm communication apparatus	2012/08/07	US12/505420	2009/07/17
13PA01-005-01	CN100544237	CN	Granted	Radio base station apparatus	2009/09/23	CN03804886	2003/08/01
13PA01-005-02	DE60325861	DE	Granted	Funkbasisstationsvorrichtung	2009/03/05	DE60325861	2003/08/01
13PA01-005-03	EP1525687	FR	Granted	Radio base station apparatus	2009/01/14	EP03766690	2003/08/01
13PA01-005-04	EP1525687	GB	Granted	Radio base station apparatus	2009/01/14	EP03766690	2003/08/01
13PA01-005-05	JP4098027	JP	Granted	Radio base station apparatus	2008/06/11	JP2002224571	2002/08/01
13PA01-005-06	US7593317	US	Granted	Radio base station apparatus	2009/09/22	US10/503010	2004/07/29
13PA01-006-01	CN101133614	CN	Lapsed	Ofdm receiver, integrated circuit and receiving method	2011/06/29	CN200680006764	2006/02/28
13PA01-006-02	DE602006004975	DE	Lapsed	Ofdm-empfÃƒÂ¤nger und empfangsverfahren	2009/03/12	DE602006004975	2006/02/28
13PA01-006-03	EP1861977	FR	Lapsed	Ofdm receiver and receiving method	2009/01/21	EP06728642	2006/02/28
13PA01-006-04	EP1861977	GB	Lapsed	Ofdm receiver and receiving method	2009/01/21	EP06728642	2006/02/28
13PA01-006-05	EP1861977	IT	Lapsed	Ofdm receiver and receiving method	2009/01/21	EP06728642	2006/02/28
13PA01-006-06	JP4971172	JP	Granted	Receiving device, integrated circuit and reception method	2012/07/11	JP2007539403	2006/02/28
13PA01-006-07	US7929627	US	Granted	Ofdm receiver, integrated circuit and receiving method	2011/04/19	US11/885042	2006/02/28
13PA01-007-01	CN101080893	CN	Granted	Re-transmission method and transmitting device for multi-antenna transmission	2010/12/29	CN200580043160	2005/12/14
13PA01-007-02	EP1821440	EP	Lapsed	Retransmitting method and transmitting method in multi-antenna transmission	2007/08/22	EP05816694	2005/12/14
13PA01-007-03	JP4863884	JP	Granted	The retransmission method in multiple antenna transmitting	2012/01/25	JP2006548891	2005/12/14
13PA01-007-04	KR100912762	KR	Granted	Retransmitting method and transmitting method in multi-antenna transmission	2009/08/18	KR20077013565	2007/06/15
13PA01-007-05	US7826557	US	Granted	Retransmitting method and transmitting method in multi-antenna transmission	2010/11/02	US11/721911	2005/12/14

13PA01-008-01	EP1895679	DE	Granted	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	2012/07/11	EP07115147	2007/08/29
13PA01-008-02	EP1895679	GB	Granted	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	2012/07/11	EP07115147	2007/08/29
13PA01-008-03	JP4837638	JP	Granted	Mimo antenna apparatus and wireless communication apparatus having it	2011/12/14	JP2007222315	2007/08/29
13PA01-008-04	US7792084	US	Granted	Mimo antenna apparatus controlling number of streams and modulation and demodulation method	2010/09/07	US11/892886	2007/08/28
13PA01-009-01	JP4864000	JP	Granted	The radio communication base station device and the radio communication method in multiple carrier communicating	2012/01/25	JP2007529557	2006/08/04
13PA01-009-02	KR20080031377	KR	Lapsed	Wireless communication base station apparatus and wireless communication method in multicarrier communication	2008/04/08	KR20087002994	2008/02/04
13PA01-009-03	US8064393	US	Granted	Wireless communication base station apparatus and wireless communication method in multicarrier communication	2011/11/22	US11/997841	2006/08/04
13PA01-010-01	CN101502025	CN	Granted	Wireless communication base station device and wireless communication method	2012/11/28	CN200780028893	2007/10/12
13PA01-010-03	EP2051410	DE	EP-Designated	Wireless communication base station device and wireless communication method	2009/04/22	EP07829721	2007/10/12
13PA01-010-02	EP2051410	EP	EP-Pending	Wireless communication base station device and wireless communication method	2009/04/22	EP07829721	2007/10/12
13PA01-010-06	EP2051410	FI	EP-Designated	Wireless communication base station device and wireless communication method	2009/04/22	EP07829721	2007/10/12
13PA01-010-04	EP2051410	FR	EP-Designated	Wireless communication base station device and wireless communication method	2009/04/22	EP07829721	2007/10/12
13PA01-010-05	EP2051410	GB	EP-Designated	Wireless communication base station device and wireless communication method	2009/04/22	EP07829721	2007/10/12
13PA01-010-07	EP2051410	SE	EP-Designated	Wireless communication base station device and wireless communication method	2009/04/22	EP07829721	2007/10/12
13PA01-010-08	JP4903033	JP	Granted	Wireless communication base station device and wireless communication method	2012/03/21	JP2006344925	2006/12/21
13PA01-	US8270332	US	Granted	Wireless communication base	2012/09/18	US12/377373	2007/10/12

010-09				station device and wireless communication method			
13PA01-010-10	US8582573	US	Granted	Radio communication base station apparatus and radio communication method	2012/12/13	US13/590841	2012/08/21
13PA01-011-01	BR9906339	BR	Pending	"aparelho de comunicaÃ§Ã£o de rÃ¡dio e mÃ©todo de controle de coeficiente de transmissÃ£o"	2000/09/19	BR9906339	1999/04/19
13PA01-011-02	CA2293606	CA	Granted	Radio communication apparatus and transmission rate control method	2005/02/08	CA2293606	1999/04/19
13PA01-011-03	CN1130944	CN	Granted	Radio communication device and method for controlling transmission rate	2003/12/10	CN99800567	1999/04/19
13PA01-011-04	DE69903110	DE	Granted	FunkÃœbertragungsgerÃ„t und verfahren zur kontrolle der Ãœbertragungsrate	2003/01/23	DE69903110	1999/04/19
13PA01-011-05	DE69914351	DE	Granted	FunkkommunikationsgerÃ¤t und verfahren zur einstellung der Ãœbertragungsrate	2004/06/24	DE69914351	1999/04/19
13PA01-011-12	EP0986282	FI	Granted	Radio communication device and method of controlling transmission rate	2002/09/25	EP99913715	1999/04/19
13PA01-011-11	EP0986282	FR	Granted	Radio communication device and method of controlling transmission rate	2002/09/25	EP99913715	1999/04/19
13PA01-011-13	EP0986282	GB	Granted	Radio communication device and method of controlling transmission rate	2002/09/25	EP99913715	1999/04/19
13PA01-011-14	EP0986282	IT	Granted	Radio communication device and method of controlling transmission rate	2002/09/25	EP99913715	1999/04/19
13PA01-011-15	EP0986282	NL	Granted	Radio communication device and method of controlling transmission rate	2002/09/25	EP99913715	1999/04/19
13PA01-011-07	EP1122965	FI	Granted	Radio communication device and method of controlling transmission rate	2004/01/21	EP01106695	1999/04/19
13PA01-011-06	EP1122965	FR	Granted	Radio communication device and method of controlling transmission rate	2004/01/21	EP01106695	1999/04/19
13PA01-011-08	EP1122965	GB	Granted	Radio communication device and method of controlling transmission rate	2004/01/21	EP01106695	1999/04/19
13PA01-011-09	EP1122965	IT	Granted	Radio communication device and method of controlling transmission rate	2004/01/21	EP01106695	1999/04/19
13PA01-011-10	EP1122965	NL	Granted	Radio communication device and method of controlling transmission rate	2004/01/21	EP01106695	1999/04/19
13PA01-	ES2184430	ES	Granted	Dispositivo de comunicacion por	2003/04/01	ES99913715	1999/04/19

011-17				radio y procedimiento que permite ajustar la velocidad de transmision.			
13PA01-011-16	ES2214356	ES	Granted	Dispositivo de comunicacion por radio y metodo para controlar la velocidad de transmision.	2004/09/16	ES01106695	1999/04/19
13PA01-011-18	JP4738451	JP	Granted	Communication terminal apparatus and communication method therefor	2011/08/03	JP2008194038	2008/07/28
13PA01-011-21	US6366763	US	Granted	Radio communication device and method of controlling transmission rate	2002/04/02	US09/648756	2000/08/28
13PA01-011-22	US6370359	US	Granted	Radio communication device and method of controlling transmission rate	2002/04/09	US09/648757	2000/08/28
13PA01-011-20	US6381445	US	Granted	Radio communication device and method of controlling transmission rate	2002/04/30	US09/648742	2000/08/28
13PA01-011-19	US6400929	US	Granted	Radio communication device and method of controlling transmission rate	2002/06/04	US09/424843	1999/12/06
13PA01-011-23	US6487394	US	Granted	Radio communication device and method of controlling transmission rate	2002/11/26	US09/649003	2000/08/28
13PA01-011-25	US6505035	US	Granted	Radio communication apparatus and transmission rate control method	2003/01/07	US10/052261	2002/01/23
13PA01-011-24	US6597894	US	Granted	Radio communication device and method of controlling transmission rate	2003/07/22	US09/649006	2000/08/28
13PA01-011-27	US6611676	US	Granted	Radio communication apparatus and transmission rate control method	2003/08/26	US10/083553	2002/02/27
13PA01-011-26	US6973289	US	Granted	Radio communication device and method of controlling transmission rate	2005/12/06	US10/057897	2002/01/29
13PA01-011-28	US7636551	US	Granted	Radio communication device and method of controlling transmission rate	2009/12/22	US11/228339	2005/09/19
13PA01-012-01	US6637001	US	Granted	Apparatus and method for image/voice transmission	2003/10/21	US09/650743	2000/08/30
13PA01-013-01	AU2407202	AU	Lapsed	Decoder and decoding method	2002/06/11	AU2407202	2001/11/22
13PA01-013-02	CN1266868	CN	Granted	Communication terminal device and decoding method	2006/07/26	CN01804109	2001/11/22
13PA01-013-03	JP3399923	JP	Granted	Decoding device and decoding method	2003/04/28	JP2000362431	2000/11/29
13PA01-013-05	US20050002477	US	Lapsed	Decoding apparatus and decoding method	2005/01/06	US10/901380	2004/07/29
13PA01-013-04	US6813323	US	Granted	Decoding method and communication terminal apparatus	2004/11/02	US10/182270	2002/07/25

13PA01-014-03	JP3492637	JP	Granted	Decoding device and decoding method	2004/02/03	JP2001046559	2001/02/22
13PA01-014-01	JP3522700	JP	Granted	Channel detecting apparatus and method therefor	2004/04/26	JP2001023713	2001/01/31
13PA01-014-02	JP3526271	JP	Granted	Decoding device and decoding method	2004/05/10	JP2001031850	2001/02/08
13PA01-014-04	KR100727732	KR	Granted	Decoding device and decoding method	2007/06/13	KR20057021280	2005/11/09
13PA01-014-08	US20050219071	US	Lapsed	Apparatus and method for decoding	2005/10/06	US11/134448	2005/05/23
13PA01-014-05	US6734810	US	Granted	Apparatus and method for decoding	2004/05/11	US10/221267	2002/09/10
13PA01-014-07	US6922159	US	Granted	Apparatus and method for decoding	2005/07/26	US10/793766	2004/03/08
13PA01-014-06	US6940428	US	Granted	Apparatus and method for decoding	2005/09/06	US10/793737	2004/03/08
13PA01-015-01	CN1114324	CN	Granted	Base station, mobile unit communication apparatus and method of communication between them	2003/07/09	CN97119237	1997/09/30
13PA01-015-02	DE69708823	DE	Granted	Spreizspektrum-verfahren und system zur ÃƒÅ"bertragung zwischen einer basisstation und einer vielzahl von mobilen stationen	2002/06/20	DE69708823	1997/10/01
13PA01-015-03	EP0836288	FI	Granted	Spread-spectrum method and system for communication between a base station and a plurality of mobile units	2001/12/05	EP97307725	1997/10/01
13PA01-015-04	EP0836288	FR	Granted	Spread-spectrum method and system for communication between a base station and a plurality of mobile units	2001/12/05	EP97307725	1997/10/01
13PA01-015-05	EP0836288	GB	Granted	Spread-spectrum method and system for communication between a base station and a plurality of mobile units	2001/12/05	EP97307725	1997/10/01
13PA01-015-06	EP0836288	SE	Granted	Spread-spectrum method and system for communication between a base station and a plurality of mobile units	2001/12/05	EP97307725	1997/10/01
13PA01-015-07	JP3720141	JP	Granted	Mobile communication method and its system	2005/11/24	JP26062596	1996/10/01
13PA01-015-08	US6069884	US	Granted	Method of communication between a base station and a plurality of mobile unit communication apparatus, a base station, and mobile unit communication apparatus	2000/05/30	US08/937005	1997/09/24
13PA01-016-01	AU710430	AU	Granted	Base station equipment for mobile communication	1999/09/23	AU4320797	1997/09/25
13PA01-	CA2238358	CA	Granted	Base station apparatus for	2001/12/04	CA2238358	1997/09/25

016-02				mobile communication			
13PA01-016-03	CN1175592	CN	Granted	Base station equipment for mobile communication	2004/11/10	CN97191312	1997/09/25
13PA01-016-04	DE69721224	DE	Granted	Verfahren fÃœr sanftes weiterreichen in einer basisstation mit sektoren und basisstation dafÃœr	2003/11/13	DE69721224	1997/09/25
13PA01-016-05	EP0869629	FR	Granted	Soft handover method in a sectored base station and base station therefor	2003/04/23	EP97941232	1997/09/25
13PA01-016-06	EP0869629	GB	Granted	Soft handover method in a sectored base station and base station therefor	2003/04/23	EP97941232	1997/09/25
13PA01-016-07	EP0869629	IT	Granted	Soft handover method in a sectored base station and base station therefor	2003/04/23	EP97941232	1997/09/25
13PA01-016-08	EP0869629	NL	Granted	Soft handover method in a sectored base station and base station therefor	2003/04/23	EP97941232	1997/09/25
13PA01-016-09	JP4098833	JP	Granted	Mobile communication base station device	2008/06/11	JP51549798	1997/09/25
13PA01-016-10	US6119004	US	Granted	Base station equipment for mobile communication	2000/09/12	US09/068541	1998/05/13
13PA01-017-01	CN1100464	CN	Granted	Differential detector with error correcting function	2003/01/29	CN98105319	1998/02/20
13PA01-017-02	DE69818323	DE	Granted	Differential-detektor mit fehlerkorrekturfunktion	2004/07/01	DE69818323	1998/02/11
13PA01-017-03	EP0860964	FR	Granted	Differential detector with error correcting function	2003/09/24	EP98301000	1998/02/11
13PA01-017-04	EP0860964	GB	Granted	Differential detector with error correcting function	2003/09/24	EP98301000	1998/02/11
13PA01-017-05	JP3468657	JP	Lapsed	Delay detector with error correction	2003/11/17	JP5251497	1997/02/21
13PA01-017-06	US6069924	US	Granted	Differential detector with error correcting function	2000/05/30	US09/027510	1998/02/20
13PA01-018-01	CN1262083	CN	Granted	Cdma radio communication system and its method	2006/06/28	CN99110630	1999/07/23
13PA01-018-02	DE69936019	DE	Granted	Cdma-funkÃ¼bertragungssystem und -verfahren	2007/08/30	DE69936019	1999/07/21
13PA01-018-04	EP0975118	ES	Lapsed	Cdma radio communication system and method	2007/05/09	EP99114151	1999/07/21
13PA01-018-05	EP0975118	FR	Granted	Cdma radio communication system and method	2007/05/09	EP99114151	1999/07/21
13PA01-018-06	EP0975118	GB	Granted	Cdma radio communication system and method	2007/05/09	EP99114151	1999/07/21
13PA01-018-07	EP0975118	IT	Lapsed	Cdma radio communication system and method	2007/05/09	EP99114151	1999/07/21
13PA01-018-08	EP0975118	SE	Lapsed	Cdma radio communication system and method	2007/05/09	EP99114151	1999/07/21
13PA01-	EP1826938 - DIV	EP	Lapsed	Cdma radio communication	2007/08/29	EP07105867	1999/07/21

018-03				system and method			
13PA01-018-10	JP3411850	JP	Granted	Cdma radio communication system	2003/06/03	JP9142999	1999/03/31
13PA01-018-09	JP3411854	JP	Granted	Cdma radio communication system and method	2003/06/03	JP19480599	1999/07/08
13PA01-018-12	US20040048578	US	Lapsed	Cdma radio transmission apparatus, cdma radio reception apparatus, and cdma radio communication method	2004/03/11	US10/419089	2003/04/21
13PA01-018-11	US6636723	US	Granted	Cdma radio communication system using chip interleaving	2003/10/21	US09/359020	1999/07/22
13PA01-019-02	CN1086524	CN	Granted	Switching over method for cdma system and base station of mobile station	2002/06/19	CN98106939	1998/04/15
13PA01-019-01	CN1170388	CN	Granted	Commutation method in cdma	2004/10/06	CN02105576	1998/04/15
13PA01-019-03	DE69817904	DE	Granted	Weiterreichen verfahren in einem spreizspektrumÃ¼betragungseinrichtung	2004/05/19	DE69817904	1998/04/14
13PA01-019-04	DE69824054	DE	Granted	Spreizspectrumkommunikations system	2004/09/09	DE69824054	1998/04/14
13PA01-019-09	EP0873034	FR	Granted	Handover method in a spread spectrum communication system	2003/09/10	EP98106758	1998/04/14
13PA01-019-10	EP0873034	GB	Granted	Handover method in a spread spectrum communication system	2003/09/10	EP98106758	1998/04/14
13PA01-019-11	EP0873034	NL	Granted	Handover method in a spread spectrum communication system	2003/09/10	EP98106758	1998/04/14
13PA01-019-12	EP0873034	SE	Granted	Handover method in a spread spectrum communication system	2003/09/10	EP98106758	1998/04/14
13PA01-019-05	EP1304899	FR	Granted	Spread spectrum communication system	2004/05/19	EP02026952	1998/04/14
13PA01-019-06	EP1304899	GB	Granted	Spread spectrum communication system	2004/05/19	EP02026952	1998/04/14
13PA01-019-07	EP1304899	NL	Granted	Spread spectrum communication system	2004/05/19	EP02026952	1998/04/14
13PA01-019-08	EP1304899	SE	Granted	Spread spectrum communication system	2004/05/19	EP02026952	1998/04/14
13PA01-019-13	KR100371837	KR	Granted	Hand-over method, mobile station apparatus and base station apparatus	2003/01/28	KR20020030497	2002/05/31
13PA01-019-14	US6628630	US	Granted	Spread spectrum communication method	2003/09/30	US09/058881	1998/04/13
13PA01-020-01	JP9271070	JP	Non-applicable	Digital mobile object communication equipment	1997/10/14	JP7642396	1996/03/29
13PA01-020-02	US6404778	US	Granted	Radio communication apparatus	2002/06/11	US09/159602	1998/09/24

13PA01-021-01	CN1134128	CN	Granted	Cdma/tdd mobile communication system and method	2004/01/07	CN99103968	1999/03/09
13PA01-021-02	DE69927200	DE	Granted	Cdma/tdd mobiles kommunikationssystem und verfahren	2006/01/12	DE69927200	1999/03/04
13PA01-021-03	DE69942350	DE	Granted	Cdma/tdd mobilstation und verfahren	2010/06/17	DE69942350	1999/03/04
13PA01-021-07	EP0948221	FR	Granted	Cdma/tdd mobile communication system and method	2005/09/14	EP99102882	1999/03/04
13PA01-021-08	EP0948221	GB	Granted	Cdma/tdd mobile communication system and method	2005/09/14	EP99102882	1999/03/04
13PA01-021-09	EP0948221	IT	Granted	Cdma/tdd mobile communication system and method	2005/09/14	EP99102882	1999/03/04
13PA01-021-04	EP1578163	FR	Granted	Cdma/tdd mobile station and method	2010/05/05	EP05013391	1999/03/04
13PA01-021-05	EP1578163	GB	Granted	Cdma/tdd mobile station and method	2010/05/05	EP05013391	1999/03/04
13PA01-021-06	EP1578163	IT	Granted	Cdma/tdd mobile station and method	2010/05/05	EP05013391	1999/03/04
13PA01-021-11	ES2248932	ES	Granted	Sistema de comunicacion movil cdma/tdd y metodo.	2006/03/16	ES99102882	1999/03/04
13PA01-021-10	ES2343414	ES	Granted	Estacion movil cdma/tdd y metodo.	2010/07/30	ES05013391	1999/03/04
13PA01-021-12	JP3881770	JP	Granted	System and method for time division duplex cdma mobile communication	2007/02/14	JP7831798	1998/03/10
13PA01-021-13	US6611509	US	Granted	Cdma/tdd mobile communication system and method	2003/08/26	US09/264826	1999/03/09
13PA01-021-14	US6807162	US	Granted	Cdma/tdd mobile communication system and method	2004/10/19	US10/166268	2002/06/11
13PA01-021-15	US6973065	US	Granted	Cdma/tdd mobile communication system and method	2005/12/06	US10/419733	2003/04/22
13PA01-021-16	US7778224	US	Granted	Cdma/tdd mobile communication system and method	2010/08/17	US10/885684	2004/07/08
13PA01-022-01	CN100413233	CN	Granted	Communication terminal device and base station device	2008/08/20	CN00131890	2000/07/05
13PA01-022-02	DE60026907	DE	Granted	KommunikationsendgerÃ¤tvorrichtung und basisstationvorrichtung	2006/08/17	DE60026907	2000/07/04
13PA01-022-03	DE60043953	DE	Granted	Cdma-sender und -empfÃ¤nger unter verwendung von midambles	2010/04/15	DE60043953	2000/07/04
13PA01-022-04	EP1067723	FR	Granted	Communication terminal apparatus and base station	2006/03/29	EP00114318	2000/07/04

				apparatus			
13PA01-022-05	EP1067723	GB	Granted	Communication terminal apparatus and base station apparatus	2006/03/29	EP00114318	2000/07/04
13PA01-022-06	EP1067723	SE	Lapsed	Communication terminal apparatus and base station apparatus	2006/03/29	EP00114318	2000/07/04
13PA01-022-07	EP1667337	FR	Granted	Cdma transmitter and receiver using midambles	2010/03/03	EP06001107	2000/07/04
13PA01-022-08	EP1667337	GB	Granted	Cdma transmitter and receiver using midambles	2010/03/03	EP06001107	2000/07/04
13PA01-022-09	EP1667337	SE	Granted	Cdma transmitter and receiver using midambles	2010/03/03	EP06001107	2000/07/04
13PA01-022-10	JP2001024556	JP	Lapsed	Communication device	2001/01/26	JP19005099	1999/07/05
13PA01-022-11	JP2001257626	JP	Lapsed	Communication unit and communication method	2001/09/21	JP2000068426	2000/03/13
13PA01-022-12	JP3748351	JP	Granted	Communication equipment and communication method	2006/02/22	JP33139199	1999/11/22
13PA01-022-13	KR20010015160	KR	Non-applicable	Communication device	2001/02/26	KR20000037971	2000/07/04
13PA01-022-14	US6765894	US	Granted	Communication terminal apparatus and base station apparatus	2004/07/20	US09/606906	2000/06/30
13PA01-022-15	US7656844	US	Granted	Radio transmission apparatus and radio reception apparatus in a cdma communication system	2010/02/02	US10/868029	2004/06/16
13PA01-022-16	US8437316	US	Granted	Radio transmission apparatus and radio reception apparatus in a cdma communication system	2013/05/07	US12/641177	2009/12/17
13PA01-023-01	CN1233119	CN	Granted	Wireless communication device and wireless communication method	2005/12/21	CN00119928	2000/07/03
13PA01-023-02	EP1065804	EP	Lapsed	Transmission/reception apparatus	2001/01/03	EP00113933	2000/06/30
13PA01-023-03	JP3678944	JP	Granted	Transmitter-receiver	2005/08/03	JP18952099	1999/07/02
13PA01-023-04	KR20010015127	KR	Granted	Transmitter-receiver	2001/02/26	KR20000037494	2000/07/01
13PA01-023-05	US6839335	US	Granted	Radio communication apparatus and radio communication method	2005/01/04	US09/605862	2000/06/29
13PA01-024-01	CA2316782	CA	Granted	Apparatus and method for transmission/reception	2012/08/21	CA2316782	1999/11/08
13PA01-024-02	CN1248438	CN	Granted	Transmitting / receiving device and transmitting / receiving method	2006/03/29	CN99801989	1999/11/08
13PA01-024-03	EP1043858	DE	Granted	Transmitting/receiving device and transmitting/receiving method	2011/08/17	EP99954417	1999/11/08
13PA01-	EP1043858	FR	Granted	Transmitting/receiving device	2011/08/17	EP99954417	1999/11/08

024-04				and transmitting/receiving method			
13PA01-024-05	EP1043858	GB	Granted	Transmitting/receiving device and transmitting/receiving method	2011/08/17	EP99954417	1999/11/08
13PA01-024-06	IL137058	IL	Granted	Apparatus and method for transmission/reception	2001/06/14	IL13705899	1999/11/08
13PA01-024-07	JP2000201132	JP	Lapsed	Transmitter-receiver	2000/07/18	JP22082799	1999/08/04
13PA01-024-11	KR388400	KR	Granted	Apparatus and method for transmission/reception	2003/06/09	KR2000-7007459	1999/11/08
13PA01-024-12	KR611866	KR	Granted	Apparatus and method for transmission/reception	2006/08/04	KR2003-7000348	2003/01/10
13PA01-024-08	NO332385	NO	Granted	Fremgangsmate og apparat for sending/mottaking	2012/09/10	NO20003476	2000/07/05
13PA01-024-09	US7072416	US	Granted	Transmitting/receiving device and transmitting/receiving method	2006/07/04	US09/582558	2000/06/29
13PA01-024-10	US7760815	US	Granted	Apparatus and method for transmission/reception	2010/07/20	US11/431606	2006/05/11
13PA01-025-01	CN1281009	CN	Granted	Apparatus and method for orthogonal frequency division multiplexing communication	2006/10/18	CN00126839	2000/09/06
13PA01-025-02	DE60041618	DE	Granted	MehrtrÃƒÂ¤gerempfÃƒÂ¤nger mit auswÃƒÂ¤hlbaren demodulatoren	2009/04/09	DE60041618	2000/09/06
13PA01-025-03	EP1083718	FR	Granted	Multicarrier receiver with selectable demodulators	2009/02/25	EP00119285	2000/09/06
13PA01-025-04	EP1083718	GB	Granted	Multicarrier receiver with selectable demodulators	2009/02/25	EP00119285	2000/09/06
13PA01-025-05	EP1083718	SE	Granted	Multicarrier receiver with selectable demodulators	2009/02/25	EP00119285	2000/09/06
13PA01-025-06	JP2001077790	JP	Precursor	Ofdm communication equipment	2001/03/23	JP25363399	1999/09/07
13PA01-025-07	JP3796076	JP	Granted	Ofdm communication equipment	2006/07/12	JP25363399	1999/09/07
13PA01-025-08	KR20010050345	KR	Non-applicable	Ofdm communication equipment	2001/06/15	KR20000052621	2000/09/06
13PA01-025-09	US6868056	US	Granted	Apparatus and method for ofdm communication	2005/03/15	US09/635096	2000/08/09
13PA01-026-01	CN1153392	CN	Granted	Interference signal removing device and interference signal removing method	2004/06/09	CN01800054	2001/01/15
13PA01-026-02	DE60114511	DE	Granted	Verfahren und vorrichtung zur beseitigung von stÃƒâ€“rsignalen	2006/06/01	DE60114511	2001/01/15
13PA01-026-03	EP1164735	FR	Granted	Interference signal removing device and interference signal removing method	2005/11/02	EP01900770	2001/01/15
13PA01-026-04	EP1164735	GB	Granted	Interference signal removing device and interference signal removing method	2005/11/02	EP01900770	2001/01/15

13PA01-026-05	JP3515033	JP	Granted	Interference signal elimination device and interference signal elimination method	2004/04/05	JP2000010877	2000/01/19
13PA01-026-06	US6944208	US	Granted	Interference signal canceling apparatus and interference signal canceling method	2005/09/13	US09/936727	2001/09/17
13PA01-027-01	CN1174643	CN	Granted	Combined signalling and signal interference ratio internal ring power control	2004/11/03	CN01102993	2001/02/13
13PA01-027-02	CN1315810	CN	Lapsed	Combined signalling and signal interference ratio internal ring power control	2001/10/03	CN01102993	2001/02/13
13PA01-027-03	DE60045506	DE	Granted	Sendeleistungsregelung mittels einer inneren schleife	2011/02/24	DE60045506	2000/11/21
13PA01-027-04	EP1139580	FR	Granted	Inner-loop power control	2011/01/12	EP00310315	2000/11/21
13PA01-027-05	EP1139580	GB	Granted	Inner-loop power control	2011/01/12	EP00310315	2000/11/21
13PA01-027-06	EP1139580	IT	Granted	Inner-loop power control	2011/01/12	EP00310315	2000/11/21
13PA01-027-07	ES2358388	ES	Granted	Control de potencia de lazo interno.	2011/05/10	ES00310315	2000/11/21
13PA01-027-08	US6781973	US	Granted	Combined signaling and sir inner-loop power control	2004/08/24	US09/538888	2000/03/30
13PA01-028-01	CN1181625	CN	Granted	Communication terminal device and transmit power control method	2004/12/22	CN00802695	2000/11/27
13PA01-028-03	EP1146668	DE	EP-Designated	Communication terminal, base station system, and method of controlling transmission power	2001/10/17	EP00977949	2000/11/27
13PA01-028-02	EP1146668	EP	EP-Pending	Communication terminal, base station system, and method of controlling transmission power	2001/10/17	EP00977949	2000/11/27
13PA01-028-04	EP1146668	FR	EP-Designated	Communication terminal, base station system, and method of controlling transmission power	2001/10/17	EP00977949	2000/11/27
13PA01-028-05	EP1146668	GB	EP-Designated	Communication terminal, base station system, and method of controlling transmission power	2001/10/17	EP00977949	2000/11/27
13PA01-028-06	JP3583343	JP	Granted	Communication terminal, base station unit and transmission power control method	2004/11/04	JP2000076032	2000/03/17
13PA01-028-07	US7145886	US	Granted	Communication terminal, base station system, and method of controlling transmission power	2006/12/05	US09/889919	2001/07/25
13PA01-029-01	AU6789101	AU	Lapsed	Base station unit and method for radio communication	2002/01/14	AU6789101	2001/07/02
13PA01-029-02	CN1148895	CN	Granted	Base station unit and method for radio communication	2004/05/05	CN01801884	2001/07/02
13PA01-029-03	CN1276596	CN	Granted	Base station apparatus and radio communication method	2006/09/20	CN200410007371	2001/07/02

13PA01-029-04	DE60117263	DE	Granted	Basisstationseinheit und verfahren zur funkkommunikation	2006/07/27	DE60117263	2001/07/02
13PA01-029-05	DE60121055	DE	Granted	Basisstationsvorrichtung und funkkommunikationsverfahren zur hochgeschwindigkeitsdatenÃ¼bertragung	2006/11/09	DE60121055	2001/07/02
13PA01-029-06	EP1209824	FR	Granted	Base station unit and method for radio communication	2006/02/15	EP01945745	2001/07/02
13PA01-029-07	EP1209824	GB	Granted	Base station unit and method for radio communication	2006/02/15	EP01945745	2001/07/02
13PA01-029-08	EP1437841	FR	Granted	Base station apparatus and radio communication method for high-speed data communication	2006/06/21	EP04003162	2001/07/02
13PA01-029-09	EP1437841	GB	Granted	Base station apparatus and radio communication method for high-speed data communication	2006/06/21	EP04003162	2001/07/02
13PA01-029-11	JP4359218	JP	Granted	Base station system and radio communication method	2009/11/04	JP2004293911	2004/10/06
13PA01-029-10	JP4409793	JP	Granted	Base station equipment and method for radio communication	2010/02/03	JP2001200184	2001/06/29
13PA01-029-12	US6847828	US	Granted	Base station apparatus and radio communication method	2005/01/25	US10/069484	2002/02/27
13PA01-029-13	US7386321	US	Granted	Base station apparatus and radio communication method	2008/06/10	US10/793738	2004/03/08
13PA01-030-01	CN1174588	CN	Granted	Grouping receiver and transmission method thereof	2004/11/03	CN02119390	2002/05/15
13PA01-030-02	DE60208466	DE	Granted	Verfahren und vorrichtung zur fehlerkorrektur der statischen informationen im kopffeld eines empfangenen packets	2006/07/13	DE60208466	2002/05/15
13PA01-030-03	EP1261184	FR	Granted	Method and device for error correction in the static header information of a received packet	2006/01/04	EP02010884	2002/05/15
13PA01-030-04	EP1261184	GB	Granted	Method and device for error correction in the static header information of a received packet	2006/01/04	EP02010884	2002/05/15
13PA01-030-05	JP3512177	JP	Granted	Packet receiver and packet transmission method	2004/03/29	JP2001146281	2001/05/16
13PA01-030-06	US7266118	US	Granted	Packet receiving apparatus and packet transmission method	2007/09/04	US10/143989	2002/05/14
13PA01-031-01	AT279085	AT	Lapsed	Funkkommunikationssystem, basisstationsgerÃ„t sowie ein in dem system aufgenommenes kommunikationsendgerÃ„t	2004/10/15	AT01999126	2001/11/27
13PA01-031-02	AT308864	AT	Lapsed	Funkkommunikationssystem, basisstation und kommunikationsendgerÃ„t	2005/11/15	AT03025316	2001/11/27

13PA01-031-03	AU2410802	AU	Lapsed	Radio communication system, base station device and communication terminal accommodated in the system	2002/06/11	AU2410802	2001/11/27
13PA01-031-04	CN1288939	CN	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2006/12/06	CN01804070	2001/11/27
13PA01-031-05	CZ20022591	CZ	Lapsed	Wireless communication system and apparatus for a base station and communication terminal apparatus applied within the system	2003/03/12	CZ20022591	2001/11/27
13PA01-031-06	DE60106196	DE	Granted	Funkkommunikationssystem, basisstationsgerÃ„t sowie ein in dem system aufgenommenes kommunikationsendgerÃ„t	2005/02/17	DE60106196	2001/11/27
13PA01-031-07	DE60114671	DE	Granted	Funkkommunikationssystem, basisstation und kommunikationsendgerÃ¤t	2006/04/20	DE60114671	2001/11/27
13PA01-031-13	EP1246492	FI	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2004/10/06	EP01999126	2001/11/27
13PA01-031-12	EP1246492	FR	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2004/10/06	EP01999126	2001/11/27
13PA01-031-11	EP1246492	GB	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2004/10/06	EP01999126	2001/11/27
13PA01-031-10	EP1246492	IT	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2004/10/06	EP01999126	2001/11/27
13PA01-031-09	EP1246492	NL	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2004/10/06	EP01999126	2001/11/27
13PA01-031-08	EP1246492	SE	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2004/10/06	EP01999126	2001/11/27
13PA01-031-14	EP1387597	FR	Granted	Radio communication system, base station and communication terminal	2005/11/02	EP03025316	2001/11/27
13PA01-031-15	EP1387597	GB	Granted	Radio communication system, base station and communication terminal	2005/11/02	EP03025316	2001/11/27
13PA01-031-16	ES2230395	ES	Granted	Sistema de radiocomunicacion que comprende un dispositivo	2005/05/01	ES01999126	2001/11/27

				de estacion base y un terminal de comunicacion.			
13PA01-031-17	JP3691383	JP	Granted	Radio communication system, base station device and communication terminal accommodated in the system	2005/09/07	JP2000363649	2000/11/29
13PA01-031-18	US7133379	US	Granted	Wireless communication system, and base station apparatus and communication terminal apparatus accommodated in the system	2006/11/07	US10/181349	2002/07/17
13PA01-032-01	AU1745202	AU	Lapsed	Radio base station apparatus and radio communication method	2002/07/01	AU1745202	2001/12/19
13PA01-032-02	BR0108503	BR	Lapsed	Aparelho de estaÃ§Ã£o de base sem fio e mÃ©todo de comunicaÃ§Ã£o sem fio	2002/12/24	BR0108503	2001/12/19
13PA01-032-03	CA2400990	CA	Lapsed	Wireless base station apparatus and wireless communication method	2010/10/19	CA2400990	2001/12/19
13PA01-032-05	CN100534005	CN	Granted	Wireless base station apparatus and wireless communication method	2009/08/26	CN200510088453	2001/12/19
13PA01-032-04	CN1162989	CN	Granted	Radio base station device and radio communication method	2004/08/18	CN01805368	2001/12/19
13PA01-032-06	CZ20022827	CZ	Lapsed	Apparatus for wireless base station and wireless communication method	2003/02/12	CZ20022827	2001/12/19
13PA01-032-07	DE60117694	DE	Lapsed	Funk-basisstationsvorrichtung und funk-kommunikationsverfahren	2006/10/05	DE60117694	2001/12/19
13PA01-032-08	EP1249949	FR	Lapsed	Radio base station apparatus and radio communication method	2006/03/08	EP01271705	2001/12/19
13PA01-032-09	EP1249949	GB	Lapsed	Radio base station apparatus and radio communication method	2006/03/08	EP01271705	2001/12/19
13PA01-032-10	JP2002190757	JP	Precursor	Radio base station equipment and radio communication method	2002/07/05	JP2000389473	2000/12/21
13PA01-032-11	JP3679000	JP	Granted	Radio base station equipment and radio communication method	2005/08/03	JP2000389473	2000/12/21
13PA01-032-12	KR100567502	KR	Lapsed	Radio transmission apparatus and radio transmission method	2006/04/03	KR20057005182	2005/03/25
13PA01-032-13	US7392019	US	Granted	Wireless base station apparatus and wireless communication method	2008/06/24	US11/053837	2005/02/10
13PA01-033-01	CN1224207	CN	Granted	Method and apparatus for automatic request repeat of sending and receiving	2005/10/19	CN02142556	2002/08/22
13PA01-	DE60104113	DE	Granted	ÃƒÅ"bertragungsverfahren und	2004/10/28	DE60104113	2001/08/22

033-02				ÃƒÅ"bertragungsgerÃƒÂ¤t mit mehrkanal-arq			
13PA01-033-03	EP1286491	FR	Granted	Multichannel arq method and apparatus	2004/06/30	EP01120182	2001/08/22
13PA01-033-04	EP1286491	GB	Granted	Multichannel arq method and apparatus	2004/06/30	EP01120182	2001/08/22
13PA01-033-05	JP3650383	JP	Granted	Transmitter, receiver and arq transmitting and receiving method	2005/05/18	JP2002241027	2002/08/21
13PA01-033-06	KR100494251	KR	Granted	Arq transmission and reception methods and apparatus	2005/06/13	KR20020049754	2002/08/22
13PA01-033-07	US7339949	US	Granted	Arq transmission and reception methods and apparatus	2008/03/04	US10/222989	2002/08/19
13PA01-034-01	CN1319307	CN	Granted	Transmission/reception apparatus and transmission/reception method	2007/05/30	CN02820398	2002/08/07
13PA01-034-02	DE60239543	DE	Granted	Sende-empfangs-vorrichtung und sende-empfangs-verfahren	2011/05/05	DE60239543	2002/08/07
13PA01-034-03	EP1422861	FR	Granted	Transmission / reception apparatus and transmission / reception method	2011/03/23	EP02755868	2002/08/07
13PA01-034-04	EP1422861	GB	Granted	Transmission / reception apparatus and transmission / reception method	2011/03/23	EP02755868	2002/08/07
13PA01-034-05	JP3880437	JP	Granted	Transmission/reception apparatus and transmission/ reception method	2007/02/14	JP2002113607	2002/04/16
13PA01-034-06	US7702025	US	Granted	Transmission/reception apparatus and transmission/reception method	2010/04/20	US10/487574	2004/02/25
13PA01-035-01	CN1224293	CN	Granted	Dispatching device, base station device and wireless communication method	2005/10/19	CN02804809	2002/11/11
13PA01-035-03	EP1365617	DE	Granted	Schedule creation apparatus, base station apparatus, and radio communication method	2012/05/09	EP02780065	2002/11/11
13PA01-035-02	EP1365617	FR	Granted	Schedule creation apparatus, base station apparatus, and radio communication method	2012/05/09	EP02780065	2002/11/11
13PA01-035-04	EP1365617	GB	Granted	Schedule creation apparatus, base station apparatus, and radio communication method	2012/05/09	EP02780065	2002/11/11
13PA01-035-05	JP3576525	JP	Granted	Schedule maker, base station device, and radio communication method	2004/10/13	JP2001345444	2001/11/09
13PA01-035-06	US7460502	US	Granted	Scheduling creation apparatus, base station apparatus, and radio communication method	2008/12/02	US10/250487	2003/07/03
13PA01-036-01	CN100514895	CN	Granted	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission	2009/07/15	CN03800915	2003/03/19

				control device			
13PA01-036-03	EP1492258	DE	EP-Designated	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission control device	2010/08/11	EP03710414	2003/03/19
13PA01-036-02	EP1492258	EP	EP-Pending	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission control device	2010/08/11	EP03710414	2003/03/19
13PA01-036-06	EP1492258	FI	EP-Designated	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission control device	2010/08/11	EP03710414	2003/03/19
13PA01-036-04	EP1492258	FR	EP-Designated	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission control device	2010/08/11	EP03710414	2003/03/19
13PA01-036-05	EP1492258	GB	EP-Designated	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission control device	2010/08/11	EP03710414	2003/03/19
13PA01-036-07	EP1492258	SE	EP-Designated	Method of data retransmission in multi-carrier transmission and communication apparatus having data retransmission control device	2010/08/11	EP03710414	2003/03/19
13PA01-036-08	JP4287751	JP	Granted	The data retransmission method in multiple carrier transmitting and the communication device which has the data retransmission control control equipment	2009/07/01	JP2003581390	2003/03/19
13PA01-036-09	US7269774	US	Granted	Data receiving apparatus, data transmitting apparatus and retransmission request method	2007/09/11	US10/484951	2004/01/28
13PA01-037-01	CN1266982	CN	Granted	Radio communication apparatus and transfer rate decision method	2006/07/26	CN03800365	2003/02/06
13PA01-037-02	DE60314588	DE	Granted	Funkkommunikationsvorrichtung und transferratenentscheidungsverfahren	2007/10/25	DE60314588	2003/02/06
13PA01-037-03	EP1424869	FR	Granted	Radio communication apparatus and transfer rate decision method	2007/06/27	EP03705051	2003/02/06
13PA01-037-04	EP1424869	GB	Granted	Radio communication apparatus and transfer rate decision	2007/06/27	EP03705051	2003/02/06

				method			
13PA01-037-06	JP2005260992	JP	Lapsed	Wireless communication apparatus and transmission rate decision method	2005/09/22	JP2005112396	2005/04/08
13PA01-037-05	JP3686614	JP	Granted	Wireless communication apparatus and transmission rate decision method	2005/08/24	JP2002030942	2002/02/07
13PA01-037-07	US7385934	US	Granted	Radio communication apparatus and transfer rate decision method	2008/06/10	US10/476845	2003/11/06
13PA01-038-01	CN100514973	CN	Granted	Rate matching device and rate matching method	2009/07/15	CN03800419	2003/01/30
13PA01-038-02	EP1388992	EP	Lapsed	Rate matching device and rate matching method	2008/04/02	EP03734892	2003/01/30
13PA01-038-03	JP3629241	JP	Granted	Device and method for rate matching	2005/03/16	JP2002021499	2002/01/30
13PA01-038-04	US7114121	US	Granted	Rate matching device and rate matching method	2006/09/26	US10/478139	2003/11/20
13PA01-039-01	CN100502273	CN	Granted	Test device, mobile terminal device and test method	2009/06/17	CN200310102691	2003/10/29
13PA01-039-02	CN1964243	CN	Granted	Test apparatus, mobile terminal apparatus and wireless transmission property test method	2012/11/07	CN200610073263	2003/10/29
13PA01-039-04	EP1441554	CH	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-05	EP1441554	DE	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-03	EP1441554	EP	PreCursor(EP)	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-06	EP1441554	FR	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-07	EP1441554	GB	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-08	EP1441554	IE	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-09	EP1441554	LI	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-10	EP1441554	LU	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-11	EP1441554	MC	Granted	Test apparatus, mobile terminal apparatus and test method	2013/03/13	EP04000733	2004/01/15
13PA01-039-12	JP2004228762	JP	Lapsed	Test apparatus, mobile terminal apparatus and test method	2004/08/12	JP2003012312	2003/01/21
13PA01-039-13	KR20040067911	KR	Lapsed	Testing device, mobile terminal and testing method, particularly for testing radio transmission characteristics with certain transmission power	2004/07/30	KR20040002903	2004/01/15
13PA01-039-14	US7162206	US	Granted	Test apparatus, mobile terminal apparatus, test method	2007/01/09	US10/612289	2003/07/03

13PA01-040-01	DE60332146	DE	Granted	Sendervorrichtung und sendeverfahren	2010/05/27	DE60332146	2003/11/13
13PA01-040-02	EP1564920	FR	Granted	Transmitter apparatus and transmitting method	2010/04/14	EP03774003	2003/11/13
13PA01-040-03	EP1564920	GB	Granted	Transmitter apparatus and transmitting method	2010/04/14	EP03774003	2003/11/13
13PA01-040-04	JP3796211	JP	Granted	Transmitter and transmitting method	2006/07/12	JP2002333448	2002/11/18
13PA01-040-05	JP4163937	JP	Granted	Ofdm-cdma transmitter and ofdm-cdma transmission method	2008/10/08	JP2002355079	2002/12/06
13PA01-040-06	US7746762	US	Granted	Transmitting apparatus and transmitting method	2010/06/29	US10/534987	2005/05/16
13PA01-041-01	CN1692592	CN	Granted	Cdma transmitting apparatus and cdma receiving apparatus	2010/07/14	CN200380100629	2003/11/14
13PA01-041-02	DE60325751	DE	Granted	Cdma mimo system	2009/02/26	DE60325751	2003/11/14
13PA01-041-03	EP1551124	FR	Granted	Cdma mimo system	2009/01/07	EP03772765	2003/11/14
13PA01-041-04	EP1551124	GB	Granted	Cdma mimo system	2009/01/07	EP03772765	2003/11/14
13PA01-041-05	JP3583414	JP	Granted	Code division multiple access transmitter and code division multiple access receiver	2004/11/04	JP2002330453	2002/11/14
13PA01-041-06	US7693140	US	Granted	Cdma transmitting apparatus and cdma receiving apparatus	2010/04/06	US10/527199	2005/03/10
13PA01-042-01	CN1714519	CN	Granted	Radio reception device and radio reception method	2011/05/04	CN200380103837	2003/11/26
13PA01-042-02	EP1569362	DE	Granted	Radio reception device and radio reception method	2011/10/26	EP03775882	2003/11/26
13PA01-042-03	EP1569362	FR	Granted	Radio reception device and radio reception method	2011/10/26	EP03775882	2003/11/26
13PA01-042-04	EP1569362	GB	Granted	Radio reception device and radio reception method	2011/10/26	EP03775882	2003/11/26
13PA01-042-05	JP3629261	JP	Granted	Apparatus and method for radio reception	2005/03/16	JP2002341741	2002/11/26
13PA01-042-07	US20080020802	US	Lapsed	Wireless receiver and wireless reception method	2008/01/24	US11/859550	2007/09/21
13PA01-042-06	US7299027	US	Granted	Mimo receiver and mimo reception method for selection of mimo separation and channel variation compensation	2007/11/20	US10/536010	2005/05/23
13PA01-043-01	CN101019360	CN	Granted	Automatic retransmission request control system and method in mimo-ofdm system	2012/06/13	CN200480043975	2004/09/13
13PA01-043-03	EP1788742	DE	Granted	Automatic retransmission request control system and retransmission method in mimo-ofdm system	2007/05/23	EP04772990	2004/09/13
13PA01-043-02	EP1788742	EP	PreCursor(EP)	Automatic retransmission request control system and retransmission method in	2007/05/23	EP04772990	2004/09/13

				mimo-ofdm system			
13PA01-043-04	EP1788742	FR	Granted	Automatic retransmission request control system and retransmission method in mimo-ofdm system	2007/05/23	EP04772990	2004/09/13
13PA01-043-05	EP1788742	GB	Granted	Automatic retransmission request control system and retransmission method in mimo-ofdm system	2007/05/23	EP04772990	2004/09/13
13PA01-043-06	EP2518920	EP	Lapsed	Automatic retransmission request control system and retransmission method in mimo-ofdm system	2012/10/31	EP12173393	2004/09/13
13PA01-043-07	EP2518921	EP	Lapsed	Automatic retransmission request (arq) control system and retransmission method in mimo-ofdm system	2012/10/31	EP12173394	2004/09/13
13PA01-043-08	JP4384668	JP	Granted	The automatic request for repetition control system and the retransmission method in the mimo-ofdm system	2009/12/16	JP2006534962	2004/09/13
13PA01-043-09c2	US14/321117	US	Pending	Automatic retransmission request control system and retransmission method in memo-ofdm system		US14/321117	2014/07/01
13PA01-043-09c1	US14/321185	US	Pending	Automatic retransmission request control system and retransmission method in memo-ofdm system		US14/321185	2014/07/01
13PA01-043-10	US20120230257	US	Lapsed	Retransmission method and transmitter	2012/09/13	US13/478996	2012/05/23
13PA01-043-11	US20120263250	US	Lapsed	Retransmission method, transmitter, and communication system	2012/10/18	US13/532576	2012/06/25
13PA01-043-12	US20120287775	US	Pending	Automatic retransmission request control system and retransmission method in mimo-ofdm system	2012/11/15	US13/554748	2012/07/20
13PA01-043-09	US8775890	US	Granted	Automatic retransmission request control system and retransmission method in memo-ofdm system	2007/11/01	US11/575015	2007/03/30
13PA01-044-01	CN100578989	CN	Granted	Cdma transmitting apparatus, base station device usinsg the same and cdma transmitting method	2010/01/06	CN200480000627	2004/04/28
13PA01-044-03	EP1630993	DE	EP-Designated	Cdma transmitting apparatus and cdma transmitting method	2006/03/01	EP04730067	2004/04/28
13PA01-044-02	EP1630993	EP	EP-Pending	Cdma transmitting apparatus and cdma transmitting method	2006/03/01	EP04730067	2004/04/28
13PA01-044-07	EP1630993	FI	EP-Designated	Cdma transmitting apparatus and cdma transmitting method	2006/03/01	EP04730067	2004/04/28

13PA01-044-04	EP1630993	FR	EP-Designated	Cdma transmitting apparatus and cdma transmitting method	2006/03/01	EP04730067	2004/04/28
13PA01-044-05	EP1630993	GB	EP-Designated	Cdma transmitting apparatus and cdma transmitting method	2006/03/01	EP04730067	2004/04/28
13PA01-044-06	EP1630993	SE	EP-Designated	Cdma transmitting apparatus and cdma transmitting method	2006/03/01	EP04730067	2004/04/28
13PA01-044-08	JP3799030	JP	Granted	Device and method for cdma transmission	2006/07/19	JP2003132133	2003/05/09
13PA01-044-09	US7251469	US	Granted	Cdma transmitting apparatus and cdma transmitting method	2007/07/31	US10/522980	2005/02/02
13PA01-044-10	US7764711	US	Granted	Cdma transmission apparatus and cdma transmission method	2010/07/27	US11/767124	2007/06/22
13PA01-045-02	CN100591000	CN	Granted	Classifying-synthesizing transmission method of multi-user feedback information at base station	2010/02/17	CN200580029870	2005/09/05
13PA01-045-03	CN101015161	CN	Granted	Classifying-synthesizing transmission method of multi-user feedback information at base station	2007/08/08	CN200580029870	2005/09/05
13PA01-045-01	CN1747568	CN	Lapsed	Method for base station to transmitting feedback data of multiple clients by sorted combinations	2006/03/15	CN200410068800	2004/09/06
13PA01-045-04	EP1777855	EP	Lapsed	Classifying-synthesizing transmission method of multi-user feedback information at base station	2007/04/25	EP05777044	2005/09/05
13PA01-045-05	JP4675904	JP	Granted	Taxonomic synthetic transmission method of feedback information multi user in base station	2011/04/27	JP2006535743	2005/09/05
13PA01-045-06	US20070254715	US	Precursor	Classifying-synthesizing transmission method of multi-user feedback information at base station	2007/11/01	US11/574636	2005/09/06
13PA01-045-07	US8086270	US	Granted	Classifying-synthesizing transmission method of multi-user feedback information at base station	2011/12/27	US11/574636	2005/09/05
13PA01-046-02	EP1811700	DE	EP-Designated	Communication apparatus, communication system, and communication method	2007/07/25	EP05807089	2005/11/18
13PA01-046-01	EP1811700	EP	EP-Pending	Communication apparatus, communication system, and communication method	2007/07/25	EP05807089	2005/11/18
13PA01-046-03	EP1811700	FR	EP-Designated	Communication apparatus, communication system, and communication method	2007/07/25	EP05807089	2005/11/18
13PA01-046-04	EP1811700	GB	EP-Designated	Communication apparatus, communication system, and communication method	2007/07/25	EP05807089	2005/11/18

13PA01-046-05	JP4838144	JP	Granted	Communication device, communication system and communication method	2011/12/14	JP2006545166	2005/11/18
13PA01-046-06	US7848439	US	Granted	Communication apparatus, communication system, and communication method	2010/12/07	US11/719611	2005/11/18
13PA01-047-01	BRPI0515242	BR	Pending	MÃ©todo para a comunicaÃ§Ã£o das informaÃ§Ãµes que estÃ£o relacionadas com a programaÃ§Ã£o de transmissÃµes de dados de ligaÃ§Ã£o superior, sistema de comunicaÃ§Ã£o mÃ³vel, estaÃ§Ã£o base em um sistema de comunicaÃ§Ã£o mÃ³vel, controlador de rede de rÃ¡dio em um sistema de c	2008/07/15	BRPI0515242	2005/08/31
13PA01-047-02	CN101053272	CN	Granted	Efficient rise over thermal (rot) control during soft handover	2012/05/23	CN200580037780	2005/08/31
13PA01-047-03	DE602004008068	DE	Granted	Effiziente "rise over thermal (rot)" steuerung wÃ¤hrend eines sanften weiterreichens	2007/11/22	DE602004008068	2004/08/31
13PA01-047-04	DE602004021447	DE	Granted	Effiziente rise-over-thermal-steuerung wÃ¤hrend eines sanften handovers	2009/07/16	DE602004021447	2004/08/31
13PA01-047-08	EP1631104	FI	Granted	Efficient rise over thermal (rot) control during soft handover	2007/08/08	EP04020647	2004/08/31
13PA01-047-05	EP1631104	FR	Granted	Efficient rise over thermal (rot) control during soft handover	2007/08/08	EP04020647	2004/08/31
13PA01-047-07	EP1631104	GB	Granted	Efficient rise over thermal (rot) control during soft handover	2007/08/08	EP04020647	2004/08/31
13PA01-047-09	EP1631104	IT	Granted	Efficient rise over thermal (rot) control during soft handover	2007/08/08	EP04020647	2004/08/31
13PA01-047-06	EP1631104	SE	Granted	Efficient rise over thermal (rot) control during soft handover	2007/08/08	EP04020647	2004/08/31
13PA01-047-13	EP1838125	FI	Granted	Efficient rise over thermal (rot) control during soft handover	2009/06/03	EP07011278	2004/08/31
13PA01-047-10	EP1838125	FR	Granted	Efficient rise over thermal (rot) control during soft handover	2009/06/03	EP07011278	2004/08/31
13PA01-047-12	EP1838125	GB	Granted	Efficient rise over thermal (rot) control during soft handover	2009/06/03	EP07011278	2004/08/31
13PA01-047-14	EP1838125	IT	Granted	Efficient rise over thermal (rot) control during soft handover	2009/06/03	EP07011278	2004/08/31
13PA01-047-11	EP1838125	SE	Granted	Efficient rise over thermal (rot) control during soft handover	2009/06/03	EP07011278	2004/08/31
13PA01-047-15	ES2291786	ES	Granted	Control eficaz del aumento de sobreexplotacion termica (rot) durante una transferencia flexible.	2008/03/01	ES04020647	2004/08/31
13PA01-047-16	ES2327008	ES	Granted	Control eficiente del rot durante transferencia blanda.	2009/10/22	ES07011278	2004/08/31

13PA01-047-20	IN200700601P2	IN	Granted	Efficient rise over thermal (rot) control during soft handover	2007/07/06	IN601/KOLNP/2007	2007/02/19
13PA01-047-17	JP2007151146	JP	Lapsed	Method for communicating information relating to scheduling of uplink data transmissions, mobile communication system, base station, wireless network controller, and mobile terminal	2007/06/14	JP2006348525	2006/12/25
13PA01-047-18	JP4041531	JP	Granted	The method of communicating the information which it is related to the scheduling of uplink data transmission, the portable communication system, base station, the radio network controller, and the portable terminal	2008/01/30	JP2007512130	2005/08/31
13PA01-047-19	KR20070051353	KR	Lapsed	Efficient rise over thermal(rot) control during soft handover	2007/05/17	KR20077007354	2007/03/30
13PA01-047-21	US8175604	US	Granted	Efficient rise over thermal (rot) control during soft handover	2012/05/08	US10/588073	2005/08/31
13PA01-048-01	CN101103575	CN	Granted	Multi-antenna communication method and multi-antenna communication device	2012/02/01	CN200680002338	2006/01/10
13PA01-048-02	JP4769201	JP	Granted	Multiple antenna communication method and multiple antenna communication device	2011/09/07	JP2006552910	2006/01/10
13PA01-048-03	US7860184	US	Granted	Multi-antenna communication method and multi-antenna communicaton apparatus	2010/12/28	US11/813650	2006/01/10
13PA01-049-01	CN101283535	CN	Granted	Method for generating and detecting multiple pilot frequencies in multi-antenna communication system	2012/04/04	CN200680037602	2006/11/22
13PA01-049-02	EP1940067	EP	Lapsed	Multi-pilot generation method and detection method in multi-antenna communication system	2008/07/02	EP06823520	2006/11/22
13PA01-049-03	JP4981682	JP	Granted	Multiple pilot formation method and the method of detection in the multiple antenna communication system	2012/07/25	JP2007546481	2006/11/22
13PA01-049-04	US8073070	US	Granted	Multi-pilot generation method and detection method in multi-antenna communication system	2011/12/06	US12/092944	2006/11/22
13PA01-050-01	CN101151832	CN	Lapsed	Communication terminal, base station, and receiving method	2008/03/26	CN200680010719	2006/03/03
13PA01-050-02	EP1855406	EP	Lapsed	Communication terminal, base station, and receiving method	2007/11/14	EP06715227	2006/03/03
13PA01-050-03	JP4914352	JP	Granted	Communication terminal unit and base station device	2012/04/11	JP2007521121	2006/03/03
13PA01-	US8249132	US	Granted	Communication terminal and	2012/08/21	US11/909425	2006/03/03

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13PA01-051-01	CN101411240	CN	Granted	Uplink resource allocation in a mobile communication system	2011/05/25	CN200680054042	2006/11/02
13PA01-051-02	CN102202414	CN	Granted	Uplink resource allocation in a mobile communication system	2011/09/28	CN201110084678	2006/11/02
13PA01-051-04	EP1816883	DE	EP-Designated	Uplink resource allocation in a mobile communication system	2007/08/08	EP06002248	2006/02/03
13PA01-051-03	EP1816883	EP	EP-Pending	Uplink resource allocation in a mobile communication system	2007/08/08	EP06002248	2006/02/03
13PA01-051-07	EP1816883	FI	EP-Designated	Uplink resource allocation in a mobile communication system	2007/08/08	EP06002248	2006/02/03
13PA01-051-05	EP1816883	FR	EP-Designated	Uplink resource allocation in a mobile communication system	2007/08/08	EP06002248	2006/02/03
13PA01-051-06	EP1816883	GB	EP-Designated	Uplink resource allocation in a mobile communication system	2007/08/08	EP06002248	2006/02/03
13PA01-051-08	EP1816883	SE	EP-Designated	Uplink resource allocation in a mobile communication system	2007/08/08	EP06002248	2006/02/03
13PA01-051-10	JP2012157036	JP	Granted	Uplink resource allocation in mobile communication system	2012/08/16	JP2012060156	2012/03/16
13PA01-051-11	JP2012213206	JP	Precursor	Uplink resource allocation in mobile communication system	2012/11/01	JP2012132803	2012/06/12
13PA01-051-09	JP5020263	JP	Granted	Allotment of the uplink resource in the portable communication system	2012/09/05	JP2008552689	2006/11/02
13PA01-051-12	JP5059982	JP	Granted	Uplink resource allocation in mobile communication system	2012/10/31	JP2012132803	2012/06/12
13PA01-051-13	US8576784	US	Granted	Uplink resource allocation in a mobile communication system	2009/05/07	US12/162592	2006/11/02
13PA01-052-02	EP2061170	DE	EP-Designated	Ofdm transmitter and ofdm receiver	2009/05/20	EP06783262	2006/09/11
13PA01-052-01	EP2061170	EP	EP-Pending	Ofdm transmitter and ofdm receiver	2009/05/20	EP06783262	2006/09/11
13PA01-052-03	EP2061170	FR	EP-Designated	Ofdm transmitter and ofdm receiver	2009/05/20	EP06783262	2006/09/11
13PA01-052-04	EP2061170	GB	EP-Designated	Ofdm transmitter and ofdm receiver	2009/05/20	EP06783262	2006/09/11
13PA01-052-05	JP4654298	JP	Granted	Ofdm transmitting device and ofdm receiving device	2011/03/16	JP2008534161	2006/09/11
13PA01-052-06	US8218681	US	Granted	Ofdm transmitter and ofdm receiver	2012/07/10	US12/440894	2009/03/11
13PA01-052-06r	US14/328576	US	Reissuing	Ofdm transmitter and ofdm receiver		US14/328576	2014/07/10
13PA01-053-01	CN101636946	CN	Lapsed	Multicarrier transmitter and multicarrier receiver	2010/01/27	CN200780052347	2007/05/25
13PA01-053-02	EP2151933	EP	Lapsed	Multicarrier transmitter and multicarrier receiver	2010/02/10	EP07744158	2007/05/25
13PA01-053-03	JP5009982	JP	Granted	Multiple carrier transmitting device	2012/08/29	JP2009516088	2007/05/25
13PA01-053-04	US8249178	US	Granted	Multicarrier transmitter and multicarrier receiver	2012/08/21	US12/601804	2007/05/25
13PA01-	CA2127616	CA	Granted	Mobile communication unit	1999/02/09	CA2127616	1994/07/07

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13PA01-054-03	CN1074875	CN	Granted	Mobile communication unit	2001/11/14	CN94108731	1994/07/16
13PA01-054-02	CN1128555	CN	Granted	Mobile communication unit and method	2003/11/19	CN00135098	2000/12/11
13PA01-054-04	KR0126874	KR	Granted	Mobile communication system	1998/04/01	KR19940017210	1994/07/16
13PA01-054-05	US5583851	US	Granted	Mobile communication apparatus having multi-codes allocating function	1996/12/10	US08/272158	1994/07/08
13PA01-055-01	CA2127672	CA	Granted	Mobile radio system	2000/02/01	CA2127672	1994/07/08
13PA01-055-02	CN1068164	CN	Granted	Mobile radio system	2001/07/04	CN94107859	1994/07/15
13PA01-055-03	JP2942977	JP	Granted	Mobile communication equipment	1999/08/30	JP19901893	1993/07/16
13PA01-055-04	KR960016641	KR	Granted	Mobile communication equipment	1996/12/19	KR19940017085	1994/07/15
13PA01-055-05	US5873027	US	Granted	Mobile radio system with control over radio wave output if a malfunction is detected	1999/02/16	US08/761552	1996/12/06
13PA01-055-06	US6336040	US	Granted	Mobile radio system with control over radio wave output if a malfunction is detected	2002/01/01	US09/207662	1998/12/09
13PA01-056-01	DE69534524	DE	Granted	Verfahren und gerÃ¤t zur synchronisierung in einem direktsequenzspreizspektrumkommunikationssystem	2005/11/24	DE69534524	1995/08/16
13PA01-056-02	EP0701333	FR	Granted	Synchronisation method and apparatus for a direct sequence spread spectrum communications system	2005/10/19	EP95305717	1995/08/16
13PA01-056-03	EP0701333	GB	Granted	Synchronisation method and apparatus for a direct sequence spread spectrum communications system	2005/10/19	EP95305717	1995/08/16
13PA01-056-04	JP3142222	JP	Granted	Synchronization method and device for spread spectrum communication	2001/03/07	JP13494595	1995/06/01
13PA01-056-05	US5757870	US	Granted	Spread spectrum communication synchronizing method and its circuit	1998/05/26	US08/517408	1995/08/21
13PA01-056-06	US5818869	US	Granted	Spread spectrum communication synchronizing method and its circuit	1998/10/06	US08/858146	1997/05/15
13PA01-057-01	JP2863993	JP	Granted	Cdma radio multiplex sender and cdma radio multiplex transmitter	1999/03/03	JP15585595	1995/06/22
13PA01-057-02	US6175558	US	Granted	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	2001/01/16	US09/000947	1997/12/30

13PA01-057-03	US6301237	US	Granted	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	2001/10/09	US09/562921	2000/05/02
13PA01-057-05	US6370131	US	Granted	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	2002/04/09	US09/576250	2000/05/24
13PA01-057-04	US6529492	US	Granted	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	2003/03/04	US09/562922	2000/05/02
13PA01-057-07	US6549526	US	Granted	Cdma radio multiplex transmitting device and a cdma multiplex receiving device	2003/04/15	US09/826005	2001/04/05
13PA01-057-06	US6584088	US	Granted	Cdma radio multiplex transmitting device and cdma radio multiplex receiving device	2003/06/24	US09/825998	2001/04/05
13PA01-057-08	US7136367	US	Granted	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	2006/11/14	US10/335916	2003/01/03
13PA01-057-09	USRE41444	US	Granted	Cdma radio multiplex transmitting device and a cdma radio multiplex receiving device	2010/07/20	US12/270499	2008/11/13
13PA01-058-01	CA2246168	CA	Granted	Pn code generating apparatus and mobile radio communication system	2002/11/19	CA2246168	1998/08/31
13PA01-058-02	CA2246168A1	CA	Precursor	Pn code generating apparatus and mobile radio communication system	1999/03/02	CA2246168	1998/08/31
13PA01-058-03	CN100379299	CN	Granted	Pn code producing method and device	2008/04/02	CN02127365	1998/08/27
13PA01-058-04	CN1094019	CN	Granted	Pn code generating device and mobile radio communication system	2002/11/06	CN98118564	1998/08/27
13PA01-058-05	DE69838572	DE	Granted	Pn-kodegenerator	2007/11/29	DE69838572	1998/08/27
13PA01-058-12	EP0901236	FI	Granted	Pn code generator	2007/10/17	EP98116233	1998/08/27
13PA01-058-13	EP0901236	FR	Granted	Pn code generator	2007/10/17	EP98116233	1998/08/27
13PA01-058-14	EP0901236	GB	Granted	Pn code generator	2007/10/17	EP98116233	1998/08/27
13PA01-058-15	EP0901236	SE	Granted	Pn code generator	2007/10/17	EP98116233	1998/08/27
13PA01-058-07	EP1835617	DE	EP-Designated	Pn code generation apparatus and method thereof	2007/10/31	EP07108762	1998/08/27
13PA01-058-06	EP1835617	EP	EP-Pending	Pn code generation apparatus and method thereof	2007/10/31	EP07108762	1998/08/27
13PA01-058-10	EP1835617	FI	EP-Designated	Pn code generation apparatus and method thereof	2007/10/31	EP07108762	1998/08/27
13PA01-058-08	EP1835617	FR	EP-Designated	Pn code generation apparatus and method thereof	2007/10/31	EP07108762	1998/08/27

13PA01-058-09	EP1835617	GB	EP-Designated	Pn code generation apparatus and method thereof	2007/10/31	EP07108762	1998/08/27
13PA01-058-11	EP1835617	SE	EP-Designated	Pn code generation apparatus and method thereof	2007/10/31	EP07108762	1998/08/27
13PA01-058-16	JP3329705	JP	Granted	Pn code generator and mobile radio communication system	2002/09/30	JP25287297	1997/09/02
13PA01-058-17	US6295301	US	Granted	Pn code generating apparatus and mobile radio communication system	2001/09/25	US09/139325	1998/08/25
13PA01-058-18	US6697384	US	Granted	Method and apparatus for calculating a state of starting a pn code generating operation	2004/02/24	US09/916284	2001/07/30
13PA01-059-01	AU8243498	AU	Lapsed	Cdma mobile station and cdma transmission method	1999/02/10	AU8243498	1998/07/16
13PA01-059-02	CA2266104	CA	Granted	Cdma mobile station and cdma transmission method	2003/09/30	CA2266104	1998/07/16
13PA01-059-03	CA2429736	CA	Lapsed	Cdma mobile station apparatus and cdma transmission method	1999/01/28	CA2429736	1998/07/16
13PA01-059-04	CN100442686	CN	Granted	Cdma mobile station equipment and cdma transmitting method	2008/12/10	CN03108352	1998/07/16
13PA01-059-05	CN1109476	CN	Granted	Cdma mobile station apparatus and cdma transmission method	2003/05/21	CN98801017	1998/07/16
13PA01-059-06	DE69831726	DE	Granted	Cdma mobile station und cdma Ãœbertragungsverfahren	2006/02/09	DE69831726	1998/07/16
13PA01-059-07	EP0936831	FR	Granted	Cdma mobile station and cdma transmission method	2005/09/28	EP98932553	1998/07/16
13PA01-059-08	EP0936831	GB	Granted	Cdma mobile station and cdma transmission method	2005/09/28	EP98932553	1998/07/16
13PA01-059-09	EP0936831	IT	Granted	Cdma mobile station and cdma transmission method	2005/09/28	EP98932553	1998/07/16
13PA01-059-10	EP0936831	NL	Granted	Cdma mobile station and cdma transmission method	2005/09/28	EP98932553	1998/07/16
13PA01-059-11	ES2251091	ES	Granted	Estacion movil cdma y procedimiento de transmision cdma.	2006/04/16	ES98932553	1998/07/16
13PA01-059-12	JP3655057	JP	Granted	Cdma mobile transmitting device and transmitting method using the device	2005/06/02	JP20964297	1997/07/19
13PA01-059-14	US20030007472	US	Lapsed	Cdma mobile station apparatus and cdma transmission method	2003/01/09	US10/235918	2002/09/06
13PA01-059-13	US6466563	US	Granted	Cdma mobile station and cdma transmission method	2002/10/15	US09/147831	1999/03/16
13PA01-060-02	CN100353693	CN	Granted	Cdma radio communication apparatus	2007/12/05	CN200410059002	1998/07/17
13PA01-060-03	CN1113497	CN	Granted	Radio communication terminal apparatus	2003/07/02	CN98116336	1998/07/17
13PA01-060-01	CN1167219	CN	Granted	Cdma radio communication equipment	2004/09/15	CN02102800	1998/07/17
13PA01-060-04	DE69825370	DE	Granted	Cdma funknachrichtenÃ¼bertragungsgerÃ¤t	2004/09/09	DE69825370	1998/07/15

13PA01-060-05	DE69839197	DE	Granted	Synchronisationsverfahren in einem kodemultiplexvielfachzugriffsystem	2008/04/10	DE69839197	1998/07/15
13PA01-060-15	EP0892503	FR	Granted	Cdma radio communication apparatus	2005/01/05	EP98113191	1998/07/15
13PA01-060-16	EP0892503	GB	Granted	Cdma radio communication apparatus	2005/01/05	EP98113191	1998/07/15
13PA01-060-17	EP0892503	IT	Granted	Cdma radio communication apparatus	2005/01/05	EP98113191	1998/07/15
13PA01-060-06	EP1447918	FR	Granted	A synchronization method for a cdma system	2008/02/27	EP04012123	1998/07/15
13PA01-060-07	EP1447918	GB	Granted	A synchronization method for a cdma system	2008/02/27	EP04012123	1998/07/15
13PA01-060-08	EP1447918	IT	Granted	A synchronization method for a cdma system	2008/02/27	EP04012123	1998/07/15
13PA01-060-10	EP1914904	DE	EP-Designated	A cdma radio communication system and a transmission apparatus for such a system	2008/04/23	EP08100709 (DE69843248)	1998/07/15
13PA01-060-09	EP1914904	EP	EP-Pending	A cdma radio communication system and a transmission apparatus for such a system	2008/04/23	EP08100709	1998/07/15
13PA01-060-13	EP1914904	ES	EP-Designated	A cdma radio communication system and a transmission apparatus for such a system	2008/04/23	EP08100709	1998/07/15
13PA01-060-11	EP1914904	FR	EP-Designated	A cdma radio communication system and a transmission apparatus for such a system	2008/04/23	EP08100709	1998/07/15
13PA01-060-12	EP1914904	GB	EP-Designated	A cdma radio communication system and a transmission apparatus for such a system	2008/04/23	EP08100709	1998/07/15
13PA01-060-14	EP1914904	IT	EP-Designated	A cdma radio communication system and a transmission apparatus for such a system	2008/04/23	EP08100709	1998/07/15
13PA01-060-19	ES2226037	ES	Granted	Aparato de comunicacion por radio cdma.	2005/03/16	ES98113191	1998/07/15
13PA01-060-18	ES2301896	ES	Granted	Procedimiento de sincronizacion para un sistema cdma.	2008/07/01	ES04012123	1998/07/15
13PA01-060-20	US6370134	US	Granted	Cdma radio communication apparatus	2002/04/09	US09/115502	1998/07/15
13PA01-060-21	US7035233	US	Granted	Radio communication terminal apparatus and radio communication base station apparatus	2006/04/25	US10/014352	2001/12/14
13PA01-060-22	US7535864	US	Granted	Radio communication terminal apparatus and radio communication base station apparatus	2009/05/19	US11/372152	2006/03/10
13PA01-061-01	CA2127606	CA	Granted	Code-division multiple-access mobile telephone system	2001/12/18	CA2127606	1994/07/07
13PA01-061-02	CN1075911	CN	Granted	Automobile on-board and/or portable telephone system	2001/12/05	CN94108729	1994/07/16

13PA01-061-03	CN1102022	CN	Granted	Automobile on-board and/or portable telephone system	1995/04/26	CN94108729	1994/07/16
13PA01-061-04	JP2863975	JP	Granted	Automobile-portable telephone system	1999/03/03	JP19901393	1993/07/16
13PA01-061-05	KR0126628	KR	Granted	Mobile communications system	1998/04/03	KR19940017209	1994/07/16
13PA01-061-06	US5677929	US	Reissue-Surrendered	Automobile on-board and/or portable telephone system	1997/10/14	US08/272156	1994/07/08
13PA01-061-07	USRE37420	US	Granted	Automobile on-board and/or portable telephone system	2001/10/23	US09/337403	1999/06/21
13PA01-061-08	USRE39954	US	Granted	Automobile on-board and/or portable telephone system	2007/12/25	US09/887042	2001/06/25
13PA01-062-02	CN100364247	CN	Granted	Method for controlling transmission power	2008/01/23	CN200410045794	2001/06/25
13PA01-062-01	CN1158790	CN	Granted	Communication terminal apparatus	2004/07/21	CN01802160	2001/06/25
13PA01-062-03	DE60110020	DE	Granted	KommunikationsendgerÃ„t	2005/09/08	DE60110020	2001/06/25
13PA01-062-04	DE60116907	DE	Granted	KommunikationsendgerÃ¤t	2006/07/20	DE60116907	2001/06/25
13PA01-062-11	DE60147140	DE	Granted	Communication terminal apparatus	2012/09/19	EP05025574	2001/06/25
13PA01-062-05	EP1204225	FR	Granted	Communication terminal apparatus	2005/04/13	EP01941209	2001/06/25
13PA01-062-06	EP1204225	GB	Granted	Communication terminal apparatus	2005/04/13	EP01941209	2001/06/25
13PA01-062-07	EP1523111	FR	Granted	Communication terminal apparatus	2006/01/25	EP05000430	2001/06/25
13PA01-062-08	EP1523111	GB	Granted	Communication terminal apparatus	2006/01/25	EP05000430	2001/06/25
13PA01-062-09	EP1630972	FR	Granted	Communication terminal apparatus	2012/09/19	EP05025574	2001/06/25
13PA01-062-10	EP1630972	GB	Granted	Communication terminal apparatus	2012/09/19	EP05025574	2001/06/25
13PA01-062-14	JP2003298510	JP	Lapsed	Method for controlling transmission power	2003/10/17	JP2003064021	2003/03/10
13PA01-062-12	JP3426194	JP	Granted	Base station device, communication terminal device, and communication method	2003/07/14	JP2000231256	2000/07/31
13PA01-062-15	JP4431189	JP	Granted	Radio communication device, radio communication method, and radio communication system	2010/03/10	JP2009197228	2009/08/27
13PA01-062-16	JP4431190	JP	Granted	Radio communication device, radio communication method, and radio communication system	2010/03/10	JP2009197229	2009/08/27
13PA01-062-17	JP4431191	JP	Granted	Radio communication system and radio communication method	2010/03/10	JP2009197230	2009/08/27
13PA01-062-13	JP4511783	JP	Granted	Base station equipment, communication terminal unit,	2010/07/28	JP2002367259	2002/12/18

				and communication method			
13PA01-062-19	US20030087644	US	Lapsed	Communication terminal apparatus and base station apparatus	2003/05/08	US10/322425	2002/12/19
13PA01-062-20	US20060121930	US	Precursor	Communication terminal apparatus and base station apparatus	2006/06/08	US11/341430	2006/01/30
13PA01-062-22	US20080261545	US	Precursor	Communication terminal apparatus and base station apparatus	2008/10/23	US12/132992	2008/06/04
13PA01-062-18	US6738646	US	Granted	Base station device and method for communication	2004/05/18	US10/069267	2002/02/25
13PA01-062-21	US7460880	US	Granted	Communication terminal apparatus and base station apparatus	2008/12/02	US11/341430	2006/01/30
13PA01-062-23	US7761113	US	Granted	Communication terminal apparatus and base station apparatus	2010/07/20	US12/132992	2008/06/04
13PA01-063-01	AU7769801	AU	Lapsed	Communication terminal, base station device, and radio communication method	2002/02/18	AU2001277698	2001/08/02
13PA01-063-02	CN100469169	CN	Granted	Communication terminal device and radio communication method	2009/03/11	CN01802181	2001/08/02
13PA01-063-03	CN1386388	CN	Granted	Communication terminal, base station device, and radio communication method	2002/12/18	CN01802181	2001/08/02
13PA01-063-04	DE60134208	DE	Granted	Nkkommunikationsverfahren	2008/07/10	DE60134208	2001/08/02
13PA01-063-05	EP1217861	FR	Granted	Communication terminal, base station device, and radio communication method	2008/05/28	EP01955557	2001/08/02
13PA01-063-06	EP1217861	GB	Granted	Communication terminal, base station device, and radio communication method	2008/05/28	EP01955557	2001/08/02
13PA01-063-08	EP1976141	DE	EP-Designated	Communication terminal apparatus, base station apparatus, and radio communication method	2008/10/01	EP08004604	2001/08/02
13PA01-063-07	EP1976141	EP	EP-Pending	Communication terminal apparatus, base station apparatus, and radio communication method	2008/10/01	EP08004604	2001/08/02
13PA01-063-09	EP1976141	FR	EP-Designated	Communication terminal apparatus, base station apparatus, and radio communication method	2008/10/01	EP08004604	2001/08/02
13PA01-063-10	EP1976141	GB	EP-Designated	Communication terminal apparatus, base station apparatus, and radio communication method	2008/10/01	EP08004604	2001/08/02

13PA01-063-13	JP2003224516	JP	Granted	Communication terminal apparatus, base station apparatus and radio communication method	2003/08/08	JP2002367213	2002/12/18
13PA01-063-12	JP2003224888	JP	Non-applicable	Communication terminal	2003/08/08	JP2002367212	2002/12/18
13PA01-063-14	JP2009284537	JP	Granted	Transmission method, receiving method, and radio communication method	2009/12/03	JP2009197375	2009/08/27
13PA01-063-11	JP3426200	JP	Granted	Communication terminal device, base station device and radio communication method	2003/07/14	JP2000285405	2000/09/20
13PA01-063-15	JP4536821	JP	Granted	Transmission apparatus, receiving apparatus and wireless communication system	2010/09/01	JP2009197376	2009/08/27
13PA01-063-16	US6760590	US	Granted	Communication terminal apparatus, base station apparatus, and radio communication method	2004/07/06	US10/089605	2002/04/01
13PA01-063-17	US6799053	US	Granted	Communication terminal apparatus	2004/09/28	US10/321500	2002/12/18
13PA01-063-18	US7206587	US	Granted	Communication terminal apparatus, base station apparatus, and radio communication method	2007/04/17	US10/321623	2002/12/18

Unique ID	Patent Number	Country	Portfolio Status	Title	Issue / Publication Date	Application Number	Filing Date
14NC01-001-01	CN1262139	CN	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2006/06/28	CN00819795.4	2000/08/10
14NC01-001-02	DE60023359	DE	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2006/07/06	EP00956419.6	2000/08/10
14NC01-001-03	FR1310129	FR	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2005/10/19	EP00956419.6	2000/08/10
14NC01-001-04	GB1310129	GB	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2005/10/19	EP00956419.6	2000/08/10
14NC01-001-05	KR693394	KR	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2007/03/12	KR7001821/2003	2000/08/10
14NC01-001-08	PCT/EP00/07779	WO	Precursor			PCT/EP00/07779	2000/08/10
14NC01-001-06	RU2262213	RU	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2005/10/10	RU2003103593	2000/08/10
14NC01-001-07	US7925762	US	Granted	SERVICE & OTHER INFORMATION TRANSFER FROM E.G. VISITED NETWORK TO HOME NETWORK INR00 REFERENCE ARCHITECTURE	2011/04/12	US10/343707	2000/08/10
14NC01-002-02	CN100473217	CN	Granted	Communication network system and network device thereof and method of providing communication	2009/03/25	CN01817056	2001/10/09
14NC01-002-04	PCT/EP00/09886	WO	Precursor			PCT/EP00/09886	2000/10/09
14NC01-002-03	PCT/EP01/11656	WO	Precursor			PCT/EP01/11656	2001/10/09
14NC01-002-01	US7623529	US	Granted	NETWORK INITIATED DEREGISTRATION FROM IP MULTIMEDIA SERVICES	2009/11/24	US10/398575	2001/10/09
14NC01-003-01	AT1346558	AT	Granted	PREPAID SERVER	2007/08/15	EP00987457.9	2000/12/22
14NC01-003-02	BRPI0017382	BR	Pending	PREPAID SERVER	2003/10/21	BRPI0017382.7	2000/12/22
14NC01-003-03	CA2428329	CA	Granted	PREPAID SERVER	2007/05/29	CA2428329	2000/12/22
14NC01-003-04	CH1346558	CH	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22

14NC01-003-05	CN1279741	CN	Granted	PREPAID SERVER	2007/07/11	CN00820083.1	2000/12/22
14NC01-003-06	DE60035531	DE	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22
14NC01-003-07	ES1346558	ES	Granted	PREPAID SERVER	2008/01/16	EP00987457.9	2000/12/22
14NC01-003-08	FR1346558	FR	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22
14NC01-003-09	GB1346558	GB	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22
14NC01-003-10	IT1346558	IT	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22
14NC01-003-11	NL1346558	NL	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22
14NC01-003-16	PCT/EP00/013248	WO	Precursor			PCT/EP00/013248	2000/12/22
14NC01-003-12	SE1346558	SE	Granted	PREPAID SERVER	2007/07/11	EP00987457.9	2000/12/22
14NC01-003-13	TR200706776T4	TR	Granted	PREPAID SERVER	2007/07/11	TR00987457.9	2000/12/22
14NC01-003-14	US11/448122	US	Not owned by INVT	PREPAID SERVER		US11/448122	2006/06/07
14NC01-003-15	US7065339	US	Granted	PREPAID SERVER	2006/06/20	US10/451236	2000/12/22
14NC01-004-01	DE60109066	DE	Granted	MULTIPLEXING SIP CALL CONTROL CONTENT OVER SUCCESSIVE SIP MESSAGES	2006/04/13	EP01929406.5	2001/03/05
14NC01-004-02	GB1368946	GB	Granted	MULTIPLEXING SIP CALL CONTROL CONTENT OVER SUCCESSIVE SIP MESSAGES	2005/02/23	EP01929406.5	2001/03/05
14NC01-004-04	PCT/EP01/02473	WO	Precursor			PCT/EP01/02473	2001/03/05
14NC01-004-03	US7991894	US	Granted	MULTIPLEXING SIP CALL CONTROL CONTENT OVER SUCCESSIVE SIP MESSAGES	2011/08/02	US10/469787	2001/03/05
14NC01-005-02	PCT/EP01/06517	WO	Precursor			PCT/EP01/06517	2002/12/20
14NC01-005-01	US7304966	US	Granted	Accessing ip multimedia subsystem	2007/12/04	US10/479457	2003/12/02
14NC01-006-02	PCT/IB02/04029	WO	Precursor			PCT/IB02/04029	2002/01/10
14NC01-006-01	US6888828	US	Granted	SERVICE EXECUTION SERVER CHAINING	2005/05/03	US09/967927	2001/10/02
14NC01-007-01	DE60046674	DE	Granted	AN INTER-WORKING UNIT (GATEWAY) BETWEEN AAL2 (ATM) BASED RANAND RTP MULTIPLEXING (IP) BASED RAN IN 3G CELLULAR ACCESS NETWORKS	2011/11/16	EP00965599.4	2000/08/09
14NC01-007-02	JP2003507936	JP	Lapsed	AN INTER-WORKING UNIT (GATEWAY) BETWEEN AAL2 (ATM) BASED RANAND RTP MULTIPLEXING	2003/02/25	JP2001-517771	2000/08/09

				(IP) BASED RAN IN 3G CELLULAR ACCESS NETWORKS			
14NC01-007-04	PCT/US00/40606	WO	Precursor			PCT/US00/40606	2000/09/08
14NC01-007-03	US6801542	US	Granted	AN INTER-WORKING UNIT (GATEWAY) BETWEEN AAL2 (ATM) BASED RANAND RTP MULTIPLEXING (IP) BASED RAN IN 3G CELLULAR ACCESS NETWORKS	2004/10/05	US09/377263	1999/08/19
14NC01-008-01	BRPI0614221	BR	Pending	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/03/15	BRPI0614221.4	2006/07/11
14NC01-008-02	CN101223756B	CN	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/11/30	CN200680025371.9	2006/07/11
14NC01-008-13	EP1905212	DE	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/04/20	EP06795099.8	2006/07/11
14NC01-008-03	EP1905212	EP	PreCursor (EP)	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/04/20	EP06795099.8	2006/07/11
14NC01-008-14	EP1905212	FR	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/04/20	EP06795099.8	2006/07/11
14NC01-008-15	EP1905212	GB	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/04/20	EP06795099.8	2006/07/11
14NC01-008-04	IDW00200800123	ID	Pending	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2007/01/18	IDW00200800123	2006/07/11
14NC01-008-05	KR1026155	KR	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/04/05	KR2008-7003214	2006/07/11
14NC01-008-06	MX282232	MX	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2008/03/14	MXMX/a/2008/000568	2006/07/11
14NC01-008-16	PCT/IB06/001915	WO	Precursor			PCT/IB06/001915	2006/07/11
14NC01-008-07	PH1-2007-502943	PH	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2007/01/18	PH1-2007-502943	2006/07/11
14NC01-008-08	RU2384004	RU	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2010/03/10	RU2008100148	2006/07/11
14NC01-008-09	SG139065	SG	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2011/04/15	SG200800268.5	2006/07/11
14NC01-008-10	US8681751	US	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2014/03/25	US11/348896	2006/02/07
14NC01-008-11	VN1-2008-00326	VN	Pending	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING	2007/04/05	VN1-2008-00326	2006/07/11

				FOR AVAILABILITY CHANGE			
14NC01-008-12	ZA200800233	ZA	Granted	EXTENDING <STATUS> PRESENCE ATTRIBUTE TO DEFINE REASONING FOR AVAILABILITY CHANGE	2008/12/31	ZA2008/0233	2006/07/11
14NC01-009-01	EP1338152	FR	Granted	3RD GEN MOBILITY USING SIP	2008/11/19	EP1338152	2001/11/21
14NC01-009-03	PCT/IB01/02196	WO	Precursor			PCT/IB01/02196	2001/11/21
14NC01-009-02	US6904035	US	Granted	3RD GEN MOBILITY USING SIP	2005/06/07	US09/991540	2001/11/14
14NC01-010-01	CN1539106	CN	Granted	THREE-PARTY AUTHENTICATION AND AUTHORIZATION SCHEME FOR INTERNET PROTOCLVERSION 6.	2010/05/12	CN02815394.4	2002/07/11
14NC01-010-04	EP1415212	DE	EP-Designated	THREE-PARTY AUTHENTICATION AND AUTHORIZATION SCHEME FOR INTERNET PROTOCLVERSION 6.	2009/12/09	EP02749143.0	2002/07/11
14NC01-010-02	EP1415212	EP	EP-Pending	THREE-PARTY AUTHENTICATION AND AUTHORIZATION SCHEME FOR INTERNET PROTOCLVERSION 6.	2009/12/09	EP02749143.0	2002/07/11
14NC01-010-05	EP1415212	FR	EP-Designated	THREE-PARTY AUTHENTICATION AND AUTHORIZATION SCHEME FOR INTERNET PROTOCLVERSION 6.	2009/12/09	EP02749143.0	2002/07/11
14NC01-010-06	EP1415212	GB	EP-Designated	THREE-PARTY AUTHENTICATION AND AUTHORIZATION SCHEME FOR INTERNET PROTOCLVERSION 6.	2009/12/09	EP02749143.0	2002/07/11
14NC01-010-07	PCT/IB02/02702	WO	Precursor			PCT/IB02/02702	2002/07/11
14NC01-010-03	US7900242	US	Granted	THREE-PARTY AUTHENTICATION AND AUTHORIZATION SCHEME FOR INTERNET PROTOCLVERSION 6.	2011/03/01	US10/192753	2002/07/09
14NC01-011-01	CN100571461	CN	Granted	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2009/12/16	CN200480000385.6	2004/02/17
14NC01-011-07	EP1595418	DE	EP-Designated	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2005/11/16	EP04711676.9	2004/02/17
14NC01-011-02	EP1595418	EP	EP-Pending	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2005/11/16	EP04711676.9	2004/02/17
14NC01-011-08	EP1595418	FR	EP-Designated	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2005/11/16	EP04711676.9	2004/02/17
14NC01-011-09	EP1595418	GB	EP-Designated	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2005/11/16	EP04711676.9	2004/02/17
14NC01-011-03	IDP0030947	ID	Granted	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2004/09/02	IDW00200501937	2004/02/17
14NC01-011-04	IN200403049	IN	Pending	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2006/02/17	IN03049/CHENP/2004	2004/02/17
14NC01-011-10	PCT/IB04/000551	WO	Precursor			PCT/IB04/000551	2004/02/17
14NC01-011-05	SG115865	SG	Granted	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2007/08/31	SG200406163.6	2004/02/17

14NC01-011-06	US7917620	US	Granted	EXTENDING THE TRUSTED NETWORK CONCEPT IN IMS	2011/03/29	US10/614343	2003/07/08
14NC01-012-01	AU2005232140	AU	Granted	SESSION PROGRESS INDICATION IN POC FOR MANUAL ANSWER MODE	2009/10/01	AU2005232140	2005/03/17
14NC01-012-02	CN1961595	CN	Granted	SESSION PROGRESS INDICATION IN POC FOR MANUAL ANSWER MODE	2011/12/21	CN200580017529.3	2005/03/17
14NC01-012-03	IN200605988	IN	Pending	SESSION PROGRESS INDICATION IN POC FOR MANUAL ANSWER MODE	2007/08/24	IN5988/DELNP/2006	2005/03/17
14NC01-012-04	KR0924513	KR	Granted	SESSION PROGRESS INDICATION IN POC FOR MANUAL ANSWER MODE	2009/11/02	KR2006-7023181	2005/03/17
14NC01-012-05	PCT/IB05/000694	WO	Precursor			PCT/IB05/000694	2005/03/17
14NC01-013-01	CN101385313	CN	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2012/09/05	CN200780005866.X	2007/01/22
14NC01-013-02	DE602007033333	DE	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-10	EP1987649	CH	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-03	EP1987649	EP	Precursor(EP)	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-12	EP1987649	FR	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-04	EP1987649	GB	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-11	EP1987649	IE	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-14	EP1987649	LI	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-13	EP1987649	LU	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-06	EP1987649	NL	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2013/10/16	EP07700656.7	2007/01/22
14NC01-013-05	IN200806684	IN	Pending	IMS-CS INTERWORKING FOR VIDEO CALLS	2008/10/24	IN6684/DELNP/2008	2007/01/22
14NC01-013-16	PCT/IB07/050209	WO	Precursor			PCT/IB07/050209	2007/01/22
14NC01-013-15	RU2408998	RU	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS		RU2008132295A	2007/01/22
14NC01-013-07	SG145112	SG	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2008/09/29	SG200805775.4	2007/01/22
14NC01-013-08	TH0701000284	TH	Pending	IMS-CS INTERWORKING FOR VIDEO CALLS	2007/11/15	TH0701000284	2007/01/23
14NC01-013-09	US7860102	US	Granted	IMS-CS INTERWORKING FOR VIDEO CALLS	2010/12/28	US11/508258	2006/08/23
14NC01-014-01	CN101444062	CN	Granted	CARRYING TRUSTED NETWORK PROVIDED ACCESS NETWORK INFO IN SIP	2012/03/21	CN200780010857.X	2007/03/27
14NC01-014-04	EP1999929	DE	EP-Designated	CARRYING TRUSTED NETWORK PROVIDED ACCESS NETWORK INFO IN SIP	2008/12/10	EP7734087.5	2007/03/26
14NC01-014-02	EP1999929	EP	EP-Pending	CARRYING TRUSTED NETWORK PROVIDED ACCESS NETWORK INFO	2008/12/10	EP7734087.5	2007/03/26

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14NC01-014-05	EP1999929	FR	EP-Designated	CARRYING TRUSTED NETWORK PROVIDED ACCESS NETWORK INFO IN SIP	2008/12/10	EP7734087.5	2007/03/26
14NC01-014-06	EP1999929	GB	EP-Designated	CARRYING TRUSTED NETWORK PROVIDED ACCESS NETWORK INFO IN SIP	2008/12/10	EP7734087.5	2007/03/26
14NC01-014-07	PCT/IB07/000758	WO	Precursor			PCT/IB07/000758	2007/03/26
14NC01-014-03	US20080039085	US	Pending	CARRYING TRUSTED NETWORK PROVIDED ACCESS NETWORK INFO IN SIP	2008/02/14	US11/691417	2007/03/26
14NC01-015-01	CN101523858	CN	Pending	DHT-BASED CORE IMS NETWORK	2014/03/26	CN200780038286.0	2007/09/11
14NC01-015-04	EP2062422	DE	EP-Designated	DHT-BASED CORE IMS NETWORK	2014/03/26	EP07803743.9	2007/09/11
14NC01-015-02	EP2062422	EP	EP-Pending	DHT-BASED CORE IMS NETWORK	2014/03/26	EP07803743.9	2007/09/11
14NC01-015-05	EP2062422	FR	EP-Designated	DHT-BASED CORE IMS NETWORK	2014/03/26	EP07803743.9	2007/09/11
14NC01-015-06	EP2062422	GB	EP-Designated	DHT-BASED CORE IMS NETWORK	2014/03/26	EP07803743.9	2007/09/11
14NC01-015-07	PCT/FI07/050482	WO	Precursor			PCT/FI07/050482	2007/09/11
14NC01-015-03	US7796990	US	Granted	DHT-BASED CORE IMS NETWORK	2010/09/14	US11/520655	2006/09/14
14NC01-016-01	US7822035	US	Granted	SIP COMMUNICATION SERVICE IDENTIFIERS	2010/10/26	US11/715209	2007/03/07

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT3287224

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	CHANGE OF NAME

CONVEYING PARTY DATA

Name	Execution Date
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.	10/01/2008

RECEIVING PARTY DATA

Name:	PANASONIC CORPORATION
Street Address:	1006 OAZA KADOMA
Internal Address:	KADOMA-SHI
City:	OSAKA
State/Country:	JAPAN
Postal Code:	571-8501

PROPERTY NUMBERS Total: 38

Property Type	Number
Patent Number:	6726297
Patent Number:	8270332
Patent Number:	6637001
Patent Number:	6734810
Patent Number:	6922159
Patent Number:	6940428
Patent Number:	6069884
Patent Number:	6119004
Patent Number:	6069924
Patent Number:	6636723
Patent Number:	6628630
Patent Number:	6404778
Patent Number:	6839335
Patent Number:	6868056
Patent Number:	6944208
Patent Number:	6781973
Patent Number:	7145886
Patent Number:	6847828
Patent Number:	7386321

Property Type	Number
Patent Number:	7266118
Patent Number:	6876870
Patent Number:	7392019
Patent Number:	7339949
Patent Number:	7114121
Patent Number:	7162206
Patent Number:	5583851
Patent Number:	5757870
Patent Number:	5818869
Patent Number:	6295301
Patent Number:	6697384
Patent Number:	6466563
Patent Number:	5677929
Patent Number:	RE37420
Patent Number:	RE39954
Patent Number:	7460880
Patent Number:	6760590
Patent Number:	6799053
Patent Number:	7206587

CORRESPONDENCE DATA

Fax Number: (408)389-3510

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 4083893510

Email: paul@inventergy.com

Correspondent Name: PAUL ROBERTS

Address Line 1: 900 E. HAMILTON AVE.

Address Line 2: SUITE 180

Address Line 4: CAMPBELL, CALIFORNIA 95008

NAME OF SUBMITTER:	PAUL A. ROBERTS
SIGNATURE:	/Paul A. Roberts/
DATE SIGNED:	03/27/2015
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 6

source=Matsushita-Panasonic Name Change 2008-10-01#page1.tif
source=Matsushita-Panasonic Name Change 2008-10-01#page2.tif
source=Matsushita-Panasonic Name Change 2008-10-01#page3.tif
source=Matsushita-Panasonic Name Change 2008-10-01#page4.tif
source=Matsushita-Panasonic Name Change 2008-10-01#page5.tif

source=Matsushita-Panasonic Name Change 2008-10-01#page6.tif

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Friday, March 27, 2015

CONFIRMATION OF CHANGE OF NAME:
MATSUSHITA TO PANASONIC

To the best of Inventergy's knowledge, a prior owner, Matsushita Electronic Industrial Co., Ltd., of the patents listed on the attached Appendix A had undergone a name change to Panasonic Corporation.

This name change is evidenced by the attached documents in Appendix B - NAME CHANGE CONFIRMATION, which includes:
(1) a copy of the official (original language) name change from Matsushita Electronic Industrial Co., Ltd. to Panasonic Corporation, and
(2) an English language translation titled "Partial Certificate of Current and Past Registration".

The documents in Appendix B - NAME CHANGE CONFIRMATION were received by Inventergy on March 26, 2015 from Panasonic Corporation.

Similar Name Change documents were filed in other cases formerly owned by Matsushita Electronic Industrial Co., Ltd. to Panasonic Corporation, such as that recorded at the USPTO at Reel /Frames: 33034-282 and 33777-873.

Therefore, Inventergy is filing these documents to evidence the name change and clarify chain of title in the Appendix A patents, which Inventergy previously purchased from Panasonic Corporation and recorded at the USPTO.

Inventergy, Inc.

By: Paul A. Roberts
Name: Paul A. Roberts
(US Patent Attorney Registration # 40,289)
Title: VP, Chief Patent Counsel

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APPENDIX A:
Patents Assigned to Inventergy

Inventergy Family Number	Patent Number	Filing Date	Inventergy Unique ID
13PA01-001	US6726297	2000-01-20	13PA01-001-09
13PA01-010	US8270332	2007-10-12	13PA01-010-09
13PA01-012	US6637001	2000-08-30	13PA01-012-01
13PA01-014	US6734810	2002-09-10	13PA01-014-05
	US6922159	2004-03-08	13PA01-014-07
	US6940428	2004-03-08	13PA01-014-06
13PA01-015	US6069884	1997-09-24	13PA01-015-08
13PA01-016	US6119004	1998-05-13	13PA01-016-10
13PA01-017	US6069924	1998-02-20	13PA01-017-06
13PA01-018	US6636723	1999-07-22	13PA01-018-11
13PA01-019	US6628630	1998-04-13	13PA01-019-14
13PA01-020	US6404778	1998-09-24	13PA01-020-02
13PA01-023	US6839335	2000-06-29	13PA01-023-05
13PA01-025	US6868056	2000-08-09	13PA01-025-09
13PA01-026	US6944208	2001-09-17	13PA01-026-06
13PA01-027	US6781973	2000-03-30	13PA01-027-08
13PA01-028	US7145886	2001-07-25	13PA01-028-07
13PA01-029	US6847828	2002-02-27	13PA01-029-12
	US7386321	2004-03-08	13PA01-029-13
13PA01-030	US7266118	2002-05-14	13PA01-030-06
13PA01-032	US6876870	2002-07-24	13PA01-032-14
	US7392019	2005-02-10	13PA01-032-13
13PA01-033	US7339949	2002-08-19	13PA01-033-07
13PA01-038	US7114121	2003-11-20	13PA01-038-04
13PA01-039	US7162206	2003-07-03	13PA01-039-14
13PA01-054	US5583851	1994-07-08	13PA01-054-05
13PA01-056	US5757870	1995-08-21	13PA01-056-05
	US5818869	1997-05-15	13PA01-056-06
13PA01-058	US6295301	1998-08-25	13PA01-058-17
	US6697384	2001-07-30	13PA01-058-18
13PA01-059	US6466563	1999-03-16	13PA01-059-13

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13PA01-061	US5677929	1994-07-08	13PA01-061-06
	USRE37420	1999-06-21	13PA01-061-07
	USRE39954	2001-06-25	13PA01-061-08
13PA01-062	US7460880	2006-01-30	13PA01-062-21
13PA01-063	US6760590	2002-04-01	13PA01-063-16
	US6799053	2002-12-18	13PA01-063-17
	US7206587	2002-12-18	13PA01-063-18

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APPENDIX B:
NAME CHANGE CONFIRMATION

[2 pages attached]

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1006, Oaza Kadoma, Kadoma-shi, Osaka
Panasonic Corporation
Registration No.: 1200-01-158218

(Translation)

Partial Certificate of Current and Past Registration

Trade Name	Matsushita Electric Industrial Co., Ltd.	
	Panasonic Corporation	Amended on October 1, 2008 Registered on October 1, 2008
Principal Office	1006, Oaza Kadoma, Kadoma-shi, Osaka	
Method of Public Notice	Electronic public notices will be given at: http://Panasonic.co.jp/index3.html where electronic public notices could not be issued for an incident or any other unavoidable reason, public notice should be given in the *Nihon Keizai Shimbun*	Amended on June 25, 2009 Registered on July 8, 2009
Date of Incorporation	December 15, 1935	
Matters regarding Company with Board of Directors	Company with Board of Directors Registered on May 2, 2006, pursuant to the Article 136 of the Act No.87 of 2005	
Matters regarding Company with Auditors	Company with Auditors Registered on May 2, 2006, pursuant to the Article 136 of the Act No.87 of 2005	
Matters regarding Company with Board of Company Auditors	Company with Board of Company Auditors Registered on May 12, 2006	
Matters regarding Company with Accounting Auditors	Company with Accounting Auditors Registered on May 12, 2006	

This is to certify that the foregoing is a part of the registered information presently in effect.

Date: July 3, 2014

Osaka Legal Affairs Bureau
Registrar ANO, Sumihide

Document No. に 604038 * The underlined indicates information erased from the registry. 1/1

履歴事項一部証明書

大阪府門真市大字門真１００６番地
パナソニック株式会社
会社法人等番号　１２００－０１－１５８２１８

商　号	~~松下電器産業株式会社~~	
	パナソニック株式会社	平成２０年１０月　１日変更 平成２０年１０月　１日登記
本　店	大阪府門真市大字門真１００６番地	
公告をする方法	電子公告とする。 ｈｔｔｐ：／／ｐａｎａｓｏｎｉｃ．ｃｏ．ｊｐ／ｉｎｄｅｘ３．ｈｔｍｌ ただし、事故その他やむを得ない事由によって電子公告をすることができない場合は、日本経済新聞に掲載して行う。	平成２１年　６月２５日変更 平成２１年　７月　８日登記
会社成立の年月日	昭和１０年１２月１５日	
取締役会設置会社に関する事項	取締役会設置会社	平成１７年法律第８７号第１３６条の規定により平成１８年　５月　２日登記
監査役設置会社に関する事項	監査役設置会社	平成１７年法律第８７号第１３６条の規定により平成１８年　５月　２日登記
監査役会設置会社に関する事項	監査役会設置会社	平成１８年　５月１２日登記
会計監査人設置会社に関する事項	会計監査人設置会社	平成１８年　５月１２日登記

これは登記簿に記録されている閉鎖されていない事項の一部であることを証明した書面である。
（大阪法務局管轄）

平成２６年　７月　３日
大阪法務局
登記官　　　　　　　　阿　野　純　秀

整理番号　に６０４０３８　　＊　下線のあるものは抹消事項であることを示す。　　

AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court District of Delaware on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED 2/27/2017	U.S. DISTRICT COURT District of Delaware
PLAINTIFF Inventergy, Inc.		DEFENDANT HTC Corporation and HTC America, Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached Sheet		
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 6,466,563 B1	10/15/2002	Inventergy, Inc.
2 US 6,611,676 B2	8/26/2003	Inventergy, Inc.
3 US 7,206,587 B2	4/17/2007	Inventergy, Inc.
4 US 7,760,815 B2	7/20/2010	Inventergy, Inc.
5 US 7,764,711 B2	7/27/2010	Inventergy, Inc.
6 US 7,848,439 B2	12/7/2010	Inventergy, Inc.
7 US 6,760,590 B2	7/6/2004	Inventergy, Inc.

AO 120 (Rev. 08/10)

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED 2/24/2017	U.S. DISTRICT COURT District of Delaware
PLAINTIFF Inventergy, Inc.		DEFENDANT Apple Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached Sheet		
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
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4 US 7,760,815 B2	7/20/2010	Inventergy, Inc.
5 US 7,764,711 B2	7/27/2010	Inventergy, Inc.
6 US 7,848,439 B2	12/7/2010	Inventergy, Inc.
7 US 6,760,590 B2	7/6/2004	Inventergy, Inc.