FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NO. PHDE 000238
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. Application No. (if known, see 37 CFR 1.5) 10/089959
INTERNATIONAL APPLICATION NO. PCT/EP01/09258	INTERNATIONAL FILING DATE AUGUST 8, 2001	PRIORITY DATE CLAIMED AUGUST 8, 2000

TITLE OF INVENTION: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DEFFERENT STANDARDS IN THE SAME FREQUENCY BAND

APPLICANT(S) FOR DO/EO/US BERNHARD WALKE; STEFAN MANGOLD

Applicant(s) herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.

3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [ ] A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).

6. [ ] A translation of the International Application into English (35 U.S.C. 371(c)(2))

7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.

8. [ ] A translation of the amendment to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).

9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.

12. [X] An assignment document for recording. A separate cover sheet is compliance with 37 C.F.R. 3.28 and 3.31 is included.

13. [ ] A FIRST preliminary amendment.
    [ ] A SECOND OR SUBSEQUENT preliminary amendment.

14. [ ] A substitute specification.

15. [X] A change of power of attorney and/or address letter.

16. [X] Other items or information:
    Application as published (WO 02/13457 A2)
    3 Sheets of Formal Drawings

CERTIFICATE OF EXPRESS MAILING

Express Mail Mailing Label No. EL 686950531

Date of Deposit April 4, 2002

I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is adressed to the Commissioner of Patents and Trademarks, Washington D.C. 20231

Edna Chapa
Typed Name

Edna Chapa
Signature

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 10/089959	INTERNATIONAL APPLICATION NO. PCT/EP01/09258	ATTORNEY'S DOCKET NUMBER PHDE 000238

17 [X] The following fees are submitted:		CALCULATIONS (PTO USE ONLY)
BASIC NATIONAL FEE (37 C.F.R. 1.492(A)(1)-(5)):		
Search Report has been prepared by the EPO or JPO	$940.00	
International preliminary-examination fee paid to USPTO (37 C.F.R. 1.482)	$720.00	
No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)	$760.00	
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO	$970.00	
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	$ 96.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =		$970.00

Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).				$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	11 - 20 =		X $ 18.00	$	
Independent claims	3 - 3 =		X $ 78.00	$	
MULTIPLE DEPENDENT CLAIMS (if applicable)			+ $260.00	$	
TOTAL OF ABOVE CALCULATIONS =				$970.00	
Reductions by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 C.F.R. 1.9, 1.27, 1.28)				$	
SUBTOTAL =				$970.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28,3.31). $40.00 per property +				$40.00	
TOTAL FEES ENCLOSED =				$1,010.00	
				Amount to be refunded	$
				charged	$

a. [ ] A check in the amount $_____ to cover the above fees is enclosed.

b. [X] Please charge my Deposit Account No. 14-1270 in the amount of $1,010.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fee, with the exception of the Base Issue Fee, which may be required, or credit any overpayment to Deposit Account No. 14-1270. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Corporate Patent Counsel
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(SIGNATURE)

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(REGISTRATION NUMBER)

DATE OF MAILING:

April 4, 2002

Method, network and control station for the two-way alternate control of radio systems of different standards in the same frequency band

The invention relates to a method of alternate control of radio systems of different standards in the same frequency band.

A radio system for wireless transmission of information is allowed to use transmission power only in accordance with standards. The national regulation authority determines on what frequencies with what transmission power and in accordance with what radio interface standard a radio system is allowed to transmit. For this purpose there is provided for so-termed ISM frequency bands (Industrial Scientific Medical) that radio systems transmit in the same frequency band in accordance with different radio interface standards. An example of this is the US radio system IEEE802.11a and the European ETSI BRAN HiperLAN/2. The two radio systems transmit in the same frequency bands between 5.5 GHz and 5.875 GHz with approximately the same radio transmission method, but different transmission protocols.

In the event of interference, method were standardized for an active switching to another frequency within the permitted frequency band, for controlling transmission power and for the adaptive coding and modulation to reduce interference. Radio systems of wideband LANs of the radio interface standards ETSI BRAN HiperLAN/2 and IEEE802.11a utilize the same radio transmission method, a 64-carrier OFDM method and an adaptive modulation and coding. About the same modulation and coding methods (Link Adaptation, LA) are defined for the two standards.

The Medium Access Control (MAC) of the two systems is totally different. ETSI BRAN HiperLAN/2 utilizes a centrally controlled reservation-based method in which a radio station takes over the role of a central instance co-ordinating the radio resources. This central radio station (Access Point, AP) which may be an access point to the wide area network, periodically signals every 2 ms the MAC frame structure from the AP and the associated stations if required.

The IEEE802.11a standard describes a CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance) method not based on reservations, in which all the radio

stations listen in on the medium and assume that the channel is unused for a minimum duration (Short InterFrame Space, SIFS) before 802.11a-MAC frames, thus user data packets, are transmitted if necessary. The method is highly suitable for self-organizing ad hoc networks, but requires positive acknowledgements of all the packets. Measures supporting service quality (Point Coordination Function PCF) in addition allow the support of multimedia applications. Fig. 2 shows by way of example the sequence for media access in accordance with IEEE802.11a. In accordance with a variant of the standard a station is to then transmit an RTS packet (Ready To Send) and wait for a CTS packet (Clear To Send) from the addressed station before it is allowed to transmit user data. All the other stations in the radio coverage area set a time monitoring (Network Allocation Vector, NAV) and do not transmit until the addressed station has sent an acknowledgement (ACKnowledge, ACK).

Wideband LANs in accordance with the HiperLAN/2 and 802.11a standards will operate in the same frequency band in the future between 5.15 and 5.825 GHz. The wideband LANs work with Transmitter Power Control (TPC), it is true, with adaptive radio transmission methods and the Dynamic Frequency Selection (DFS) to minimize the alternating interfering effects, these methods, however, do not make optimum use and spreading possible of the radio channels over the stations which transmit in accordance with different standards. The guarantee of the service quality necessary for the multimedia applications is impossible in the case of interference caused by their own stations or stations of outside systems. In case of alternating interference, systems do not work efficiently and occupy a frequency channel even at low transmission rates.

It is an object of the invention to provide a method, a wireless network and a control station which make efficient use of radio transmission channels possible.

This object is achieved for the method in accordance with the invention by an interface control protocol method for a radio system, which system comprises at least a frequency band provided for the alternate use of a first and a second radio interface standard, the radio system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, respectively, a control station being provided which controls the alternate use of the frequency band.

The invention is based on the idea of providing a comprehensive standard exchange of implicit or explicit control information in systems that have the same radio transmission methods but different radio transmission protocols. This makes a simple and efficient use possible of a radio channel via a plurality of radio interface standards.

The radio system comprises one or more stations. The stations may be, for example, computers of a wireless local area network. These stations may be arranged, for example, only for operation in accordance with a first or second radio interface standard. But it is also possible for stations to operate in accordance with both the first and the second radio interface standard.

A first number of stations preferably forms a wireless local area network in accordance with a first radio interface standard and a second number of stations forms a wireless network in accordance with a second radio interface standard. The first radio interface standard may be, for example, the HiperLAN/2 standard and the second radio interface standard may be the IEEE802.11a standard.

For these two standards is reserved the frequency band from 5.15 GHz to 5.825 GHz.

In accordance with the invention a control station is provided which controls the alternate use of the common frequency band of the two radio interface standards.

The control station is preferably a station that may operate in accordance with both the first and the second radio interface standard.

The control of the alternate use of the common frequency band may be effected in various ways. For example, it is possible to provide certain predefinable time intervals for the use of the first and second radio interface standard and allocate the frequency band alternately to the first radio interface standard and then to the second radio interface standard in a kind of time-division multiplex mode.

However, it is advantageous to effect the allocation by means of adaptive protocols. The common radio channel can then be utilized more effectively particularly when the demand for transmission capacity in accordance with the first and the second radio interface standard varies.

In the advantageous embodiment of the invention as claimed in claim 2, the control station is provided, on the one hand, for controlling the access to the frequency band for stations operating in accordance with the first radio interface standard. If the first radio interface standard is, for example, the HiperLAN/2 standard, the control station performs the function of the central controller (Access Point AP) in accordance with this standard. In that case the stations of the HiperLAN/2 standard send a request for capacity to the control station and the control station allocates transmission capacity to each respective station.

On the other hand, the control station is provided in an advantageous embodiment of the invention as claimed in claim 2 for releasing the common frequency band

for access by stations operating in accordance with the second radio interface standard, if stations operating in accordance with the first radio interface standard do not request access to the frequency band. In this advantageous embodiment of the invention the first radio interface standard is given priority over the second radio interface standard in this manner. The release of the common frequency band for the second radio interface standard may be effected, for example, explicitly by the sending of control information to the stations of the second radio interface standard.

Alternatively, it is possible, for example, that the point coordinator provided in accordance with the IEEE802.11a standard operates as the central control station and controls the alternate access of stations of the first and second radio interface standard to the common frequency band. In this advantageous embodiment of the invention the point coordinator could for example periodically render the common frequency band available to another radio interface standard, for example, to the HiperLAN/2 standard.

In the advantageous embodiment as claimed in claim 3, the control is effected in that the control station determines the respective duration in which the stations operating in accordance with the second radio interface standard can utilize the common frequency band. Determining the duration may advantageously be effected as claimed in claim 4 in that the control station sends a broadcast signal which informs the stations of a time period in which the frequency band can be used by stations operating in accordance with the second radio interface standard.

It is an advantage of the invention that when radio systems are operated in phases in which no information is sent or received by a radio station in accordance with a first radio interface standard, the additional sending of information in accordance with another radio interface standard becomes possible, so that the access to the radio channel can be controlled by competing radio systems.

It is then possible for a first radio station operating in accordance with a first radio interface standard to additionally carry out certain functions described in a second radio interface standard, while the first radio station or a coordinating further radio station that transmits in accordance with the first radio interface standard determines the beginning and duration of the phase that may be used by the first station for transmission in accordance with the second radio interface standard.

Depending on the radio interface standard, beginning and duration can be defined only approximately, while the respective standards are violated regularly or from time to time. The first station may preferably end the phase during which it transmits in

accordance with the second radio interface standard, while disregarding resulting interference in stations operating in accordance with the second radio interface standard.

The first radio station may, in addition to functions in accordance with the second radio interface standard, also carry out functions that cause radio systems working in accordance with the second radio interface standard or radio systems working in accordance with the first radio interface standard to interpret the radio channel as interfered and occupy another radio channel for its own operation.

The efficient common use of a radio channel by different radio systems may be achieved via a suitable control protocol method. Such a radio interface control protocol method enables a first station of a radio system working in accordance with the first radio interface standard to control the access times to the radio channel by other stations. For this purpose this first station then has to carry out functions described in another, second radio interface standard in addition to the functions laid down by its own first radio interface standard at times at which stations working in accordance with the first radio interface standard do not send and do not expect information in accordance with the standard from the first station, while the first station or a further station determines the duration for which the first station is allowed to transmit in accordance with the second radio interface standard. The duration of the operation in accordance with the second radio interface standard need not be determined exactly but may also be determined approximately. A transmission in accordance with the first radio interface standard can provide that the first station terminates the use of the radio interface in accordance with the second radio interface standard without taking resulting interference into account in stations that send in accordance with the second radio interface standard.

The object of the invention is achieved for the network by a wireless network that has at least one frequency band that is provided for the alternate use by a first and a second radio interface standard, while the wireless network comprises stations that work in accordance with the first and/or the second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

Several examples of embodiment of the invention will be further explained below with reference to the drawing in the Figs. 1 to 3, in which:

Fig. 1 shows the frame structure in accordance with the ETSI BRAN HiperLAN/2 standard,

Fig. 2 gives a diagrammatic representation of the access to a radio channel in systems in accordance with the IEEE802.11a standard, and

Fig. 3 shows two wireless local area networks in accordance with a first and a second radio interface standard.

Fig. 1 shows the structure of the HiperLAN/2-MAC frame.

Fig. 2 diagrammatically shows the media access in systems working in accordance with the radio interface standard IEEE802.11a.

In a HiperLAN/2 system the central controller can be controlled via the Access Point (AP) which periodically generates the MAC frame and then transmits the data of the broadcast phase to individually control the service quality (packet delay sending rate and so on) of individual links.

Transmission in Figs. 1 and 2 with respect to the associated standards is understood to mean that a HiperLAN/2 AP in a partially unused downlink, uplink and direct-mode phase could dispense with sending useless (dummy) information and giving 802.11-systems no opportunity to observe an unused channel for a period of time SIFS and starting the run as shown in Fig. 2. The AP could readily regain the control in which the transmission in accordance with the HiperLan/2 standard does not suppress the broadcast phase, but transmission takes place. Likewise, the function PCF of the 802.11 standard could be used to occasionally render the radio channel available to HiperLAN/2 systems with a time limit (periodically).

The alternate control of radio systems of different standards, which control is proposed here and discussed with respect to an example of the wideband LANs ETSI BRAN HiperLAN/2 and IEEE802.11a, may guarantee in a heterogeneous environment in which various radio systems simultaneously transmit very close together in the same spectrum, a decentrally controlled adaptivity relative to the transmission capacity available in the respective systems for the management of the respective current traffic supply, of the required service quality and of the environment of use. When the integrated controller in accordance with the invention is used, different radio systems may be made compatible in the way that they constructively coexist in the same frequency band and then can provide services that require a high service quality. The radio spectrum is clearly used more efficiently; without the implementation of the new method this is only possible with respective exclusively used radio channels.

Fig. 3 diagrammatically shows two wireless local area networks.

A first wireless local area network comprises three stations 10, 11 and 12. These three stations 10, 11 and 12 work in accordance with the first radio interface standard A, for example, in accordance with the HiperLAN/2 standard.

A second wireless local area network includes four stations 14, 15, 16 and 17. These four stations 14, 15, 16 and 17 work in accordance with the second radio interface standard B, for example, in accordance with the IEEE802.11a standard.

The stations may be, for example, computers which include a radio interface. The communication between the individual stations is effected in a wireless fashion, for example, by radio.

For wireless local area networks in accordance with the HiperLAN/2 and IEEE802.11a standards the frequency band is comprised between 5.15 GHz and 5.825 GHz.

A central control station 13 is provided which controls the alternate access by the first wireless network and the second wireless network to the common frequency band.

This may be effected in an advantageous manner in that the station 13 sends a broadcast message to the stations 14 to 17 of the IEEE802.11a standard when the stations 10 to 12 do not need transmission capacity. This broadcast message preferably contains time information which informs the stations 14 to 17 of the IEEE802.11 standard how long they are allowed to utilize the common frequency band. During this time the control station 13 can also carry out functions in accordance with the IEEE802.11a standard, for example, also be used for data transmission in accordance with the IEEE802.11a standard.

If the stations 10 to 12 of the first wireless network are HiperLAN/2 stations, the control station 13 preferably also operates as the central control station (Access Point) of the HiperLAN/2 network and co-ordinates its radio resources. In HiperLAN/2 systems it is planned beforehand at what time the stations are allowed to send. For this purpose the HiperLAN/2 systems have a central controller (Access Point, AP) which receives the requests for capacity from the various stations and assigns capacity accordingly. The central control station 13 is preferably also provided for carrying out the function of the access point of the HiperLAN/2 standard. The central control station 13 then periodically signals every 2 ms the MAC frame structure in accordance with the requirements of the individual stations of the HiperLAN/2 network.

Alternatively, it is also possible, however, in HiperLAN/2 systems for the function of the access point and the function of the alternating control of the access to the common frequency band by the first wireless network and the second wireless network to be realized in separate stations. In that case, however, with respect to the duration in which the

frequency band can be utilized by the first or second radio interface standard a data exchange is necessary between these separate stations.

Alternatively, it is possible, for example, for the point co-ordinator provided in accordance with the IEEE802.11 standard to operate as a central control station and to control the alternate access to the common frequency band by stations of the first and second radio interface standards. In this embodiment the point co-ordinator would, for example, periodically render the common frequency band available to another radio interface standard, for example, to the HiperLAN/2 standard.

CLAIMS:

1. An interface-control protocol method for a radio system which has at least one frequency band that is provided for the alternate use by a first and a second radio interface standard, the radio system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

2. A method as claimed in claim 1, characterized in that the control station controls the access to the frequency band for stations working in accordance with the first radio interface standard and in that the control station renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band.

3. A method as claimed in claim 1, characterized in that the control station determines the respective duration in which the stations working in accordance with the second radio interface standard are allowed to utilize the frequency band.

4. A method as claimed in claim 1, characterized in that the control station sends a broadcast signal informing the stations of a time duration in which the frequency band can be used by stations working in accordance with the second radio interface standard.

5. A method as claimed in claim 3, characterized in that the duration of operation in accordance with the first and second radio interface standards is laid down only approximately while the respective standards are violated regularly or from time to time.

6. A method as claimed in claim 1, characterized in that the control station terminates the use of the radio interface in accordance with the second radio interface standard by transmitting in accordance with the first radio interface standard, without taking

account of resulting interference in stations working in accordance with the second radio interface standard.

7. A method as claimed in claim 1, characterized in that the control station controls the access to the frequency band by stations working in accordance with the first radio interface standard and in that duration and type of control of the radio interface in accordance with the second radio interface standard is determined by a further station and transmitted to the control station.

8. A method as claimed in claim 1, characterized in that the control station, in addition to functions in accordance with the second radio interface standard, also carries out functions which cause radio systems in accordance with the second radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

9. A method as claimed in claim 1, characterized in that the control station also carries out functions which cause radio systems in accordance with the first radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

10. A wireless network comprising at least one frequency band provided for the alternate use by a first and a second radio interface standard, the wireless network comprising stations which work in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

11. A control station for a wireless network, the control station being provided for controlling the alternate use of a frequency band by stations which work in accordance with a first radio interface standard and stations which work in accordance with a second radio interface standard.

ABSTRACT:

The invention relates to an interface-control protocol method for a radio system, which has at least one frequency band provided for the two-way alternate utilization of a first and a second radio interface standard. The radio system comprises a number of stations, which each function in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, in which a control station is provided that controls the two-way alternate utilization of the frequency band.

Fig. 3

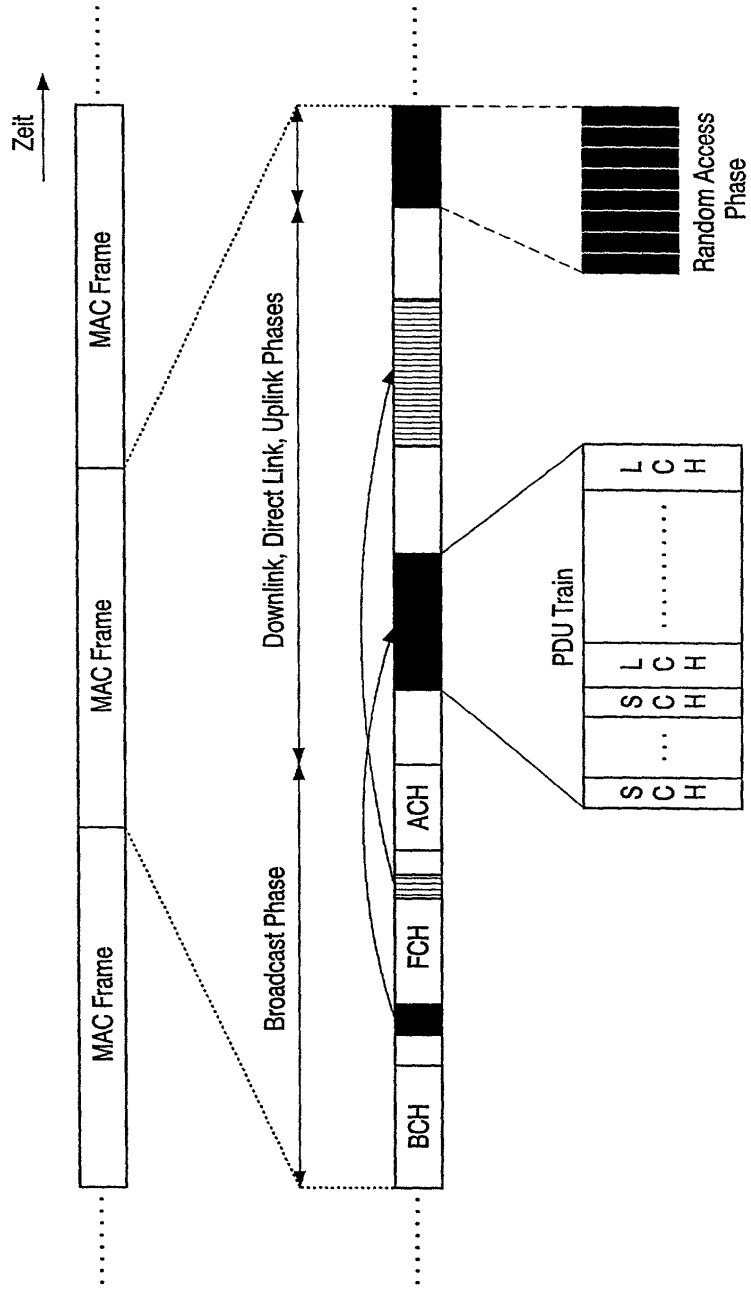

FIG. 1

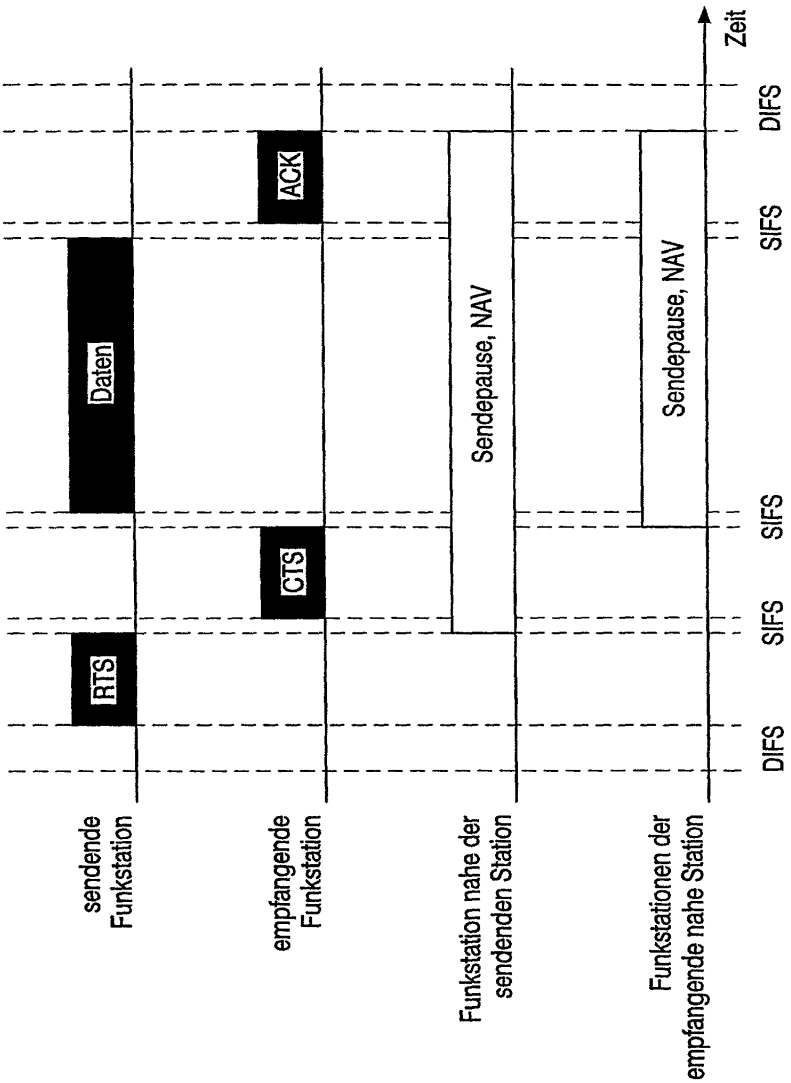

FIG. 2

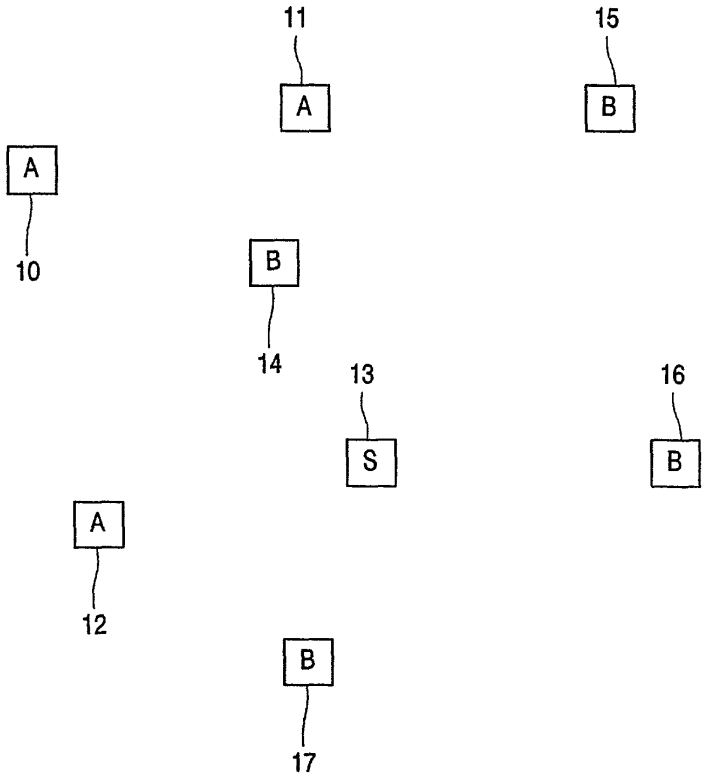

FIG. 3

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (includes Reference to PCT International Applications)	ATTORNEY'S DOCKET NUMBER **PHDE000238 US**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated 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:

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application

Serial No _____

on _____

and was amended

on _____

☒ was filed as PCT international application

Number PCT/EP01/09258

on 8 August 2001

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state 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 information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have 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 before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
Germany	**10039532.5**	**8 August 2000**	**YES**

Combined Declaration For Patent Application and Power of Attorney (Continued) (includes Reference to PCT International Applications)	Attorneys Docket Number **PHDE000238 US**

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) abnd/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

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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 if Title 18 of the United states Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202
Bernhard Walke	
DATE 28 February 2002	DATE 28 February 2002

U.S. DEPARTMENT OF COMMERCE- Patent and Trademarks Office

(July 1994)

10/089959

FILED UNDER 35 U.S.C. 371

U.S. UTILITY Patent Application

PATENT NUMBER and ISSUE DATE

APPL NUM	FILING DATE	CLASS	SUBCLASS	GAU	EXAMINER
10089959	04/04/2002	455	434	~~2681~~ 2685	~~Smith~~ C, TRAN

**APPLICANTS: Walke Bernhard; Mangold Stefan;

**CONTINUING DATA VERIFIED:
THIS APPLICATION IS A 371 OF PCT/EP01/09258 08/08/2001

** FOREIGN APPLICATIONS VERIFIED:
GERMANY 10039532.5 08/08/2000

PG-PUB	DO NOT PUBLISH ☐	RESCIND ☐

Foreign priority claimed	☐ yes ☐ no	ATTORNEY DOCKET NO
35 USC 119 conditions met	☐ yes ☐ no	PHDE000238
Verified and Acknowledged Examiners's intials		

TITLE : Method, network and control station for the two-way alternate control of radio systems of different standards in the same frequency band

NOTICE OF ALLOWANCE MAILED	Assistant Examiner	CLAIMS ALLOWED	
		Total Claims	Print Claim for O.G
ISSUE FEE		DRAWING	
Amount Due / Date Paid		Sheets Drwg. / Figs.Drwg. / Print Fig.	
☐ TERMINAL DISCLAIMER	Primary Examiner	Application Examiner	
	PREPARED FOR ISSUE		

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[redacted]

SEARCH

Class	Sub.	Date	Exmr.
455	434 *	9/16/04	CO
	435.2		
	438		
370	464	9/17/04	
	465		
	416 *		
	467 *		
	468		
	469		
	395.5		
	395.82		
	395.53		

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES

(List databases searched. Attach search strategy inside.)

	Date	Exmr.

ISSUE SLIP STAPLE AREA (for additional cross-references)

ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)	
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
INTERNATIONAL CLASSIFICATION			
/			
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/			^ Continued on Issue Slip Inside File Jacket

INDEX OF CLAIMS

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

Claim Final	Claim Original	Date
	1	9/16/04
	2	V
	3	V
	4	V
	5	V
	6	V
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If more than 150 claims or 9 actions staple additional sheet here

JC09 Rec'd PCT/PTO 04 APR 2002

FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NO. PHDE 000238
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. Application No. (If known, see 37 CFR 1.5) 10/089959
INTERNATIONAL APPLICATION NO. PCT/EP01/09258	INTERNATIONAL FILING DATE AUGUST 8, 2001	PRIORITY DATE CLAIMED AUGUST 8, 2000

TITLE OF INVENTION: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DEFFERENT STANDARDS IN THE SAME FREQUENCY BAND

APPLICANT(S) FOR DO/EO/US BERNHARD WALKE; STEFAN MANGOLD

Applicant(s) herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.

3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [ ] A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] has been transmitted by the International Bureau.
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6. [ ] A translation of the International Application into English (35 U.S.C. 371(c)(2))

7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
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   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.

8. [ ] A translation of the amendment to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).

9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.

12. [X] An assignment document for recording. A separate cover sheet is compliance with 37 C.F.R. 3.28 and 3.31 is included.

13. [ ] A FIRST preliminary amendment.
    [ ] A SECOND OR SUBSEQUENT preliminary amendment.

14. [ ] A substitute specification.

15. [X] A change of power of attorney and/or address letter.

16. [X] Other items or information:
    Application as published (WO 02/13457 A2)
    3 Sheets of Formal Drawings

CERTIFICATE OF EXPRESS MAILING

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Date of Deposit April 4, 2002

I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is adressed to the Commissioner of Patents and Trademarks, Washington D.C. 20231

Edna Chapa
Typed Name

Edna Chapa
Signature

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 10/089959	INTERNATIONAL APPLICATION NO. PCT/EP01/09258	ATTORNEY'S DOCKET NUMBER PHDE 000238

17 [X] The following fees are submitted:		CALCULATIONS (PTO USE ONLY)
BASIC NATIONAL FEE (37 C.F.R. 1.492(A)(1)-(5)):		
Search Report has been prepared by the EPO or JPO	$940.00	
International preliminary-examination fee paid to USPTO (37 C.F.R. 1.482)	$720.00	
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International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	$ 96.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =		$970.00

Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	11 - 20 =		X $ 18.00	$	
Independent claims	3 - 3 =		X $ 78.00	$	
MULTIPLE DEPENDENT CLAIMS (if applicable)			+ $260.00	$	

TOTAL OF ABOVE CALCULATIONS =	$970.00	
Reductions by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 C.F.R. 1.9, 1.27, 1.28)	$	
SUBTOTAL =	$970.00	
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Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28,3.31). $40.00 per property +	$40.00	
TOTAL FEES ENCLOSED =	$1,010.00	
	Amount to be refunded	$
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NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Corporate Patent Counsel
Philips Electronics North America Corporation
Tarrytown, NY 10591

(SIGNATURE)

Russel Gross

40,007
(REGISTRATION NUMBER)

DATE OF MAILING:

April 4, 2002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Atty. Docket

BERNHARD WALKE ET AL PHDE 000238

Serial No.:

Filed: CONCURRENTLY

Title: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

Commissioner for Patents
Washington, D.C. 20231

AUTHORIZATION PURSUANT TO 37 CFR §1.136(a)(3)
AND TO CHARGE DEPOSIT ACCOUNT

Sir:

The Commissioner is hereby requested and authorized to treat any concurrent or future reply in this application requiring a petition for extension of time for its timely submission, as incorporating a petition for extension of time for the appropriate length of time.

Please charge any additional fees which may now or in the future be required in this application, including extension of time fees, but excluding the issue fee unless explicitly requested to do so, and credit any overpayment, to Deposit Account No. 14-1270.

Respectfully submitted,

By _____
Russell Gross, Reg. 40,007
Attorney
(914) 333-9631

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JC09 Rec'd PCT/PTO 04 APR 2002

FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NO. PHDE 000238
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. Application No. (If known, see 37 CFR 1.5) 10/089959
INTERNATIONAL APPLICATION NO. PCT/EP01/09258	INTERNATIONAL FILING DATE AUGUST 8, 2001	PRIORITY DATE CLAIMED AUGUST 8, 2000

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Edna Chapa
Typed Name

Edna Chapa
Signature

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Respectfully submitted,

By _____
Russell Gross, Reg. 40,007
Attorney
(914) 333-9631

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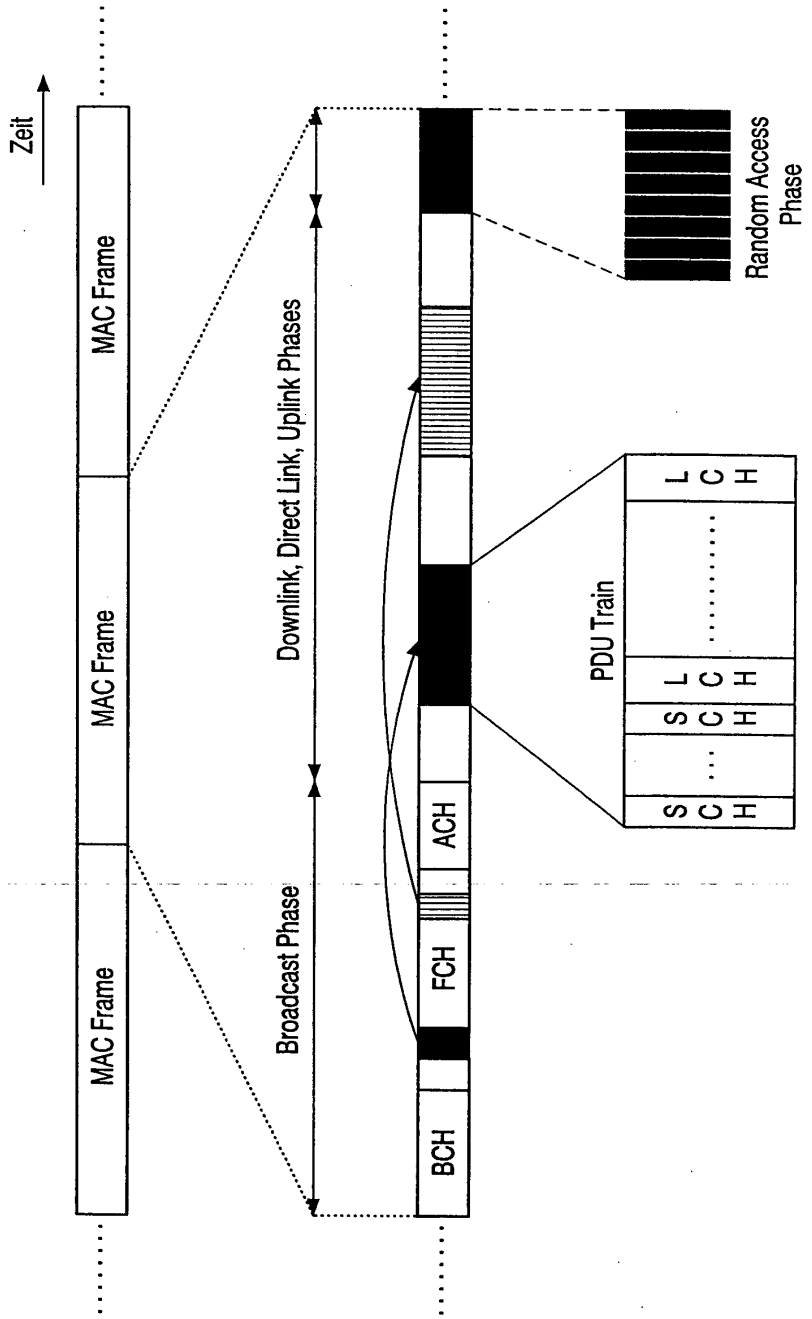
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FIG. 1

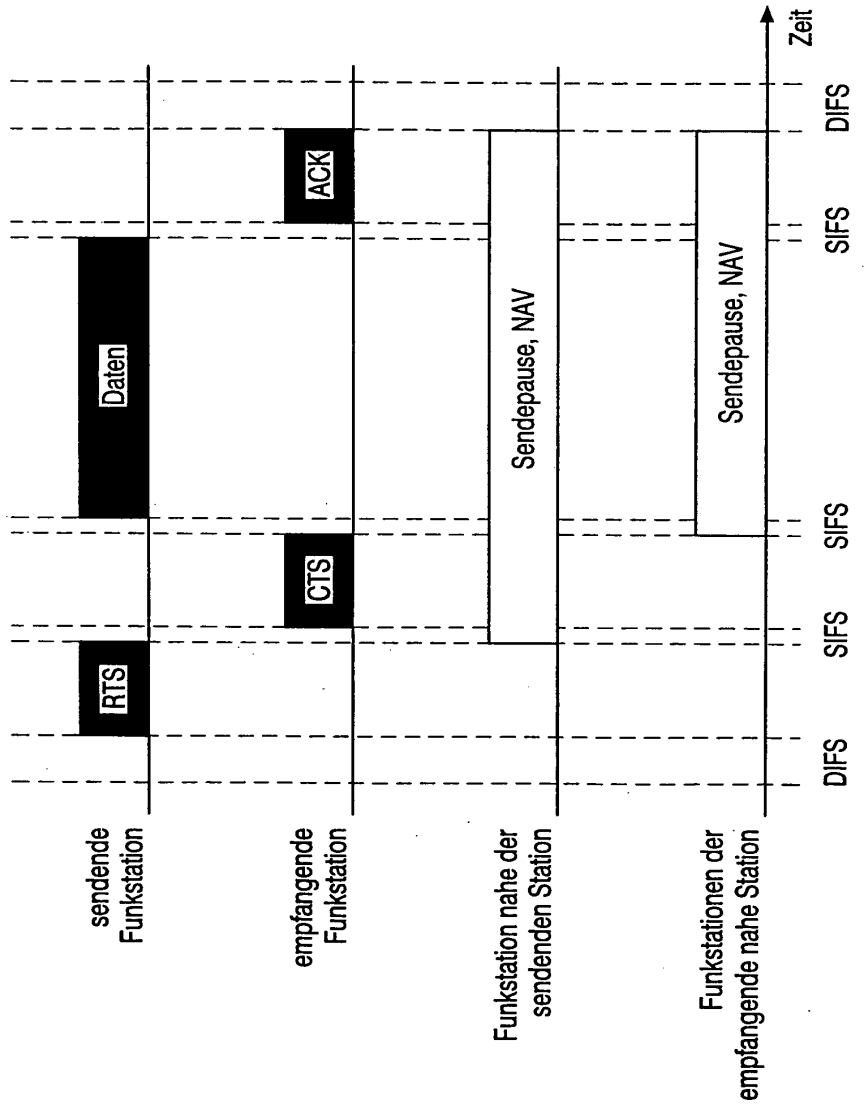

FIG. 2

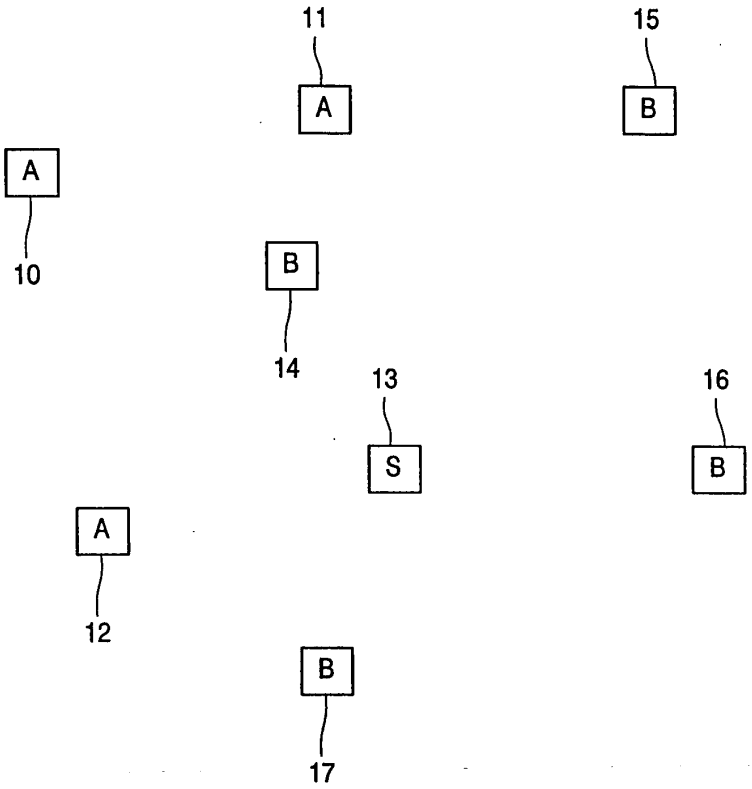

FIG. 3

Method, network and control station for the two-way alternate control of radio systems of different standards in the same frequency band

The invention relates to a method of alternate control of radio systems of different standards in the same frequency band.

A radio system for wireless transmission of information is allowed to use transmission power only in accordance with standards. The national regulation authority determines on what frequencies with what transmission power and in accordance with what radio interface standard a radio system is allowed to transmit. For this purpose there is provided for so-termed ISM frequency bands (Industrial Scientific Medical) that radio systems transmit in the same frequency band in accordance with different radio interface standards. An example of this is the US radio system IEEE802.11a and the European ETSI BRAN HiperLAN/2. The two radio systems transmit in the same frequency bands between 5.5 GHz and 5.875 GHz with approximately the same radio transmission method, but different transmission protocols.

In the event of interference, method were standardized for an active switching to another frequency within the permitted frequency band, for controlling transmission power and for the adaptive coding and modulation to reduce interference. Radio systems of wideband LANs of the radio interface standards ETSI BRAN HiperLAN/2 and IEEE802.11a utilize the same radio transmission method, a 64-carrier OFDM method and an adaptive modulation and coding. About the same modulation and coding methods (Link Adaptation, LA) are defined for the two standards.

The Medium Access Control (MAC) of the two systems is totally different. ETSI BRAN HiperLAN/2 utilizes a centrally controlled reservation-based method in which a radio station takes over the role of a central instance co-ordinating the radio resources. This central radio station (Access Point, AP) which may be an access point to the wide area network, periodically signals every 2 ms the MAC frame structure from the AP and the associated stations if required.

The IEEE802.11a standard describes a CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance) method not based on reservations, in which all the radio

stations listen in on the medium and assume that the channel is unused for a minimum duration (Short InterFrame Space, SIFS) before 802.11a-MAC frames, thus user data packets, are transmitted if necessary. The method is highly suitable for self-organizing ad hoc networks, but requires positive acknowledgements of all the packets. Measures supporting service quality (Point Coordination Function PCF) in addition allow the support of multimedia applications. Fig. 2 shows by way of example the sequence for media access in accordance with IEEE802.11a. In accordance with a variant of the standard a station is to then transmit an RTS packet (Ready To Send) and wait for a CTS packet (Clear To Send) from the addressed station before it is allowed to transmit user data. All the other stations in the radio coverage area set a time monitoring (Network Allocation Vector, NAV) and do not transmit until the addressed station has sent an acknowledgement (ACKnowledge, ACK).

Wideband LANs in accordance with the HiperLAN/2 and 802.11a standards will operate in the same frequency band in the future between 5.15 and 5.825 GHz. The wideband LANs work with Transmitter Power Control (TPC), it is true, with adaptive radio transmission methods and the Dynamic Frequency Selection (DFS) to minimize the alternating interfering effects, these methods, however, do not make optimum use and spreading possible of the radio channels over the stations which transmit in accordance with different standards. The guarantee of the service quality necessary for the multimedia applications is impossible in the case of interference caused by their own stations or stations of outside systems. In case of alternating interference, systems do not work efficiently and occupy a frequency channel even at low transmission rates.

It is an object of the invention to provide a method, a wireless network and a control station which make efficient use of radio transmission channels possible.

This object is achieved for the method in accordance with the invention by an interface control protocol method for a radio system, which system comprises at least a frequency band provided for the alternate use of a first and a second radio interface standard, the radio system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, respectively, a control station being provided which controls the alternate use of the frequency band.

The invention is based on the idea of providing a comprehensive standard exchange of implicit or explicit control information in systems that have the same radio transmission methods but different radio transmission protocols. This makes a simple and efficient use possible of a radio channel via a plurality of radio interface standards.

The radio system comprises one or more stations. The stations may be, for example, computers of a wireless local area network. These stations may be arranged, for example, only for operation in accordance with a first or second radio interface standard. But it is also possible for stations to operate in accordance with both the first and the second radio interface standard.

A first number of stations preferably forms a wireless local area network in accordance with a first radio interface standard and a second number of stations forms a wireless network in accordance with a second radio interface standard. The first radio interface standard may be, for example, the HiperLAN/2 standard and the second radio interface standard may be the IEEE802.11a standard.

For these two standards is reserved the frequency band from 5.15 GHz to 5.825 GHz.

In accordance with the invention a control station is provided which controls the alternate use of the common frequency band of the two radio interface standards.

The control station is preferably a station that may operate in accordance with both the first and the second radio interface standard.

The control of the alternate use of the common frequency band may be effected in various ways. For example, it is possible to provide certain predefinable time intervals for the use of the first and second radio interface standard and allocate the frequency band alternately to the first radio interface standard and then to the second radio interface standard in a kind of time-division multiplex mode.

However, it is advantageous to effect the allocation by means of adaptive protocols. The common radio channel can then be utilized more effectively particularly when the demand for transmission capacity in accordance with the first and the second radio interface standard varies.

In the advantageous embodiment of the invention as claimed in claim 2, the control station is provided, on the one hand, for controlling the access to the frequency band for stations operating in accordance with the first radio interface standard. If the first radio interface standard is, for example, the HiperLAN/2 standard, the control station performs the function of the central controller (Access Point AP) in accordance with this standard. In that case the stations of the HiperLAN/2 standard send a request for capacity to the control station and the control station allocates transmission capacity to each respective station.

On the other hand, the control station is provided in an advantageous embodiment of the invention as claimed in claim 2 for releasing the common frequency band

for access by stations operating in accordance with the second radio interface standard, if stations operating in accordance with the first radio interface standard do not request access to the frequency band. In this advantageous embodiment of the invention the first radio interface standard is given priority over the second radio interface standard in this manner. The release of the common frequency band for the second radio interface standard may be effected, for example, explicitly by the sending of control information to the stations of the second radio interface standard.

Alternatively, it is possible, for example, that the point coordinator provided in accordance with the IEEE802.11a standard operates as the central control station and controls the alternate access of stations of the first and second radio interface standard to the common frequency band. In this advantageous embodiment of the invention the point coordinator could for example periodically render the common frequency band available to another radio interface standard, for example, to the HiperLAN/2 standard.

In the advantageous embodiment as claimed in claim 3, the control is effected in that the control station determines the respective duration in which the stations operating in accordance with the second radio interface standard can utilize the common frequency band. Determining the duration may advantageously be effected as claimed in claim 4 in that the control station sends a broadcast signal which informs the stations of a time period in which the frequency band can be used by stations operating in accordance with the second radio interface standard.

It is an advantage of the invention that when radio systems are operated in phases in which no information is sent or received by a radio station in accordance with a first radio interface standard, the additional sending of information in accordance with another radio interface standard becomes possible, so that the access to the radio channel can be controlled by competing radio systems.

It is then possible for a first radio station operating in accordance with a first radio interface standard to additionally carry out certain functions described in a second radio interface standard, while the first radio station or a coordinating further radio station that transmits in accordance with the first radio interface standard determines the beginning and duration of the phase that may be used by the first station for transmission in accordance with the second radio interface standard.

Depending on the radio interface standard, beginning and duration can be defined only approximately, while the respective standards are violated regularly or from time to time. The first station may preferably end the phase during which it transmits in

accordance with the second radio interface standard, while disregarding resulting interference in stations operating in accordance with the second radio interface standard.

The first radio station may, in addition to functions in accordance with the second radio interface standard, also carry out functions that cause radio systems working in accordance with the second radio interface standard or radio systems working in accordance with the first radio interface standard to interpret the radio channel as interfered and occupy another radio channel for its own operation.

The efficient common use of a radio channel by different radio systems may be achieved via a suitable control protocol method. Such a radio interface control protocol method enables a first station of a radio system working in accordance with the first radio interface standard to control the access times to the radio channel by other stations. For this purpose this first station then has to carry out functions described in another, second radio interface standard in addition to the functions laid down by its own first radio interface standard at times at which stations working in accordance with the first radio interface standard do not send and do not expect information in accordance with the standard from the first station, while the first station or a further station determines the duration for which the first station is allowed to transmit in accordance with the second radio interface standard. The duration of the operation in accordance with the second radio interface standard need not be determined exactly but may also be determined approximately. A transmission in accordance with the first radio interface standard can provide that the first station terminates the use of the radio interface in accordance with the second radio interface standard without taking resulting interference into account in stations that send in accordance with the second radio interface standard.

The object of the invention is achieved for the network by a wireless network that has at least one frequency band that is provided for the alternate use by a first and a second radio interface standard, while the wireless network comprises stations that work in accordance with the first and/or the second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

Several examples of embodiment of the invention will be further explained below with reference to the drawing in the Figs. 1 to 3, in which:

Fig. 1 shows the frame structure in accordance with the ETSI BRAN HiperLAN/2 standard,

Fig. 2 gives a diagrammatic representation of the access to a radio channel in systems in accordance with the IEEE802.11a standard, and

Fig. 3 shows two wireless local area networks in accordance with a first and a second radio interface standard.

Fig. 1 shows the structure of the HiperLAN/2-MAC frame.

Fig. 2 diagrammatically shows the media access in systems working in accordance with the radio interface standard IEEE802.11a.

In a HiperLAN/2 system the central controller can be controlled via the Access Point (AP) which periodically generates the MAC frame and then transmits the data of the broadcast phase to individually control the service quality (packet delay sending rate and so on) of individual links.

Transmission in Figs. 1 and 2 with respect to the associated standards is understood to mean that a HiperLAN/2 AP in a partially unused downlink, uplink and direct-mode phase could dispense with sending useless (dummy) information and giving 802.11-systems no opportunity to observe an unused channel for a period of time SIFS and starting the run as shown in Fig. 2. The AP could readily regain the control in which the transmission in accordance with the HiperLan/2 standard does not suppress the broadcast phase, but transmission takes place. Likewise, the function PCF of the 802.11 standard could be used to occasionally render the radio channel available to HiperLAN/2 systems with a time limit (periodically).

The alternate control of radio systems of different standards, which control is proposed here and discussed with respect to an example of the wideband LANs ETSI BRAN HiperLAN/2 and IEEE802.11a, may guarantee in a heterogeneous environment in which various radio systems simultaneously transmit very close together in the same spectrum, a decentrally controlled adaptivity relative to the transmission capacity available in the respective systems for the management of the respective current traffic supply, of the required service quality and of the environment of use. When the integrated controller in accordance with the invention is used, different radio systems may be made compatible in the way that they constructively coexist in the same frequency band and then can provide services that require a high service quality. The radio spectrum is clearly used more efficiently; without the implementation of the new method this is only possible with respective exclusively used radio channels.

Fig. 3 diagrammatically shows two wireless local area networks.

A first wireless local area network comprises three stations 10, 11 and 12. These three stations 10, 11 and 12 work in accordance with the first radio interface standard A, for example, in accordance with the HiperLAN/2 standard.

A second wireless local area network includes four stations 14, 15, 16 and 17. These four stations 14, 15, 16 and 17 work in accordance with the second radio interface standard B, for example, in accordance with the IEEE802.11a standard.

The stations may be, for example, computers which include a radio interface. The communication between the individual stations is effected in a wireless fashion, for example, by radio.

For wireless local area networks in accordance with the HiperLAN/2 and IEEE802.11a standards the frequency band is comprised between 5.15 GHz and 5.825 GHz.

A central control station 13 is provided which controls the alternate access by the first wireless network and the second wireless network to the common frequency band.

This may be effected in an advantageous manner in that the station 13 sends a broadcast message to the stations 14 to 17 of the IEEE802.11a standard when the stations 10 to 12 do not need transmission capacity. This broadcast message preferably contains time information which informs the stations 14 to 17 of the IEEE802.11 standard how long they are allowed to utilize the common frequency band. During this time the control station 13 can also carry out functions in accordance with the IEEE802.11a standard, for example, also be used for data transmission in accordance with the IEEE802.11a standard.

If the stations 10 to 12 of the first wireless network are HiperLAN/2 stations, the control station 13 preferably also operates as the central control station (Access Point) of the HiperLAN/2 network and co-ordinates its radio resources. In HiperLAN/2 systems it is planned beforehand at what time the stations are allowed to send. For this purpose the HiperLAN/2 systems have a central controller (Access Point, AP) which receives the requests for capacity from the various stations and assigns capacity accordingly. The central control station 13 is preferably also provided for carrying out the function of the access point of the HiperLAN/2 standard. The central control station 13 then periodically signals every 2 ms the MAC frame structure in accordance with the requirements of the individual stations of the HiperLAN/2 network.

Alternatively, it is also possible, however, in HiperLAN/2 systems for the function of the access point and the function of the alternating control of the access to the common frequency band by the first wireless network and the second wireless network to be realized in separate stations. In that case, however, with respect to the duration in which the

frequency band can be utilized by the first or second radio interface standard a data exchange is necessary between these separate stations.

Alternatively, it is possible, for example, for the point co-ordinator provided in accordance with the IEEE802.11 standard to operate as a central control station and to control the alternate access to the common frequency band by stations of the first and second radio interface standards. In this embodiment the point co-ordinator would, for example, periodically render the common frequency band available to another radio interface standard, for example, to the HiperLAN/2 standard.

CLAIMS:

1. An interface-control protocol method for a radio system which has at least one frequency band that is provided for the alternate use by a first and a second radio interface standard, the radio system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

2. A method as claimed in claim 1, characterized in that the control station controls the access to the frequency band for stations working in accordance with the first radio interface standard and in that the control station renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band.

3. A method as claimed in claim 1, characterized in that the control station determines the respective duration in which the stations working in accordance with the second radio interface standard are allowed to utilize the frequency band.

4. A method as claimed in claim 1, characterized in that the control station sends a broadcast signal informing the stations of a time duration in which the frequency band can be used by stations working in accordance with the second radio interface standard.

5. A method as claimed in claim 3, characterized in that the duration of operation in accordance with the first and second radio interface standards is laid down only approximately while the respective standards are violated regularly or from time to time.

6. A method as claimed in claim 1, characterized in that the control station terminates the use of the radio interface in accordance with the second radio interface standard by transmitting in accordance with the first radio interface standard, without taking

account of resulting interference in stations working in accordance with the second radio interface standard.

7. A method as claimed in claim 1, characterized in that the control station controls the access to the frequency band by stations working in accordance with the first radio interface standard and in that duration and type of control of the radio interface in accordance with the second radio interface standard is determined by a further station and transmitted to the control station.

8. A method as claimed in claim 1, characterized in that the control station, in addition to functions in accordance with the second radio interface standard, also carries out functions which cause radio systems in accordance with the second radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

9. A method as claimed in claim 1, characterized in that the control station also carries out functions which cause radio systems in accordance with the first radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

10. A wireless network comprising at least one frequency band provided for the alternate use by a first and a second radio interface standard, the wireless network comprising stations which work in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

11. A control station for a wireless network, the control station being provided for controlling the alternate use of a frequency band by stations which work in accordance with a first radio interface standard and stations which work in accordance with a second radio interface standard.

ABSTRACT:

The invention relates to an interface-control protocol method for a radio system, which has at least one frequency band provided for the two-way alternate utilization of a first and a second radio interface standard. The radio system comprises a number of stations, which each function in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, in which a control station is provided that controls the two-way alternate utilization of the frequency band.

Fig. 3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of | Atty. Docket

BERNHARD WALKE ET AL | PHDE 000238

Serial No.:

Filed: CONCURRENTLY

Title: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

Commissioner for Patents
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all prior appointments (if any) of Associate Attorney(s) or Agent(s) in the above-captioned case and appoints:

RUSSELL GROSS **(Registration No. 40,007)**

c/o PHILIPS ELECTRONICS NORTH AMERICA CORPORATION, Corporate Intellectual Property, 580 White Plains Road, Tarrytown, New York 10591, his Associate Attorney(s)/Agent(s) with all the usual powers to prosecute the above-identified application and any division or continuation thereof, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED ATTORNEY OF RECORD.

Respectfully,

Michael E. Marion, Reg. 32,266
Attorney of Record

Dated at Tarrytown, New York
on April 3, 2002.

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COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (includes Reference to PCT International Applications)	ATTORNEY'S DOCKET NUMBER **PHDE000238 US**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated 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:

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application

Serial No _____

on _____

and was amended

on _____

☒ was filed as PCT international application

Number PCT/EP01/09258

on 8 August 2001

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state 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 information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have 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 before that of the application(s) of which priority is claimed:

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COUNTRY	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
Germany	**10039532.5**	**8 August 2000**	**YES**

Combined Declaration For Patent Application and Power of Attorney (Continued) (includes Reference to PCT International Applications)	Attorneys Docket Number **PHDE000238 US**

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) abnd/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

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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 if Title 18 of the United states Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202
Bernhard Walke	
DATE 28 February 2002	DATE 28 February 2002

U.S. DEPARTMENT OF COMMERCE- Patent and Trademarks Office

(July 1994)

PATENT APPLICATION SERIAL NO. 10-089959

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
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PATENT APPLICATION E DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number
10-08995

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	11 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 ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE		OR	BASIC FEE	
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
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	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDI-TIONAL FEE		RATE	ADDI-TIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

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				☐

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TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

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Independent	*	Minus	***	=
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(FOR USE WITH FORM PTO-875)

SERIAL NO. 10-089,959

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CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
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TOTAL DEP.	8					
TOTAL CLAIMS	11					

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TOTAL DEP.						
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FORM PTO-1360 (REV. 3-78)

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- ☐ Article 19 Amendments
- ☐ PCT/IB/331
- ☐ PCT/IPEA/409 IPER (PCT/IPEA/416 on front)
- ☐ Annexes to 409
- ☐ Priority Document (s) No. _____
- ☐ International Appl. on Double Sided Paper *(COPIES MA*
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- ☑ PCT/ISA/210 - Search Report
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Date of Completion of DO/ EO 916 - Notification of Defective Response	
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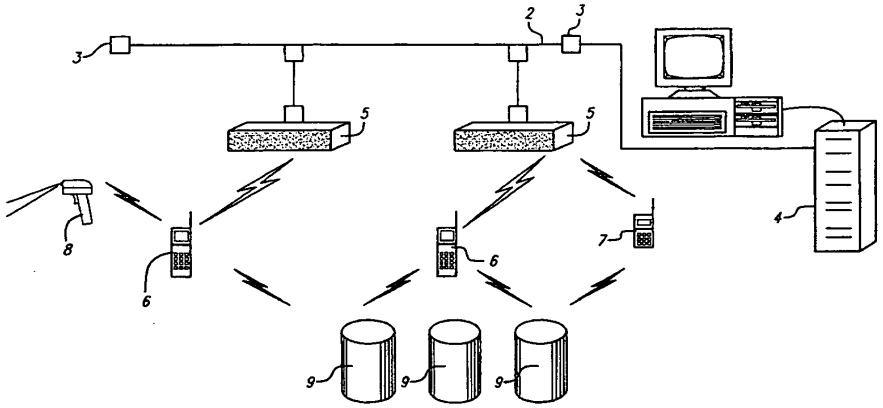

(57) Abstract

A multi–mode radio frequency network comprises a first type of computing device having a radio receiver/transmitter adapted for communication over a narrowband frequency range, and a second type of computing device having a radio receiver/transmitter adapted for communication over both the narrowband frequency range and a wideband frequency range. A network access controller is adapted for communication with both types of computing device over respective ones of the narrowband and wideband frequency ranges. The network access controller provides synchronization signals for coordinating the timing of communications over the narrowband and wideband frequency ranges. The second type of computing device may be adapted for either frequency–hopping or direct sequence spread spectrum communication signals over the wideband frequency range. The synchronization signals further comprise periodic beacon signals that define discrete time periods which further include a synchronous portion for commnunication of the narrowband signals and an asynchronous portion for communication of the wideband signal. The multi–mode radio frequency network may further include data storage/retrieval devices and data collection devices adapted for communication with the first and second types of computing device over the narrowband frequency range.

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BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
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CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
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MULTI-MODE RADIO FREQUENCY NETWORK SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to computing devices coupled together into a wireless local area network, and more particularly, to a wireless local area network infrastructure that permits communication in plural modes to support both wideband spread spectrum and narrowband radio frequency signals.

2. Description of Related Art

A wireless local area network (WLAN) comprises a plurality of remote computing devices which communicate together over radio frequency (RF) signals. As in a wired local area network (LAN), the WLAN allows users to seamlessly access disk drives, printers, and additional computer resources and systems connected to the WLAN. The remote computing devices include a radio receiver/transmitter adapted for RF communication with the other elements of the WLAN. The WLAN may also include a central host processing unit that sends information to and receives information from any one of the plurality of remotely disposed computing devices. The central host processor may also form part of a separate wired LAN to provide a bridge with the WLAN. In such a WLAN, the remote computing devices may comprise portable units that operate within a defined environment to report information back to the central host processing unit. WLAN systems offer increased flexibility over wired LAN systems by enabling operators of the remote computing devices substantial freedom of movement through the environment, and are particularly useful for remote data collection applications such as inventory control, manufacturing and production flow management, and asset tracking.

For simplicity, the radio receiver/transmitter provided within each remote computing device may communicate using conventional narrowband RF signals. Narrowband RF operation has a significant drawback in that the radio receiver/transmitter must be operated at relatively low power levels in order to ensure compliance with certain governmental regulations, and at such low power levels the RF signals are highly susceptible to interference and have low data throughput rates. To overcome these and other drawbacks, commercial WLAN systems have adopted so-called "spread spectrum" modulation techniques. In a spread spectrum system, the transmitted signal is spread over a frequency band that is significantly wider than the minimum bandwidth required to transmit the information being sent. As a result of the signal spreading, spread spectrum systems enable high data integrity and security. Moreover, by spreading transmission power across a broad bandwidth, power levels at any given frequency within the bandwidth are significantly reduced, thereby reducing interference to other radio devices.

In one type of spread spectrum communication system, an RF carrier is shifted in discrete increments in a pattern dictated by a predetermined sequence. These spread spectrum systems are known as "frequency-hopping" modulation systems, since the transmitter jumps from frequency to frequency in accordance with the predetermined sequence. The information signal is modulated onto the shifting carrier frequencies using frequency shift keying (FSK) modulation. Another type of spread spectrum communication system utilizes an RF carrier modulated by a digital code sequence having a spreading code rate, or chipping rate, much higher than the clock rate of the information signal. These spread spectrum systems are known as "direct sequence" modulation systems. The RF carrier may be modulated such that a data stream has one phase when a spreading code sequence represents a data "one" and 180° phase shift when the spreading code sequence represents a data "zero." The RF carrier

may also be binary or quadrature modulated by one or more data streams such that the data streams have one phase when a spreading code sequence represents a data "one" and a predetermined phase shift (e.g., 180° for binary, and 90° for quadrature) when the spreading code sequence represents a data "zero." These types of modulation are commonly referred to as binary shift key (BPSK) and quadrature shift key (QPSK) modulation, respectively.

A primary drawback of operating a WLAN using spread spectrum communication is the high cost of the computing devices due primarily to the complexity of the radio receiver/transmitter. For certain applications, a narrowband RF radio receiver/transmitter would provide satisfactory performance while the high data throughput and integrity provided by a wideband spread spectrum radio receiver/transmitter would be unnecessary. Nevertheless, it would be costly and impractical to operate two separate narrowband and wideband WLAN systems simultaneously. As a result, WLAN system designers must select a single communication mode that provides a sufficient level of performance within practical cost parameters.

Thus, it would be highly desirable to provide a WLAN infrastructure that permits multi-mode communication over both wideband spread spectrum and narrowband RF signals. Such a multi-mode WLAN could be constructed using a combination of higher performance computing devices communicating using wideband spread spectrum RF signals and lower performance computing devices communicating using narrowband RF signals.

SUMMARY OF THE INVENTION

In accordance with the teachings of the present application, a multi-mode radio frequency network is provided. The multi-mode radio frequency network permits RF communication using both wideband spread

spectrum RF signals and narrowband RF signals.

More particularly, the multi-mode radio frequency network comprises a first type of computing device having a radio receiver/transmitter adapted for communication over a narrowband frequency range, and a second type of computing device having a radio receiver/transmitter adapted for communication over both the narrowband frequency range and a wideband frequency range. A network access controller is adapted for communication with both types of computing device over respective ones of the narrowband and wideband frequency ranges. The network access controller provides synchronization signals for coordinating the timing of communications over the narrowband and wideband frequency ranges. The second type of computing device may be adapted for either frequency-hopping or direct sequence spread spectrum communication signals over the wideband frequency range. The synchronization signals further comprise periodic beacon signals that define discrete time periods which further include a synchronous portion for communication of the narrowband signals and an asynchronous portion for communication of the wideband signal. The multi-mode radio frequency network may further include data storage/retrieval devices and data collection devices adapted for communication with the first and second types of computing device over the narrowband frequency range.

In a first embodiment of the invention, the second radio receiver/transmitter is adapted to receive frequency-hopping spread spectrum communication signals in addition to narrowband communication signals. A receive section is adapted to receive radio frequency (RF) signals over the wideband and the narrowband frequency ranges and having a dowconversion mixer to mix the RF signals with a frequency-shifted carrier signal to downconvert the RF signals to intermediate frequency (IF) signals. An IF filter section is adapted to receive the IF signals and has a wideband bandpass filter and a narrowband bandpass filter that are alternatively

coupled to the IF signals to provide filtered IF signals. A demodulation section is adapted to receive the filtered IF signals and recover wideband and narrowband receive signals therefrom. A synthesizer section is adapted to generate the frequency-shifted carrier for the receive section. The frequency-shifted carrier is further modulated by wideband and narrowband transmit data signals to provide modulated transmit signals, and a transmit section is adapted to transmit the modulated transmit signals.

In a second embodiment of the invention, the second radio receiver/transmitter is adapted to receive direct sequence spread spectrum communication signals in addition to narrowband communication signals. A receive section is adapted to receive radio frequency (RF) signals and has a downconversion mixer to mix the RF signals with a carrier signal to downconvert the RF signals to intermediate frequency (IF) signals. A demodulation section receives the filtered IF signals and provides in-phase and quadrature receive data signals therefrom. A synthesizer section generates the carrier for the receive section, and the carrier is further modulated by in-phase and quadrature transmit data signals. A transmit section transmit the modulated transmit signals. Lastly, a control section controls the switching between wideband and narrowband modes of the second radio receiver/transmitter in which the in-phase and quadrature receive signals comprise wideband data in the wideband mode of the second radio receiver/transmitter, and the in-phase receive signals comprise narrowband data in the narrowband mode of the second radio receiver/transmitter.

A more complete understanding of the multi-mode radio frequency network will be afforded to those skilled in the art, as well as a realization of additional advantages and objects thereof, by a consideration of the following detailed description of the preferred embodiment. Reference will be made to the appended sheets of drawings which will first be described briefly.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a system diagram illustrating a multi-mode WLAN of the present invention which includes a first type of computing device using wideband RF communication signals and second type of computing device using narrowband RF communication signals;

Fig. 2 is a block diagram illustrating a first embodiment of a multi-mode radio receiver/transmitter adapted for frequency-hopping spread spectrum communication;

Fig. 3 is a block diagram illustrating a second embodiment of a multi-mode radio receiver/transmitter adapted for direct sequence spread spectrum communication; and

Fig. 4 is a timing diagram illustrating synchronous and asynchronous communication periods following a periodic beacon.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention satisfies the need for a multi-mode WLAN infrastructure that supports both wideband spread spectrum and narrowband radio frequency signals. The multi-mode WLAN can be constructed using a combination of higher performance computing devices communicating using wideband spread spectrum RF signals and lower performance computing devices communicating using narrowband RF signals. In the detailed description that follows, it should be appreciated that like reference numerals are used to identify like elements illustrated in one or more of the figures.

Referring first to Fig. 1, a system diagram of a multi-mode WLAN of the present invention is illustrated. The multi-mode WLAN includes a wired medium 2 having a plurality of interconnected nodes 3. At one of the nodes 3, a central computer controller 4 is coupled thereto which acts as a server for the WLAN and controls communications between the nodes on

the wired medium 2. Two of the nodes 3 have access points 5 coupled thereto which permit communication between the wired medium 2 and the wireless computing devices of the WLAN that will be described in greater detail below. The access points 5 include an RF receiver/transmitter that communicates between the wired medium 2 and the wireless computing devices. As known in the art, information transmitted on the wired medium 2 may be in the form of data packets in accordance with well established computer network protocols, such as Ethernet or Token Ring. It should also be appreciated that other computer network elements, such as computers, servers, printers, and data storage devices may be coupled to other nodes 3 of the wired medium 2.

The WLAN further includes a multi-mode computing device 6, a single-mode computing device 7, data collection devices 8, and data storage/retrieval devices 9. The multi-mode computing device 6 comprises a multi-mode RF receiver/transmitter adapted to communicate both narrowband RF signals and wideband RF signals. The single-mode computing device 7 comprises a single-mode RF receiver/transmitter adapted to communicate only narrowband RF signals. Both the multi-mode and single-mode computing device 6, 7 have generally similar external features, such as a keypad, a data display, and an antenna; however, it is anticipated that the multi-mode computing device 6 be more sophisticated and have greater internal data processing capability than the single-mode computing device 7. For example, the multi-mode computing device 6 may include a faster central processing unit (CPU) and greater memory storage capacity than the single-mode computing device 7, and similarly, may have a larger or more complete keypad and/or data display. For these reasons, it is anticipated that the multi-mode computing device 6 be utilized by supervisory level users and the single-mode computing device 7 be utilized by ordinary level users.

The data collection devices 8 comprise conventional bar code readers used to convert information encoded in bar code symbols into electronic data signals. As known in the art, such data collection devices 8 typically include a light source adapted to be scanned across the bar code field, such as provided by a laser or light emitting diode (LED). The bar and space elements of the bar code symbol have different light reflectivity, and the information encoded into the bar code may thus be detected in the reflected light therefrom. Alternatively, the data collection devices 8 may collect an image of the bar code using an electro-optical imaging element, such as a charge coupled device (CCD), allowing the information encoded into the bar code symbol to be interpreted from the collected image. The data collection devices 8 are adapted to communicate with the computing devices 6, 7 via narrowband RF signals, or alternatively, may be directly coupled to the computing devices via an electrical cable.

The data storage/retrieval devices 9 comprise conventional magnetic disk or tape drives used for non-volatile data storage. The data storage/retrieval devices 9 are adapted to communicate with the computing devices 6, 7 via narrowband RF signals. Data collected by the computing devices 6, 7 may thus be downloaded to the data storage/retrieval devices 9 during the course of data collection operations, or alternatively, data stored in the data storage/retrieval devices may be accessed by the computing devices 6, 7. As a result, the data storage capacity of the computing devices 6, 7 can be reduced accordingly.

To operate the multi-mode WLAN, the access points 5 transmit periodic beacon signals that enable all the wireless elements of the WLAN to synchronize. As shown in Fig. 4, the periodic beacon signals (B) indicate the start of a time period during which RF communication will occur. This time period is divided into a synchronous communication period (S) and an asynchronous communication period (A). The synchronous communication period is further sub-divided into fixed-length time slots S_1-S_6 which allow the

multi-mode computing device 6 to sequentially poll the data storage retrieval devices 9, the single-mode computing device 7, and the data collection devices 8 via narrowband RF communication signals. Also, the single-mode computing device 7 communicates with the access point 5 via narrowband RF communication signals during one of the time slots. It is anticipated that the synchronous RF communication signals be transmitted using a common system clock that is synchronized to the periodic beacon signals.

During the asynchronous communication period, the multi-mode computing devices 6 communicate with the access points 5 over wideband spread spectrum RF communication signals. The spread spectrum RF communication signals may be either of the frequency-hopping or direct sequence variety, as will be further described below. The asynchronous spread spectrum communication signals A_1-A_2 do not have fixed time duration, but rather such signals are provided in the form of message packets that generally include a header identifying a start of a message and a trailer identifying an end of a message in accordance with known data protocols.

Referring now to Fig. 2, an embodiment of the multi-mode RF receiver/transmitter included in the multi-mode computing device 6 is illustrated. In accordance with this embodiment, the multi-mode RF receiver/transmitter is adapted to communicate both narrowband RF signals and wideband frequency-hopping spread spectrum RF signals. The multi-mode RF receiver/transmitter of Fig. 2 includes an RF receive section 10, an IF filter section 20, a demodulation section 30, a digital control section 40, a synthesizer section 50 and a transmit section 60.

The RF receive section 10 includes an antenna 12, a transmit/receive switch 14, a bandpass filter 15, low noise amplifier stages 16, 17, and a downconversion mixer 18. The antenna 12 is provided for receiving and transmitting RF signals to and from the receiver/transmitter. The transmit/receive switch 14 has a common terminal that is electrically

coupled to the antenna 12, and two contact positions electrically coupled to the bandpass filter 14 of the receive circuit and transmit circuit 60 (described below), respectively. The transmit/receive switch 14 enables the antenna 12 to be configured for either transmitting or receiving operations. As known in the art, the transmit/receive switch 14 can be provided by mechanical switch elements, such as a relay, or can comprise solid state switching circuitry. It is preferable that the transmit/receive switch 14 have generally high speed switching characteristics to reduce delays between respective receiving and transmitting operations. Within the receive section 10, a received RF signal is first provided to a bandpass filter 15 which rejects adjacent extraneous frequencies outside the bandwidth of the received signal. The low noise amplifier stages 16, 17 amplify the received and filtered signal to a desired amplitude level. The mixer 18 multiplies the amplified signal with a locally generated frequency-shifted carrier from the synthesizer section 50 to produce an intermediate frequency (IF) signal having a constant difference in frequency between the received signal and the locally generated signal.

In the IF filter section 20, the IF signal is provided to one of two bandpass filters depending on whether the received RF signal is a synchronous narrowband signal or an asynchronous wideband signal. The IF filter section 20 includes a first bandpass filter 24 and a second bandpass filter 26 coupled in parallel between two switch stages 22, 28. The first bandpass filter 24 is for reception of wideband frequency-hopping spread spectrum signals, and the second bandpass filter 26 is for reception of narrowband signals. It should be appreciated that the bandwidth of the first bandpass filter 24 represents that of a single frequency channel within the wideband frequency range over which frequency-hopping spread spectrum signals are transmitted, and not the bandwidth of the entire wideband frequency range. The switches 22, 28 are controlled by the digital control section 40 (described below), so that the first bandpass filter 24 is enabled during asynchronous communication periods and the second bandpass filter

26 is enabled during synchronous communication periods.

Following the IF filter section 20, the filtered IF signal is provided to the demodulation section 30 which recovers the information contained within the original RF signal. The IF demodulation section 30 comprises an IF amplifier 32, an IF limiter 34, and a demodulator 36. The IF amplifier 32 and IF limiter 34 are used to adjust the signal level of the filtered IF signal to a level sufficient for demodulation. The gain of these stages may be set at different levels depending on whether the received RF signal is a wideband or narrowband signal. The demodulator 36 is adapted to recover both frequency shift key (FSK) modulated signals from a frequency-hopping spread spectrum wideband signal, and frequency modulation (FM) from a synchronous narrowband signal. A single demodulator circuit could be utilized to demodulate both wideband and narrowband signals either by dynamically changing the circuit's quality factor Q, or by accepting a decreased signal to noise ration for the narrowband signal. Alternatively, separate demodulator circuits could be used for the narrowband and wideband signals that are selectively switched in the same manner as the IF filter section 20.

The digital control section 40 provides the main signal processing hardware for the radio receiver/transmitter, and is responsible for controlling the transmit/receive switching, bandwidth selection, frequency synthesizer programming, clock recovery and data handling/generation. The digital control section 40 comprises a microcontroller 42 and a host interface 44. The microcontroller 42 may be provided by an application specific integrated circuit (ASIC), a microprocessor, a digital signal processor or other such circuit element. The host interface 44 provides for communication between the receiver/transmitter portion of the computing device and a host portion that processes and utilizes the information that has been communicated. As known in the art, the microcontroller 42 performs its functions by executing a series of commands or instructions, also referred to

as a software program, that may be disposed on a permanent storage medium, such as a semiconductor read only memory (ROM) device or a magnetic medium.

The synthesizer section 50 communicates with the digital control section 40 to control the timing and selection of carrier frequencies. The synthesizer section 50 comprises a digital-to-analog (D/A) converter 52, a frequency synthesizer 54, a transmit loop filter 55, a receive loop filter 56, a transmit local oscillator 57, a receive local oscillator 58 and a voltage controlled oscillator 46. The frequency synthesizer 54 is programmed by a plurality of digital data signals from the microcontroller 42, and provides a D.C. voltage signal to the transmit and receive local oscillators 57, 58 that corresponds to a selected frequency. The transmit and receive loop filters 55, 56 comprise low pass filters that remove high frequency noise from the D.C. voltage signals that occurs in the feedback loop. The transmit and receive local oscillators 57, 58 further comprise voltage controlled oscillator (VCO) circuits that receive the D.C. voltage signals, and generate corresponding oscillating signals at the selected frequency. The oscillating signals from the transmit and receive local oscillators 57, 58 are also provided back to the frequency synthesizer 54 as feedback signals, as known in the art.

The oscillating signal from the receive local oscillator 58 is provided to the mixer 18 of the receive section 10 as the frequency-shifted carrier. Digital data from the microcontroller 42 is converted to an analog signal by the D/A converter 52, which is provided to the transmit local oscillator 57 to control the waveshape (i.e., amplitude and frequency) of the oscillating signal. By changing the frequency of the oscillating signal, multiple data rates can be supported. Also, by changing the amplitude of the oscillating signal, the frequency deviation of the transmitted carrier can be changed, allowing modulation of both wideband and narrowband data. The modulated oscillating signal from the transmit local oscillator 57 passes

through a VCO buffer amplifier 59, and is provided to the transmit section 60.

The transmit section 60 essentially reverses the process performed by the receive section 10. The data-modulated, frequency-shifted carrier passes through a bandpass filter 64 to remove any VCO harmonics generated by the synthesizer section 50. Thereafter, the data-modulated, frequency-shifted carrier is provided to a pre-driver 66 and a power amplifier 67 that amplify the carrier signal to a desired output level, and a low pass filter 68 for noise attenuation. Lastly, the amplified carrier signal is provided to the antenna 12 for RF transmission. It should be appreciated that the pre-driver 66 and amplifier 67 stages need not be linear amplifiers due to the constant envelope modulation, thereby making them more efficient than linear counterparts.

The transmit section 60 further includes a D/A converter 62 that modifies the characteristics of the pre-driver 66 and power amplifier 67. The microcontroller 42 calculates a digital offset value for the transmit section 60 based on the frequency generated by the synthesizer section 50, in order to maintain an optimum power output level of the radio receiver/transmitter for each of the shifted frequencies across the wideband frequency range. The digital offset value is provided to the D/A converter, which provides an analog control signal to bias the pre-driver 66 and power amplifier 67. An example of an RF transmitter that maintains power output level linearity across a range of transmitting frequencies is disclosed in Serial Number 08/823,611 for ADAPTIVE POWER LEVELING OF AN RF TRANSCEIVER UTILIZING INFORMATION STORED IN NON-VOLATILE MEMORY, filed March 25, 1997, by the assignee herein.

Fig. 3 illustrates an alternative embodiment of the multi-mode RF receiver/transmitter in the multi-mode computing device 6 which is adapted to communicate both narrowband RF signals and wideband direct sequence spread spectrum RF signals. The multi-mode RF receiver/transmitter of Fig. 3 includes an RF receive section 10, a

demodulation section 70, a digital control section 40, a synthesizer section 80 and a transmit section 60. The RF receive section 10, digital control section 40 and transmit section 60 of Fig. 3 are substantially the same as the corresponding sections of the multi-mode RF receiver/transmitter of Fig. 2, and further description of these sections is therefore omitted.

Following the RF receive section 10, the IF signal is provided to the demodulation section 70 which recovers the information contained within the original RF signal. The demodulation section 70 comprises a bandpass filter 72, an IF amplifier 73, an IF limiter 74, a demodulator 76, and a narrowband and a wideband data low pass filter 77, 78. The bandpass filter 72 has a bandwidth sufficient for reception of wideband direct sequence spread spectrum signals. The IF amplifier 73 and IF limiter 74 are used to adjust the signal level of the filtered IF signal to a level sufficient for demodulation. As in the previous embodiment, the gain of these stages may be set at different levels depending on whether the received RF signal is a wideband or narrowband signal.

The demodulator 76 is adapted to recover binary phase shift key (BPSK) modulated signals from a direct sequence spread spectrum wideband signal and frequency modulation (FM) from a synchronous narrowband signal. The demodulator 76 may further comprise a conventional QPSK demodulator circuit which provides an in phase (I) output and a quadrature (Q) output. By modulating the direct sequence spread spectrum data using BPSK modulation, the Q channel output provides the demodulated BPSK data through the associated wideband filter 78 and the I channel output provides the demodulated FM signal through the associated narrowband filter 77. This way, a single demodulator circuit could be utilized to demodulate both wideband and narrowband signals without having to switch filters as in the previous embodiment.

The synthesizer section 80 communicates with the digital control section 40 to control the timing and selection of carrier frequencies.

On the receive side, the synthesizer section 80 comprises a frequency synthesizer 82, a receive loop filter 83 and a receive local oscillator 84. As in the previous embodiment, the frequency synthesizer 82 is programmed by a plurality of digital data signals from the microcontroller 42, and provides a D.C. voltage signal to the receive local oscillator 84 that corresponds to a selected frequency. The oscillating signal from the receive local oscillator 84 is provided back to the frequency synthesizer 82 as a feedback signal, and the receive loop filter 87 comprises a low pass filter that removes high frequency noise from the D.C. voltage signal that occurs in the feedback loop.

On the transmit side, the synthesizer section further comprises a transmit loop filter 87, a transmit local oscillator 89, an I-channel data low pass filter 85, a Q-channel data low pass filter 88, an I-channel mixer 86, a Q-channel mixer 91, a phase shift circuit 92 and a summing circuit 94. The frequency synthesizer 82 provides a D.C. voltage signal to the transmit local oscillator 89 to provide an oscillating signal, which is in turn provided back to the frequency synthesizer as a feedback signal. The oscillating signal from the transmit local oscillator 89 is provided to the phase shift circuit 92, which provides the oscillating signal to the I-channel mixer 86 and shifts the phase of the oscillating signal by 90° and provides the phase-shifted oscillating signal to the Q-channel mixer 91. I-channel data (i.e., narrowband data) and Q-channel data (i.e., wideband data) generated by the digital control section 40 is provided through the respective filters 85, 88 to the respective mixers 86, 91. The Q-channel data low pass filter 88 has a wider bandwidth than the I-channel data low pass filter 85 with a frequency cutoff consistent with the required direct sequence spread spectrum data format. The mixers 86, 91 modulate the I and Q-channel data with the respective oscillating signals, and these modulated data signals are summed by the summing device 94. Lastly, the modulated oscillating signal from the summing device 94 passes through a VCO buffer amplifier 96, and is provided to the transmit section 60.

In the wideband mode (i.e., direct sequence spread spectrum communication), the receiver/transmitter operates as an ordinary direct sequence spread spectrum radio. The digital control section 40 controls the transmit and receive operation, using data from the wideband filter 78, programs the synthesizer 82 for the desired channel frequency, and outputs the proper spreading sequence data to the synthesizer section 80 for transmit on the Q-channel. In the narrowband mode, the operation is the same, except that at the time interval defined by the beacon signal the receiver/transmitter is placed in the narrowband mode. The digital control section 40 selects the data from the narrowband filter 77 for reception of narrowband data. When transmitting, the digital control section 40 outputs data of a lower data rate onto the I-channel only, creating a signal of narrower bandwidth than the direct sequence spread spectrum signal.

Having thus described a preferred embodiment of a multi-mode radio frequency network, it should be apparent to those skilled in the art that certain advantages have been achieved. It should also be appreciated that various modifications, adaptations, and alternative embodiments thereof may be made within the scope and spirit of the present invention. The invention is solely defined by the following claims.

CLAIMS

What is Claimed is:

1. A multi-mode radio frequency network, comprising:

at least one first type of computing device having a first radio receiver/transmitter adapted for communication over a narrowband frequency range;

at least one second type of computing device having a second radio receiver/transmitter adapted for communication over both said narrowband frequency range and a wideband frequency range; and

a network access controller adapted for communication with said at least one first type of computing device and said at least one second type of computing device over respective ones of said narrowband and said wideband frequency ranges, said network access controller providing synchronization signals for coordinating timing of communications over said narrowband and said wideband frequency ranges.

2. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter provides spread spectrum communication signals over said wideband frequency range.

3. The multi-mode radio frequency network of Claim 2, wherein said spread spectrum communication signals further comprise frequency-hopping spread spectrum signals.

4. The multi-mode radio frequency network of Claim 2, wherein said spread spectrum communication signals further comprise direct sequence spread spectrum signals.

5. The multi-mode radio frequency network of Claim 1, wherein said wideband frequency range communications occur in a substantially asynchronous manner.

6. The multi-mode radio frequency network of Claim 1, wherein said narrowband frequency range communications occur in a substantially synchronous manner.

7. The multi-mode radio frequency network of Claim 1, further comprising at least one data storage/retrieval device adapted for communication with each of said at least one first type of computing device and said at least one second type of computing device over said narrowband frequency range.

8. The multi-mode radio frequency network of Claim 1, further comprising at least one data collection device adapted for communication with said at least one first type of computing device and said at least one second type of computing device over said narrowband frequency range.

9. The multi-mode radio frequency network of Claim 1, wherein said synchronization signals further comprise periodic beacon signals.

10. The multi-mode radio frequency network of Claim 9, wherein said periodic beacon signals define respective discrete time periods which further include a synchronous portion and an asynchronous portion.

11. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter further comprises an

intermediate frequency portion having a wideband filter, a narrowband filter, and means for switching between said wideband and narrowband filters based upon said synchronization signals.

12. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter further comprises:

a receive section adapted to receive radio frequency (RF) signals over said wideband and said narrowband frequency ranges and having a dowconversion mixer to mix the RF signals with a frequency-shifted carrier signal to downconvert the RF signals to intermediate frequency (IF) signals;

an IF filter section adapted to receive said IF signals and having a wideband bandpass filter and a narrowband bandpass filter that are alternatively coupled to said IF signals to provide filtered IF signals;

a demodulation section adapted to receive said filtered IF signals and recover wideband and narrowband receive signals therefrom;

a synthesizer section adapted to generate said frequency-shifted carrier for said receive section, said frequency-shifted carrier being further modulated by wideband and narrowband transmit data signals to provide modulated transmit signals; and

a transmit section adapted to transmit said modulated transmit signals.

13. The multi-mode radio frequency network of Claim 12, further comprising a control section adapted to select between said wideband bandpass filter and said narrowband bandpass filter.

14. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter further comprises:

a receive section adapted to receive radio frequency (RF) signals and having a downconversion mixer to mix the RF signals with a

carrier signal to downconvert the RF signals to intermediate frequency (IF) signals;

a demodulation section adapted to receive said filtered IF signals and provide in-phase and quadrature receive data signals therefrom;

a synthesizer section adapted to generate said carrier for said receive section, said carrier being further modulated by in-phase and quadrature transmit data signals;

a transmit section adapted to transmit said modulated transmit signals; and

a control section adapted to control switching between wideband and narrowband modes of said second radio receiver/transmitter, wherein said in-phase and quadrature receive signals comprise wideband data in said wideband mode of said second radio receiver/transmitter, and said in-phase receive signals comprising narrowband data in said narrowband mode of said second radio receiver/transmitter.

15. The multi-mode radio frequency network of Claim 14, wherein said demodulation section further comprises a demodulator adapted to recover frequency modulation (FM) from said narrowband data and quadrature phase shift key (QPSK) modulation from said wideband data.

16. The multi-mode radio frequency network of Claim 14, wherein said wideband data further comprises direct sequence spread spectrum data.

17. An apparatus for communicating in both narrowband and wideband frequency ranges comprising:

a receive section adapted to receive radio frequency (RF) signals and having a downconversion mixer to mix the RF signals with a frequency-shifted carrier signal to downconvert the RF signals to

intermediate frequency (IF) signals;

an IF filter section adapted to receive said IF signals and having a wideband bandpass filter and a narrowband bandpass filter that are alternatively coupled to said IF signals to provide filtered IF signals;

a demodulation section adapted to receive said filtered IF signals and recover wideband and narrowband receive signals therefrom;

a synthesizer section adapted to generate said frequency-shifted carrier for said receive section, said frequency-shifted carrier being further modulated by wideband and narrowband transmit data signals to provide modulated transmit signals; and

a transmit section adapted to transmit said modulated transmit signals.

18. The apparatus of Claim 17, wherein said demodulation section further comprises a demodulator adapted to recover frequency modulation (FM) from said narrowband signals and frequency shift key (FSK) modulation from said wideband signals.

19. An apparatus for communicating in both narrowband and wideband frequency ranges comprising:

a receive section adapted to receive radio frequency (RF) signals and having a downconversion mixer to mix the RF signals with a carrier signal to downconvert the RF signals to intermediate frequency (IF) signals;

a demodulation section adapted to receive said filtered IF signals and provide in-phase and quadrature receive data signals therefrom;

a synthesizer section adapted to generate said carrier for said receive section, said carrier being further modulated by in-phase and quadrature transmit data signals;

a transmit section adapted to transmit said modulated transmit signals; and

a control section adapted to control switching between wideband and narrowband modes of said apparatus, wherein said in-phase and quadrature receive signals comprise wideband data in said wideband mode of the apparatus, and said in-phase receive signals comprising narrowband data in said narrowband mode of the apparatus.

20. The apparatus of Claim 19, wherein said demodulation section further comprises a demodulator adapted to recover frequency modulation (FM) from said narrowband data and quadrature phase shift key (QPSK) modulation from said wideband data.

21. The apparatus of Claim 19, wherein said wideband data further comprises direct sequence spread spectrum data.

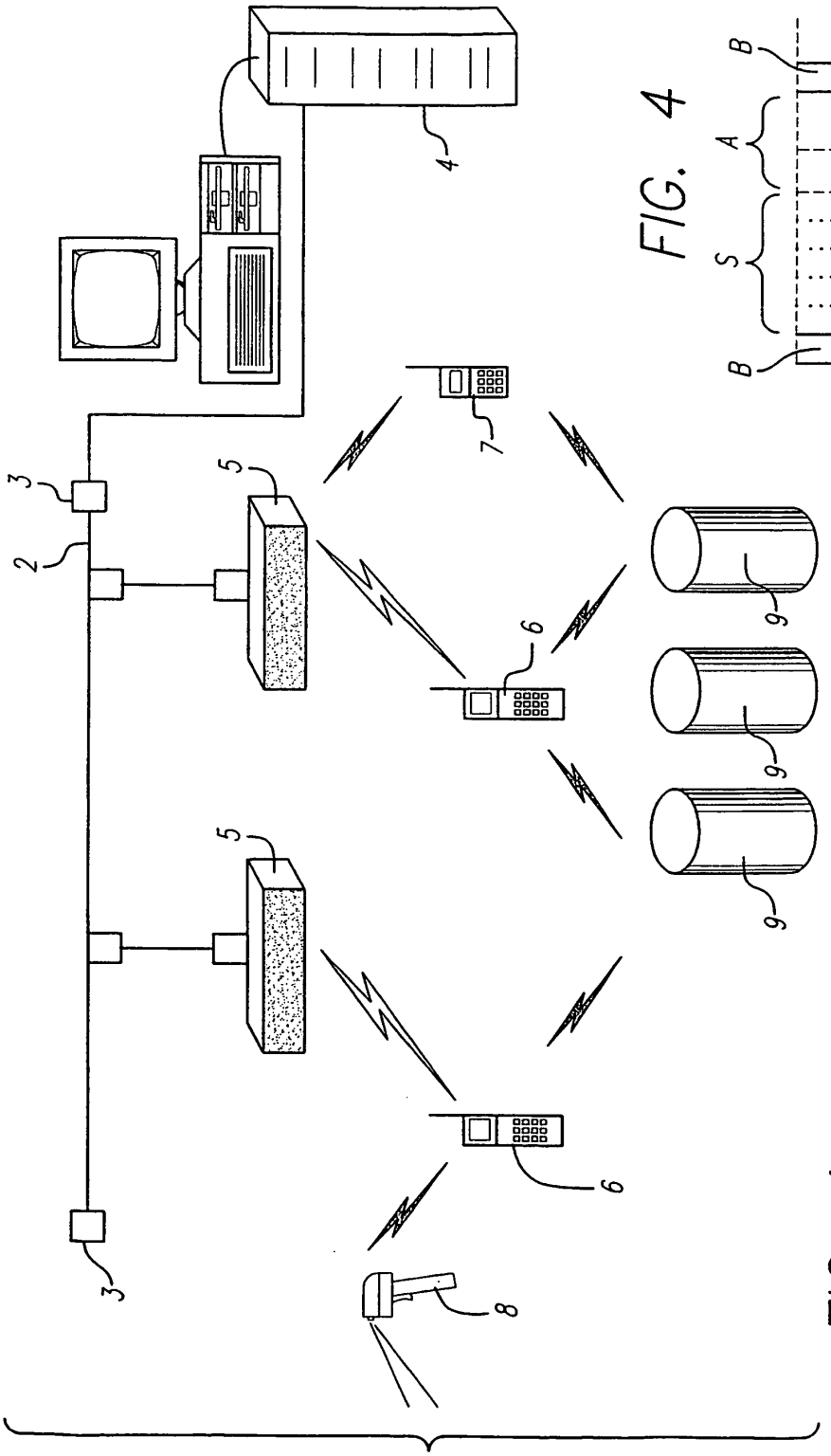

FIG. 1

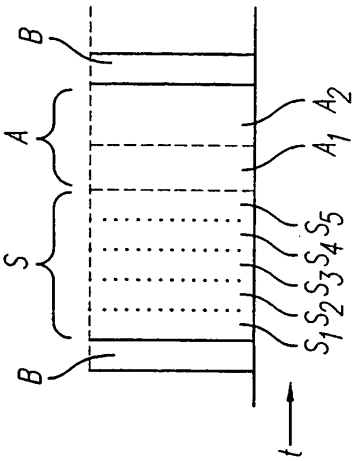

FIG. 4

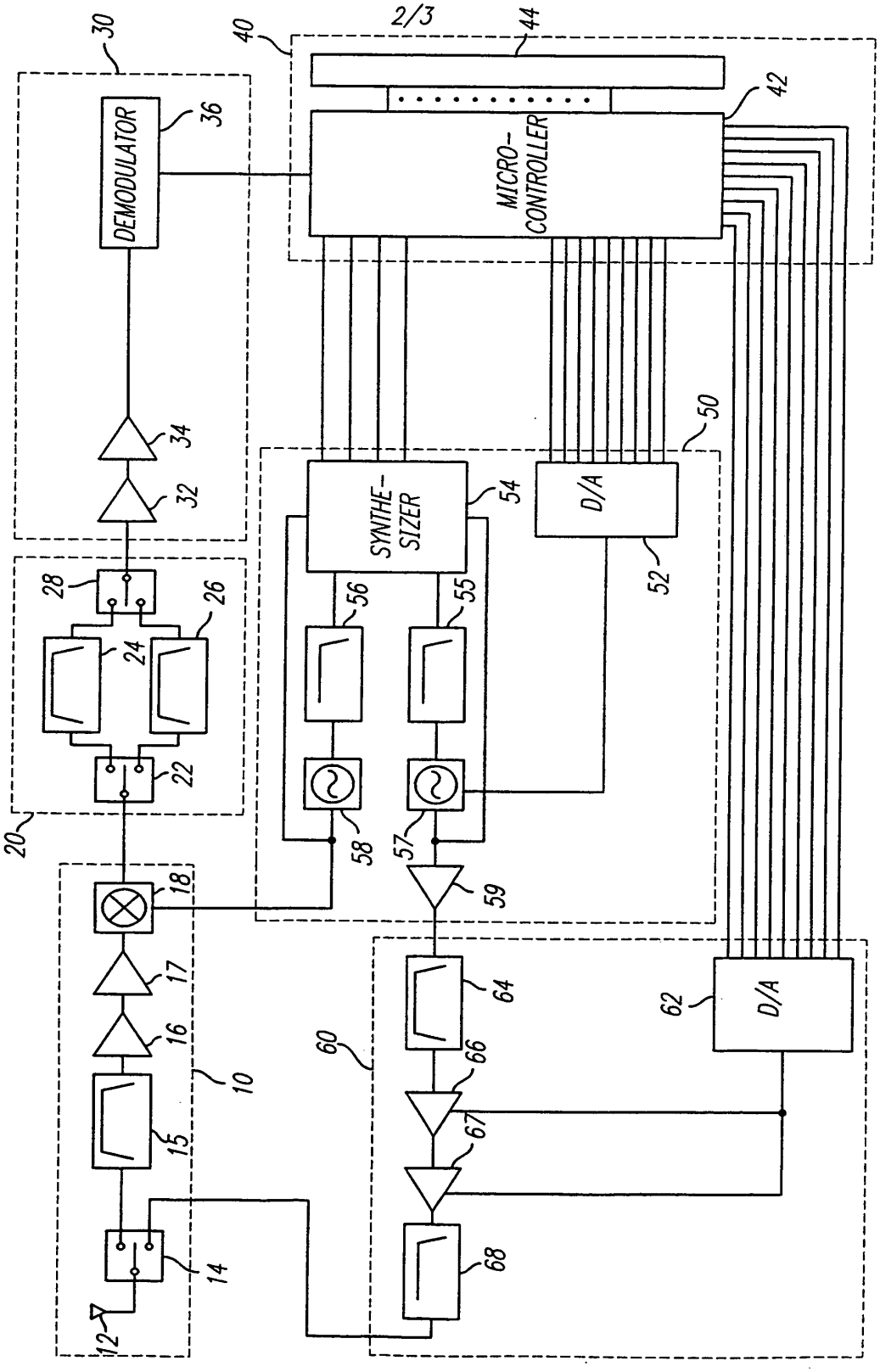

FIG. 2

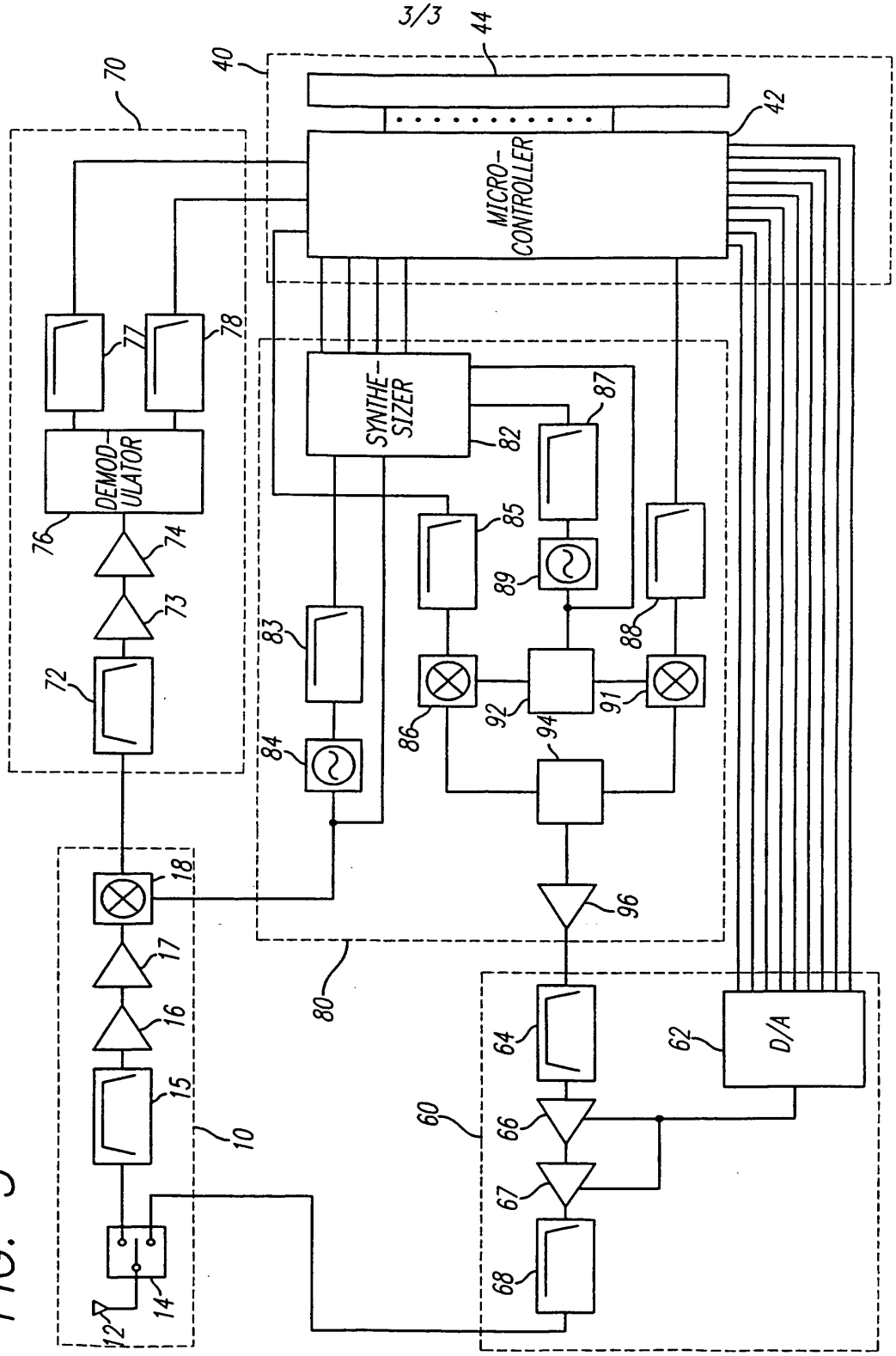

FIG. 3

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, 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.
A	US 5 291 516 A (DIXON ROBERT C ET AL) 1 March 1994 see column 1, line 60 - column 3, line 30 see column 4, line 57 - column 8, line 14 see claims 1,4-6 ---	1,4, 11-14, 16,17, 19,21
A	WO 97 32403 A (ERICSSON GE MOBILE INC) 4 September 1997 see abstract see page 2, line 5 - page 5, line 14 see page 6, line 23 - page 7, line 2 see page 11, line 22 - page 12, line 13 see claims 1,10 --- -/--	1,11-13

[X] Further documents are listed in the continuation of box C.

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Intern[redacted] Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	BANTZ D F ET AL: "WIRELESS LAN DESIGN ALTERNATIVES" IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS, vol. 8, no. 2, 1 March 1994, pages 43-53, XP000515079 see page 46, left-hand column, line 35 - page 47, left-hand column, line 46	2-4,16, 21

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INTERNATIONAL SEARCH REPORT

[redacted]tion on patent family members

[redacted]nal Application No
[redacted]/US 98/22969

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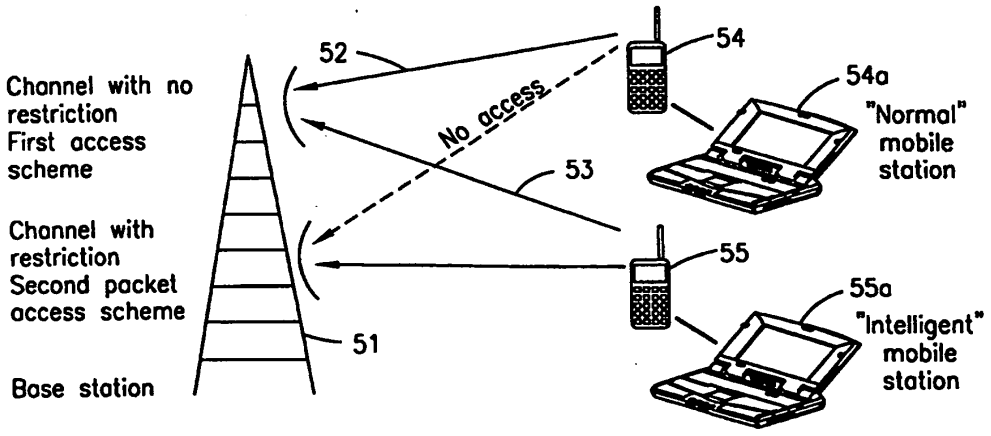

(57) Abstract

A digital radio network (12) having a first single random access (52, 59) for packet data is enhanced by providing a second access (53, 58) which includes a second random access channel (61) for controlled short data messages and a polled data channel (62, 63) for larger data messages. All mobiles (54, 55) operating within the system can access the first channel but only dual–mode mobiles (55) can connect to the second access.

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DIGITAL CELLULAR COMMUNICATION SYSTEM WITH SEVERAL MULTIPLE ACCESS SCHEMES FOR PACKET DATA

CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. Patent Application Serial No.08/955,664, filed on even date herewith in the name of the same inventors and entitled "Access Scheme for Packet Data in a Digital Cellular Communications System" (attorney's Docket No. 34646/00270) which is hereby incorporated by reference herein.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to radio telecommunications and, more particularly, to a packet data telecommunication system for a cellular radio network.

Description of the Related Art

In radio telecommunications, such as cellular radio systems, digital modulation schemes, such as time division multiple access (TDMA), are used to transmit both control information and voice traffic over the radio network. In addition, in recent years the transmission of data between computers and other data processing devices over the radio network is increasingly common. One technique which is used for the handling of data traffic over the radio network is circuit switched data services in which a dedicated circuit between a transmitting and a receiving station conveys the data from one to the other. An attractive alternative to such circuit switched data services for operators of mobile telephony networks are packet data services. The use of packet data switching enables several mobile users to share the available channel capacity within the system. This technique is well suited to modern data communication applications since data transmissions are usually of a bursty nature and thus do not continuously require a dedicated communications circuit.

A number of different channel access schemes are commonly used in radio communication systems. Each such access scheme has distinct advantages and

disadvantages for various applications. For example, fixed assignment access schemes within a radio telecommunications system are used for circuit switched services such as conventional voice telephony and fax. Although not yet widely used in cellular systems, polling schemes may also be employed to enhance the frequency efficiency of a radio system. The most common scheme used for multiple access in a radio system are random access schemes, conventionally employed in many cellular radio telecommunications systems.

In conventional mobile packet radio communication systems, a base station (BS) communicates with a plurality of mobile stations (MSs) over one or more shared packet radio channels. Downlink packet traffic is scheduled by the base station, so that downlink contention between mobile stations is avoided. However, in order for the mobile stations to gain access to the base station on the uplink, they must compete using a random multiple access protocol which inevitably leads to contention and multiple collisions between the different mobile stations which are competing with one another for access on the uplink. Referring to Fig. 1, there is shown a simplified block diagram of a radio communications system which includes facilities for transferring packet data to and from a mobile station. The system 10 includes a communication network 12 which includes a base station/transceiver section 14. The network 12 can be a public land mobile network (PLMN) such as the Personal (formerly, Pacific) Digital Cellular (PDC) system, a digital TDMA cellular radio network.

Network 12 communicates with a mobile station 16 which has the capacity of sending and receiving packet data, via a base station 14 using existing air interface and switching communication protocols. The network 12 also communicates with other mobile stations 20 via a second base station 18 in the network 12, fixed telephones 22 in a public switch telephone network (PSTN), and terminal work stations 24 and 26. As shown, the communication between computer terminal 24 and network 12 are made over a wired line connection. The communication between computer terminal 26 and the network 12 are via a wireless radio connection through base station 14. Consequently, communications to and from phone 22 and computer terminals 24 and 26 can be routed to and from the mobile stations 20 and 16 by means of a network 12.

Referring next to Fig. 2, there is shown the channel structure of an illustrative air interface in a cellular radio system of the type illustrated in Fig. 1 which

accommodates random access packet data channel. The channel structure includes a broadcast channel (BCCH) which is used by the network to broadcast various information to mobile stations such as channel allocation and system information. A set of common control channels (CCCH), including a paging channel (PCH) and a single cell signaling channel (SCCH) are used for transmitting signal information. The PCH is used to page a mobile station while the SCCH is used for transmitting information between the network and the mobile units, for example, requests by a mobile seeking access to the network. The uplink channel of the SCCH is of the random access type. A user packet channel (UPCH) is a channel which is available to multiple users for the transmission of user packet data. The uplink channel of the UPCH is also a random access type.

The appended control channels (ACCH) comprise an auxiliary channel appended to the traffic channel (TCH) for transmitting signal information between the network and the mobile station. The ACCH is further divided into the slow appended control channel (SACCH) which comprises a data channel carrying continuous system administration information such as measurement reports from each mobile of received signal strength measurements obtained for both its presently serving cell and adjacent cells. The fast appended control channel (FACCH) is also appended to a TCH and is a channel which temporarily steals the TCH to perform high speed transmissions. A housekeeping channel (RCH) sometimes replaces the SACCH and is used for transmitting maintenance information on the radio channel. Finally, the traffic channel (TCH) is used for transferring encoded speech and circuit switched user data. It is often further divided into full rate TCH and a half rate TCH for encoded speech.

It is conventional today to use the random access method for uplinking data transfer from a mobile station on the user packet channel (UPCH). The channel structure of the cell is communicated to the mobile users within that cell through the information transmitted on the broadcast channel (BCCH). For example, in the PDC system there is broadcast on the BCCH (and on other channels from time to time) a broadcast information message which contains numerous mandatory and optional parameters, including packet channel structure information and channel restriction information. The latter comprises one octet of data of which a small number of the

possible 256 bit combinations are used to indicate to the mobile whether or not particular channels are restricted from access by those mobiles.

In accordance with conventional random access procedures, as soon as the user packet data channel (UPCH) is idle, all mobile users which want to send user data packets to the network will simultaneously compete for the use of that channel. If there is only one access during this competition phase, that user will get hold of the channel and remain its user until the complete data packet has been sent. During the time when the user utilizes the channel, no other mobile seeking to transmit a data packet will try to access it. However, if during the competition phase there is more than one user which simultaneously accesses the channel, a collision occurs and a maximum of one, or often none of those competing users, will get data through the channel. In such cases, each failing user must wait a random time period before it can make a new attempt to seize the channel.

The use of shared random access data channels in conventional packet services within radio networks has numerous disadvantages. For example, during high traffic loads and long packet messages, the probability of a mobile station being able to send its data packets is dramatically reduced and a mobile must wait an inordinately long period of time for the channel to become free so that it can even attempt to access it.

As illustrated in Fig. 3, each of the two mobile stations 31 and 32, equipped respectively for handling packet data from two portable computers 31a and 32a receive information broadcast on the downlink of the air interface, 33 and 34 respectively. Each mobile 31 and 32 receives the same information 35 broadcast on the BCCH. If both of the mobile stations 31 and 32 seek to send packet data to the network, they both listen for information on the BCCH indicating the availability of a random access user data channel (UPCH). An algorithm which uses the mobile's own unique identity (MSI) as one input parameter attempts to spread the mobiles evenly over the available channels. We assume each of the two mobiles 31 and 32 find the same UPCH 38 when applying the algorithm. If their respective access data packets 36 and 37 do not collide and obliterate one another when received at the base station, the packets 36 and 37 are successfully delivered to the network. If, instead, two user packets 36 and 37 collide, then its likely that neither of the two mobile stations 31 or 32 succeeds to access the channel and both must wait a random period of time before it make a new

attempt to access the channel. The random access control process in a digital mobile radio communication system of the PDC type illustrated in Figs. 1 and 3, is shown in Fig. 5.

Once a mobile successfully has started sending a packet it will continue to complete that packet. Each packet transfer is done under competition with other mobiles. Fig. 4 illustrates the layer 1 view of an uplink access scheme if we assume MS1 "has" the channel.

It is obvious that the more MSs that the algorithm allots to the same UPCH, the higher the risk of colliding packets.

In Fig. 5, the downlink user packet channel UPCH, and signaling channel SCCH, include a collision control field 41. This field is labeled E and, in this example, is 22 bits in length. This information is used by the mobile station during random access. Processing of the collision control bit field E at the base station comprises the processing of several sub-fields including the setting of an I/B field 42 to the bits "111" if the uplink UPCH is idle and to "000" if the uplink UPCH is busy. An R/N field 43 is set by the base station to "111" if valid information was received on the UPCH channel in the previous slot and to "000" if no valid information was received on the UPCH channel in the previous slot. The PE field 44 is set to all zeros if the channel is idle or no message was received. If a message is received on the UPCH channel, the detected and checked (CRC) (16 bits) from the UPCH message received from the mobile station are used as a partial echo in the PE field 44 in the downlink transmission.

With respect to processing of the packet data information in the mobile station, when the mobile station has data to send, it sequentially checks UPCH channels for an idle condition and starts the transmission. Next it looks for the R/N and PE fields to confirm that the first packet unit was correctly received by the base station. If this did not occur, the mobile station will, after a random delay, look again for an idle UPCH channel and try to retransmit its packet.

Referring next to Fig. 6, an example of random access control between two mobile stations in an illustrative digital cellular system of the PDC type is illustrated. In this example, two mobile stations MS1 and MS2 each have a packet to transmit to the network. The packets both consist of two bursts on the UPCH channel. The

sequence of events corresponds to the sequence of circled numbers in Fig. 6. First, the uplink UPCH is idle, which is indicated by the E field on the downlink UPCH, and thus both mobiles start transmission of their packets. Second, the base station is able to receive the first packet burst from MS2 uncorrupted and responds accordingly by setting the following indications in the E field on the downlink: I/B field: B=B (busy); and R/N field: =R (burst received); and PE field: the CRC value from the burst received from MS2. Thirdly, MS2 detects that the PE field contains the CRC from the burst it has transmitted, which together with the appropriate B and R indications tell this mobile station to continue transmitting its packet. MS1, since it lost the contention with MS2, will inhibit all transmissions for a random time and then start searching for an indication that the channel has become idle again. In the fourth step, when mobile station MS2 has completed its transmission the channel will again be marked idle and, in this example, MS1 starts transmission of its packet. At 5, MS1 receives an indication that its first burst was correctly received.

From these illustrations, it can be seen how a mobile station, seeking random access within the system could encounter substantial difficulty in obtaining use of the packet data channel when either a great deal of packet traffic is present in the network or the packets being sent by the packet channel user are lengthy and therefore occupy the channel for extended periods of time.

Thus, there exists a need for an alternative solution within such radio telecommunication networks which enhance the packet data access by users within the system.

BRIEF SUMMARY OF THE INVENTION

In one aspect the present invention includes providing packet data access in a digital cellular communications network by incorporating a first random access scheme within the network in which packet data access for low traffic areas is provided only over a shared data channel and mobile stations seeking packet data access must compete with one another for usage of the channel. A second access scheme is provided within the network with which packet data access is provided over a random access channel which is used only for control signaling and short data messages and at least one polling data channel is used for sending larger quantities of

data in high traffic areas between a mobile station and the network. Messages are broadcast over the control channel (BCCH) which indicate the presence and operative parameters of the second access scheme to all mobile stations. Access to the second access scheme is inhibited to all mobile stations which are not capable of communicating over both the first and second access schemes.

In another aspect, the invention includes improving the performance of a digital mobile radio communications network that includes a first random access packet data scheme by allocating the nonexclusive use of the first random access packet data scheme for packet data transmission within the mobile communication network by all mobile stations having packet data capability within the system. A second packet data access scheme is provided within the network which includes a second user data and control channel accessible only by a selected class of dual mode mobile stations capable of packet data transmission within both the first and second access schemes of the network and at least one data channel for exclusive use of the dual mode mobiles for sending packet data information in both directions between the mobile station and the network. Both the first and second access schemes may be provided by reallocating the existing channel structure within the radio network. Dual mode mobile stations may select to use the second packet data access scheme to which they have exclusive access based upon, for example, the number of collisions which are currently occurring on the packet data access channel to which all mobiles have access.

In yet another aspect, the present invention provides a method of providing a second packet access scheme into a radio system which has an existing access scheme. The second access scheme is provided in a manner which does not affect the existing mobile stations which are only capable of operating within the existing system.

BRIEF DESCRIPTION OF THE DRAWINGS

For an understanding of the present invention and for further objects and advantages thereof, reference can now be had to the following description, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a pictorial block diagram illustrating a prior art radio telecommunications system;

FIG. 2 is a diagram illustrating the radio channel structure within the air interface of an illustrative prior cellular system having a packet data channel;

FIG. 3 is a diagram illustrating random access of a shared packet data channel in an illustrative prior art digital cellular system;

FIG. 4 is a pictorial diagram illustrating competition for a single random access packet data channel and possible collisions which may occur in a prior art system;

FIG. 5 is a diagram illustrating the downlink signaling format within a control channel of a prior digital cellular system illustrating collision control messaging;

FIG. 6 is a diagram illustrating random access for communication by two separate mobile stations, both seeking random packet access to a base station in a prior art digital cellular system;

FIG. 7 is a pictorial diagram illustrating the addition of a separate parallel packet data access scheme within a digital cellular system having a random access packet data channel in accordance with the present invention;

FIG. 8 is a pictorial diagram illustrating selective access of the separate parallel dedicated packet data channel in a system constructed in accordance with the teachings of the present invention;

FIG. 9 is a pictorial diagram illustrating access to a parallel packet data access scheme incorporated into a network in accordance with the present invention;

FIG. 10 is a signaling diagram illustrating large quantity data transfer initiated by a mobile station in a system constructed in accordance with the present invention;

FIG. 11 is a signaling diagram illustrating large quantities of data transfer initiated by the network when a mobile station is in active state in a system constructed in accordance with the present invention; and

FIG. 12 is a signaling diagram illustrating large quantities of data transfer initiated by the network when a mobile station is initially in a packet standby state in a system constructed in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As discussed above, a shared random access packet data channel has distinct disadvantages in a digital radio telecommunication system when packet traffic is heavy and/or large quantities of data need to be sent. The system of the present

invention provides an improved solution to this situation by incorporating a second multiple access dedicated packet data scheme which is used simultaneously with the existing shared random access scheme. The system also provides for a second class of mobile station which has the capability of accessing either the first access scheme or both the first access scheme and the dedicated packet access scheme.

As illustrated in Fig. 7, a base station 51 in a system constructed in accordance with the present invention, includes means for providing random access attempts 52 and 53 from a pair of mobile stations 54 and 55 each of which include, respectively, packet data access capabilities 54a and 55a. The BCCH contains an indication of which packet channels are available within the system. Access to the first access scheme by the respective mobile stations 54 and 55 is accomplished by random access contention by the two mobile stations in response to information on the downlink UPCH for the first access scheme. In addition, mobile station 55 includes the additional capability of using a second dedicated packet access scheme incorporated as part of the system of the present invention. The first access scheme, available to both mobile stations 54 and 55, includes only random packet access. The second access scheme, available to only mobile station 55, is dedicated packet traffic only. The mobile station 55 is, in effect, a dual mode mobile station having the capability of securing packet data access on either of the two schemes while the mobile station 54 only has the capability of access under the first random access scheme.

One exemplary technique for allowing access to the dedicated packet to only the limited group of dual mode mobiles capable of accessing both schemes is with the use of channel restriction parameters. Under present PDC standards, for example, a broadcast information message is sent on the downlink of the BCCH and on other channels from time to time. The broadcast information message contains numerous mandatory and optional parameters including packet channel structure information and channel restriction information. The channel restriction parameter combines one octet of data allowing for 256 combinations of bits. Presently, under current PDC standards, only 11 eight bit combinations are known to and recognizable by existing mobiles and used by the network to control access to the current random packet access scheme. Thus, bit combinations other than those 11 would be unrecognized and ignored by the older single mode mobiles which can only access the random packet

access scheme. However, the new dual mode mobiles are programmed to recognize a group of new eight bit combinations in the channel restriction parameter (as well as the old combinations) and thereby know that the dedicated packet access channels are available to them.

Referring next to Fig. 8, there is shown a pictorial diagram illustrating use of the parallel multiple access schemes of the system of the present invention utilized by the dual mode mobile station 55. The first digital random access scheme 59 is essentially the same as that illustrated in the prior art system of Fig. 3 in which multiple mobile stations contend for random access to a packet data channel. The second multiple access scheme 58 may consist, for example, of one channel of random access type 61 and a number of channels which use the polling principle of access. In one exemplary embodiment, the random access channel 61 of the second access scheme comprises an access and control channel (ACH) which is used for control signaling and short data signals. In this embodiment, polling data channels (PDCH) 62 and 63 are used for larger quantities of data to be sent between the mobile station 55 and the network. Only the presence and the operative parameters of the random access channel (ACH) are communicated to all the mobile stations 54 and 55 on the BCCH 35; however, the channel restriction information on the BCCH tells the single mode mobiles 54 that this ACH is not available to them. A dual mode mobile station 55 which has a relatively large quantity of data to send to the network utilizes the present system of the present invention by sending a data registration signal 64 on the ACH. The network can then dynamically allocate one or more polling data channels PDCHs 62 and 63 depending upon the quantity of data to be sent. The network also allocates one or more PDCHs when there is data to be sent to a mobile station. For the polling data channels, PDCHs, either a standard polling scheme, such as in accordance with one of the options of the high level datalink control (HDLC), for example, or a messaging scheme of the type set forth below can be used. The burst structure of the type described above in connection with Figs. 5 and 6 contains an E field for the administration of collision control bits. In this exemplary embodiment of a possible second access scheme, however, the E field is replaced by flag patterns which are controlled by the network. Each pattern is associated with a specific mobile station and, when recognized, allows it to send its data to the network. The layer 1 uplink

scheme of this exemplary second access scheme is illustrated in Fig. 9. The use of polling flags on the PCDH uses the same burst format as, but not the same content as, the use of the E-bits in the random access channel.

One goal in a possible embodiment of a second access system is to minimize the changes in the existing system necessary to implement the new system. For example, the existing downlink signaling format for the control channel is shown in Fig. 5 and discussed above. This format contains an E field which is 22 bits in length and which is used in the existing random access to control packet collisions. In this exemplary second access scheme, the technique of controlling access by the various mobiles seeking access to the PDCH is to replace the collision control bits of the E field with a six bit "flag pattern" repeated 3 times (18 bits) for redundancy. This will give a maximum number of 64 possible combinations. When a dual mode mobile registers with the system on the ACH to obtain access for sending data packets on the PDCH it is assigned one particular flag pattern. That mobile may only send data after it recognizes its own flag pattern as having been broadcast by the network over the PDCH on the downlink indicating that mobile's turn to send packets to the network on the uplink PDCH. For example, a mobile which has recognized its unique flag pattern in the E field may, 190 symbols after the interface between the syncword and color code broadcast by the network, start sending bursts and continue for up to 18 bursts in a single layer 2 message. Thereafter, the network resumes control and sends the flag pattern of a different mobile on the downlink PDCH in the E field giving a different mobile the opportunity to send packets. The allocation of a specific time to send packets to each mobile means that there will be no collisions on the PDCH. The present system allows the same burst format to be used on both the existing random access packet channel and the dedicated PDCH.

This technique of the first exemplary embodiment described above greatly enhances the efficiency of packet data access in a system over both the purely random access system as well as GSM-like systems which offer a mobile the opportunity to continue to maintain ownership of the packet channel (by continuing to request ownership after sending repeated units of packet data). This exemplary embodiment of the system of the present invention provides a much fairer allocation of packet data resources to all the mobiles in the system.

As shown in Figs. 10-12 for one exemplary embodiment of a second access, there are a number of different traffic situations wherein the messaging scheme outline should be used. For example, in Fig. 10 there illustrates a situation in which transfer of a large quantity of data is to be initiated by the mobile station. First, the mobile station (MS) sends a data registration message 71 to the network (NW) on the random access channel (ACH). Thereafter, the network sends a channel allocation message 72 back to the mobile station which then enters the active mode and performs a first data transfer 73 from the mobile station to the network via the polling data channel (PCDH). Thereafter, multiple units, each comprising large quantities of data 74 may be transferred in both directions between the mobile station and the network.

Similarly, Fig. 11 illustrates large quantities of data transfer initiated by the network when the mobile station is in active state. In this instance, the network issues a channel allocation message 75 on the random access channel (ACH) to the mobile station which transmits a channel allocation acknowledgment (ACK) 76 on the packet data channel (PDCH) to the network. A first data transfer 77 takes place on the PDCH from the network to the mobile station and thereafter large quantities of data transfer 78 take place in both directions between the mobile station and the network on the PDCH.

Finally, Fig. 12 illustrates large quantities of data transfer initiated by the network when the mobile station is in a packet standby state wherein in order to save power, the mobile listens less frequently to messages sent by the network. In this instance, a page message 81 is sent on the random access (ACH channel) from the network to the mobile station and the mobile responds with a terminating condition report message 82 on the ACH. The network responds with a channel allocation message 83 to the mobile station who forwards a channel allocation acknowledgment 84 on the PDCH back to the network. A first data transfer 85 takes place on the PDCH from the network to the mobile station followed by large quantity data transfers 86 in both directions between the mobile station and the network.

A second exemplary embodiment of a second access scheme in the multiple access scheme of the present invention might be similar to the first. However, instead of sequentially and cyclically polling the various mobiles and sequentially and cyclically allocating access in accordance with unique flag patterns as described

above, a mobile could be allocated access to the PDCH and allowed to send packets continuously as long as it had any to send. This would also prevent collisions on the PDCH and allow more efficient handling of large amounts of packet data in the network over the single random access system. It would not give each mobile as fair an access to the packet system as in the first exemplary embodiment.

The provision of two parallel access packet data channels, one accessible by all mobiles in the network and the other selectively accessible by dual mode mobiles, can be used in existing systems with random access packet data channels without effecting their existing functions. Minimal change to existing standards, such as PDC, are required to implement the system of the present invention.

The availability of access by mobile stations to one or the other of the dual access schemes of the present invention is controlled by a channel restriction information element, i.e. a parameter, included, for example, within the layer 3 downlink messages called "Broadcast Information," "Zone Information Notification," and "Packet System Information" within the PDC standard used herein as an exemplary embodiment of the invention. This parameter is presently used in PDC to prevent too many mobile stations from using one specific random access channel. In the present invention, this parameter is assigned a value which prevents mobile stations which do not have the capability to communicate on both the conventional random access scheme and the second access scheme from being able to access the latter. Only the "dual-mode" mobiles are allowed by the broadcast parameter to access both schemes. Dual mode mobile stations may be attracted to the second access scheme by selected values of the same parameters used to exclude non-dual mode mobiles from access or by the receipt of information over the BCCH channel which indicates, for example, the number of collisions which are currently occurring on the first random access scheme open to all mobiles.

The present invention enhances the facility of the existing radio telecommunications networks by adding increased capacity on several bases: (1) no collisions will occur on the second access scheme giving superior packet transfer behavior at medium and high traffic loads within the network; (2) the messages sent on the first access scheme will be very short (with no or only very limited data transmissions) which also decreases the probability of collision between dual mode

mobiles accessing this alternative channel and is more suitable for low traffic areas; and (3) the second access scheme is dynamically allocated for usage by the mobile stations according to the amount of data to be transmitted.

The method and system of the present invention also allows a flexible assignment of available packet data resources for each cell. In low traffic cells a single random access packet data channel scheme may be preferred because of lower cost. However, for higher traffic densities, either in numbers of mobiles seeking access for packet data transmission or the larger quantities of data to be sent between mobile stations and the network, a base station which supports both access schemes is considerably more efficient. The provision of the additional access channels may be made by changing the set up parameters for the channels within a cell. The currently available channel structure within each cell is communicated to the mobile stations through normal broadcast procedures.

Although preferred embodiments of the method and apparatus of the present invention have been illustrated in the accompanying drawings and described in the foregoing description, it is understood that the invention is not limited to the embodiment(s) disclosed but it capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined in the following claims.

WHAT IS CLAIMED IS:

1. A method for providing packet data access in a digital cellular communications network which includes:

providing a broadcast control channel (BCCH) over which the network broadcasts system control information to mobile stations in the network;

providing a first random access scheme within said network in which packet data access for low traffic areas is provided over a data channel and mobile stations seeking packet data access compete with one another for use of the channel based upon channel availability messages broadcast to all mobile stations;

providing a second access scheme within said system in which packet data access for high traffic areas is provided for sending larger quantities of data between a mobile station and the network;

broadcasting messages over said control channel (BCCH) which indicate the presence and operative parameters of the channels utilizing said second access scheme to all mobile stations; and

allowing access to the channels utilizing said second access scheme to only mobile stations which are capable of communicating over both the channels utilizing said first and second access schemes.

2. A method for providing packet data access in a digital cellular communications network as set forth in claim 1 wherein said access allowing step includes:

broadcasting control messages over said BCCH which include an information parameter which is interpreted by all mobile stations which are not capable of communications over both of said first and second access schemes as indicating that all channels utilizing said second scheme are not available.

3. A method for providing packet data access in a digital cellular communications network as set forth in claim 1 wherein said access allowing step also includes:

broadcasting control messages over said BCCH which include an information parameter which is interpreted by all mobile stations which are capable

of communications over both of said first and second access schemes as indicating that said second scheme is available to them and attracts said mobile stations to the channels utilizing said second scheme rather than the channels utilizing said first scheme.

4. A method for providing packet data access in a digital cellular communications network as set forth in claim 1 wherein said first access scheme also includes:

broadcasting on the downlink of the channel messages which include a collision control bit field indicating whether the uplink of the shared channel is idle or busy.

5. A method for providing packet data access in a digital cellular communications network as set forth in claim 1 wherein said second access scheme includes a polling data channel and said method further includes the additional step of:

broadcasting on the polling access channel messages which include a flag pattern field indicating which mobile can send its data to the network on the channel utilizing said second access.

6. A method for improving the performance of a digital mobile radio communications network that includes a first random access packet data scheme, comprising the steps of:

allocating the nonexclusive use of the channels utilizing said first random access packet data scheme for packet data transmission within said mobile communication network by all mobile stations having packet data capability within the system;

providing a second packet data access scheme within said network which includes the additional steps of:

providing a second random access user data and control channel accessible only by a selected class of dual mode mobile stations capable of packet data transmission within both said first and second access schemes of said network; and

allocating at least one polling data channel for exclusive use of said dual mode mobiles for sending packet data information in both directions between the mobile station and the network.

7. A method as set forth in Claim 6 wherein the channels of both said first and second access schemes are provided by reallocating the existing channel structure within said radio network.

8. A method as set forth in claim 6 wherein the channels of both said first and second access schemes employ the same burst format.

9. A method as set forth in claim 6 wherein said dual mode mobile stations select to use the second packet data access scheme to which they have exclusive access in response to the number of collisions which are currently occurring on the packet data access channel to which all mobiles have access.

10. A method for providing a second multiple access scheme in an existing digital cellular communications system without affecting mobiles designed according to the standards of said existing system in which said existing system includes a random packet access scheme wherein packet data access for low traffic areas is provided over a data channel and mobile stations seeking packet data access compete with one another for use of the channel based upon channel availability messages broadcast to all mobile stations, said method comprising:

providing a second access scheme within said existing system in which packet data access for high traffic areas is provided for sending larger quantities of data between a mobile station and the network;

broadcasting messages on the control channel (BCCH) of said existing system which indicate the presence and operative parameters of the channels, utilizing said second access scheme to all mobiles stations; and

allowing access to channels utilizing said second access scheme to only mobile stations which are capable of communicating over channels utilizing both said existing and said second access schemes.

11. A method for providing a second multiple access scheme in an existing digital cellular communications system as set forth in claim 10 wherein said access allowing step includes:

broadcasting control messages over said existing BCCH which include an information parameter which is interpreted by all mobile stations which are designed in accordance with the standards of said existing system and not capable of communications over both of said existing and second access schemes as indicating that all channels utilizing said second scheme are not available.

12. A method for providing a second access scheme in an existing digital cellular communications system as set forth in claim 10 wherein said access allowing step also includes:

broadcasting control messages over said existing BCCH which include an information parameter which is interpreted by all mobile stations which are capable of communications over both of said existing and said access schemes as indicating that said second scheme is available to them and which attracts said mobile stations to channels utilizing said second scheme rather than channels utilizing said existing scheme.

13. A method for providing a second access scheme in an existing digital cellular communications system as set forth in claim 10 wherein said first access scheme also includes:

broadcasting on the downlink of the channel messages which include a collision control bit field indicating whether the uplink of the shared channel is idle or busy.

14. A method for providing a second access scheme in an existing digital cellular communications system as set forth in claim 10 wherein said second access scheme includes a polling data channel and said method further includes the additional step of:

broadcasting on the polling data channel messages which include a flag pattern field indicating which mobile can send its data to the network on the channel utilizing said second access.

15. A system for providing packet data access in a digital cellular communications network which includes:

means for providing a broadcast control channel (BCCH) over means for which the network broadcasts system control information to mobile station in the network;

means for providing a first random access scheme within said network in which packet data access for low traffic areas is provided over a data channel and mobile stations seeking packet data access compete with one another for use of the channel based upon messages broadcast on the downlink of the channel utilizing said first random access scheme;

means for providing channels utilizing a second access scheme within said system in which packet data access for high traffic areas is provided for sending larger quantities of data between a mobile station and the network;

means for broadcasting messages over said control channel (BCCH) which indicate the presence and operative parameters of the channels utilizing said second random access scheme to all mobile stations; and

means for allowing access to channels utilizing said second access scheme to only mobile stations which are capable of communicating over both said first and second access schemes.

16. A system for providing packet data access in a digital cellular communications network as set forth in claim 15 wherein said access allowing means includes:

means for broadcasting control messages over said BCCH which include an information parameter which is interpreted by all mobile stations which are not capable of communications over both of said first and second access schemes as indicating that the channels utilizing said second scheme are not available.

17. A system for providing packet data access in a digital cellular communications network as set forth in claim 15 wherein said access allowing means also includes:

means for broadcasting control messages over said BCCH which include an information parameter which is interpreted by all mobile stations which are capable of communications over both of said first and second access schemes as indicating that the channels utilizing said second scheme is available to them and attracts said mobile stations to the channels utilizing said second scheme rather than the channels utilizing said first scheme.

18. A system for providing packet data access in a digital cellular communications network as set forth in claim 15 wherein said first access scheme also includes:

means for broadcasting messages on the downlink of the channel utilizing said first access scheme which include a collision control bit field indicating whether the shared channel is idle or busy.

19. A system for providing packet data access in a digital cellular communications network as set forth in claim 15 wherein said second access scheme includes a polling data channel and said system also includes:

means for broadcasting on the polling data channel messages which include a flag pattern field indicating which mobile can send its data to the network on the channel utilizing said second access.

20. A system for improving the performance of a digital mobile radio communications network that includes a first random access packet data scheme, comprising:

means for allocating the nonexclusive use of channels utilizing said first random access packet data scheme for packet data transmission within said mobile communication network by all mobile stations having packet data capability within the system;

means for providing channels utilizing a second packet data access scheme within said network which includes:

means for providing a second random access user data and control channel accessible only by a selected class of dual mode mobile stations capable of packet data transmission within both said first and second access schemes of said network; and

means for allocating at least one polling data channel for exclusive use of said dual mode mobiles for sending packet data information in both directions between the mobile station and the network.

21. A system as set forth in Claim 20 wherein the channels of both said first and second access schemes are provided by reallocating the existing channel structure within said radio network.

22. A system as set forth in claim 20 wherein the channels of both said first and second access schemes employ the same burst format.

23. A system as set forth in claim 24 wherein said dual mode mobile stations select to use the second packet data access scheme to which they have exclusive access in response to the number of collisions which are currently occurring on the packet data access channel to which all mobiles have access.

24. A system for providing a second multiple access scheme in an existing digital cellular communications system without affecting mobiles designed according to the standards of said existing system in which said existing system includes a random packet access scheme wherein packet data access for low traffic areas is provided over a data channel and mobile stations seeking packet data access compete with one another for use of the channel based upon channel availability messages broadcast to all mobile stations, said system comprising:

means for providing a second access scheme within said existing system in which packet data access for high traffic areas is provided for sending larger quantities of data between a mobile station and the network;

means for broadcasting messages of the control channel (BCCH) of said existing system which indicate the presence and operative parameters of the channels, utilizing said second access scheme to all mobiles stations; and

means for allowing access to channels utilizing said second access scheme to only mobile stations which are capable of communicating over channels utilizing both said existing and said second access schemes.

25. A system for providing a second multiple access scheme in an existing digital cellular communications system as set forth in claim 24 wherein said means for allowing access comprises:

means for broadcasting control messages over said existing BCCH which include an information parameter which is interpreted by all mobile stations which are designed in accordance with the standards of said existing system and not capable of communications over both of said existing and second access schemes as indicating that all channels utilizing said second scheme are not available.

26. A system for providing a second access scheme in an existing digital cellular communications system as set forth in claim 24 wherein said means for allowing access comprises:

means for broadcasting control messages over said existing BCCH which include an information parameter which is interpreted by all mobile stations which are capable of communications over both of said existing and said access schemes as indicating that said second scheme is available to them and which attracts said mobile stations to channels utilizing said second scheme rather than channels utilizing said existing scheme.

27. A system for providing a second access scheme in an existing digital cellular communications system as set forth in claim 24 wherein said first access scheme also includes:

means for broadcasting on the downlink of the channel messages which include a collision control bit field indicating whether the uplink of the shared channel is idle or busy.

28. A system for providing a second access scheme in an existing digital cellular communications system as set forth in claim 24 wherein said second access scheme includes a polling data channel and said system further comprises:

means for broadcasting on the polling data channel messages which include a flag pattern field indicating which mobile can send its data to the network on the channel utilizing said second access.

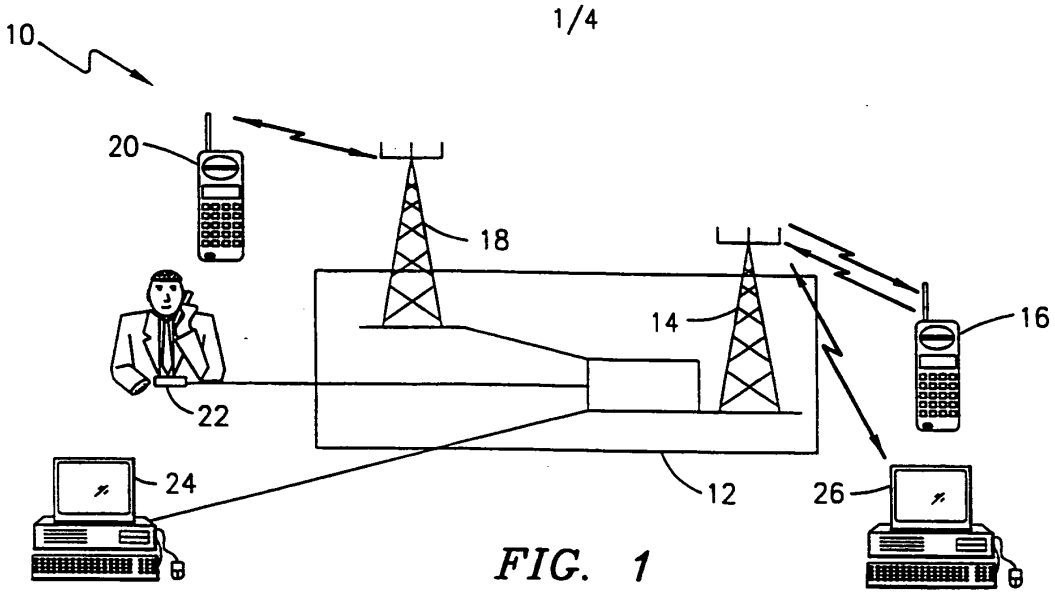


FIG. 1

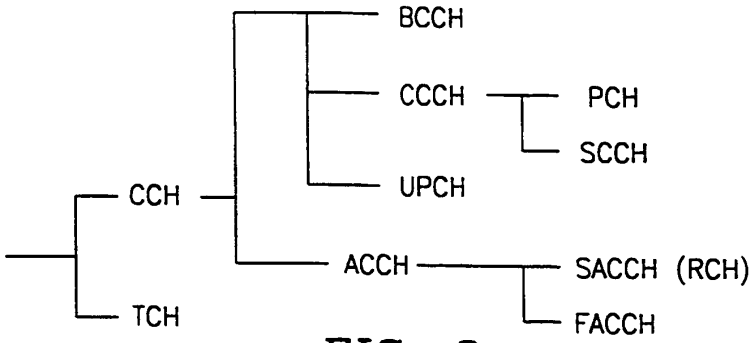


FIG. 2

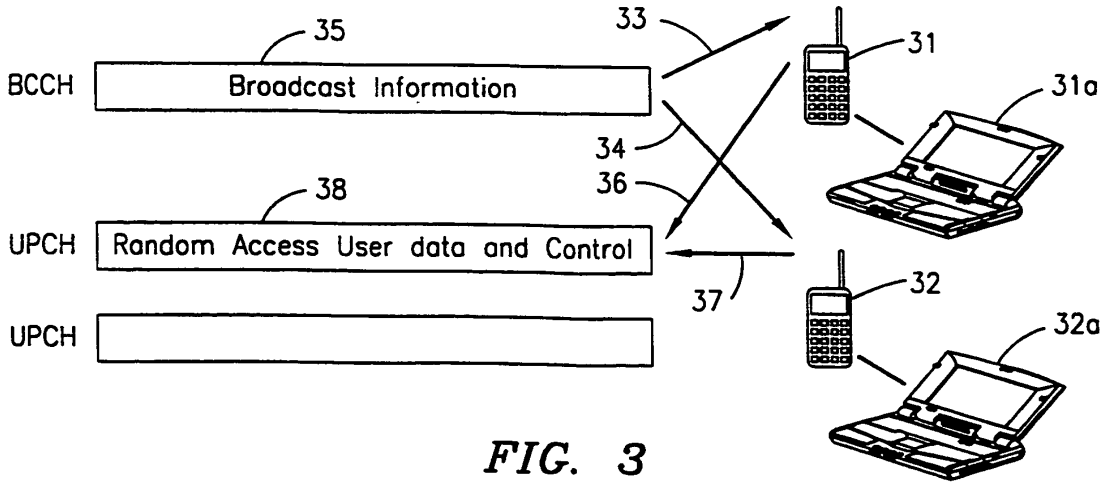


FIG. 3

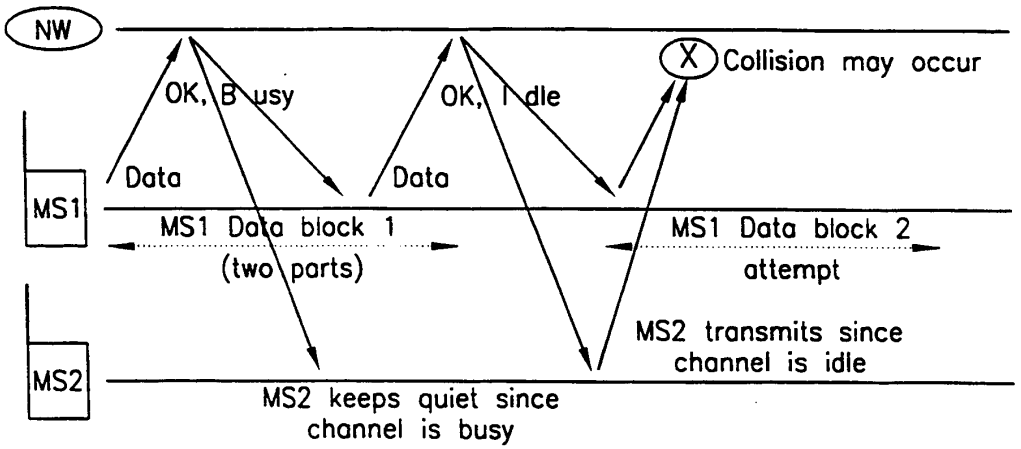
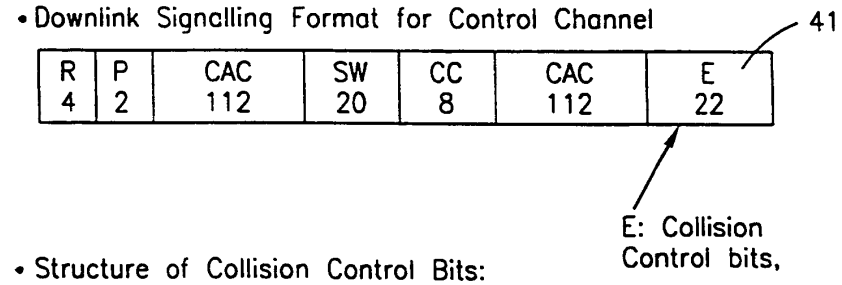


FIG. 4



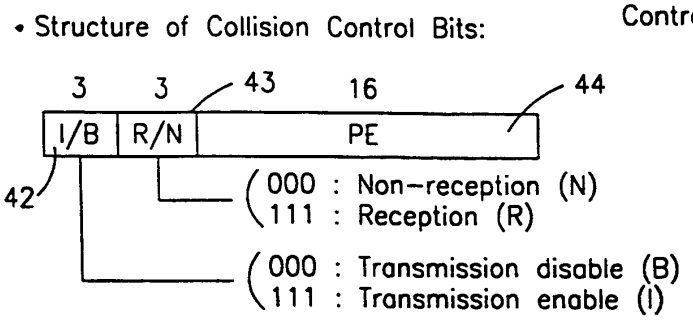


FIG. 5

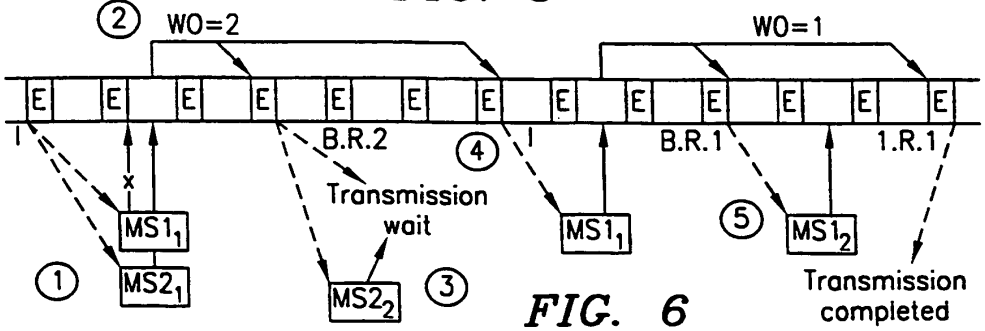


FIG. 6

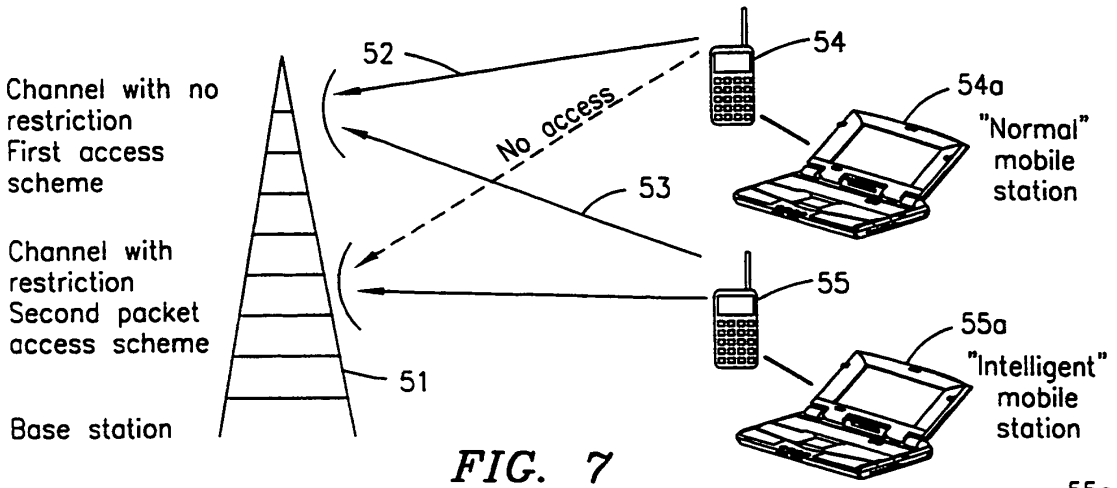


FIG. 7

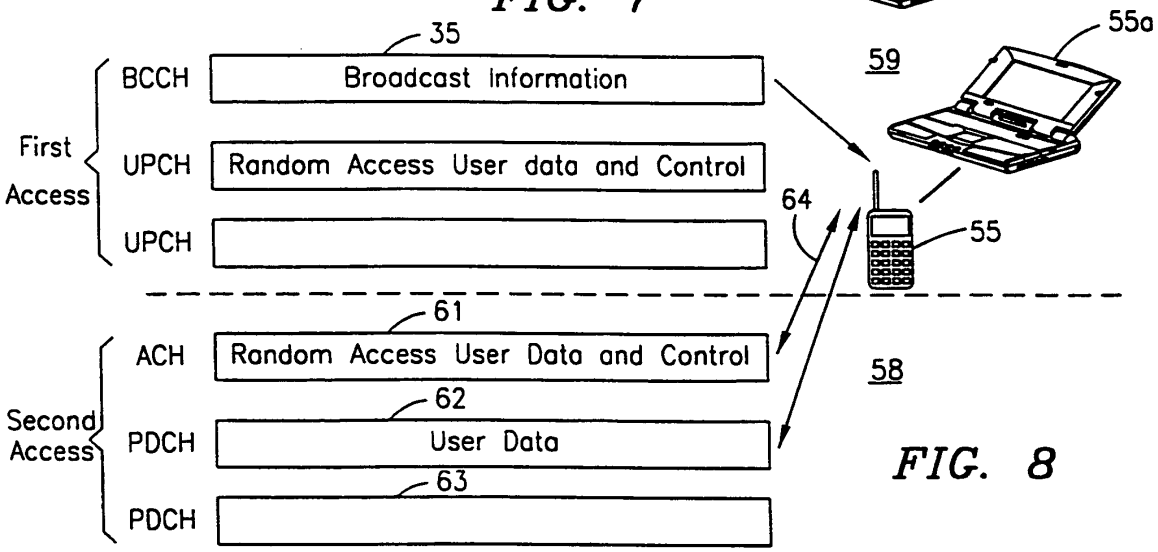


FIG. 8

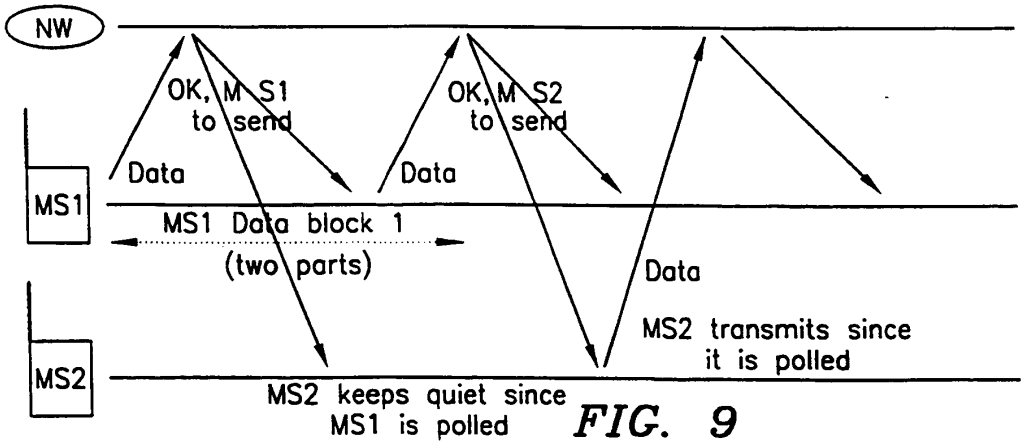


FIG. 9

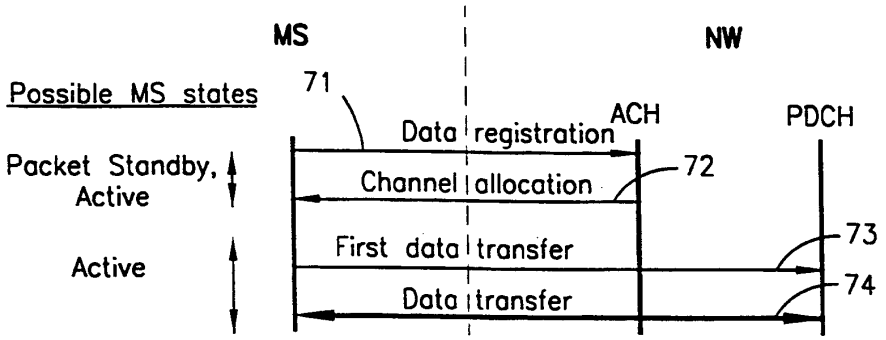


FIG. 10

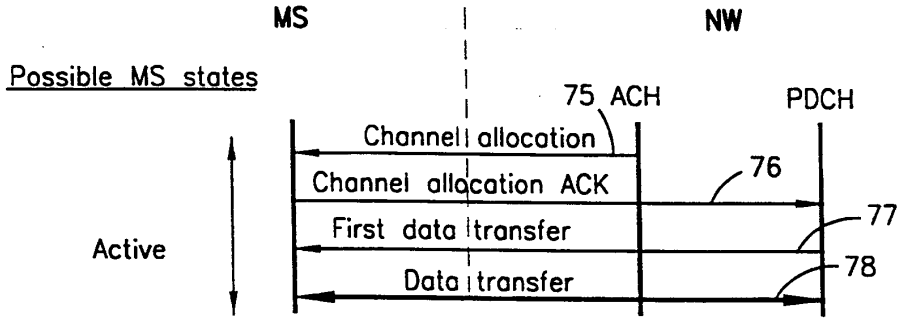


FIG. 11

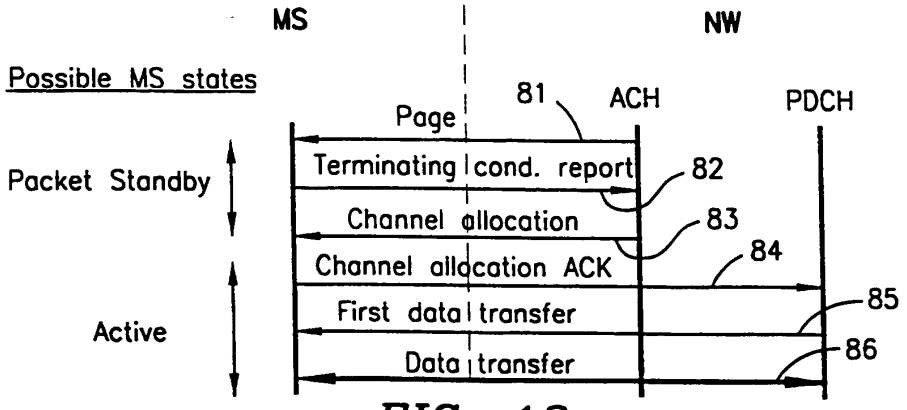


FIG. 12

INTERNATIONAL SEARCH REPORT

itional Application No
PCT/SE 98/01884

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L12/56 H04Q7/22 H04L12/403 H04L12/413

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)
IPC 6 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, 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	WO 96 37079 A (QUALCOMM INC) 21 November 1996 see page 1, line 8 - line 13 see page 2, line 19 - page 7, line 15 see page 9, line 8 - page 11, line 28 see page 13, line 29 - page 14, line 22 see page 16, line 30 - page 18, line 25 see page 19, line 11 - line 18 see claim 3	1,3,15, 17
Y		2,4,10, 12,16, 18,24,26
A		5-8,11, 13,14, 19-22, 25,27,28

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[X] Further documents are listed in the continuation of box C.° [X] Patent family members are listed in 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
26 February 1999	17/03/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Vaskimo, K

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Form PCT/ISA/210 (second sheet) (July 1992)

BNSDOCID: <WO___9921328A1_I_>

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 590 133 A (BILLSTROEM LARS ET AL) 31 December 1996 see column 3, line 53 - column 5, line 8 see column 6, line 66 - column 7, line 28 see column 9, line 1 - column 10, line 6 see column 11, line 7 - column 12, line 55 see column 13, line 20 - column 14, line 44 see column 15, line 2 - column 20, line 55	1,3,15, 17
Y		2,4,10, 12,16, 18,24,26
A		5-8,11, 13,14, 19-22, 25,27,28

Y	US 5 012 469 A (SARDANA KARAMVIR) 30 April 1991 see column 1, line 6 - column 6, line 49	1-3, 15-17
A		5,6, 8-10,13, 14,19, 20, 22-24, 27,28

Y	MICHEL MOULY, MARIE-BERNADETTE PAUTET: "GSM System for Mobile Communications" 2 September 1993 , EUROPE MEDIA , LASSAY-LES-CHATEAUX, FR XP002063457 200240 see page 367, paragraph 6.3.1. - page 373, paragraph 6.3.1.2. see page 424, paragraph 6.3.10. - page 428, paragraph 6.3.10.4	1-3, 15-17

Y	WO 97 38502 A (ERICSSON GE MOBILE INC ;HASSAN AMER (US); RAMESH RAJARAM (US); REI) 16 October 1997 see abstract see page 1, line 15 - page 6, line 15 see page 8, line 2 - page 15, line 22 see page 16, line 27 - page 23, line 4	10,12, 24,26
A		5-9,14, 19-23,28

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INTERNATIONAL SEARCH REPORT

ational Application No
PCT/SE 98/01884

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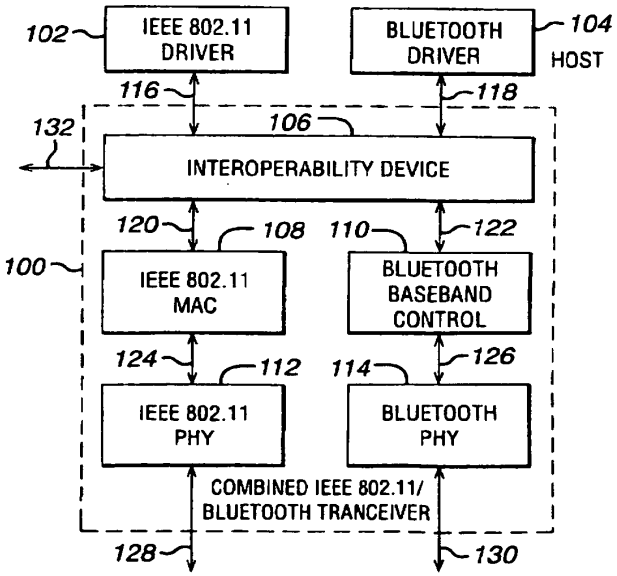
(54) Interoperability for bluetooth/IEEE 802.11

(57) The key of the invention is to introduce an interoperability device in a communication system which integrates an IEEE 802.11 transceiver and a Bluetooth transceiver. The device prevents that one transceiver is transmitting while the other is receiving, which would cause interference at the receiving transceiver. In addition, the device preferably prevents that both systems are transmitting at the same time to avoid interference at the receiving device(s). Optionally the device prohibits simultaneous reception of both transceivers. In that way the radio receiver can be shared between the devices, allowing a cheaper and smaller hardware design.

FIG. 1



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Description

[0001] The present invention relates to both Bluetooth and IEEE 802.11 radio communication systems.

[0002] IEEE 802.11 is a standard for wireless systems that operate in the 2.4 - 2.5 GHz ISM (industrial, scientific and medical) band. This ISM band is available world-wide and allows unlicensed operation for spread spectrum systems. For both the US and Europe, the 2,400 - 2,483.5 MHz band has been allocated, while for some other countries, such as Japan, another part of the 2.4 - 2.5 GHz ISM band has been assigned. The 802.11 standard focuses on the MAC (medium access control) protocol and PHY (physical layer) protocol for access point (AP) based networks and ad-hoc networks.

[0003] In access point based networks, the stations within a group or cell can communicate only directly to the access point. This access point forwards messages to the destination station within the same cell or through a wired distribution system to another access point, from which such messages arrive finally at the destination station. In ad-hoc networks, the stations operate on a peer-to-peer level and there is no access point or (wired) distribution system.

[0004] The 802.11 standard supports: DSSS (direct sequence spread spectrum) with differential encoded BPSK and QPSK; FHSS (frequency hopping spread spectrum) with GFSK (Gaussian FSK); and infrared with PPM (pulse position modulation). These three physical layer protocols (DSSS, FHSS and infrared) all provide bit rates of 2 and 1 Mbit/s. The 802.11 standard further includes extensions 11a and 11b. Extension 11b is for a high rate CCK (Complementary Code Keying) physical layer protocol, providing bit rates 11 and 5.5 Mbit/s as well as the basic DSSS bit rates of 2 and 1 Mbit/s within the same 2.4 - 2.5 GHz ISM band. Extension 11a is for a high bit rate OFDM (Orthogonal Frequency Division Multiplexing) physical layer protocol standard providing bit rates in the range of 6 to 54 Mbit/s in the 5 GHz band. The 802.11 basic medium access behaviour allows interoperability between compatible physical layer protocols through the use of the CSMA/CA (carrier sense multiple access with a collision avoidance) protocol and a random back-off time following a busy medium condition. In addition all directed traffic uses immediate positive acknowledgement (ACK frame), where a retransmission is scheduled by the sender if no positive acknowledgement is received. The 802.11 CSMA/CA protocol is designed to reduce the collision probability between multiple stations accessing the medium at the point in time where collisions are most likely occur. The highest probability of a collision occurs just after the medium becomes free, following a busy medium. This is because multiple stations would have been waiting for the medium to become available again. Therefore, a random back-off arrangement is used to resolve medium contention conflicts. In addition, the 802.11 MAC defines: special functional behaviour for fragmentation of packets; medium reservation via RTS/CTS (request-to-send/clear-to-send) polling interaction; and point co-ordination (for time-bounded services).

[0005] The IEEE 802.11 MAC also defines Beacon frames, sent at a regular interval by an AP to allow STAs to monitor the presence of the AP. IEEE 802.11 also defines a set of management frames including Probe Request frames which are sent by an STA, and are followed by Probe Response frames sent by the AP. Probe Request frames allow an STA to actively scan whether there is an AP operating on a certain channel frequency, and for the AP to show to the STA what parameter settings this AP is using.

[0006] Bluetooth technology allows for the replacement of the many proprietary cables that connect one device to another with one universal short-range radio link. For instance, Bluetooth radio technology built into both a cellular telephone and a laptop would replace the cumbersome cable used today to connect a laptop to a cellular telephone. Printers, personal digital assistant's (PDA's), desktops, computers, fax machines, keyboards, joysticks and virtually any other digital device can be part of the Bluetooth system. But beyond un-tethering devices by replacing the cables, Bluetooth radio technology provides a universal bridge to existing data networks, a peripheral interface, and a mechanism to form small private ad-hoc groupings of connected devices away from fixed network infrastructures.

[0007] Designed to operate in a noisy radio frequency environment, the Bluetooth radio system uses a fast acknowledgement and frequency hopping scheme to make the link robust. Bluetooth radio modules avoid interference from other signals by hopping to a new frequency after transmitting or receiving a packet. Compared with other systems operating in the same frequency band, the Bluetooth radio system typically hops faster and uses shorter packets. This makes the Bluetooth radio system more robust than other systems. Short packets and fast hopping also limit the impact of domestic and professional microwave ovens. Use of Forward Error Correction (FEC) limits the impact of random noise on long-distance links. The encoding is optimised for an uncoordinated environment. Bluetooth radios operate in the unlicensed ISM band at 2.4 GHz. A frequency hop transceiver is applied to combat interference and fading. A shaped, binary FM modulation is applied to minimise transceiver complexity. The gross data rate is 1Mb/s.

[0008] A Time-Division Duplex scheme is used for full-duplex transmission. The Bluetooth baseband protocol is a combination of circuit and packet switching. Slots can be reserved for synchronous packets. Each packet is transmitted in a different hop frequency. A packet nominally covers a single slot, but can be extended to cover up to five slots. Bluetooth can support an asynchronous data channel, up to three simultaneous synchronous voice channels, or a channel which simultaneously supports asynchronous data and synchronous voice. Each voice channel supports 64 kb/s synchronous (voice) link. The asynchronous channel can support an asymmetric link of maximally 721 kb/s in

either direction while permitting 57.6 kb/s in the return direction, or a 432.6 kb/s symmetric link.

[0009] The IEEE 802.11 standard is well-established and local area networks are already implemented based on the standard, typically in office environments. As Bluetooth comes into the market, it is likely to be implemented in a domestic environment for communications within the home, for example. Thus someone with a lap-top computer may wish to connect to a IEEE 802.11 wireless local area network in the workplace, and connect to a device, such as a mobile telephone, using a Bluetooth interface outside of the workplace.

[0010] It is therefore an object of the present invention to provide a means for enabling such a single device to interface via both an IEEE 802.11 radio system and a Bluetooth radio system.

[0011] According to one aspect of the present invention there is provided a device incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, wherein the device further includes a control means adapted to control the first and second radio systems such that such that only one or the other radio system may transmit at any one time. The first radio system may be a Bluetooth system and the second radio system may be an IEEE 802.11 system.

[0012] The device may be additionally controlled such that when one device is transmitting the other device cannot receive or transmit. The device may be additionally controlled such that when one device is receiving the other device cannot receive or transmit.

[0013] The control means may comprise a switching means, the switching means being adapted to switch on and off the first and second radio systems.

[0014] The control means may comprise a multiplexing means adapted to time multiplex transmissions from the first and second radio systems.

[0015] The control means may comprise a multiplexing means adapted to time multiplex transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

[0016] The Bluetooth transmissions may be through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four. The Bluetooth transmissions may be through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six. The Bluetooth transmissions may be through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

[0017] The control means may prevent transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission. The control means may prevent transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

[0018] The first and second radio systems may share a common physical layer.

[0019] According to another aspect of the present invention there is provided a method of incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, into a single device, wherein the first and second radio systems are controlled such that only one or the other radio system may transmit at any one time. The first radio system may be a Bluetooth system and the second radio system may be an IEEE 802.11 system.

[0020] The method may further comprise controlling the radio systems such that when one radio system is transmitting the other device cannot receive or transmit.

[0021] The method may further comprise controlling the radio systems such that one device is receiving the other device cannot receive or transmit.

[0022] The radio systems may be controlled by switching on and off the first and second radio systems.

[0023] The radio systems may be controlled by time multiplexing transmissions from the first and second radio systems.

[0024] The method may comprise time multiplexing transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

[0025] The Bluetooth transmissions may be through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four. The Bluetooth transmissions may be through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six. The Bluetooth transmissions may be through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

[0026] The method may further comprising preventing transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission. The method may further comprising preventing transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

[0027] The first and second radio systems may share a common physical layer.

[0028] Therefore if both an IEEE 802.11 radio transceiver and a Bluetooth radio transceiver reside in a single device (for instance in a laptop computer) they can transmit and receive in the same radio frequency simultaneously, even though both communication standards make use of the same 85 MHz wide ISM band, at around 2.4 GHz. This is

achieved by a Bluetooth device in a computer being prevented from transmitting data whilst an 802.11 device is attempting to receive data and vice versa.

[0029] Even if the RF frequency that the receiving device is tuned to is different, but still in the same band that the transmitting device is using, the emitted power will jam the receiver, rendering it unable to receive the intended signal.

[0030] The invention solves this problem by introducing an interoperability device, that is connected both to the medium access controller of the IEEE 802.11 device and to the baseband controller of the Bluetooth device.

[0031] The invention also proposes an alternative solution, called dual mode operation, where the IEEE 802.11 devices operate in a different radio frequency band than the Bluetooth system.

[0032] The key of the invention to introduce an interoperability device in a communication system which integrates an IEEE 802.11 transceiver and a Bluetooth transceiver. The device prevents that one transceiver is transmitting while the other is receiving, which would cause interference at the receiving transceiver. In addition, the device prevents that both systems are transmitting at the same time to avoid interference at the receiving device(s). optionally the device prohibits simultaneous reception of both transceivers. In that way the radio receiver can be shared between the devices, allowing a cheaper and smaller hardware design. The invention also covers a dual band mode in which the IEE802.11 device and the Bluetooth device work in a different frequency band, and allows completely parallel operation of the two devices.

[0033] The invention will now be described by way of example with reference to the accompanying Figures, in which:

Figure 1 illustrates a high-level architecture for implementing the present invention;

Figure 2 illustrates the architecture of Figure 1 adapted to utilise radio re-use in accordance with a preferred embodiment of the invention;

Figure 3 illustrates a Bluetooth HV-*i* packet;

Figure 4 illustrates the time-slot allocation for transmission of three different HV-*i* schemes;

Figure 5 illustrates a forward and reverse packet structure for IEEE 802.11; and

Figure 6 illustrates a possible single chip implementation of the present invention.

[0034] The invention serves to solve a fundamental problem associated with providing both a Bluetooth radio system and an IEEE 802.11 radio system in a single device. The fundamental problem that has been identified is that if either one of the radio systems is transmitting, there is need to prevent the other radio system from receiving or else the receiving system will be drowned out by the transmitting system. As will be further discussed hereinbelow, further problems associated with the dual operation of a IEEE 802.11 and Bluetooth radio system are overcome by preferred embodiments of the present invention as discussed hereinbelow.

[0035] Referring to Figure 1, there is illustrated a high-level architecture of the combination of an IEEE 802.11 radio system transceiver and a Bluetooth radio system transceiver in a single system, in conjunction with an interoperability device in accordance with the present invention. It will be understood by one skilled in the art that only those elements necessary for the implementation of the present invention are shown in Figure 1.

[0036] The dual mode transceiver of Figure 1 comprises: an IEEE 802.11 physical layer functional element 112; an IEEE 802.11 MAC layer functional element 108; a Bluetooth physical layer functional element 114; a Bluetooth baseband control functional element 110; and an interoperability device 106, all of which comprise a combined IEEE 802.11 /Bluetooth transceiver generally designated by reference numeral 100. In addition an IEEE 802.11 driver 102 and a Bluetooth driver 104 are shown in Figure 1.

[0037] The IEEE 802.11 driver 102 receives IEEE 802.11 packets from the dual mode transceiver 100 on lines 116, and transmits IEEE 802.11 packets to the dual mode transceiver 100 on lines 116. The Bluetooth driver 104 receives Bluetooth packets from the dual mode transceiver 100 on lines 118, and transmits Bluetooth packets to the dual mode transceiver on lines 118. The operation of the respective drivers 102 and 104 is exactly the same as their operation would be if the device were provided with a single IEEE 802.11 or Bluetooth transceiver respectively. However their function may be extended in the sense that they pass on switching signal from application(s) to the interoperability device 106.

[0038] The IEEE 802.11 MAC functional element 108 and the IEEE 802.11 physical functional element 112 form the IEEE 802.11 transceiver of the dual mode transceiver. The IEEE 802.11 MAC functional element 108 operates in accordance with the IEEE standard arrangement to control access to the IEEE 802.11 transmission medium by the device to which it is connected. The IEEE 802.11 MAC functional element 108 receives and transmits IEEE 802.11 packets to and from the interoperability device 106 via lines 120, and transmits and receives IEEE 802.11 packets to

and from the IEEE 802.11 physical layer functional element 112 via lines 124. The IEEE 802.11 physical layer functional element 112 operates in accordance with the IEEE standard arrangement to perform modulation etc. of the IEEE 802.11 packets and transmit/receive the packets via lines 128, which interface the element to the device antenna.

[0039] The Bluetooth baseband control functional element 110 and the Bluetooth physical layer functional element 114 form the Bluetooth transceiver of the dual mode transceiver. The Bluetooth baseband control functional element 110 operates in accordance with the Bluetooth standard arrangement to control access to the transmission medium by the device to which it is connected. The Bluetooth baseband control functional element 110 receives and transmits Bluetooth packets to and from the interoperability device 106 via lines 122, and transmits and receives Bluetooth packets to and from the Bluetooth physical layer functional element 114 via lines 126. The IEEE 802.11 physical layer functional element 114 operates in accordance with the Bluetooth standard arrangement to perform modulation etc. of the Bluetooth packets and transmit/receive the packets via lines 130, which interface the element to the device antenna.

[0040] The control of IEEE 802.11 packets and Bluetooth packets from the respective drivers 102 and 104 to the respective transceiver elements 108/112 and 110/114 is controlled in accordance with the invention by the interoperability device 106. As shown in Figure 1, the interoperability device is additionally connected to control circuitry within the device via control signal lines 132.

[0041] The dual mode transceiver 100 operates in accordance with the invention in one of two modes. A first mode is a switching mode and a second mode is a multiplexing mode, both of which modes are discussed in further detail herein below.

[0042] In the switching mode of operation, the interoperability device 106 deactivates the Bluetooth transceiver (110/114) whenever the IEEE 802.11 transceiver (108/112) is activated, and vice versa. The interoperability device 106 is adapted to make the decision as to which mode of operation to switch to or activate. There are several alternative criteria on which the interoperability device may make this decision.

[0043] In a first alternative, the user of the device may decide which mode to switch to. For instance when the user is at home and wants to connect to the Internet through a telephone, the user may decide to switch to Bluetooth mode and dial up to an Internet Service Provider (ISP). When the user is in the office, where an IEEE 802.11 wireless LAN is present, the IEEE 802.11 mode may be selected by the user, to enable the user to log on to the network. This mode requires the user to know which is the appropriate interface to use for the chosen application. The user command will most likely be provided through an interface, such as a screen and keypad, on the device itself, and notified to the interoperability device 106 via a command signal from a central processor or controller in the device. In addition mixed environments, where both Bluetooth and IEEE 802.11 exist, may be present for example in an office environment.

[0044] In an alternative, the notification of the mode of operation may be provided to the transceivers via control from the CPU through regular drivers, or through a dedicated interoperability device driver.

[0045] In a second alternative, application software may control which mode the device switches to. For instance when the user chooses to synchronise a Personal Digital Assistant (PDA), the data-synchronisation application in the PC may tell the interoperability device to switch to Bluetooth mode. When the user chooses to surf the World Wide Web (WWW), the browser application (or the network driver software supporting it) may tell the interoperability device to switch to IEEE 802.11 mode. Again, the interoperability device 106 may be instructed via a command signal from a central processor or controller.

[0046] In a third alternative, a protocol sniffer may determine whether it detects the presence of an IEEE 802.11 device or a Bluetooth device on the air interface, and set the mode of the interoperability device accordingly. When the protocol sniffer detects both Bluetooth and IEEE 802.11 devices, it may choose a mode that the user has indicated as preferential, or it may consult the user as in the first alternative. Alternatively, the protocol sniffer may let the application decide as in the second alternative.

[0047] Thus in the switching mode the interoperability device operates merely to deactivate, or switch off, one of the two transceivers within the dual mode transceiver. This operation is transparent to the functional elements of the respective transceivers, and also to the other processing functionality in the device itself. When the interoperability device is switched to "IEEE 802.11" mode the transceiver 100 behaves as an IEEE 802.11 transceiver. When the interoperability device is switched to "Bluetooth" mode the transceiver 100 behaves as an Bluetooth transceiver.

[0048] In the switching mode, turning off one transceiver when the other is transmitting means that the one transceiver cannot receive or transmit when the other is transmitting. Thus when employing the switching mode only one radio system needs to be operating at a given time, which means that the radio hardware can be reused.

[0049] Figure 2 illustrates the dual mode transceiver of Figure 1 re-configured to utilise radio re-use. As can be seen from Figure 2, the functionality of the IEEE 802.11 physical layer functional element 112 and the Bluetooth physical layer functional element 114 are combined into a single functional element referred to as the IEEE 802.11/Bluetooth dual physical layer functional element, and denoted by reference numeral 200. The dual functional element 200 transmits and receives IEEE 802.11 and Bluetooth packets on signal lines 204 to the device antenna.

[0050] The IEEE 802.11/Bluetooth dual physical layer functional element is controlled by the interoperability device

via signal lines 202 to operate as the physical layer functional element for either IEEE 802.11 or Bluetooth in accordance with the current mode of operation selected.

[0051] In the multiplexing mode of operation the IEEE 802.11 transmitter is switched off when the Bluetooth transmitter is receiving data and the Bluetooth transmitter is switched off when the IEEE 802.11 device is receiving data. In this way one radio system is never transmitting when the other is receiving, and vice versa. The interoperability device 106 observes the rules of the medium access control protocols, and while the transmission and reception of the IEEE 802.11 and Bluetooth radio systems are time multiplexed, it will appear to the user that the two systems operate in parallel. There will, however, be some performance impact (reduced data throughput, increased data error rate, reduced voice quality).

[0052] Furthermore, the interoperability device 106 additionally preferably does not allow the IEEE 802.1 and Bluetooth radio systems to transmit at the same time. Thus interference of one signal with the other at an external (remote) receiver is prevented.

[0053] In a preferred implementation of the multiplexing mode, if an IEEE 802.11 packet must be transmitted, all Bluetooth data connections are placed in the so-called PARK mode. The interoperability device 106 will issue one HLC_Park_Mode primitive per active ACL (Asynchronous Connectionless data) connection to the Bluetooth transceiver, to put all ACL connections in PARK mode. The PARK mode of the Bluetooth radio system will be familiar to one skilled in the art. In this way, the Bluetooth radio system is deactivated whilst an IEEE 802.11 transmission takes place.

[0054] Although the example implementation is presented herein with reference to a discussion of the Bluetooth PARK mode, it will be appreciated by one skilled in the art that the Bluetooth HOLD mode may alternatively be utilised.

[0055] If-there are active Bluetooth SCO (Synchronous, connection-oriented voice) connections, which transmit and receive periodically in a 0.625 ms Bluetooth slot, then the IEEE 802.11 transceiver must schedule its packet transmissions in-between the Bluetooth packets. The Bluetooth SCO connections are real-time (voice) connections. The interoperability device 106 must take the full IEEE packet exchange period into account, which includes an acknowledgement packet (ACK) and (when the RTS/CTS transmission mode is used) an RTS and CTS packet.

[0056] Further hereinbelow a detailed implementation for scheduling IEEE 802.11 packets in an active SCO connection is given. A 'slot-stealing' scheme is explained and a calculation of data throughput that can be achieved given.

[0057] The IEEE 802.11 packets may need to be as short as a single slot when such a slot-stealing scheme is implemented, and this implies that the interoperability device 106 has to implement a packet fragmentation and reassembly scheme, so that it can divide IEEE 802.11 packets in chunks that can be accommodated in the number of Bluetooth slots that are available. The IEEE 802.11's own fragmentation mechanisms cannot be used, since these mechanisms assume that all fragments are sent consecutively. In the detailed implementation described hereinbelow, a suitable fragmentation scheme is discussed.

[0058] In the following, an example is given for introducing the IEEE 802.11 functionality into a Bluetooth radio system, to enable both radio systems to function together in the same device. The following example is not limiting of the present invention, and the person skilled in the art will recognise that other possibilities exist for the implementation of such an architecture. However, as the Bluetooth specification is dominant the following is a preferred implementation.

[0059] The standard Bluetooth radio system uses Frequency Shift Keying (FSK) modulation, sending one bit of information per symbol time of 1μs. Thus the raw bit-rate is 1 Mbit/s. A packet consists of a preamble, containing a channel access code and a payload. The payload, in turn, is divided into a header (containing packet type, destination address and some other information fields) and a user payload field.

[0060] On the synchronous connection orientated (SCO) links, voice packets are used. The voice packets are typically of the high-quality voice (HV) types HV1, HV2 or HV3. All of these packet types have a 30-byte payload. The most robust packet, HV1, uses rate 1/3 Forward Error Correction (FEC). Packet type HV2 uses rate 2/3 FEC, and type HV3 does not use FEC at all. The number of user bytes is 10,20 and 30 bytes respectively for HV1, HV2 and HV3. The packet layout of an Hv-i (where i=1,2,3) packet is shown in Figure 3. The total duration of a HV-i voice packet is 330 μs. Referring to Figure 3, it can be seen that the Hv-i packet 300 comprises a 72 bit preamble 302, an 18 bit header 304, and a 240 bit (or 30 byte) payload 306.

[0061] In addition to the HV-i type packets, there also exists for Bluetooth a data and voice (DV) type packet. The DV type packet offers the same performance as HV3 (i.e. with no FEC), and carries a variable amount of data as well as voice in the same packet. However, a DV packet carries only 10 user bytes, i.e. a third of HV3's user bytes. The duration of the DV packet is 238 to 356 μs, depending on the amount of data carried.

[0062] Bluetooth packets are sent in time slots, which each have a duration of 625 μs. However packets must be less then 625 μs to allow the radio system sufficient time to hop to another frequency between time slots. Examples of channel operation for HV1, HV2 and HV3 connection are shown in Figure 4, and described further hereinbelow.

[0063] Figures 4(a) to 4(c) illustrate timing diagrams for a single Bluetooth voice connection, based on HV1 (Figure 4(a)), HV2 (Figure 4(b)), or HV3 (Figure 4(c)) packets. The shaded packets are in the forward direction (from Bluetooth master device to Bluetooth slave device), and the clear packets are in the reverse direction (from Bluetooth slave device to Bluetooth master device). Eight time slots TS1 to TS8 are shown. As can be seen forward packets are sent

in odd-numbered time-slots and reverse packets are sent in even-numbered time-slots. The frequency hops, in accordance with the Bluetooth standard, on every time slot, such that the frequencies f_1 to f_8 are hopped-to in times slots TSIto TS8 respectively.

[0064] All voice connection rates are specified to be 64 kbit/s. To achieve this rate a HV1 packet must be sent every other slot, since in every HV1 packet (1/3)×30×8 = 80 bits of user data are sent. (1/3) is the FEC used in HV1, and 30x8 is the number of bits in a 30 byte payload. One packet is sent every 2×0.625ms time-slots, which is equal to 1.25 milliseconds, 0.625 ms being the length of each slot. The user bit rate is thus 80/1.25 bits/ms = 64 kbit/s. Since a voice link is full duplex, the other remaining alternate empty slots are required for the reverse link. This allocation of forward and reverse packets to time-slots is shown in Figure 4(a).

[0065] HV2 packets carry twice the number of user bits as HV1 packets and hence only one forward and one reverse packet is required for every four slots, as shown in Figure 4(b).

[0066] HV3 packets carry twice the number of user bits as HV1 packets and hence only one forward and one reverse packet is required for every six slots, as shown in Figure 4(c). Thus even if there were two HV3 links active, there would still be required only four time-slots in every six time-slots, leaving two time-slots in every six free.

[0067] As a DV packet, similar to a HV1 packet, carries only 10 user bytes, a DV packet must similarly be transmitted every other slot to achieve a rate of 64 kbit/s.

[0068] Hence in combination with a single HV1 or DV voice link, no IEEE 802.11 data traffic can be transmitted or received without reducing the voice quality of the transmission.

[0069] With a single HV2 link, or HV3 links, two slots are available for IEEE 802.11 traffic. With a single HV3 link, 4 slots are available for IEEE 802.11 traffic.

[0070] Working within these parameters set by the Bluetooth transmission system, it is necessary to determine what IEEE 802.11 user bit rate is possible, given the available time slots. As discussed further hereinbelow, this depends to a certain extent on the overhead of the IEEE802.11 packet.

[0071] IEEE 802.11 packets have either a short or a long preamble, of 96 or 192 μs respectively. The IEEE 802.11 packet payload is transmitted at a rate of one byte in every symbol time with a duration of 8/11-th μs. This gives a bit rate of 11 Mbit/s. The payload contains a 24 byte header and a 32 bit (4 byte) CRC field, which takes 28 × (8/11) = 20.3 μs to send in total. A SIFS (Short Interframe Space) time of 10 μs after correct reception of a packet, the recipient transmits an acknowledgement packet, which consists of a header of 96 or 192 μs. The payload contains MAC protocol control information of 14 bytes that take 14×8/11 = 10.2 μs to transmit. Figure 5 depicts an IEEE 802.11 packet transmission.

[0072] As shown in Figure 6, an IEEE 802.11 forward data packet 500 consists of a preamble 504, a MAC header 506 and a data field 508. If received correctly, the receiver, responds with an acknowledgement packet 502 after a SIFS period. The latter packet consists of a preamble 510 and an acknowledgement field 512 comprising MAC information.

[0073] There are thus 4 scenarios to consider: there are two possible IEEE preamble lengths (96 and 192 μs); and there are either two or four Bluetooth "idle" periods (two and four slots).

[0074] The scenario where two Bluetooth slots are available for transmission for IEEE transmissions having a long preamble is considered.

[0075] The overhead due to preambles, SIFS, and MAC overhead amounts to [2 × 192] + 10 + [(28+14) × (8/11)] = 424.5 μs. Of the two idle slots, it is permissible only to use 625 + 366 = 991 μs according to the Bluetooth specification. This is to leave 625 - 366 = 259 μs to allow the radio system to hop to the frequency of the next slot. Subtract 424.5 from 991, to get 566.5, which is the time left for actual data transmission at 11 Mbit/s. In this time 566.5 / (8/11) = 779 IEEE 802.11 bytes can be transmitted. This data can be transmitted every 4 slots. Hence the effective bit rate is equal to (8 × 779)/(4 × 625) = 2.5 Mbit/s.

[0076] The scenario where four Bluetooth slots are available for transmission for IEEE transmissions having a long preamble is now considered.

[0077] If four Bluetooth slots are available, then the time for payload transmission is equal to payload time 625 × 3 + 366 - 424.5 = 1817. This Equates to 1817 / (8/11) = 2498 IEEE 802.11 CCK bytes. The equivalent bit rate is now (8 × 2498)/(6 × 625) = 5.33 Mbit/s

[0078] If the calculations are repeated for short IEEE 802.11 preambles, the bit rates are 3.33 Mbit/s for an HV2 connection or for two HV3 connections. For a single HV3 connection the bit rate is 5.89 Mbit/s. The results are summarised in Table 1.

Table 1

IEEE 802.11 throughput	Two Slots	Four Slots
Short preamble	3.33 Mbit/s	5.89 Mbit/s

Table 1 (continued)

IEEE 802.11 throughput	Two Slots	Four Slots
long preamble	2.49 Mbit/s	5.33 Mbit/s

[0079] Table 1 shows IEEE 802.11 user throughputs if IEEE 802.11 packets are transmitted in slots that are left idle by Bluetooth. If there is one HV2 connection or two HV3 connections, there are 2 idle slots to transmit. If there is one HV3 connection, there are 4 idle slots to transmit. If there is on HV1 or DV1 connection there are no idle slots. If there is no SCO connection at all, then all slots are available for transmission, and the theoretical IEEE 802.11 maximum of 11 Mbit/s can be achieved.

[0080] If a Bluetooth ACL packet must be transmitted, the interoperability device 106 simply holds back IEEE 802.11 packets. As the ACL packets are none real time data packets, they can be held back. When a Bluetooth ACL packet is to be transmitted, an IEEE 802.11 packet transmission will not be in progress, as the ACL connection would be in PARK mode if an IEEE transmission was in progress, as discussed hereinabove.

[0081] In an alternative formulation, if a Bluetooth ACL packet transmission or reception is in progress, the IEEE 802.11 transmission is held back until the Bluetooth transmission/reception is completed. Then the Bluetooth ACL connection is put in HOLD or PARK mode, and the IEEE802.11 transmission can be scheduled and organised around SCO transmissions, as described above.

[0082] Optionally, the interoperability device has a further mode in which it will not allow the IEEE 802.11 devices and Bluetooth device to receive in parallel. By not allowing this, only one radio will be operating at a given time, which implies that the radio hardware can be reused. This again results in an architecture as shown in Figure 2. In this mode Bluetooth SCO slots are always received. If neither the Bluetooth nor the IEEE 802.11 transmitter need to transmit, the common receiver listens to either Bluetooth or IEEE 802.11 packets, according to an algorithm.

[0083] Such an algorithm may be static; for instance the receiver listens to IEEE 802.11 in odd slots and to Bluetooth packets in even slots. Also given the distribution of traffic between Bluetooth and IEEE802.11, the algorithm could give preference to one over the other.

[0084] Finally, the receiver may have a dual synchronisation mode, where it listens to the channel, detects on the fly what type of packet is in the medium (Bluetooth or IEEE 802.11), and reports this to the receiver, which will switch to the appropriate reception mode.

[0085] Both IEEE 802.11 and Bluetooth Packets may be longer than a single slot. In that case the receiver attempts to receive the packet until completion.

[0086] In a typical embodiment of the invention, the MAC controller of the IEE802.11 device and the baseband controller of the Bluetooth device may be implemented in separate, dedicated processor chips. The interoperability device's functionality may be implemented in an additional chip. Alternatively, the functionality of the interoperability device can be added to the controller chips of either the Bluetooth or the IEE802.11 device. In a still further alternative, it is possible to integrate the IEEE 802.11 MAC control functions and the Bluetooth control function in a single chip and add the interoperability functionality to the same chip as well. Other arrangements of chips and division of interoperability functionality are also possible.

[0087] Figure 6 illustrates an example of a "system on a chip" implementation of a combined IEEE 802.11 MAC controller and a Bluetooth Baseband controller. The chip 600 includes a DMA (Direct Memory Access) 610, an interrupt controller (Int. Ctrl) 612, timers 614, RAM (Random Access Memory) 616 all connected to a CPU (central processor unit) 622 via an internal bus 624, which elements are all required for both the IEEE 802.11 and Bluetooth functions. An external bus (Ext. Bus) block 608 is also required for both the IEEE 802.11 and Bluetooth functions, and is connected to the CPU 622 via internal bus 624 and to an external flash memory and/or ROM via lines 626. A USB (Universal Serial Bus) block 606, connected to internal bus 624, is used to interface the Bluetooth transceiver and optionally the IEEE 802.11 transceiver to a host PC via connections 628. The (mini) PCI block 602, connected to the internal bus 624, is used to interface between the host PC (via connections 628) and the IEEE 802.11 transceiver. A PCI based interface between host PC and Bluetooth is not yet defined but is foreseen. The UART block is also connected to the internal bus 624 and to the external connections 628.

[0088] The CPU micro-controller 622 runs firmware that implements the IEEE 802.11 MAC and Bluetooth baseband functions. A Bluetooth Link Controller block 618 and an IEEE 802.11 MAC support block 620 are connected to the CPU via the internal bus 624, and operate in conjunction with the CPU 622 to implement hardware assist functions for both the Bluetooth and IEEE 802.11 transceivers respectively.

[0089] The Bluetooth Link Controller 618 is connected to the Bluetooth physical layer functional elements (not shown) via connections 632, and similarly the IEEE 802.1 MAC support block 620 is connected to the IEEE 802.11 physical layer functional elements (not shown) via connections 634

Claims

1. A device incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, wherein the device further includes a control means adapted to control the first and second radio systems such that such that only one or the other radio system may transmit at any one time.

2. The device of claim 1 wherein the first radio system is a Bluetooth system and the second radio system is an IEEE 802.11 system.

3. The device of claim 1 or claim 2 wherein the device is additionally controlled such that when one device is transmitting the other device cannot receive or transmit.

4. The device of any one of claims 1 to 3 wherein the device is additionally controlled such that one device is receiving the other device cannot receive or transmit.

5. The device of claim 1 or claim 2, wherein the control means comprises a switching means, the switching means being adapted to switch on and off the first and second radio systems.

6. The device of claim 1 or claim 2, wherein the control means comprises a multiplexing means adapted to time multiplex transmissions from the first and second radio systems.

7. The device of claim 2, wherein the control means comprises a multiplexing means adapted to time multiplex transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

8. The device of claim 7, wherein the Bluetooth transmissions are through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four.

9. The device of claim 7, wherein the Bluetooth transmissions are through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six.

10. The device of claim 7, wherein the Bluetooth transmissions are through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

11. The device of claim 2 wherein the control means prevents transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission.

12. The device of claim 2 wherein the control means prevents transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

13. The device of any one of claims 1 to 12 in which the first and second radio systems share a common physical layer.

14. A method of incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, into a single device, wherein the first and second radio systems are controlled such that only one or the other radio system may transmit at any one time.

15. The method of claim 14 wherein the first radio system is a Bluetooth system and the second radio system is an IEEE 802.11 system.

16. The method of claim 14 or 15 further comprising controlling the radio systems such that when one radio system is transmitting the other device cannot receive or transmit.

17. The method of any one of claims 14 to 16 further comprising controlling the radio systems such that one device is receiving the other device cannot receive or transmit.

18. The method of claim 14 or 15 wherein the radio systems are controlled by switching on and off the first and second

radio systems.

19. The device of claim 14 or claim 15 wherein the radio systems are controlled by time multiplexing transmissions from the first and second radio systems.

20. The method of claim 15, comprising time multiplexing transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

21. The method of claim 20, wherein the Bluetooth transmissions are through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four.

22. The method of claim 20, wherein the Bluetooth transmissions are through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six.

23. The method of claim 20, wherein the Bluetooth transmissions are through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

24. The method of claim 15 further comprising preventing transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission.

25. The method of claim 15 further comprising preventing transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

26. The method of any one of claims 14 to 25 in which the first and second radio systems share a common physical layer.

FIG. 1

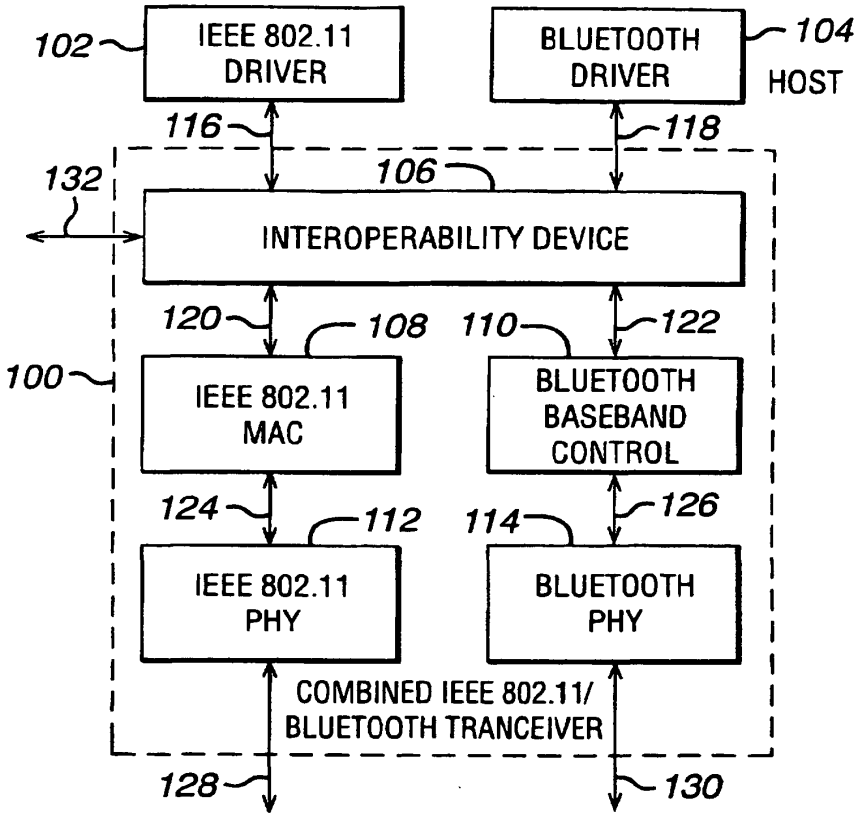


FIG. 3

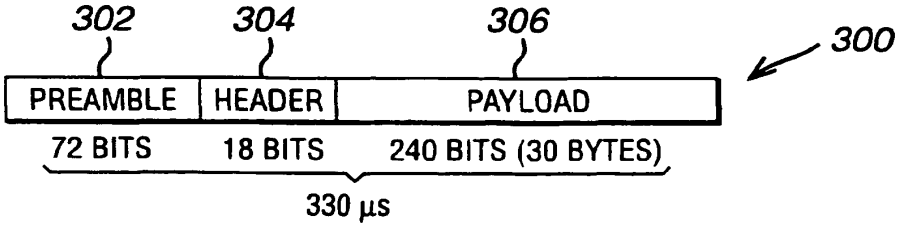


FIG. 2

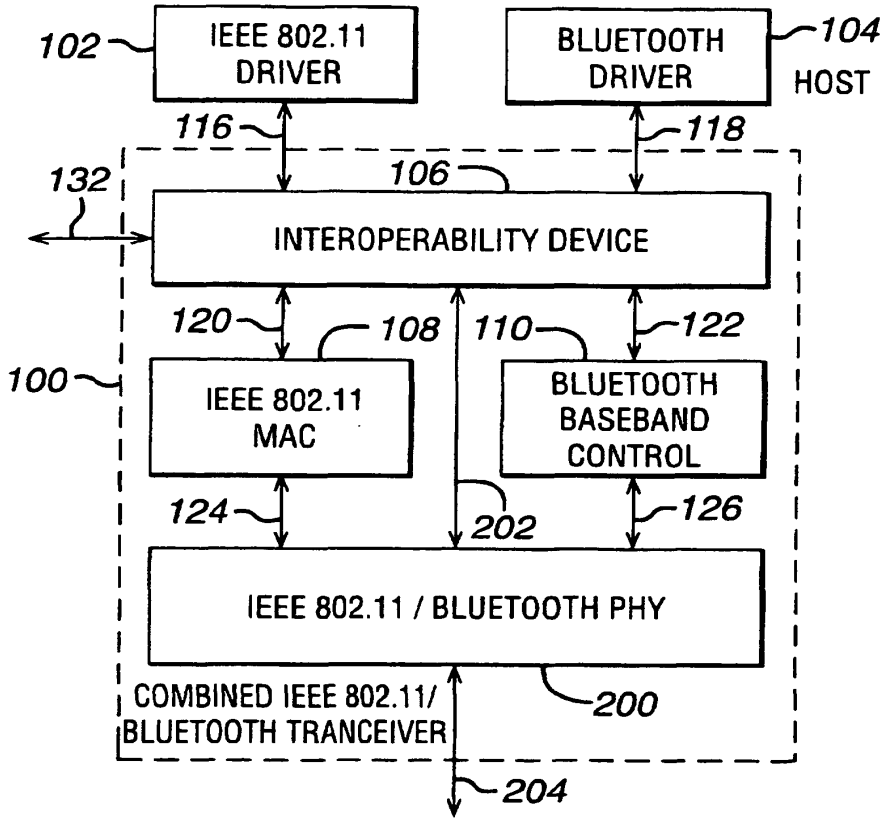


FIG. 5

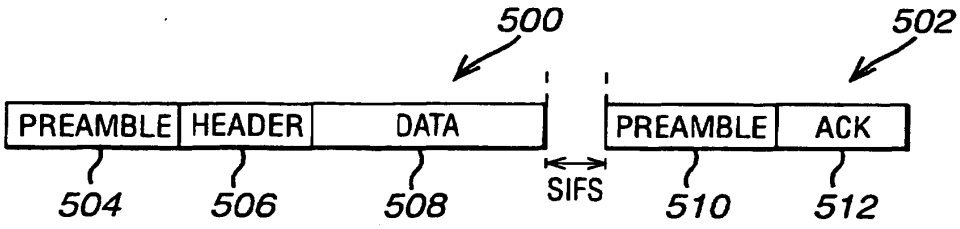


FIG. 4

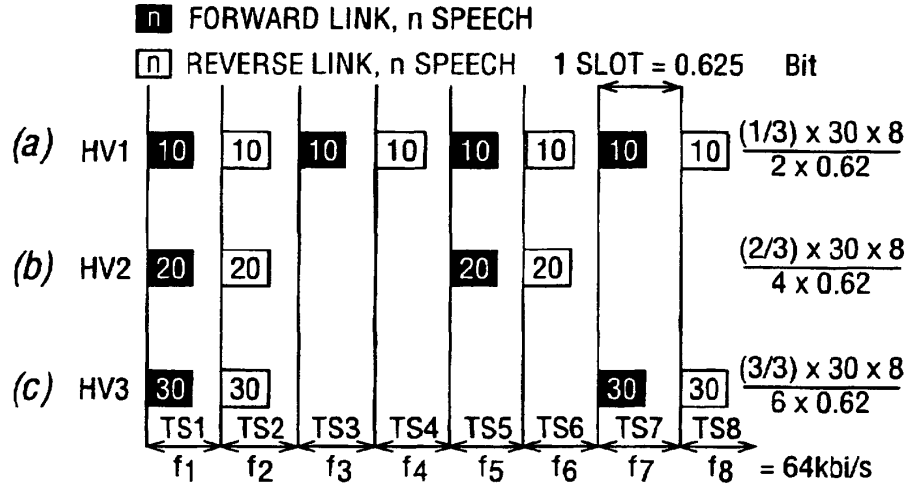
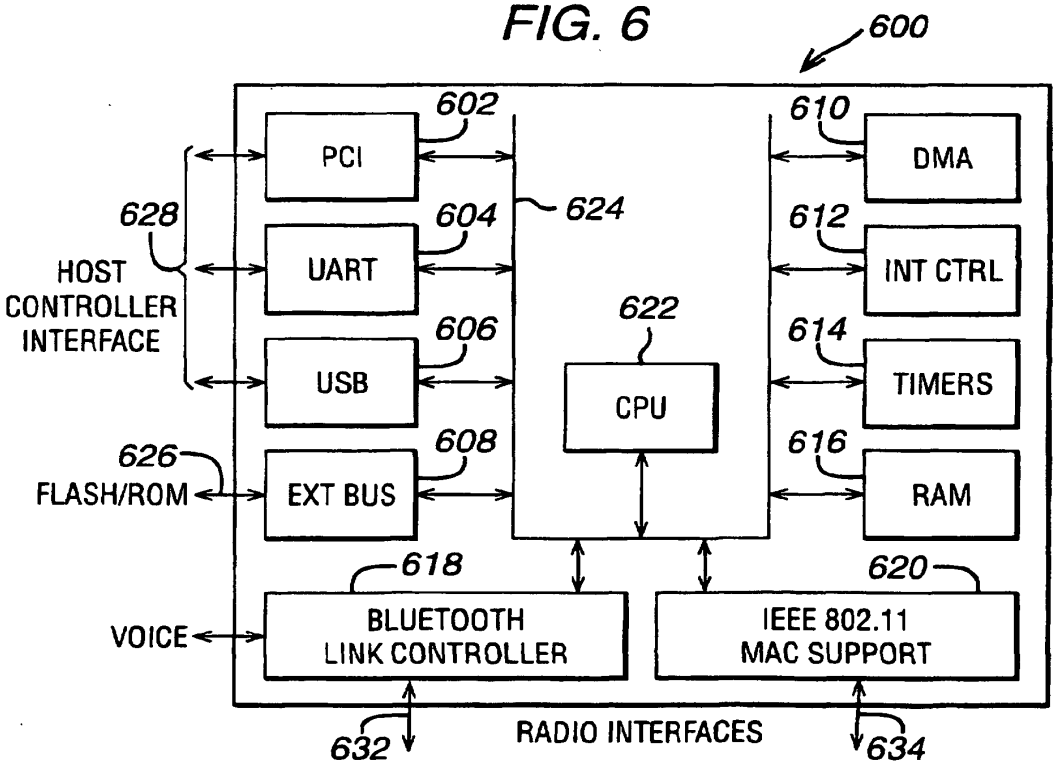


FIG. 6



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 0397

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	US 5 960 344 A (MAHANY RONALD L) 28 September 1999 (1999-09-28)	1,14	H04L12/28 H04L12/56
A	* column 4, line 36 - column 5, line 30 * * column 9, line 66 - column 10, line 21 *	3-5, 16-18	
X	US 5 903 548 A (DELAMATER JEFF) 11 May 1999 (1999-05-11)	1,14	
A	* column 2, line 64 - column 3, line 23 * * column 3, line 48 - line 61 * * column 4, line 45 - line 55 * * column 5, line 17 - line 48 * * column 8, line 7 - column 9, line 6 *	3-5,13, 16-18,26	
A	WO 99 29126 A (JOERESSEN OLAF J ;NOKIA MOBILE PHONES LTD (FI)) 10 June 1999 (1999-06-10) * page 1, line 25 - line 29 * * page 4, line 4 - line 12 *	1,2, 7-12, 14-16, 20-26	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7) H04L H04Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 June 2000	Heinrich, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 0397

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20-06-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
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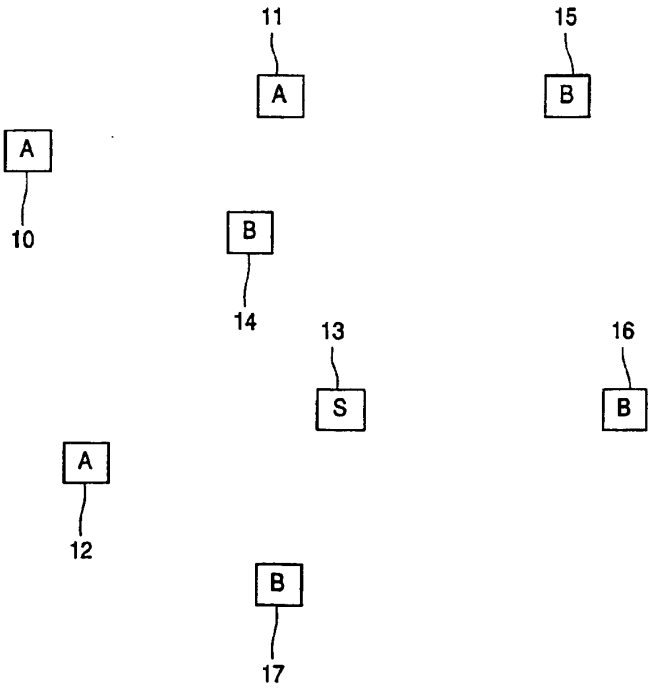
(81) Bestimmungsstaaten *(national)*: JP, US.

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

(54) Bezeichnung: VERFAHREN, NETZWERK UND STEUERSTATION ZUR WECHSELSEITIGEN STEUERUNG VON FUNKSYSTEMEN UNTERSCHIEDLICHER STANDARDS IM GLEICHEN FREQUENZBAND



(57) Abstract: The invention relates to an interface-control protocol method for a radio system, which has at least one frequency band provided for the two-way alternate utilization of a first and a second radio interface standard. The radio system comprises a number of stations, which each function in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, whereby a control station is provided that controls the two-way alternate utilization of the frequency band.

(57) Zusammenfassung: Die Erfindung bezieht sich auf ein Schnittstellen-Steuerungsprotokollverfahren für ein Funksystem, welches wenigstens ein Frequenzband aufweist, das für die wechselseitige Nutzung eines ersten und eines zweiten Funkschnittstellenstandards vorgesehen ist, wobei das Funksystem mehrere Stationen aufweist, welche jeweils nach einem ersten Funkschnittstellenstandard und/oder nach einem zweiten Funkschnittstellenstandard arbeiten, wobei eine Steuerstation vorgesehen ist, welche die wechselseitige Nutzung des Frequenzbandes steuert.

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(84) **Bestimmungsstaaten** *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Veröffentlicht:

— *ohne internationalen Recherchenbericht und erneut zu veröffentlichen nach Erhalt des Berichts*

— *insgesamt in elektronischer Form (mit Ausnahme des Kopfbogens); auf Antrag vom Internationalen Büro erhältlich*

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Verfahren, Netzwerk und Steuerstation zur wechselseitigen Steuerung von Funksystemen unterschiedlicher Standards im gleichen Frequenzband

Die Erfindung betrifft ein Verfahren zur wechselseitigen Steuerung von Funksystemen unterschiedlicher Standards im gleichen Frequenzband.

Ein Funksystem zur drahtlosen Übertragung von Information darf nur standardgemäß Sendeleistungen benutzen. Die nationale Regulierungsbehörde bestimmt, auf welchen Frequenzen, mit welcher Sendeleistung, und nach welchem Funkschnittstellenstandard ein Funksystem übertragen darf.
Dabei ist für so genannte ISM-Frequenzbänder (*Industrial Scientific Medical*) vorgesehen, dass Funksysteme nach unterschiedlichen Funkschnittstellenstandards im gleichen Frequenzband übertragen. Ein Beispiel ist das US-amerikanische Funksystem IEEE 802.11a und das europäische ETSI BRAN HiperLAN/2. Beide Funksysteme übertragen in gleichen Frequenzbändern zwischen 5.15 GHz und 5.875 GHz mit annähernd dem gleichen Funkübertragungsverfahren, aber verschiedenen Übertragungsprotokollen.

Für den Fall einer Störung wurden Verfahren für ein aktives Ausweichen auf eine andere Frequenz innerhalb des erlaubten Frequenzbands, Sendeleistungsregelung und adaptive Codierung und Modulation zur Interferenzreduzierung standardisiert.
Funksysteme von BreitbandLANs der Funkschnittstellen-Standards ETSI BRAN HiperLAN/2 und IEEE 802.11a nutzen das gleiche Funkübertragungsverfahren, ein 64-Träger OFDM-Verfahren mit einer adaptiven Modulation und Codierung. Annähernd die gleichen Modulations- und Codierverfahren (*Link Adaptation, LA*) sind für beide Standards definiert.
Das Medienzugriffsverfahren (*Medium Access Control, MAC*) beider Systeme ist vollständig unterschiedlich. ETSI BRAN HiperLAN/2 verwendet ein zentral gesteuertes, reservierungsbasiertes Verfahren, bei dem eine Funkstation die Aufgabe einer zentralen, die Funkressourcen koordinierenden Instanz übernimmt. Diese zentrale Funkstation (*Access Point, AP*), die unter Umständen Zugangspunkt zum Weitverkehrsnetz ist, signalisiert periodisch alle 2ms die MAC-Rahmenstruktur je nach Bedarf von AP und den zugehörigen Stationen.

Der IEEE 802.11a Standard beschreibt ein nicht reservierungsbasiertes CSMA/CA Verfahren (*Carrier Sense Multiple Access/Collision Avoidance*), bei dem alle

Funkstationen das Medium abhören und voraussetzen, dass der Kanal für eine Mindestdauer (*Short Inter Frame Space, SIFS*) ungenutzt ist bevor bei Bedarf 802.11a-MAC-Frames, also Nutzdatenpakete, versendet werden. Das Verfahren ist gut für selbstorganisierende Ad-Hoc Netze geeignet, verlangt jedoch positive Quittierungen aller Pakete. Dienstgüte unterstützende Maßnahmen (*Point Coordination Function, PCF*) erlauben darüber hinaus die Unterstützung von Multimedia-Anwendungen. Abb. 2 zeigt beispielhaft den Zeitablauf beim Medienzugriff bei IEEE 802.11a. Demnach muss in einer Variante des Standards eine Station ein RTS Paket (*Ready To Send*) übertragen und auf ein CTS (*Clear To Send*) Paket der adressierten Station warten, bevor sie Nutzdaten übertragen darf. Alle anderen Stationen in Funkreichweite setzen eine Zeitüberwachung (*Network Allocation Vector, NAV*) und übertragen erst wieder, wenn die adressierte Station eine Bestätigung (*Acknowledge, ACK*) gesendet hat.

BreitbandLANs nach den Standards HiperLAN/2 und 802.11a werden in Zukunft im gleichen Frequenzband zwischen 5.15 und 5.825 GHz operieren. Die BreitbandLANs arbeiten zwar mit Sendeleistungsregelung (*Transmitter Power Control, TPC*), adaptiven Funkübertragungsverfahren und der dynamischen Auswahl von Frequenzen (*Dynamic Frequency Selection, DFS*), um die wechselseitig störenden Einflüsse zu minimieren, diese Verfahren ermöglichen jedoch nicht die optimale Nutzung und Aufteilung der Funkkanäle auf die nach verschiedenen Standards übertragenden Stationen. Die Garantie der für Multimedia-Anwendungen nötigen Dienstgüte ist bei Störung durch eigene Stationen oder Stationen fremder Systeme nicht möglich. Bei wechselseitiger Störung arbeiten Systeme ineffizient und belegen selbst bei geringen Übertragungsraten einen Frequenzkanal.

Es ist Aufgabe der Erfindung, ein Verfahren, ein drahtloses Netzwerk sowie eine Steuerstation aufzuzeigen, welche eine effiziente Nutzung von Funkübertragungskanälen ermöglichen.

Diese Aufgabe ist für das Verfahren erfindungsgemäß gelöst durch ein Schnittstellen -Steuerungsprotokollverfahren für ein Funksystem, welches wenigstens ein Frequenzband aufweist, das für die wechselseitige Nutzung eines ersten und eines zweiten Funkschnittstellenstandards vorgesehen ist, wobei das Funksystem Stationen aufweist, welche jeweils nach einem ersten Funkschnittstellenstandard und/oder nach einem zweiten Funkschnittstellenstandard arbeiten, wobei eine Steuerstation vorgesehen ist, welche die wechselseitige Nutzung des Frequenzbandes steuert.

Der Erfindung liegt die Idee zugrunde, bei Systemen mit gleichen Funkübertragungsverfahren, aber verschiedenen Funkübertragungsprotokollen, einen standardübergreifenden Austausch von impliziter bzw. auch expliziter Steuerinformationen vorzusehen. Dies ermöglicht eine einfache und effiziente Nutzung eines Funkkanals durch mehrere Funkschnittstellenstandards.

Das Funksystem weist ein oder mehrere Stationen auf. Die Stationen können z.B. Computer eines drahtlosen lokalen Netzwerks sein. Diese Stationen können z.B. jeweils nur für den Betrieb gemäß dem ersten oder dem zweiten Funkschnittstellenstandard ausgelegt sein. Es ist jedoch auch möglich, daß Stationen sowohl gemäß dem ersten als auch gemäß dem zweiten Funkschnittstellenstandard arbeiten können.

Vorzugsweise bildet eine erste Anzahl von Stationen ein lokales drahtloses Netzwerk nach einem ersten Funkschnittstellen-Standard und eine zweite Anzahl von Stationen bildet ein drahtloses Netzwerk nach einem zweiten Funkschnittstellen-Standard. Der erste Funkschnittstellen-Standard kann z.B. der HiperLAN2-Standard und der zweite Funkschnittstellen-Standard der IEEE 802.11a-Standard sein.

Für diese beiden Standards ist das Frequenzband von 5.15 GHz bis 5.825 GHz vorgesehen.

Erfindungsgemäß ist eine Steuerstation vorgesehen, welche die wechselseitige Nutzung des gemeinsamen Frequenzbandes von den beiden Funkschnittstellen-Standards steuert.

Die Steuerstation ist vorzugsweise eine Station, die sowohl nach dem ersten Funkschnittstellenstandard als auch nach dem zweiten Funkschnittstellenstandard operieren kann.

Die Steuerung der wechselseitigen Nutzung des gemeinsamen Frequenzbandes kann auf verschiedene Weise erfolgen. So ist es beispielsweise möglich, für die Nutzung des ersten und des zweiten Funkschnittstellenstandards bestimmte vorgebbare Zeitintervalle vorzusehen und in einer Art Zeitmultiplex abwechselnd das Frequenzband dem ersten Funkschnittstellenstandard und danach dem zweiten Funkschnittstellenstandard zuzuweisen.

Vorteilhaft ist es jedoch, die Zuteilung mittels adaptiver Protokolle vorzunehmen. Dadurch kann der gemeinsame Funkkanal effektiver genutzt werden, insbesondere wenn der Bedarf an Übertragungskapazität nach dem ersten und dem zweiten Funkschnittstellenstandard variiert.

Bei der vorteilhaften Ausgestaltung der Erfindung nach Anspruch 2 ist die Steuerstation einerseits dazu vorgesehen, für Stationen, die gemäß dem ersten Funkschnittstellenstandard arbeiten, den Zugriff auf das Frequenzband zu steuern. Ist der erste Funkschnittstellen-Standard z.B. der HiperLAN/2-Standard, so führt die Steuerstation die Funktion des gemäß diesem Standard vorgesehenen zentralen Controllers (Access Point, AP) aus. In diesem Fall senden die Stationen des HiperLAN/2-Standards jeweils eine Kapazitätsanforderung an die Steuerstation und die Steuerstation weist den Stationen jeweils Übertragungskapazität zu.

Andererseits ist die Steuerstation bei der vorteilhaften Ausgestaltung der Erfindung nach Anspruch 2 dazu vorgesehen, das gemeinsame Frequenzband für den Zugriff von Stationen, die gemäß dem zweiten Funkschnittstellenstandard arbeiten, freizugeben, wenn Stationen, die gemäß dem ersten Funkschnittstellenstandard arbeiten, keinen Zugriff auf das Frequenzband anfordern. Bei dieser vorteilhaften Ausgestaltung der Erfindung wird somit der erste Funkschnittstellenstandard gegenüber dem zweiten Funkschnittstellenstandard priorisiert. Die Freigabe des gemeinsamen Frequenzbandes für den zweiten Funkschnittstellenstandard kann z.B. explizit durch Senden einer Steuerinformation an die Stationen des zweiten Funkschnittstellenstandards erfolgen.

Alternativ ist es z.B. möglich, daß der gemäß dem IEEE 802.11 Standard vorgesehene Punkt-Koordinator (Point Coordinator) als zentrale Steuerstation fungiert und den wechselseitigen Zugriff von Stationen des ersten und des zweiten Funkschnittstellenstandards auf das gemeinsame Frequenzband steuert. Bei dieser vorteilhaften Ausgestaltung der Erfindung würde der Punkt-Koordinator z.B. periodisch einem anderen Funkschnittstellenstandard, z.B. dem HiperLAN/2 Standard, das gemeinsame Frequenzband zur Verfügung stellen.

Bei der vorteilhaften Ausgestaltung der Erfindung nach Anspruch 3 erfolgt die Steuerung dadurch, daß die Steuerstation die jeweilige Zeitdauer festlegt, während der Stationen, die gemäß dem zweiten Funkschnittstellen-Standard operieren, das gemeinsame Frequenzband nutzen dürfen. Die Festlegung der Zeitdauer kann vorteilhaft gemäß Anspruch 4 dadurch erfolgen, daß die Steuerstation ein Broadcast-Signal sendet, welches den Stationen eine Zeitdauer mitteilt, während der das Frequenzband von Stationen, die gemäß dem zweiten Funkschnittstellenstandard arbeiten, nutzbar ist.

Die Erfindung hat den Vorteil, daß beim Betrieb von Funksystemen in Phasen, in denen standardgemäß keine Information von einer Funkstation gemäß einem ersten Funkschnittstellenstandard gesendet oder empfangen wird, das zusätzliche Senden von

Informationen gemäß eines anderen Funkschnittstellenstandards möglich wird, so dass der Zugriff auf den Funkkanal durch konkurrierende Funksysteme gesteuert werden kann.

Dabei ist es möglich, dass eine erste Funkstation, die nach einem ersten Funkschnittstellenstandard operiert, zusätzlich bestimmte in einem zweiten Funkschnittstellenstandard beschriebene Funktionen ausführt, wobei durch die erste Funkstation oder eine koordinierende weitere Funkstation, die nach dem ersten Funkschnittstellenstandard überträgt, Beginn und Dauer der Phase, die gemäß dem zweiten Funkschnittstellenstandard von der ersten Station zur Übertragung benutzt werden darf, festgelegt werden.

Je nach Funkschnittstellenstandard können Beginn und Dauer nur näherungsweise definiert werden, wobei Festlegungen der betroffenen Standards zeitweise oder regelmäßig verletzt werden. Die erste Station kann vorzugsweise die Phase, während der sie nach dem zweiten Funkschnittstellenstandard überträgt, jederzeit beenden, ohne Rücksicht auf resultierende Störungen bei Stationen gemäß dem zweiten Funkschnittstellenstandard.

Die erste Funkstation kann neben Funktionen nach dem zweiten Funkschnittstellenstandard auch Funktionen ausführen, die Funksysteme nach dem zweiten Funkschnittstellenstandard oder Funksysteme nach dem ersten Funkschnittstellenstandard veranlassen, den Funkkanal als gestört zu interpretieren und einen anderen Funkkanal für den eigenen Betrieb belegen.

Die effiziente gemeinsame Nutzung eines Funkkanals durch unterschiedliche Funksysteme kann durch ein geeignetes Steuerungsprotokollverfahren erreicht werden. Ein solches Funkschnittstellen-Steuerungsprotokollverfahren ermöglicht einer ersten Station eines Funksystems nach dem ersten Funkschnittstellenstandard die Zeitpunkte des Zugriffs auf den Funkkanal durch andere Stationen zu steuern. Sie muss dafür neben den durch ihren eigenen ersten Funkschnittstellenstandard festgelegten Funktionen zu Zeitpunkten, zu denen Stationen gemäß dem ersten Funkschnittstellenstandard nicht übertragen und keine standardgemäße Information von der ersten Station erwarten, in einem anderen zweiten Funkschnittstellenstandard beschriebene Funktionen ausführen, wobei die erste Station oder eine weitere Station die Dauer festlegt, während der die erste Station gemäß dem zweiten Funkschnittstellenstandard übertragen darf.

Die Dauer des Betriebs nach dem zweiten Funkschnittstellenstandard muss nicht exakt, sonder kann auch nur näherungsweise festgelegt sein.

Die erste Station kann die Nutzung der Funkschnittstelle gemäß dem zweiten Funkschnittstellenstandard ohne Rücksicht auf resultierende Störungen bei Stationen, die gemäß dem zweiten Funkschnittstellenstandard übertragen, durch Übertragung gemäß dem ersten Funkschnittstellenstandard beenden.

Die Aufgabe der Erfindung ist für das Netzwerk gelöst durch ein drahtloses Netzwerk, welches wenigstens ein Frequenzband aufweist, das für die wechselseitige Nutzung eines ersten und eines zweiten Funkschnittstellenstandards vorgesehen ist, wobei das drahtlose Netzwerk Stationen aufweist, welche jeweils nach einem ersten Funkschnittstellenstandard und/oder nach einem zweiten Funkschnittstellenstandard arbeiten, wobei eine Steuerstation vorgesehen ist, welche die wechselseitige Nutzung des Frequenzbandes steuert.

Einige Ausführungsbeispiele der Erfindung werden nachfolgend anhand der Zeichnung in den Fig. 1 bis 3 näher erläutert. Es zeigen:

Fig. 1 die Rahmenstruktur gemäß dem ETSI BRAN HiperLAN/2 Standard,

Fig. 2 eine schematische Darstellung des Zugriffs auf einen Funkkanal bei Systemen gemäß dem IEEE 802.11a Standard,

Fig. 3 zwei drahtlose lokale Netzwerke gemäß einem ersten und einem zweiten Funkschnittstellen-Standard.

Fig. 1 zeigt die Struktur des HiperLAN/2 MAC-Rahmens.

Fig. 2 zeigt schematisch den Medienzugriff bei Systemen, die gemäß dem Funkschnittstellenstandard IEEE 802-11a arbeiten.

Bei einem HiperLAN/2 System ist mittels der zentralen Steuerung durch den Access-Point (AP), der den MAC-Rahmen periodisch erzeugt und dabei die Daten der Broadcast-Phase überträgt, die Dienstgüte (Paketverzögerung, Übertragungsrate usw.) einzelner Verbindungen individuell steuerbar.

Übertragen auf die Fig. 1 und 2 bzw. die zugehörigen Standards bedeutet das, dass ein HiperLAN/2 AP bei teilweise nicht genutzter *Downlink-*, *Uplink-* und *Direct Mode* Phase darauf verzichten könnte, nutzlose (*dummy*) Information zu übertragen und 802.11-Systemen keine Gelegenheit zu geben, eine Zeitspanne SIFS lang einen ungenutzten Kanal zu beobachten und den Ablauf nach Fig. 2 zu beginnen. Der AP könnte die Kontrolle sehr bald zurückgewinnen, in dem die HiperLAN/2-Standard-gemäße Übertragung die *Broadcast*-Phase nicht unterdrückt, sondern gesendet wird.
Ebenso könnte die Funktion PCF des 802.11-Standards genutzt werden, um HiperLAN/2-Systemen zeitweise befristet (periodisch) den Funkkanal zur Verfügung zu stellen.

Die hier vorgeschlagene und am Beispiel der BreitbandLANs ETSI BRAN HiperLAN/2 und IEEE 802.11a diskutierte wechselseitige Steuerung von Funksystemen unterschiedlicher Standards kann in einer heterogenen Umgebung, in der verschiedene Funksysteme zur gleichen Zeit in unmittelbarer Nähe im gleichen Spektrum übertragen, eine dezentral gesteuerte Adaptivität bezüglich der in den jeweiligen Systemen verfügbaren Übertragungskapazität zur Bewältigung des jeweils aktuellen Verkehrsangebots, der geforderten Dienstgüte und der momentanen Nutzungsumgebung gewährleisten.
Bei der Anwendung der erfindungsgemäßen integrierten Steuerung können unterschiedliche Funksysteme kompatibel gemacht werden in dem Sinn, dass sie konstruktiv im gleichen Frequenzband koexistieren und dabei Dienste erbringen können, die eine hohe Dienstgüte verlangen. Das Funkspektrum wird deutlich effizienter genutzt, ohne Anwendung des neuen Verfahrens ist dies nur mit jeweils exklusiv verwendeten Funkkanälen möglich

Fig.3 zeigt schematisch zwei drahtlose lokale Netzwerke.

Ein erstes drahtloses lokales Netzwerk weist drei Stationen 10, 11 und 12 auf. Diese drei Stationen 10, 11, 12 und 13 arbeiten nach einem ersten Funkschnittstellenstandard A, z.B. nach dem HiperLAN2 – Standard.

Ein zweites drahtloses lokales Netzwerk weist vier Stationen 14, 15, 16 und 17 auf. Diese vier Stationen 14, 15, 16 und 17 arbeiten nach einem zweiten Funkschnittstellenstandard B, z.B. nach dem IEEE802.11a – Standard.

Die Stationen können z.B. Computer mit einer Funkschnittstelle sein. Die Kommunikation zwischen den einzelnen Stationen erfolgt drahtlos, z.B. per Funk.

Für drahtlose lokale Netzwerke nach den Standards HiperLAN/2 und IEEE 802.11a ist das Frequenzband zwischen 5.15 GHz und 5.825 GHz vorgesehen.

Es ist eine zentrale Steuerstation 13 vorgesehen, welche den wechselseitigen Zugriff des ersten drahtlosen Netzwerks und des zweiten drahtlosen Netzwerks auf das gemeinsame Frequenzband steuert.

Dies kann vorteilhaft z.B. dadurch erfolgen, daß die Station 13 eine Broadcast-Nachricht an die Stationen 14 bis 17 des IEEE 802.11a Standards verschickt, wenn die Stationen 10 bis 12 keinen Bedarf an Übertragungskapazität haben. Diese Broadcast Nachricht enthält vorzugsweise eine Zeitinformation, welche den Stationen 14 bis 17 des IEEE 802.11 Standards mitteilt, wie lange sie das gemeinsame Frequenzband nutzen dürfen. Während dieser Zeit kann die Steuerstation 13 auch Funktionen nach dem IEEE 802.11a - Standard ausführen, z.B. auch zur Datenübertragung nach dem IEEE 802.11a-Standard benutzt werden.

Handelt es sich bei den Stationen 10 bis 12 des ersten drahtlosen Netzwerks um HiperLAN/2 Stationen, so operiert die Steuerstation 13 vorzugsweise auch als zentrale Station (Access-Point) des HiperLAN2 Netzwerkes und koordiniert deren Funkresourcen. Bei Hiperlan/2 Systemen wird vorab geplant, zu welcher Zeit die Stationen senden dürfen. Zu diesem Zweck gibt es bei HiperLAN/2- Systemen eine zentrale Einrichtung (Access Point, AP), welche die Kapazitätsanforderungen von den verschiedenen Stationen erhält und demgemäß Kapazität zuweist. Die zentrale Steuerstation 13 ist vorzugsweise auch dazu vorgesehen, die Funktion des Access Point des HiperLAN/2 Standards auszuführen. Die zentrale Steuerstation 13 signalisiert dann periodisch alle 2ms die MAC-Rahmenstruktur je nach Bedarf der einzelnen Stationen des HiperLAN2 Netzwerkes.

Alternativ ist es jedoch auch möglich, daß bei HiperLAN/2 Systemen die Funktion des Access-Points und die Funktion der wechselseitigen Steuerung des Zugriffs des ersten drahtlosen Netzwerks und des zweiten drahtlosen Netzwerks auf das gemeinsame Frequenzband in getrennten Stationen realisiert ist. Dann ist aber ein Datenaustausch hinsichtlich der Dauer, während der das Frequenzband von dem ersten bzw. dem zweiten Funkschnittstellenstandard genutzt werden darf, zwischen diesen getrennten Stationen erforderlich.

Alternativ ist es z.B. möglich, daß der gemäß dem IEEE 802.11 Standard vorgesehene Punkt-Koordinator (Point Coordinator) als zentrale Steuerstation fungiert und den wechselseitigen Zugriff von Stationen des ersten und des zweiten Funkschnittstellenstandards auf das gemeinsame Frequenzband steuert. Bei dieser Ausführungsform würde der Punkt-Koordinator z.B. periodisch einem anderen Funkschnittstellenstandard, z.B. dem HiperLAN/2 Standard, das gemeinsame Frequenzband zur Verfügung stellen.

PATENTANSPRÜCHE:

1. Schnittstellen - Steuerungsprotokollverfahren für ein Funksystem, welches wenigstens ein Frequenzband aufweist, das für die wechselseitige Nutzung eines ersten und eines zweiten Funkschnittstellenstandards vorgesehen ist, wobei das Funksystem Stationen aufweist, welche jeweils nach einem ersten Funkschnittstellenstandard und/oder nach einem zweiten Funkschnittstellenstandard arbeiten, wobei eine Steuerstation vorgesehen ist, welche die wechselseitige Nutzung des Frequenzbandes steuert.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation für Stationen, die gemäß dem ersten Funkschnittstellenstandard arbeiten, den Zugriff auf das Frequenzband steuert und daß die Steuerstation das Frequenzband für den Zugriff von Stationen, die gemäß dem zweiten Funkschnittstellenstandard arbeiten, freigibt, wenn Stationen, die gemäß dem ersten Funkschnittstellenstandard arbeiten, keinen Zugriff auf das Frequenzband anfordern.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation die jeweilige Zeitdauer festlegt, während der Stationen, die gemäß dem zweiten Funkschnittstellenstandard arbeiten, das Frequenzband nutzen dürfen.

4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation ein Broadcast-Signal sendet, welches den Stationen eine Zeitdauer mitteilt, während der das Frequenzband von Stationen, die gemäß dem zweiten Funkschnittstellenstandard arbeiten, nutzbar ist.

5. Verfahren nach Anspruch 3, dadurch gekennzeichnet, dass die Zeitdauer des Betriebs nach dem ersten und dem zweiten Funkschnittstellenstandard nur näherungsweise festgelegt wird, wobei Festlegungen der betroffenen Standards zeitweise oder regelmäßig verletzt werden.

6. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation die Nutzung der Funkschnittstelle gemäß dem zweiten Funkschnittstellenstandard durch Übertragung gemäß dem ersten Funkschnittstellenstandard beendet, ohne Rücksicht auf resultierende Störungen bei Stationen gemäß dem zweiten Funkschnittstellenstandard.

7. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation für Stationen, die gemäß dem ersten Funkschnittstellenstandard arbeiten, den Zugriff auf das Frequenzband steuert und daß Dauer und Art der Steuerung der Funkschnittstelle gemäß dem zweiten Funkschnittstellenstandard durch eine weitere Station festgelegt und an die Steuerstation übermittelt wird.

8. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation neben Funktionen nach dem zweiten Funkschnittstellenstandard auch Funktionen ausführt, die Funksysteme nach dem zweiten Funkschnittstellenstandard veranlassen, den Funkkanal als gestört zu interpretieren und einen anderen Funkkanal für den eigenen Betrieb zu belegen.

9. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Steuerstation auch Funktionen ausführt, die Funksysteme nach dem ersten Funkschnittstellenstandard veranlassen, den Funkkanal als gestört zu interpretieren und einen anderen Funkkanal für den eigenen Betrieb zu belegen.

10. Drahtloses Netzwerk, welches wenigstens ein Frequenzband aufweist, das für die wechselseitige Nutzung eines ersten und eines zweiten Funkschnittstellenstandards vorgesehen ist, wobei das drahtlose Netzwerk Stationen aufweist, welche jeweils nach einem ersten Funkschnittstellenstandard und/oder nach einem zweiten Funkschnittstellenstandard arbeiten, wobei eine Steuerstation vorgesehen ist, welche die wechselseitige Nutzung des Frequenzbandes steuert.

11. Steuerstation für ein drahtloses Netzwerk, wobei die Steuerstation dazu vorgesehen ist, die wechselseitige Nutzung eines Frequenzbandes von Stationen, welche nach einem ersten Funkschnittstellenstandard arbeiten und Stationen, welche nach einem zweiten Funkschnittstellenstandard arbeiten, zu steuern.

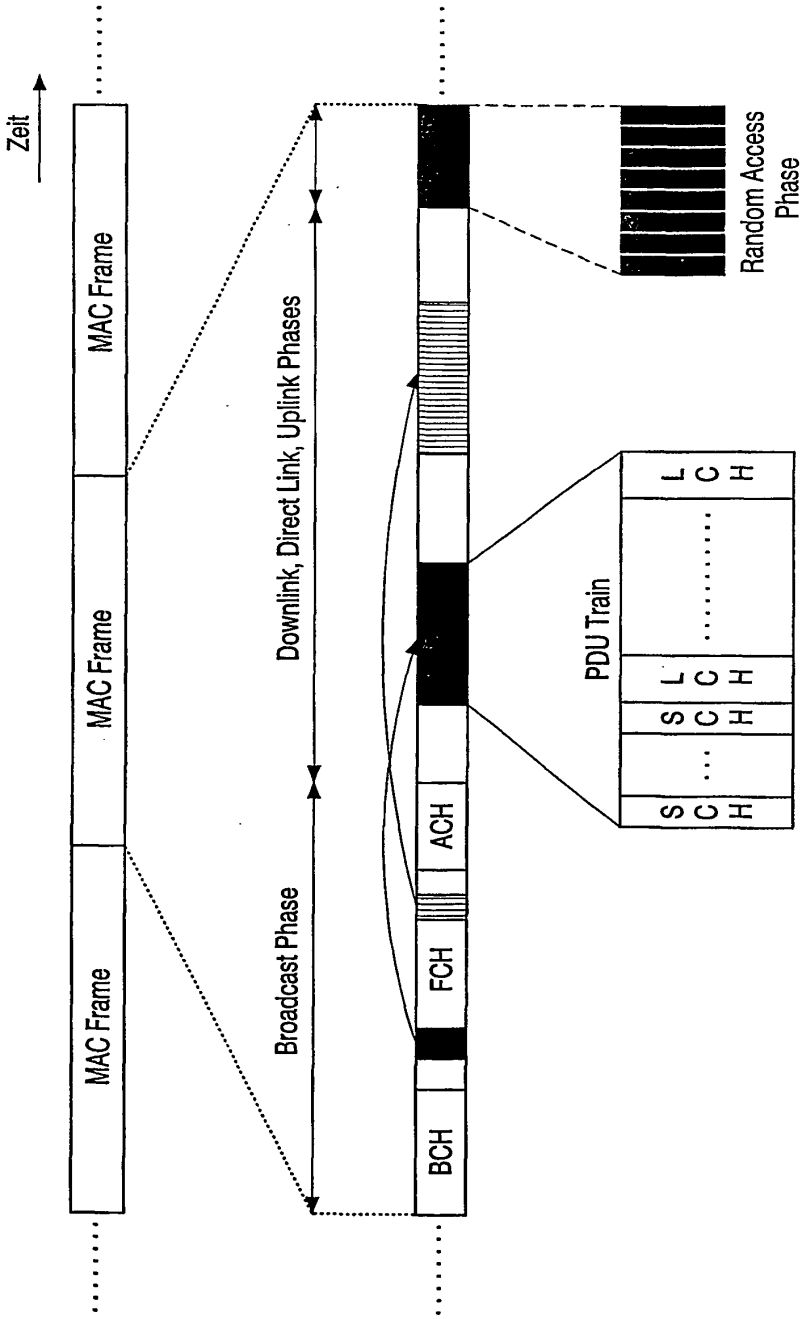
Zeit
MAC Frame
MAC Frame
MAC Frame
Downlink, Direct Link, Uplink Phases
Broadcast Phase
BCH
FCH
ACH
Random Access Phase
PDU Train
S
C
H
L
C
H

FIG. 1

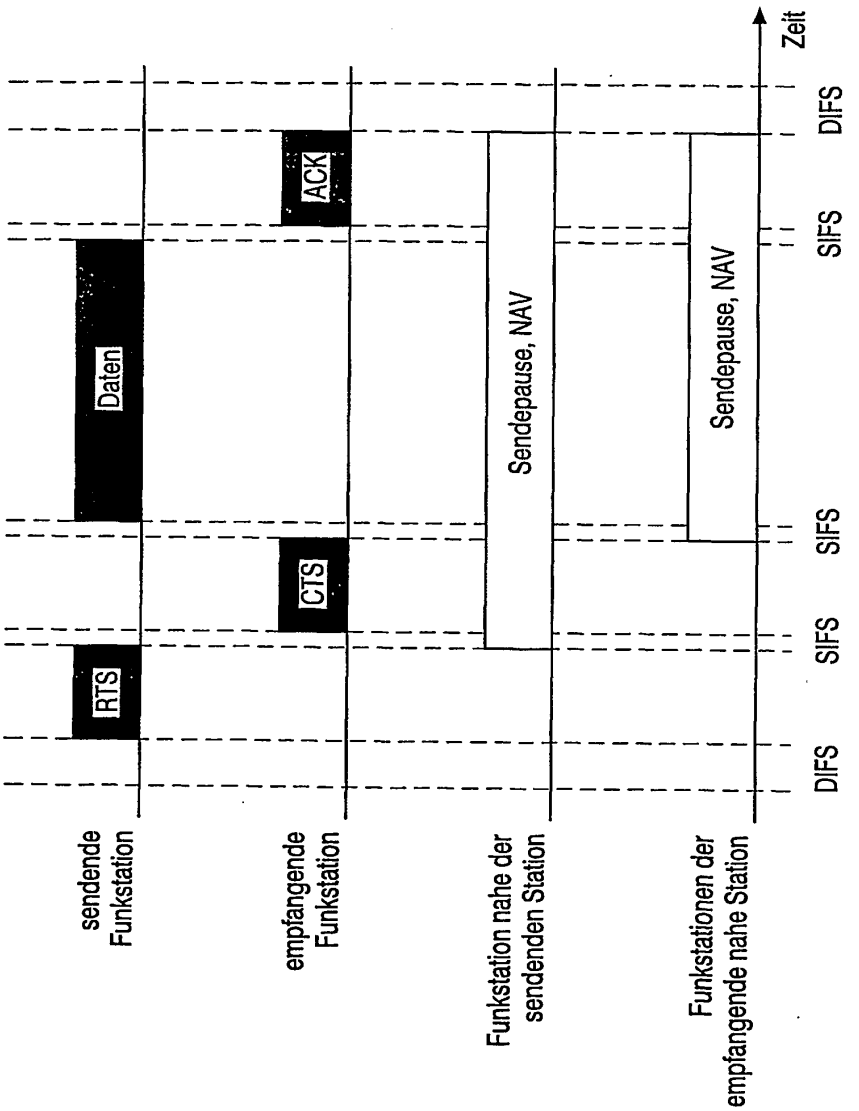
Zeit
DIFS
SIFS
SIFS
SIFS
DIFS
RTS
CTS
Daten
ACK
Sendepause, NAV
Sendepause, NAV
sendende Funkstation
empfangende Funkstation
Funkstation nahe der sendenden Station
Funkstationen der empfangende nahe Station

FIG. 2

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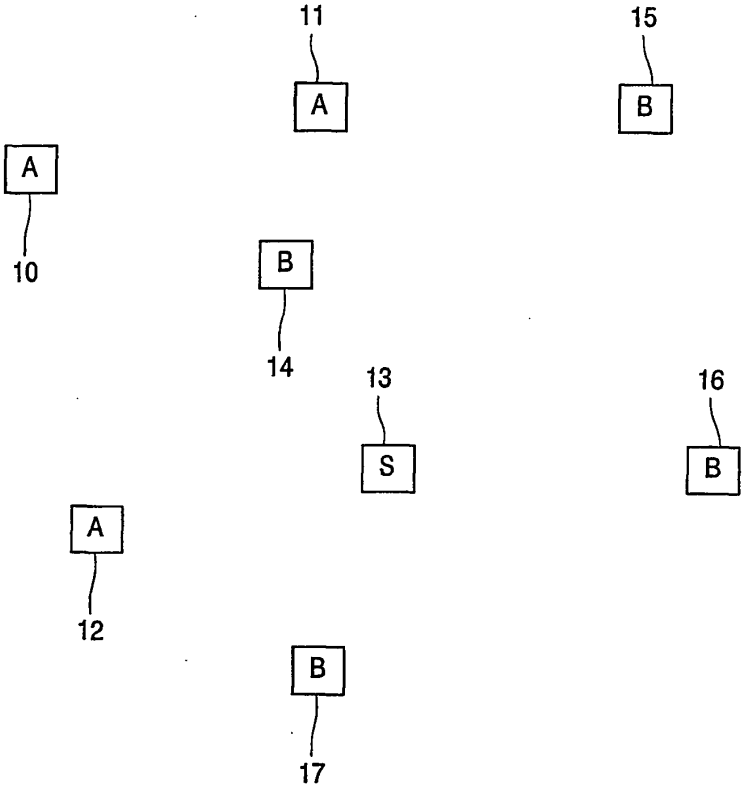

FIG. 3

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **WALKE, Bernard** [DE/NL]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **MANGOLD, Stefan** [DE/NL]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

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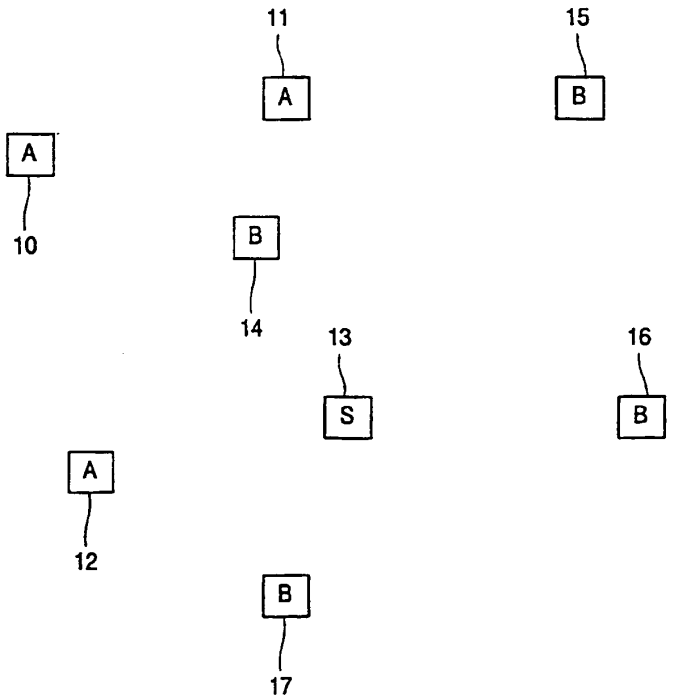
(81) Bestimmungsstaaten *(national)*: JP, US.

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

(54) Bezeichnung: VERFAHREN, NETZWERK UND STEUERSTATION ZUR WECHSELSEITIGEN STEUERUNG VON FUNKSYSTEMEN UNTERSCHIEDLICHER STANDARDS IM GLEICHEN FREQUENZBAND



(57) Abstract: The invention relates to an interface-control protocol method for a radio system, which has at least one frequency band provided for the two-way alternate utilization of a first and a second radio interface standard. The radio system comprises a number of stations, which each function in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, whereby a control station is provided that controls the two-way alternate utilization of the frequency band.

(57) Zusammenfassung: Die Erfindung bezieht sich auf ein Schnittstellen-Steuerungsprotokollverfahren für ein Funksystem, welches wenigstens ein Frequenzband aufweist, das für die wechselseitige Nutzung eines ersten und eines zweiten Funkschnittstellenstandards vorgesehen ist, wobei das Funksystem mehrere Stationen aufweist, welche jeweils nach einem ersten Funkschnittstellenstandard und/oder nach einem zweiten Funkschnittstellenstandard arbeiten, wobei eine Steuerstation vorgesehen ist, welche die wechselseitige Nutzung des Frequenzbandes steuert.

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(84) Bestimmungsstaaten (regional): europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Veröffentlicht:

- *mit internationalem Recherchenbericht*
- *vor Ablauf der für Änderungen der Ansprüche geltenden Frist: Veröffentlichung wird wiederholt, falls Änderungen eintreffen*
- *insgesamt in elektronischer Form (mit Ausnahme des Kopfbogens): auf Antrag vom Internationalen Büro erhältlich*

(88) Veröffentlichungsdatum des internationalen Recherchenberichts: 23. Mai 2002

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

INTERNATIONAL SEARCH REPORT

Inter ·ional Application No
PC1/EP 01/09258

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/28

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)
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 23790 A (INTERMEC IP CORP) 14 May 1999 (1999-05-14) page 3, line 28 -page 4, line 21 page 5, line 18 - line 24 page 8, line 24 -page 9, line 17 page 10, line 17 - line 28 page 16, line 3 - line 9 figures 1,4 ---	1-11
X	US 5 710 766 A (SCHWENDEMAN ROBERT JOHN) 20 January 1998 (1998-01-20) column 1, line 55 -column 3, line 15 column 6, line 47 - line 50 column 9, line 1 - line 20 figures 3,10 --- -/--	1,10,11

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 March 2002	12/03/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Barel, C

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 21328 A (ERICSSON TELEFON AB L M) 29 April 1999 (1999-04-29) page 9, line 18 -page 10, line 20 page 7, line 6 - line 21 page 11, line 12 - line 25 figures 7,8	1,2,10, 11
P,X	EP 1 119 137 A (LUCENT TECHNOLOGIES INC) 25 July 2001 (2001-07-25) page 3, line 9 - line 14 page 3, line 46 - line 54 page 4, line 9 - line 16 page 7, line 45 -page 8, line 10 figure 1	1-3,10, 11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 01/09258

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 9923790	A	14-05-1999	US	6295461 B1	25-09-2001
			WO	9923790 A1	14-05-1999
US 5710766	A	20-01-1998	NONE		
WO 9921328	A	29-04-1999	US	6226279 B1	01-05-2001
			AU	9768598 A	10-05-1999
			JP	2001521330 T	06-11-2001
			WO	9921328 A1	29-04-1999
EP 1119137	A	25-07-2001	EP	1119137 A1	25-07-2001
			JP	2001217853 A	10-08-2001
			US	2001010689 A1	02-08-2001

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 01/09258

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 H04L12/28

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 H04L H04Q

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	WO 99 23790 A (INTERMEC IP CORP) 14. Mai 1999 (1999-05-14) Seite 3, Zeile 28 -Seite 4, Zeile 21 Seite 5, Zeile 18 - Zeile 24 Seite 8, Zeile 24 -Seite 9, Zeile 17 Seite 10, Zeile 17 - Zeile 28 Seite 16, Zeile 3 - Zeile 9 Abbildungen 1,4	1-11
X	US 5 710 766 A (SCHWENDEMAN ROBERT JOHN) 20. Januar 1998 (1998-01-20) Spalte 1, Zeile 55 -Spalte 3, Zeile 15 Spalte 6, Zeile 47 - Zeile 50 Spalte 9, Zeile 1 - Zeile 20 Abbildungen 3,10	1,10,11

-/--

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
5. März 2002	12/03/2002

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Barel, C

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

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Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	WO 99 21328 A (ERICSSON TELEFON AB L M) 29. April 1999 (1999-04-29) Seite 9, Zeile 18 -Seite 10, Zeile 20 Seite 7, Zeile 6 - Zeile 21 Seite 11, Zeile 12 - Zeile 25 Abbildungen 7,8	1,2,10, 11
P,X	EP 1 119 137 A (LUCENT TECHNOLOGIES INC) 25. Juli 2001 (2001-07-25) Seite 3, Zeile 9 - Zeile 14 Seite 3, Zeile 46 - Zeile 54 Seite 4, Zeile 9 - Zeile 16 Seite 7, Zeile 45 -Seite 8, Zeile 10 Abbildung 1	1-3,10, 11

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/EP 01/09258

Im Recherchenbericht angeführtes Patentdokument		Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
WO 9923790	A	14-05-1999	US	6295461 B1	25-09-2001
			WO	9923790 A1	14-05-1999
US 5710766	A	20-01-1998	KEINE		
WO 9921328	A	29-04-1999	US	6226279 B1	01-05-2001
			AU	9768598 A	10-05-1999
			JP	2001521330 T	06-11-2001
			WO	9921328 A1	29-04-1999
EP 1119137	A	25-07-2001	EP	1119137 A1	25-07-2001
			JP	2001217853 A	10-08-2001
			US	2001010689 A1	02-08-2001

VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS

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INTERNATIONALER RECHERCHENBERICHT

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PHDE000238WO		
Internationales Aktenzeichen	Internationales Anmeldedatum *(Tag/Monat/Jahr)*	(Frühestes) Prioritätsdatum *(Tag/Monat/Jahr)*
PCT/EP 01/09258	08/08/2001	08/08/2000
Anmelder		
KONINKLIJKE PHILIPS ELECTRONICS N.V.		

Dieser internationale Recherchenbericht wurde von der Internationalen Recherchenbehörde erstellt und wird dem Anmelder gemäß Artikel 18 übermittelt. Eine Kopie wird dem Internationalen Büro übermittelt.

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[X] Darüber hinaus liegt ihm jeweils eine Kopie der in diesem Bericht genannten Unterlagen zum Stand der Technik bei.

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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/089,959	Bernhard Walke	PHDE000238

INTERNATIONAL APPLICATION NO.	
PCT/EP01/09258	
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08/08/2001	08/08/2000

Corporate Patent Counsel
Philips Electronics North America Corporation
Tarrytown, NY 10591

CONFIRMATION NO. 1142
371 ACCEPTANCE LETTER

OC000000008270309

Date Mailed: 06/26/2002

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.494 OR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated Office (37 CFR 1.494) , has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

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DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF RECEIPT OF ALL 35 U.S.C. REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

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2681 #3 MH 7-25-02

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Enclosed herewith is a Form PTO-1449, required copies of documents listed thereon, and a concise explanation of their relevance is described below or enclosed herewith per 37 CFR 1.97.

Application Number	10/089,959
Filing Date	APRIL 4, 2002
First Named Inventor	BERNHARD WALKE ET AL
Group Art Unit	2681
Examiner Name	
Attorney Docket Number	PHDE 000238

These documents may be relevant in that they have been:

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Signature	Russell Gross	*Date*	7/11/02

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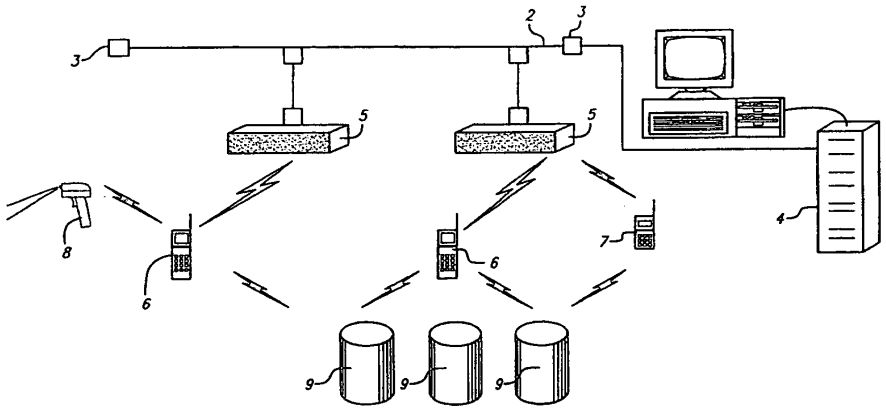

(57) Abstract

A multi–mode radio frequency network comprises a first type of computing device having a radio receiver/transmitter adapted for communication over a narrowband frequency range, and a second type of computing device having a radio receiver/transmitter adapted for communication over both the narrowband frequency range and a wideband frequency range. A network access controller is adapted for communication with both types of computing device over respective ones of the narrowband and wideband frequency ranges. The network access controller provides synchronization signals for coordinating the timing of communications over the narrowband and wideband frequency ranges. The second type of computing device may be adapted for either frequency–hopping or direct sequence spread spectrum communication signals over the wideband frequency range. The synchronization signals further comprise periodic beacon signals that define discrete time periods which further include a synchronous portion for commnunication of the narrowband signals and an asynchronous portion for communication of the wideband signal. The multi–mode radio frequency network may further include data storage/retrieval devices and data collection devices adapted for communication with the first and second types of computing device over the narrowband frequency range.

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MULTI-MODE RADIO FREQUENCY NETWORK SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to computing devices coupled together into a wireless local area network, and more particularly, to a wireless local area network infrastructure that permits communication in plural modes to support both wideband spread spectrum and narrowband radio frequency signals.

2. Description of Related Art

A wireless local area network (WLAN) comprises a plurality of remote computing devices which communicate together over radio frequency (RF) signals. As in a wired local area network (LAN), the WLAN allows users to seamlessly access disk drives, printers, and additional computer resources and systems connected to the WLAN. The remote computing devices include a radio receiver/transmitter adapted for RF communication with the other elements of the WLAN. The WLAN may also include a central host processing unit that sends information to and receives information from any one of the plurality of remotely disposed computing devices. The central host processor may also form part of a separate wired LAN to provide a bridge with the WLAN. In such a WLAN, the remote computing devices may comprise portable units that operate within a defined environment to report information back to the central host processing unit. WLAN systems offer increased flexibility over wired LAN systems by enabling operators of the remote computing devices substantial freedom of movement through the environment, and are particularly useful for remote data collection applications such as inventory control, manufacturing and production flow management, and asset tracking.

For simplicity, the radio receiver/transmitter provided within each remote computing device may communicate using conventional narrowband RF signals. Narrowband RF operation has a significant drawback in that the radio receiver/transmitter must be operated at relatively low power levels in order to ensure compliance with certain governmental regulations, and at such low power levels the RF signals are highly susceptible to interference and have low data throughput rates. To overcome these and other drawbacks, commercial WLAN systems have adopted so-called "spread spectrum" modulation techniques. In a spread spectrum system, the transmitted signal is spread over a frequency band that is significantly wider than the minimum bandwidth required to transmit the information being sent. As a result of the signal spreading, spread spectrum systems enable high data integrity and security. Moreover, by spreading transmission power across a broad bandwidth, power levels at any given frequency within the bandwidth are significantly reduced, thereby reducing interference to other radio devices.

In one type of spread spectrum communication system, an RF carrier is shifted in discrete increments in a pattern dictated by a predetermined sequence. These spread spectrum systems are known as "frequency-hopping" modulation systems, since the transmitter jumps from frequency to frequency in accordance with the predetermined sequence. The information signal is modulated onto the shifting carrier frequencies using frequency shift keying (FSK) modulation. Another type of spread spectrum communication system utilizes an RF carrier modulated by a digital code sequence having a spreading code rate, or chipping rate, much higher than the clock rate of the information signal. These spread spectrum systems are known as "direct sequence" modulation systems. The RF carrier may be modulated such that a data stream has one phase when a spreading code sequence represents a data "one" and 180° phase shift when the spreading code sequence represents a data "zero." The RF carrier

may also be binary or quadrature modulated by one or more data streams such that the data streams have one phase when a spreading code sequence represents a data "one" and a predetermined phase shift (e.g., 180° for binary, and 90° for quadrature) when the spreading code sequence represents a data "zero." These types of modulation are commonly referred to as binary shift key (BPSK) and quadrature shift key (QPSK) modulation, respectively.

A primary drawback of operating a WLAN using spread spectrum communication is the high cost of the computing devices due primarily to the complexity of the radio receiver/transmitter. For certain applications, a narrowband RF radio receiver/transmitter would provide satisfactory performance while the high data throughput and integrity provided by a wideband spread spectrum radio receiver/transmitter would be unnecessary. Nevertheless, it would be costly and impractical to operate two separate narrowband and wideband WLAN systems simultaneously. As a result, WLAN system designers must select a single communication mode that provides a sufficient level of performance within practical cost parameters.

Thus, it would be highly desirable to provide a WLAN infrastructure that permits multi-mode communication over both wideband spread spectrum and narrowband RF signals. Such a multi-mode WLAN could be constructed using a combination of higher performance computing devices communicating using wideband spread spectrum RF signals and lower performance computing devices communicating using narrowband RF signals.

SUMMARY OF THE INVENTION

In accordance with the teachings of the present application, a multi-mode radio frequency network is provided. The multi-mode radio frequency network permits RF communication using both wideband spread

spectrum RF signals and narrowband RF signals.

More particularly, the multi-mode radio frequency network comprises a first type of computing device having a radio receiver/transmitter adapted for communication over a narrowband frequency range, and a second type of computing device having a radio receiver/transmitter adapted for communication over both the narrowband frequency range and a wideband frequency range. A network access controller is adapted for communication with both types of computing device over respective ones of the narrowband and wideband frequency ranges. The network access controller provides synchronization signals for coordinating the timing of communications over the narrowband and wideband frequency ranges. The second type of computing device may be adapted for either frequency-hopping or direct sequence spread spectrum communication signals over the wideband frequency range. The synchronization signals further comprise periodic beacon signals that define discrete time periods which further include a synchronous portion for communication of the narrowband signals and an asynchronous portion for communication of the wideband signal. The multi-mode radio frequency network may further include data storage/retrieval devices and data collection devices adapted for communication with the first and second types of computing device over the narrowband frequency range.

In a first embodiment of the invention, the second radio receiver/transmitter is adapted to receive frequency-hopping spread spectrum communication signals in addition to narrowband communication signals. A receive section is adapted to receive radio frequency (RF) signals over the wideband and the narrowband frequency ranges and having a dowconversion mixer to mix the RF signals with a frequency-shifted carrier signal to downconvert the RF signals to intermediate frequency (IF) signals. An IF filter section is adapted to receive the IF signals and has a wideband bandpass filter and a narrowband bandpass filter that are alternatively

coupled to the IF signals to provide filtered IF signals. A demodulation section is adapted to receive the filtered IF signals and recover wideband and narrowband receive signals therefrom. A synthesizer section is adapted to generate the frequency-shifted carrier for the receive section. The frequency-shifted carrier is further modulated by wideband and narrowband transmit data signals to provide modulated transmit signals, and a transmit section is adapted to transmit the modulated transmit signals.

In a second embodiment of the invention, the second radio receiver/transmitter is adapted to receive direct sequence spread spectrum communication signals in addition to narrowband communication signals. A receive section is adapted to receive radio frequency (RF) signals and has a downconversion mixer to mix the RF signals with a carrier signal to downconvert the RF signals to intermediate frequency (IF) signals. A demodulation section receives the filtered IF signals and provides in-phase and quadrature receive data signals therefrom. A synthesizer section generates the carrier for the receive section, and the carrier is further modulated by in-phase and quadrature transmit data signals. A transmit section transmit the modulated transmit signals. Lastly, a control section controls the switching between wideband and narrowband modes of the second radio receiver/transmitter in which the in-phase and quadrature receive signals comprise wideband data in the wideband mode of the second radio receiver/transmitter, and the in-phase receive signals comprise narrowband data in the narrowband mode of the second radio receiver/transmitter.

A more complete understanding of the multi-mode radio frequency network will be afforded to those skilled in the art, as well as a realization of additional advantages and objects thereof, by a consideration of the following detailed description of the preferred embodiment. Reference will be made to the appended sheets of drawings which will first be described briefly.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a system diagram illustrating a multi-mode WLAN of the present invention which includes a first type of computing device using wideband RF communication signals and second type of computing device using narrowband RF communication signals;

Fig. 2 is a block diagram illustrating a first embodiment of a multi-mode radio receiver/transmitter adapted for frequency-hopping spread spectrum communication;

Fig. 3 is a block diagram illustrating a second embodiment of a multi-mode radio receiver/transmitter adapted for direct sequence spread spectrum communication; and

Fig. 4 is a timing diagram illustrating synchronous and asynchronous communication periods following a periodic beacon.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention satisfies the need for a multi-mode WLAN infrastructure that supports both wideband spread spectrum and narrowband radio frequency signals. The multi-mode WLAN can be constructed using a combination of higher performance computing devices communicating using wideband spread spectrum RF signals and lower performance computing devices communicating using narrowband RF signals. In the detailed description that follows, it should be appreciated that like reference numerals are used to identify like elements illustrated in one or more of the figures.

Referring first to Fig. 1, a system diagram of a multi-mode WLAN of the present invention is illustrated. The multi-mode WLAN includes a wired medium 2 having a plurality of interconnected nodes 3. At one of the nodes 3, a central computer controller 4 is coupled thereto which acts as a server for the WLAN and controls communications between the nodes on

the wired medium 2. Two of the nodes 3 have access points 5 coupled thereto which permit communication between the wired medium 2 and the wireless computing devices of the WLAN that will be described in greater detail below. The access points 5 include an RF receiver/transmitter that communicates between the wired medium 2 and the wireless computing devices. As known in the art, information transmitted on the wired medium 2 may be in the form of data packets in accordance with well established computer network protocols, such as Ethernet or Token Ring. It should also be appreciated that other computer network elements, such as computers, servers, printers, and data storage devices may be coupled to other nodes 3 of the wired medium 2.

The WLAN further includes a multi-mode computing device 6, a single-mode computing device 7, data collection devices 8, and data storage/retrieval devices 9. The multi-mode computing device 6 comprises a multi-mode RF receiver/transmitter adapted to communicate both narrowband RF signals and wideband RF signals. The single-mode computing device 7 comprises a single-mode RF receiver/transmitter adapted to communicate only narrowband RF signals. Both the multi-mode and single-mode computing device 6, 7 have generally similar external features, such as a keypad, a data display, and an antenna; however, it is anticipated that the multi-mode computing device 6 be more sophisticated and have greater internal data processing capability than the single-mode computing device 7. For example, the multi-mode computing device 6 may include a faster central processing unit (CPU) and greater memory storage capacity than the single-mode computing device 7, and similarly, may have a larger or more complete keypad and/or data display. For these reasons, it is anticipated that the multi-mode computing device 6 be utilized by supervisory level users and the single-mode computing device 7 be utilized by ordinary level users.

The data collection devices 8 comprise conventional bar code readers used to convert information encoded in bar code symbols into electronic data signals. As known in the art, such data collection devices 8 typically include a light source adapted to be scanned across the bar code field, such as provided by a laser or light emitting diode (LED). The bar and space elements of the bar code symbol have different light reflectivity, and the information encoded into the bar code may thus be detected in the reflected light therefrom. Alternatively, the data collection devices 8 may collect an image of the bar code using an electro-optical imaging element, such as a charge coupled device (CCD), allowing the information encoded into the bar code symbol to be interpreted from the collected image. The data collection devices 8 are adapted to communicate with the computing devices 6, 7 via narrowband RF signals, or alternatively, may be directly coupled to the computing devices via an electrical cable.

The data storage/retrieval devices 9 comprise conventional magnetic disk or tape drives used for non-volatile data storage. The data storage/retrieval devices 9 are adapted to communicate with the computing devices 6, 7 via narrowband RF signals. Data collected by the computing devices 6, 7 may thus be downloaded to the data storage/retrieval devices 9 during the course of data collection operations, or alternatively, data stored in the data storage/retrieval devices may be accessed by the computing devices 6, 7. As a result, the data storage capacity of the computing devices 6, 7 can be reduced accordingly.

To operate the multi-mode WLAN, the access points 5 transmit periodic beacon signals that enable all the wireless elements of the WLAN to synchronize. As shown in Fig. 4, the periodic beacon signals (B) indicate the start of a time period during which RF communication will occur. This time period is divided into a synchronous communication period (S) and an asynchronous communication period (A). The synchronous communication period is further sub-divided into fixed-length time slots S_1-S_6 which allow the

multi-mode computing device 6 to sequentially poll the data storage retrieval devices 9, the single-mode computing device 7, and the data collection devices 8 via narrowband RF communication signals. Also, the single-mode computing device 7 communicates with the access point 5 via narrowband RF communication signals during one of the time slots. It is anticipated that the synchronous RF communication signals be transmitted using a common system clock that is synchronized to the periodic beacon signals.

During the asynchronous communication period, the multi-mode computing devices 6 communicate with the access points 5 over wideband spread spectrum RF communication signals. The spread spectrum RF communication signals may be either of the frequency-hopping or direct sequence variety, as will be further described below. The asynchronous spread spectrum communication signals A_1-A_2 do not have fixed time duration, but rather such signals are provided in the form of message packets that generally include a header identifying a start of a message and a trailer identifying an end of a message in accordance with known data protocols.

Referring now to Fig. 2, an embodiment of the multi-mode RF receiver/transmitter included in the multi-mode computing device 6 is illustrated. In accordance with this embodiment, the multi-mode RF receiver/transmitter is adapted to communicate both narrowband RF signals and wideband frequency-hopping spread spectrum RF signals. The multi-mode RF receiver/transmitter of Fig. 2 includes an RF receive section 10, an IF filter section 20, a demodulation section 30, a digital control section 40, a synthesizer section 50 and a transmit section 60.

The RF receive section 10 includes an antenna 12, a transmit/receive switch 14, a bandpass filter 15, low noise amplifier stages 16, 17, and a downconversion mixer 18. The antenna 12 is provided for receiving and transmitting RF signals to and from the receiver/transmitter. The transmit/receive switch 14 has a common terminal that is electrically

coupled to the antenna 12, and two contact positions electrically coupled to the bandpass filter 14 of the receive circuit and transmit circuit 60 (described below), respectively. The transmit/receive switch 14 enables the antenna 12 to be configured for either transmitting or receiving operations. As known in the art, the transmit/receive switch 14 can be provided by mechanical switch elements, such as a relay, or can comprise solid state switching circuitry. It is preferable that the transmit/receive switch 14 have generally high speed switching characteristics to reduce delays between respective receiving and transmitting operations. Within the receive section 10, a received RF signal is first provided to a bandpass filter 15 which rejects adjacent extraneous frequencies outside the bandwidth of the received signal. The low noise amplifier stages 16, 17 amplify the received and filtered signal to a desired amplitude level. The mixer 18 multiplies the amplified signal with a locally generated frequency-shifted carrier from the synthesizer section 50 to produce an intermediate frequency (IF) signal having a constant difference in frequency between the received signal and the locally generated signal.

In the IF filter section 20, the IF signal is provided to one of two bandpass filters depending on whether the received RF signal is a synchronous narrowband signal or an asynchronous wideband signal. The IF filter section 20 includes a first bandpass filter 24 and a second bandpass filter 26 coupled in parallel between two switch stages 22, 28. The first bandpass filter 24 is for reception of wideband frequency-hopping spread spectrum signals, and the second bandpass filter 26 is for reception of narrowband signals. It should be appreciated that the bandwidth of the first bandpass filter 24 represents that of a single frequency channel within the wideband frequency range over which frequency-hopping spread spectrum signals are transmitted, and not the bandwidth of the entire wideband frequency range. The switches 22, 28 are controlled by the digital control section 40 (described below), so that the first bandpass filter 24 is enabled during asynchronous communication periods and the second bandpass filter

26 is enabled during synchronous communication periods.

Following the IF filter section 20, the filtered IF signal is provided to the demodulation section 30 which recovers the information contained within the original RF signal. The IF demodulation section 30 comprises an IF amplifier 32, an IF limiter 34, and a demodulator 36. The IF amplifier 32 and IF limiter 34 are used to adjust the signal level of the filtered IF signal to a level sufficient for demodulation. The gain of these stages may be set at different levels depending on whether the received RF signal is a wideband or narrowband signal. The demodulator 36 is adapted to recover both frequency shift key (FSK) modulated signals from a frequency-hopping spread spectrum wideband signal, and frequency modulation (FM) from a synchronous narrowband signal. A single demodulator circuit could be utilized to demodulate both wideband and narrowband signals either by dynamically changing the circuit's quality factor Q, or by accepting a decreased signal to noise ration for the narrowband signal. Alternatively, separate demodulator circuits could be used for the narrowband and wideband signals that are selectively switched in the same manner as the IF filter section 20.

The digital control section 40 provides the main signal processing hardware for the radio receiver/transmitter, and is responsible for controlling the transmit/receive switching, bandwidth selection, frequency synthesizer programming, clock recovery and data handling/generation. The digital control section 40 comprises a microcontroller 42 and a host interface 44. The microcontroller 42 may be provided by an application specific integrated circuit (ASIC), a microprocessor, a digital signal processor or other such circuit element. The host interface 44 provides for communication between the receiver/transmitter portion of the computing device and a host portion that processes and utilizes the information that has been communicated. As known in the art, the microcontroller 42 performs its functions by executing a series of commands or instructions, also referred to

as a software program, that may be disposed on a permanent storage medium, such as a semiconductor read only memory (ROM) device or a magnetic medium.

The synthesizer section 50 communicates with the digital control section 40 to control the timing and selection of carrier frequencies. The synthesizer section 50 comprises a digital-to-analog (D/A) converter 52, a frequency synthesizer 54, a transmit loop filter 55, a receive loop filter 56, a transmit local oscillator 57, a receive local oscillator 58 and a voltage controlled oscillator 46. The frequency synthesizer 54 is programmed by a plurality of digital data signals from the microcontroller 42, and provides a D.C. voltage signal to the transmit and receive local oscillators 57, 58 that corresponds to a selected frequency. The transmit and receive loop filters 55, 56 comprise low pass filters that remove high frequency noise from the D.C. voltage signals that occurs in the feedback loop. The transmit and receive local oscillators 57, 58 further comprise voltage controlled oscillator (VCO) circuits that receive the D.C. voltage signals, and generate corresponding oscillating signals at the selected frequency. The oscillating signals from the transmit and receive local oscillators 57, 58 are also provided back to the frequency synthesizer 54 as feedback signals, as known in the art.

The oscillating signal from the receive local oscillator 58 is provided to the mixer 18 of the receive section 10 as the frequency-shifted carrier. Digital data from the microcontroller 42 is converted to an analog signal by the D/A converter 52, which is provided to the transmit local oscillator 57 to control the waveshape (i.e., amplitude and frequency) of the oscillating signal. By changing the frequency of the oscillating signal, multiple data rates can be supported. Also, by changing the amplitude of the oscillating signal, the frequency deviation of the transmitted carrier can be changed, allowing modulation of both wideband and narrowband data. The modulated oscillating signal from the transmit local oscillator 57 passes

through a VCO buffer amplifier 59, and is provided to the transmit section 60.

The transmit section 60 essentially reverses the process performed by the receive section 10. The data-modulated, frequency-shifted carrier passes through a bandpass filter 64 to remove any VCO harmonics generated by the synthesizer section 50. Thereafter, the data-modulated, frequency-shifted carrier is provided to a pre-driver 66 and a power amplifier 67 that amplify the carrier signal to a desired output level, and a low pass filter 68 for noise attenuation. Lastly, the amplified carrier signal is provided to the antenna 12 for RF transmission. It should be appreciated that the pre-driver 66 and amplifier 67 stages need not be linear amplifiers due to the constant envelope modulation, thereby making them more efficient than linear counterparts.

The transmit section 60 further includes a D/A converter 62 that modifies the characteristics of the pre-driver 66 and power amplifier 67. The microcontroller 42 calculates a digital offset value for the transmit section 60 based on the frequency generated by the synthesizer section 50, in order to maintain an optimum power output level of the radio receiver/transmitter for each of the shifted frequencies across the wideband frequency range. The digital offset value is provided to the D/A converter, which provides an analog control signal to bias the pre-driver 66 and power amplifier 67. An example of an RF transmitter that maintains power output level linearity across a range of transmitting frequencies is disclosed in Serial Number 08/823,611 for ADAPTIVE POWER LEVELING OF AN RF TRANSCEIVER UTILIZING INFORMATION STORED IN NON-VOLATILE MEMORY, filed March 25, 1997, by the assignee herein.

Fig. 3 illustrates an alternative embodiment of the multi-mode RF receiver/transmitter in the multi-mode computing device 6 which is adapted to communicate both narrowband RF signals and wideband direct sequence spread spectrum RF signals. The multi-mode RF receiver/transmitter of Fig. 3 includes an RF receive section 10, a

demodulation section 70, a digital control section 40, a synthesizer section 80 and a transmit section 60. The RF receive section 10, digital control section 40 and transmit section 60 of Fig. 3 are substantially the same as the corresponding sections of the multi-mode RF receiver/transmitter of Fig. 2, and further description of these sections is therefore omitted.

Following the RF receive section 10, the IF signal is provided to the demodulation section 70 which recovers the information contained within the original RF signal. The demodulation section 70 comprises a bandpass filter 72, an IF amplifier 73, an IF limiter 74, a demodulator 76, and a narrowband and a wideband data low pass filter 77, 78. The bandpass filter 72 has a bandwidth sufficient for reception of wideband direct sequence spread spectrum signals. The IF amplifier 73 and IF limiter 74 are used to adjust the signal level of the filtered IF signal to a level sufficient for demodulation. As in the previous embodiment, the gain of these stages may be set at different levels depending on whether the received RF signal is a wideband or narrowband signal.

The demodulator 76 is adapted to recover binary phase shift key (BPSK) modulated signals from a direct sequence spread spectrum wideband signal and frequency modulation (FM) from a synchronous narrowband signal. The demodulator 76 may further comprise a conventional QPSK demodulator circuit which provides an in phase (I) output and a quadrature (Q) output. By modulating the direct sequence spread spectrum data using BPSK modulation, the Q channel output provides the demodulated BPSK data through the associated wideband filter 78 and the I channel output provides the demodulated FM signal through the associated narrowband filter 77. This way, a single demodulator circuit could be utilized to demodulate both wideband and narrowband signals without having to switch filters as in the previous embodiment.

The synthesizer section 80 communicates with the digital control section 40 to control the timing and selection of carrier frequencies.

On the receive side, the synthesizer section 80 comprises a frequency synthesizer 82, a receive loop filter 83 and a receive local oscillator 84. As in the previous embodiment, the frequency synthesizer 82 is programmed by a plurality of digital data signals from the microcontroller 42, and provides a D.C. voltage signal to the receive local oscillator 84 that corresponds to a selected frequency. The oscillating signal from the receive local oscillator 84 is provided back to the frequency synthesizer 82 as a feedback signal, and the receive loop filter 87 comprises a low pass filter that removes high frequency noise from the D.C. voltage signal that occurs in the feedback loop.

On the transmit side, the synthesizer section further comprises a transmit loop filter 87, a transmit local oscillator 89, an I-channel data low pass filter 85, a Q-channel data low pass filter 88, an I-channel mixer 86, a Q-channel mixer 91, a phase shift circuit 92 and a summing circuit 94. The frequency synthesizer 82 provides a D.C. voltage signal to the transmit local oscillator 89 to provide an oscillating signal, which is in turn provided back to the frequency synthesizer as a feedback signal. The oscillating signal from the transmit local oscillator 89 is provided to the phase shift circuit 92, which provides the oscillating signal to the I-channel mixer 86 and shifts the phase of the oscillating signal by 90° and provides the phase-shifted oscillating signal to the Q-channel mixer 91. I-channel data (i.e., narrowband data) and Q-channel data (i.e., wideband data) generated by the digital control section 40 is provided through the respective filters 85, 88 to the respective mixers 86, 91. The Q-channel data low pass filter 88 has a wider bandwidth than the I-channel data low pass filter 85 with a frequency cutoff consistent with the required direct sequence spread spectrum data format. The mixers 86, 91 modulate the I and Q-channel data with the respective oscillating signals, and these modulated data signals are summed by the summing device 94. Lastly, the modulated oscillating signal from the summing device 94 passes through a VCO buffer amplifier 96, and is provided to the transmit section 60.

In the wideband mode (i.e., direct sequence spread spectrum communication), the receiver/transmitter operates as an ordinary direct sequence spread spectrum radio. The digital control section 40 controls the transmit and receive operation, using data from the wideband filter 78, programs the synthesizer 82 for the desired channel frequency, and outputs the proper spreading sequence data to the synthesizer section 80 for transmit on the Q-channel. In the narrowband mode, the operation is the same, except that at the time interval defined by the beacon signal the receiver/transmitter is placed in the narrowband mode. The digital control section 40 selects the data from the narrowband filter 77 for reception of narrowband data. When transmitting, the digital control section 40 outputs data of a lower data rate onto the I-channel only, creating a signal of narrower bandwidth than the direct sequence spread spectrum signal.

Having thus described a preferred embodiment of a multi-mode radio frequency network, it should be apparent to those skilled in the art that certain advantages have been achieved. It should also be appreciated that various modifications, adaptations, and alternative embodiments thereof may be made within the scope and spirit of the present invention. The invention is solely defined by the following claims.

CLAIMS

What is Claimed is:

1. A multi-mode radio frequency network, comprising:

at least one first type of computing device having a first radio receiver/transmitter adapted for communication over a narrowband frequency range;

at least one second type of computing device having a second radio receiver/transmitter adapted for communication over both said narrowband frequency range and a wideband frequency range; and

a network access controller adapted for communication with said at least one first type of computing device and said at least one second type of computing device over respective ones of said narrowband and said wideband frequency ranges, said network access controller providing synchronization signals for coordinating timing of communications over said narrowband and said wideband frequency ranges.

2. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter provides spread spectrum communication signals over said wideband frequency range.

3. The multi-mode radio frequency network of Claim 2, wherein said spread spectrum communication signals further comprise frequency-hopping spread spectrum signals.

4. The multi-mode radio frequency network of Claim 2, wherein said spread spectrum communication signals further comprise direct sequence spread spectrum signals.

5. The multi-mode radio frequency network of Claim 1, wherein said wideband frequency range communications occur in a substantially asynchronous manner.

6. The multi-mode radio frequency network of Claim 1, wherein said narrowband frequency range communications occur in a substantially synchronous manner.

7. The multi-mode radio frequency network of Claim 1, further comprising at least one data storage/retrieval device adapted for communication with each of said at least one first type of computing device and said at least one second type of computing device over said narrowband frequency range.

8. The multi-mode radio frequency network of Claim 1, further comprising at least one data collection device adapted for communication with said at least one first type of computing device and said at least one second type of computing device over said narrowband frequency range.

9. The multi-mode radio frequency network of Claim 1, wherein said synchronization signals further comprise periodic beacon signals.

10. The multi-mode radio frequency network of Claim 9, wherein said periodic beacon signals define respective discrete time periods which further include a synchronous portion and an asynchronous portion.

11. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter further comprises an

intermediate frequency portion having a wideband filter, a narrowband filter, and means for switching between said wideband and narrowband filters based upon said synchronization signals.

12. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter further comprises:

a receive section adapted to receive radio frequency (RF) signals over said wideband and said narrowband frequency ranges and having a dowconversion mixer to mix the RF signals with a frequency-shifted carrier signal to downconvert the RF signals to intermediate frequency (IF) signals;

an IF filter section adapted to receive said IF signals and having a wideband bandpass filter and a narrowband bandpass filter that are alternatively coupled to said IF signals to provide filtered IF signals;

a demodulation section adapted to receive said filtered IF signals and recover wideband and narrowband receive signals therefrom;

a synthesizer section adapted to generate said frequency-shifted carrier for said receive section, said frequency-shifted carrier being further modulated by wideband and narrowband transmit data signals to provide modulated transmit signals; and

a transmit section adapted to transmit said modulated transmit signals.

13. The multi-mode radio frequency network of Claim 12, further comprising a control section adapted to select between said wideband bandpass filter and said narrowband bandpass filter.

14. The multi-mode radio frequency network of Claim 1, wherein said second radio receiver/transmitter further comprises:

a receive section adapted to receive radio frequency (RF) signals and having a downconversion mixer to mix the RF signals with a

carrier signal to downconvert the RF signals to intermediate frequency (IF) signals;

a demodulation section adapted to receive said filtered IF signals and provide in-phase and quadrature receive data signals therefrom;

a synthesizer section adapted to generate said carrier for said receive section, said carrier being further modulated by in-phase and quadrature transmit data signals;

a transmit section adapted to transmit said modulated transmit signals; and

a control section adapted to control switching between wideband and narrowband modes of said second radio receiver/transmitter, wherein said in-phase and quadrature receive signals comprise wideband data in said wideband mode of said second radio receiver/transmitter, and said in-phase receive signals comprising narrowband data in said narrowband mode of said second radio receiver/transmitter.

15. The multi-mode radio frequency network of Claim 14, wherein said demodulation section further comprises a demodulator adapted to recover frequency modulation (FM) from said narrowband data and quadrature phase shift key (QPSK) modulation from said wideband data.

16. The multi-mode radio frequency network of Claim 14, wherein said wideband data further comprises direct sequence spread spectrum data.

17. An apparatus for communicating in both narrowband and wideband frequency ranges comprising:

a receive section adapted to receive radio frequency (RF) signals and having a downconversion mixer to mix the RF signals with a frequency-shifted carrier signal to downconvert the RF signals to

intermediate frequency (IF) signals;

an IF filter section adapted to receive said IF signals and having a wideband bandpass filter and a narrowband bandpass filter that are alternatively coupled to said IF signals to provide filtered IF signals;

a demodulation section adapted to receive said filtered IF signals and recover wideband and narrowband receive signals therefrom;

a synthesizer section adapted to generate said frequency-shifted carrier for said receive section, said frequency-shifted carrier being further modulated by wideband and narrowband transmit data signals to provide modulated transmit signals; and

a transmit section adapted to transmit said modulated transmit signals.

18. The apparatus of Claim 17, wherein said demodulation section further comprises a demodulator adapted to recover frequency modulation (FM) from said narrowband signals and frequency shift key (FSK) modulation from said wideband signals.

19. An apparatus for communicating in both narrowband and wideband frequency ranges comprising:

a receive section adapted to receive radio frequency (RF) signals and having a downconversion mixer to mix the RF signals with a carrier signal to downconvert the RF signals to intermediate frequency (IF) signals;

a demodulation section adapted to receive said filtered IF signals and provide in-phase and quadrature receive data signals therefrom;

a synthesizer section adapted to generate said carrier for said receive section, said carrier being further modulated by in-phase and quadrature transmit data signals;

a transmit section adapted to transmit said modulated transmit signals; and

a control section adapted to control switching between wideband and narrowband modes of said apparatus, wherein said in-phase and quadrature receive signals comprise wideband data in said wideband mode of the apparatus, and said in-phase receive signals comprising narrowband data in said narrowband mode of the apparatus.

20. The apparatus of Claim 19, wherein said demodulation section further comprises a demodulator adapted to recover frequency modulation (FM) from said narrowband data and quadrature phase shift key (QPSK) modulation from said wideband data.

21. The apparatus of Claim 19, wherein said wideband data further comprises direct sequence spread spectrum data.

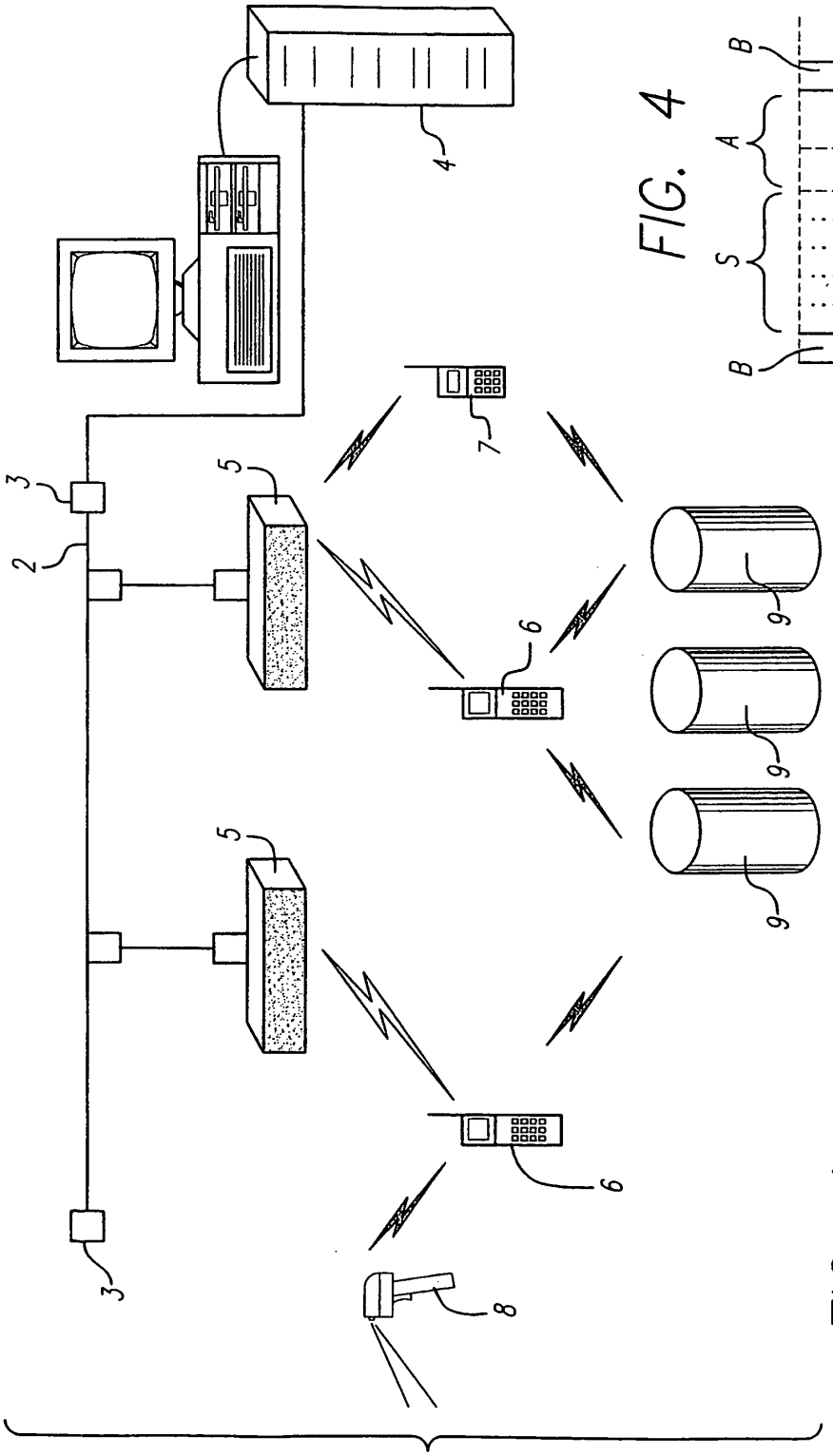

FIG. 1

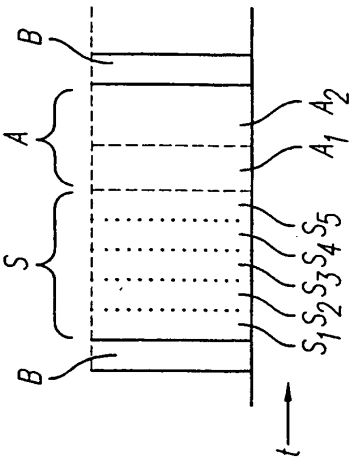

FIG. 4

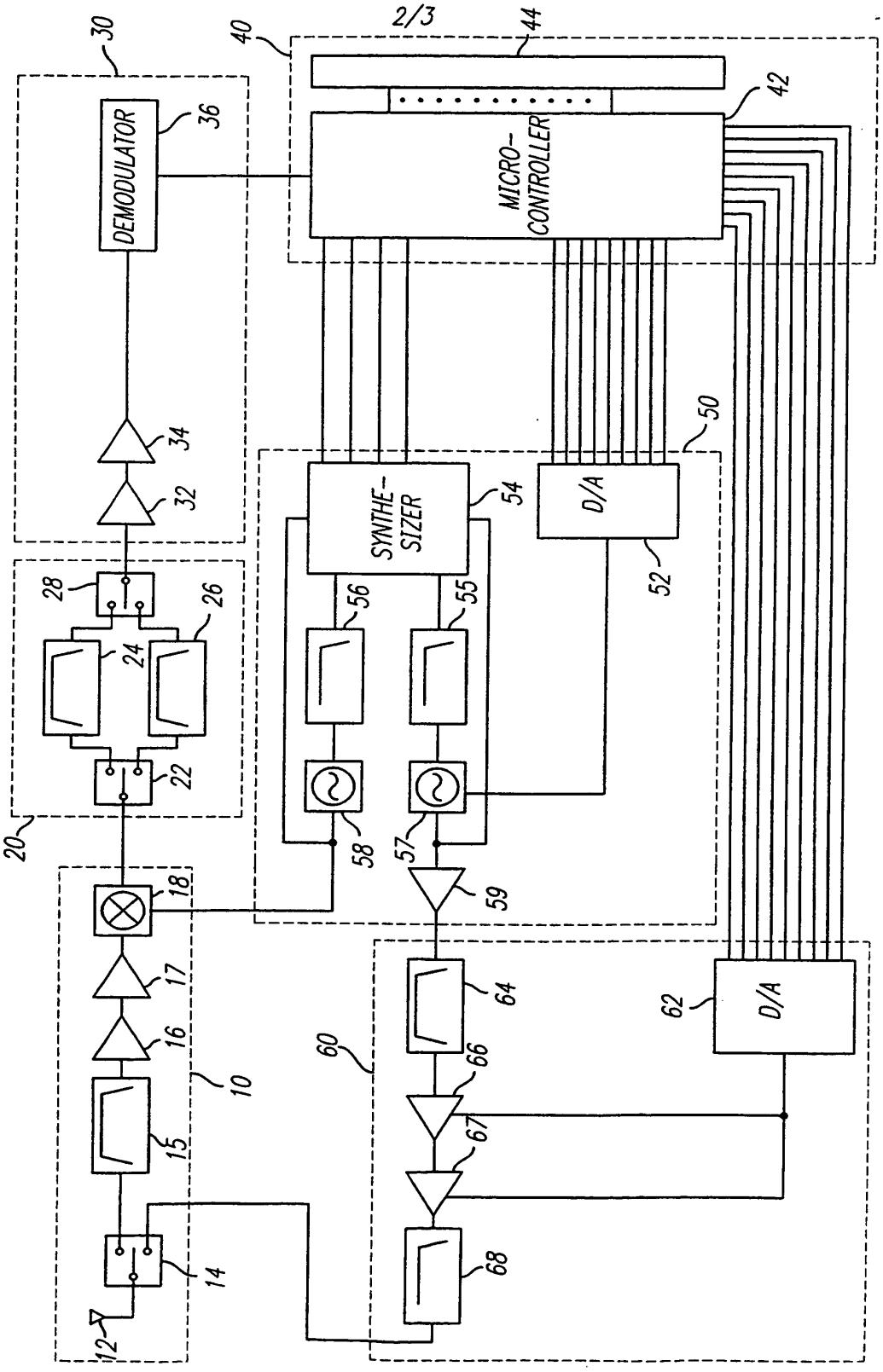

FIG. 2

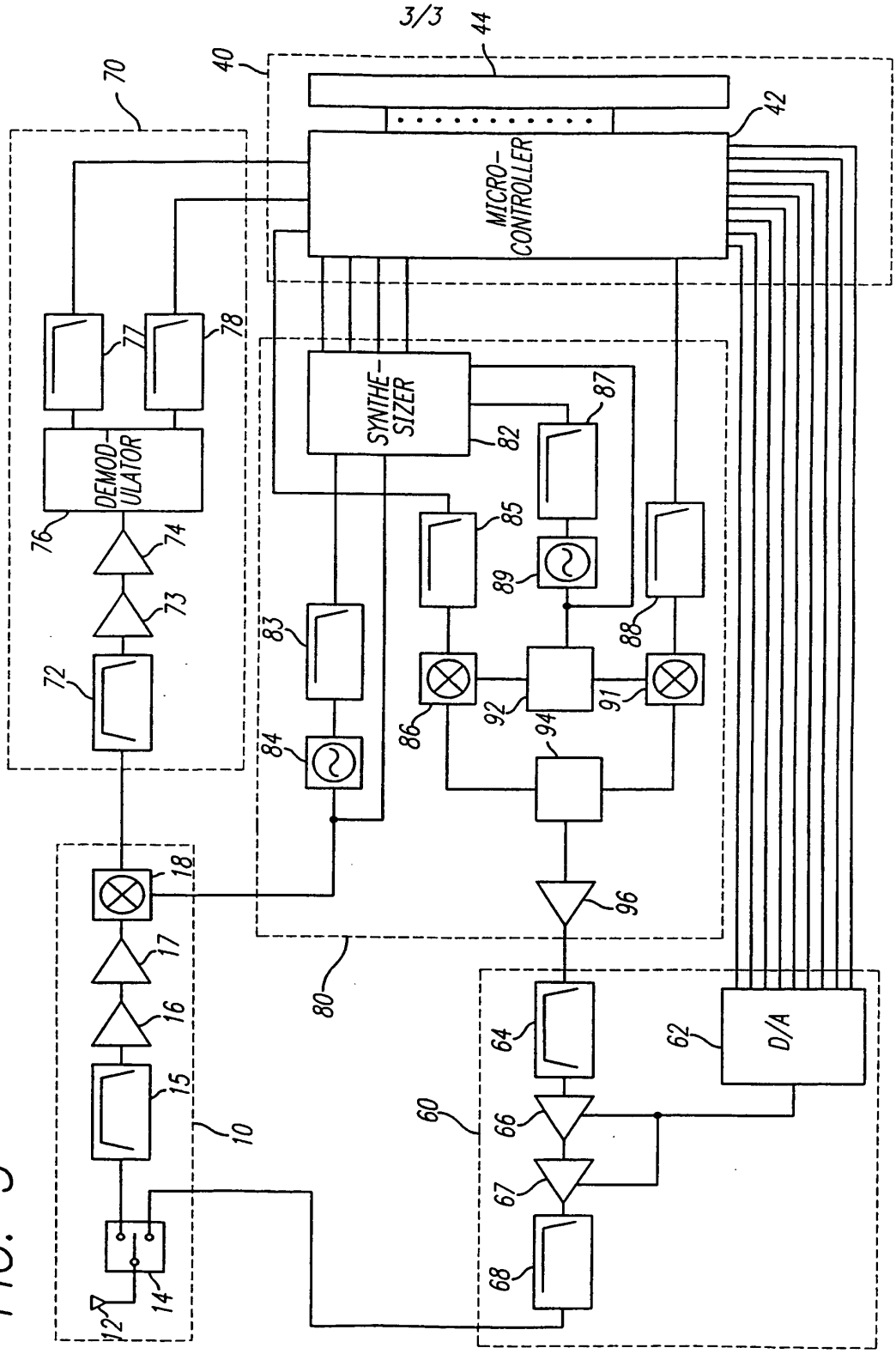

FIG. 3

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/US 98/22969

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L12/28 H04B1/69

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)
IPC 6 H04L H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, 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.
A	US 5 291 516 A (DIXON ROBERT C ET AL) 1 March 1994 see column 1, line 60 - column 3, line 30 see column 4, line 57 - column 8, line 14 see claims 1,4-6 ---	1,4, 11-14, 16,17, 19,21
A	WO 97 32403 A (ERICSSON GE MOBILE INC) 4 September 1997 see abstract see page 2, line 5 - page 5, line 14 see page 6, line 23 - page 7, line 2 see page 11, line 22 - page 12, line 13 see claims 1,10 --- -/--	1,11-13

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"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	Date of mailing of the international search report
19 February 1999	02/03/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Karavassilis, N

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BNSDOCID: <WO___9923790A1_I_>

INTERNATIONAL SEARCH REPORT

Internat Application No
PCT/US 98/22969

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	BANTZ D F ET AL: "WIRELESS LAN DESIGN ALTERNATIVES" IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS, vol. 8, no. 2, 1 March 1994, pages 43-53, XP000515079 see page 46, left-hand column, line 35 - page 47, left-hand column, line 46 -----	2-4,16, 21

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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BNSDOCID: <WO___9923790A1_I_>

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(11) EP 1 119 137 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.07.2001 Bulletin 2001/30

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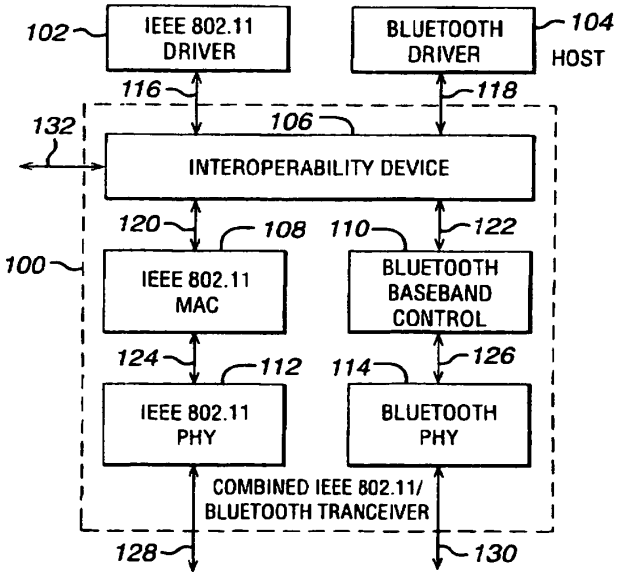
(54) Interoperability for bluetooth/IEEE 802.11

(57) The key of the invention is to introduce an interoperability device in a communication system which integrates an IEEE 802.11 transceiver and a Bluetooth transceiver. The device prevents that one transceiver is transmitting while the other is receiving, which would cause interference at the receiving transceiver. In addition, the device preferably prevents that both systems are transmitting at the same time to avoid interference at the receiving device(s). Optionally the device prohibits its simultaneous reception of both transceivers. In that way the radio receiver can be shared between the devices, allowing a cheaper and smaller hardware design.

FIG. 1



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Description

[0001] The present invention relates to both Bluetooth and IEEE 802.11 radio communication systems.

[0002] IEEE 802.11 is a standard for wireless systems that operate in the 2.4 - 2.5 GHz ISM (industrial, scientific and medical) band. This ISM band is available world-wide and allows unlicensed operation for spread spectrum systems. For both the US and Europe, the 2,400 - 2,483.5 MHz band has been allocated, while for some other countries, such as Japan, another part of the 2.4 - 2.5 GHz ISM band has been assigned. The 802.11 standard focuses on the MAC (medium access control) protocol and PHY (physical layer) protocol for access point (AP) based networks and ad-hoc networks.

[0003] In access point based networks, the stations within a group or cell can communicate only directly to the access point. This access point forwards messages to the destination station within the same cell or through a wired distribution system to another access point, from which such messages arrive finally at the destination station. In ad-hoc networks, the stations operate on a peer-to-peer level and there is no access point or (wired) distribution system.

[0004] The 802.11 standard supports: DSSS (direct sequence spread spectrum) with differential encoded BPSK and QPSK; FHSS (frequency hopping spread spectrum) with GFSK (Gaussian FSK); and infrared with PPM (pulse position modulation). These three physical layer protocols (DSSS, FHSS and infrared) all provide bit rates of 2 and 1 Mbit/s. The 802.11 standard further includes extensions 11a and 11b. Extension 11b is for a high rate CCK (Complementary Code Keying) physical layer protocol, providing bit rates 11 and 5.5 Mbit/s as well as the basic DSSS bit rates of 2 and 1 Mbit/s within the same 2.4 - 2.5 GHz ISM band. Extension 11a is for a high bit rate OFDM (Orthogonal Frequency Division Multiplexing) physical layer protocol standard providing bit rates in the range of 6 to 54 Mbit/s in the 5 GHz band. The 802.11 basic medium access behaviour allows interoperability between compatible physical layer protocols through the use of the CSMA/CA (carrier sense multiple access with a collision avoidance) protocol and a random back-off time following a busy medium condition. In addition all directed traffic uses immediate positive acknowledgement (ACK frame), where a retransmission is scheduled by the sender if no positive acknowledgement is received. The 802.11 CSMA/CA protocol is designed to reduce the collision probability between multiple stations accessing the medium at the point in time where collisions are most likely occur. The highest probability of a collision occurs just after the medium becomes free, following a busy medium. This is because multiple stations would have been waiting for the medium to become available again. Therefore, a random back-off arrangement is used to resolve medium contention conflicts. In addition, the 802.11 MAC defines: special functional behaviour for fragmentation of packets; medium reservation via RTS/CTS (request-to-send/clear-to-send) polling interaction; and point co-ordination (for time-bounded services).

[0005] The IEEE 802.11 MAC also defines Beacon frames, sent at a regular interval by an AP to allow STAs to monitor the presence of the AP. IEEE 802.11 also defines a set of management frames including Probe Request frames which are sent by an STA, and are followed by Probe Response frames sent by the AP. Probe Request frames allow an STA to actively scan whether there is an AP operating on a certain channel frequency, and for the AP to show to the STA what parameter settings this AP is using.

[0006] Bluetooth technology allows for the replacement of the many proprietary cables that connect one device to another with one universal short-range radio link. For instance, Bluetooth radio technology built into both a cellular telephone and a laptop would replace the cumbersome cable used today to connect a laptop to a cellular telephone. Printers, personal digital assistant's (PDA's), desktops, computers, fax machines, keyboards, joysticks and virtually any other digital device can be part of the Bluetooth system. But beyond un-tethering devices by replacing the cables, Bluetooth radio technology provides a universal bridge to existing data networks, a peripheral interface, and a mechanism to form small private ad-hoc groupings of connected devices away from fixed network infrastructures.

[0007] Designed to operate in a noisy radio frequency environment, the Bluetooth radio system uses a fast acknowledgement and frequency hopping scheme to make the link robust. Bluetooth radio modules avoid interference from other signals by hopping to a new frequency after transmitting or receiving a packet. Compared with other systems operating in the same frequency band, the Bluetooth radio system typically hops faster and uses shorter packets. This makes the Bluetooth radio system more robust than other systems. Short packets and fast hopping also limit the impact of domestic and professional microwave ovens. Use of Forward Error Correction (FEC) limits the impact of random noise on long-distance links. The encoding is optimised for an uncoordinated environment. Bluetooth radios operate in the unlicensed ISM band at 2.4 GHz. A frequency hop transceiver is applied to combat interference and fading. A shaped, binary FM modulation is applied to minimise transceiver complexity. The gross data rate is 1Mb/s.

[0008] A Time-Division Duplex scheme is used for full-duplex transmission. The Bluetooth baseband protocol is a combination of circuit and packet switching. Slots can be reserved for synchronous packets. Each packet is transmitted in a different hop frequency. A packet nominally covers a single slot, but can be extended to cover up to five slots. Bluetooth can support an asynchronous data channel, up to three simultaneous synchronous voice channels, or a channel which simultaneously supports asynchronous data and synchronous voice. Each voice channel supports 64 kb/s synchronous (voice) link. The asynchronous channel can support an asymmetric link of maximally 721 kb/s in

either direction while permitting 57.6 kb/s in the return direction, or a 432.6 kb/s symmetric link.

[0009] The IEEE 802.11 standard is well-established and local area networks are already implemented based on the standard, typically in office environments. As Bluetooth comes into the market, it is likely to be implemented in a domestic environment for communications within the home, for example. Thus someone with a lap-top computer may wish to connect to a IEEE 802.11 wireless local area network in the workplace, and connect to a device, such as a mobile telephone, using a Bluetooth interface outside of the workplace.

[0010] It is therefore an object of the present invention to provide a means for enabling such a single device to interface via both an IEEE 802.11 radio system and a Bluetooth radio system.

[0011] According to one aspect of the present invention there is provided a device incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, wherein the device further includes a control means adapted to control the first and second radio systems such that such that only one or the other radio system may transmit at any one time. The first radio system may be a Bluetooth system and the second radio system may be an IEEE 802.11 system.

[0012] The device may be additionally controlled such that when one device is transmitting the other device cannot receive or transmit. The device may be additionally controlled such that when one device is receiving the other device cannot receive or transmit.

[0013] The control means may comprise a switching means, the switching means being adapted to switch on and off the first and second radio systems.

[0014] The control means may comprise a multiplexing means adapted to time multiplex transmissions from the first and second radio systems.

[0015] The control means may comprise a multiplexing means adapted to time multiplex transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

[0016] The Bluetooth transmissions may be through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four. The Bluetooth transmissions may be through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six. The Bluetooth transmissions may be through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

[0017] The control means may prevent transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission. The control means may prevent transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

[0018] The first and second radio systems may share a common physical layer.

[0019] According to another aspect of the present invention there is provided a method of incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, into a single device, wherein the first and second radio systems are controlled such that only one or the other radio system may transmit at any one time. The first radio system may be a Bluetooth system and the second radio system may be an IEEE 802.11 system.

[0020] The method may further comprise controlling the radio systems such that when one radio system is transmitting the other device cannot receive or transmit.

[0021] The method may further comprise controlling the radio systems such that one device is receiving the other device cannot receive or transmit.

[0022] The radio systems may be controlled by switching on and off the first and second radio systems.

[0023] The radio systems may be controlled by time multiplexing transmissions from the first and second radio systems.

[0024] The method may comprise time multiplexing transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

[0025] The Bluetooth transmissions may be through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four. The Bluetooth transmissions may be through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six. The Bluetooth transmissions may be through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

[0026] The method may further comprising preventing transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission. The method may further comprising preventing transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

[0027] The first and second radio systems may share a common physical layer.

[0028] Therefore if both an IEEE 802.11 radio transceiver and a Bluetooth radio transceiver reside in a single device (for instance in a laptop computer) they can transmit and receive in the same radio frequency simultaneously, even though both communication standards make use of the same 85 MHz wide ISM band, at around 2.4 GHz. This is

achieved by a Bluetooth device in a computer being prevented from transmitting data whilst an 802.11 device is attempting to receive data and vice versa.

[0029] Even if the RF frequency that the receiving device is tuned to is different, but still in the same band that the transmitting device is using, the emitted power will jam the receiver, rendering it unable to receive the intended signal.

[0030] The invention solves this problem by introducing an interoperability device, that is connected both to the medium access controller of the IEEE 802.11 device and to the baseband controller of the Bluetooth device.

[0031] The invention also proposes an alternative solution, called dual mode operation, where the IEEE 802.11 devices operate in a different radio frequency band than the Bluetooth system.

[0032] The key of the invention to introduce an interoperability device in a communication system which integrates an IEEE 802.11 transceiver and a Bluetooth transceiver. The device prevents that one transceiver is transmitting while the other is receiving, which would cause interference at the receiving transceiver. In addition, the device prevents that both systems are transmitting at the same time to avoid interference at the receiving device(s). optionally the device prohibits simultaneous reception of both transceivers. In that way the radio receiver can be shared between the devices, allowing a cheaper and smaller hardware design. The invention also covers a dual band mode in which the IEE802.11 device and the Bluetooth device work in a different frequency band, and allows completely parallel operation of the two devices.

[0033] The invention will now be described by way of example with reference to the accompanying Figures, in which:

Figure 1 illustrates a high-level architecture for implementing the present invention;

Figure 2 illustrates the architecture of Figure 1 adapted to utilise radio re-use in accordance with a preferred embodiment of the invention;

Figure 3 illustrates a Bluetooth HV-*i* packet;

Figure 4 illustrates the time-slot allocation for transmission of three different HV-*i* schemes;

Figure 5 illustrates a forward and reverse packet structure for IEEE 802.11; and

Figure 6 illustrates a possible single chip implementation of the present invention.

[0034] The invention serves to solve a fundamental problem associated with providing both a Bluetooth radio system and an IEEE 802.11 radio system in a single device. The fundamental problem that has been identified is that if either one of the radio systems is transmitting, there is need to prevent the other radio system from receiving or else the receiving system will be drowned out by the transmitting system. As will be further discussed hereinbelow, further problems associated with the dual operation of a IEEE 802.11 and Bluetooth radio system are overcome by preferred embodiments of the present invention as discussed hereinbelow.

[0035] Referring to Figure 1, there is illustrated a high-level architecture of the combination of an IEEE 802.11 radio system transceiver and a Bluetooth radio system transceiver in a single system, in conjunction with an interoperability device in accordance with the present invention. It will be understood by one skilled in the art that only those elements necessary for the implementation of the present invention are shown in Figure 1.

[0036] The dual mode transceiver of Figure 1 comprises: an IEEE 802.11 physical layer functional element 112; an IEEE 802.11 MAC layer functional element 108; a Bluetooth physical layer functional element 114; a Bluetooth baseband control functional element 110; and an interoperability device 106, all of which comprise a combined IEEE 802.11 /Bluetooth transceiver generally designated by reference numeral 100. In addition an IEEE 802.11 driver 102 and a Bluetooth driver 104 are shown in Figure 1.

[0037] The IEEE 802.11 driver 102 receives IEEE 802.11 packets from the dual mode transceiver 100 on lines 116, and transmits IEEE 802.11 packets to the dual mode transceiver 100 on lines 116. The Bluetooth driver 104 receives Bluetooth packets from the dual mode transceiver 100 on lines 118, and transmits Bluetooth packets to the dual mode transceiver on lines 118. The operation of the respective drivers 102 and 104 is exactly the same as their operation would be if the device were provided with a single IEEE 802.11 or Bluetooth transceiver respectively. However their function may be extended in the sense that they pass on switching signal from application(s) to the interoperability device 106.

[0038] The IEEE 802.11 MAC functional element 108 and the IEEE 802.11 physical functional element 112 form the IEEE 802.11 transceiver of the dual mode transceiver. The IEEE 802.11 MAC functional element 108 operates in accordance with the IEEE standard arrangement to control access to the IEEE 802.11 transmission medium by the device to which it is connected. The IEEE 802.11 MAC functional element 108 receives and transmits IEEE 802.11 packets to and from the interoperability device 106 via lines 120, and transmits and receives IEEE 802.11 packets to

and from the IEEE 802.11 physical layer functional element 112 via lines 124. The IEEE 802.11 physical layer functional element 112 operates in accordance with the IEEE standard arrangement to perform modulation etc. of the IEEE 802.11 packets and transmit/receive the packets via lines 128, which interface the element to the device antenna.

[0039] The Bluetooth baseband control functional element 110 and the Bluetooth physical layer functional element 114 form the Bluetooth transceiver of the dual mode transceiver. The Bluetooth baseband control functional element 110 operates in accordance with the Bluetooth standard arrangement to control access to the transmission medium by the device to which it is connected. The Bluetooth baseband control functional element 110 receives and transmits Bluetooth packets to and from the interoperability device 106 via lines 122, and transmits and receives Bluetooth packets to and from the Bluetooth physical layer functional element 114 via lines 126. The IEEE 802.11 physical layer functional element 114 operates in accordance with the Bluetooth standard arrangement to perform modulation etc. of the Bluetooth packets and transmit/receive the packets via lines 130, which interface the element to the device antenna.

[0040] The control of IEEE 802.11 packets and Bluetooth packets from the respective drivers 102 and 104 to the respective transceiver elements 108/112 and 110/114 is controlled in accordance with the invention by the interoperability device 106. As shown in Figure 1, the interoperability device is additionally connected to control circuitry within the device via control signal lines 132.

[0041] The dual mode transceiver 100 operates in accordance with the invention in one of two modes. A first mode is a switching mode and a second mode is a multiplexing mode, both of which modes are discussed in further detail herein below.

[0042] In the switching mode of operation, the interoperability device 106 deactivates the Bluetooth transceiver (110/114) whenever the IEEE 802.11 transceiver (108/112) is activated, and vice versa. The interoperability device 106 is adapted to make the decision as to which mode of operation to switch to or activate. There are several alternative criteria on which the interoperability device may make this decision.

[0043] In a first alternative, the user of the device may decide which mode to switch to. For instance when the user is at home and wants to connect to the Internet through a telephone, the user may decide to switch to Bluetooth mode and dial up to an Internet Service Provider (ISP). When the user is in the office, where an IEEE 802.11 wireless LAN is present, the IEEE 802.11 mode may be selected by the user, to enable the user to log on to the network. This mode requires the user to know which is the appropriate interface to use for the chosen application. The user command will most likely be provided through an interface, such as a screen and keypad, on the device itself, and notified to the interoperability device 106 via a command signal from a central processor or controller in the device. In addition mixed environments, where both Bluetooth and IEEE 802.11 exist, may be present for example in an office environment.

[0044] In an alternative, the notification of the mode of operation may be provided to the transceivers via control from the CPU through regular drivers, or through a dedicated interoperability device driver.

[0045] In a second alternative, application software may control which mode the device switches to. For instance when the user chooses to synchronise a Personal Digital Assistant (PDA), the data-synchronisation application in the PC may tell the interoperability device to switch to Bluetooth mode. When the user chooses to surf the World Wide Web (WWW), the browser application (or the network driver software supporting it) may tell the interoperability device to switch to IEEE 802.11 mode. Again, the interoperability device 106 may be instructed via a command signal from a central processor or controller.

[0046] In a third alternative, a protocol sniffer may determine whether it detects the presence of an IEEE 802.11 device or a Bluetooth device on the air interface, and set the mode of the interoperability device accordingly. When the protocol sniffer detects both Bluetooth and IEEE 802.11 devices, it may choose a mode that the user has indicated as preferential, or it may consult the user as in the first alternative. Alternatively, the protocol sniffer may let the application decide as in the second alternative.

[0047] Thus in the switching mode the interoperability device operates merely to deactivate, or switch off, one of the two transceivers within the dual mode transceiver. This operation is transparent to the functional elements of the respective transceivers, and also to the other processing functionality in the device itself. When the interoperability device is switched to "IEEE 802.11" mode the transceiver 100 behaves as an IEEE 802.11 transceiver. When the interoperability device is switched to "Bluetooth" mode the transceiver 100 behaves as an Bluetooth transceiver.

[0048] In the switching mode, turning off one transceiver when the other is transmitting means that the one transceiver cannot receive or transmit when the other is transmitting. Thus when employing the switching mode only one radio system needs to be operating at a given time, which means that the radio hardware can be reused.

[0049] Figure 2 illustrates the dual mode transceiver of Figure 1 re-configured to utilise radio re-use. As can be seen from Figure 2, the functionality of the IEEE 802.11 physical layer functional element 112 and the Bluetooth physical layer functional element 114 are combined into a single functional element referred to as the IEEE 802.11/Bluetooth dual physical layer functional element, and denoted by reference numeral 200. The dual functional element 200 transmits and receives IEEE 802.11 and Bluetooth packets on signal lines 204 to the device antenna.

[0050] The IEEE 802.11/Bluetooth dual physical layer functional element is controlled by the interoperability device

via signal lines 202 to operate as the physical layer functional element for either IEEE 802.11 or Bluetooth in accordance with the current mode of operation selected.

[0051] In the multiplexing mode of operation the IEEE 802.11 transmitter is switched off when the Bluetooth transmitter is receiving data and the Bluetooth transmitter is switched off when the IEEE 802.11 device is receiving data. In this way one radio system is never transmitting when the other is receiving, and vice versa. The interoperability device 106 observes the rules of the medium access control protocols, and while the transmission and reception of the IEEE 802.11 and Bluetooth radio systems are time multiplexed, it will appear to the user that the two systems operate in parallel. There will, however, be some performance impact (reduced data throughput, increased data error rate, reduced voice quality).

[0052] Furthermore, the interoperability device 106 additionally preferably does not allow the IEEE 802.1 and Bluetooth radio systems to transmit at the same time. Thus interference of one signal with the other at an external (remote) receiver is prevented.

[0053] In a preferred implementation of the multiplexing mode, if an IEEE 802.11 packet must be transmitted, all Bluetooth data connections are placed in the so-called PARK mode. The interoperability device 106 will issue one HLC_Park_Mode primitive per active ACL (Asynchronous Connectionless data) connection to the Bluetooth transceiver, to put all ACL connections in PARK mode. The PARK mode of the Bluetooth radio system will be familiar to one skilled in the art. In this way, the Bluetooth radio system is deactivated whilst an IEEE 802.11 transmission takes place.

[0054] Although the example implementation is presented herein with reference to a discussion of the Bluetooth PARK mode, it will be appreciated by one skilled in the art that the Bluetooth HOLD mode may alternatively be utilised.

[0055] If-there are active Bluetooth SCO (Synchronous, connection-oriented voice) connections, which transmit and receive periodically in a 0.625 ms Bluetooth slot, then the IEEE 802.11 transceiver must schedule its packet transmissions in-between the Bluetooth packets. The Bluetooth SCO connections are real-time (voice) connections. The interoperability device 106 must take the full IEEE packet exchange period into account, which includes an acknowledgement packet (ACK) and (when the RTS/CTS transmission mode is used) an RTS and CTS packet.

[0056] Further hereinbelow a detailed implementation for scheduling IEEE 802.11 packets in an active SCO connection is given. A 'slot-stealing' scheme is explained and a calculation of data throughput that can be achieved given.

[0057] The IEEE 802.11 packets may need to be as short as a single slot when such a slot-stealing scheme is implemented, and this implies that the interoperability device 106 has to implement a packet fragmentation and reassembly scheme, so that it can divide IEEE 802.11 packets in chunks that can be accommodated in the number of Bluetooth slots that are available. The IEEE 802.11's own fragmentation mechanisms cannot be used, since these mechanisms assume that all fragments are sent consecutively. In the detailed implementation described hereinbelow, a suitable fragmentation scheme is discussed.

[0058] In the following, an example is given for introducing the IEEE 802.11 functionality into a Bluetooth radio system, to enable both radio systems to function together in the same device. The following example is not limiting of the present invention, and the person skilled in the art will recognise that other possibilities exist for the implementation of such an architecture. However, as the Bluetooth specification is dominant the following is a preferred implementation.

[0059] The standard Bluetooth radio system uses Frequency Shift Keying (FSK) modulation, sending one bit of information per symbol time of 1μs. Thus the raw bit-rate is 1 Mbit/s. A packet consists of a preamble, containing a channel access code and a payload. The payload, in turn, is divided into a header (containing packet type, destination address and some other information fields) and a user payload field.

[0060] On the synchronous connection orientated (SCO) links, voice packets are used. The voice packets are typically of the high-quality voice (HV) types HV1, HV2 or HV3. All of these packet types have a 30-byte payload. The most robust packet, HV1, uses rate 1/3 Forward Error Correction (FEC). Packet type HV2 uses rate 2/3 FEC, and type HV3 does not use FEC at all. The number of user bytes is 10,20 and 30 bytes respectively for HV1, HV2 and HV3. The packet layout of an Hv-i (where i=1,2,3) packet is shown in Figure 3. The total duration of a HV-i voice packet is 330 μs. Referring to Figure 3, it can be seen that the Hv-i packet 300 comprises a 72 bit preamble 302, an 18 bit header 304, and a 240 bit (or 30 byte) payload 306.

[0061] In addition to the HV-i type packets, there also exists for Bluetooth a data and voice (DV) type packet. The DV type packet offers the same performance as HV3 (i.e. with no FEC), and carries a variable amount of data as well as voice in the same packet. However, a DV packet carries only 10 user bytes, i.e. a third of HV3's user bytes. The duration of the DV packet is 238 to 356 μs, depending on the amount of data carried.

[0062] Bluetooth packets are sent in time slots, which each have a duration of 625 μs. However packets must be less then 625 μs to allow the radio system sufficient time to hop to another frequency between time slots. Examples of channel operation for HV1, HV2 and HV3 connection are shown in Figure 4, and described further hereinbelow.

[0063] Figures 4(a) to 4(c) illustrate timing diagrams for a single Bluetooth voice connection, based on HV1 (Figure 4(a)), HV2 (Figure 4(b)), or HV3 (Figure 4(c)) packets. The shaded packets are in the forward direction (from Bluetooth master device to Bluetooth slave device), and the clear packets are in the reverse direction (from Bluetooth slave device to Bluetooth master device). Eight time slots TS1 to TS8 are shown. As can be seen forward packets are sent

in odd-numbered time-slots and reverse packets are sent in even-numbered time-slots. The frequency hops, in accordance with the Bluetooth standard, on every time slot, such that the frequencies f_1 to f_8 are hopped-to in times slots TSIto TS8 respectively.

[0064] All voice connection rates are specified to be 64 kbit/s. To achieve this rate a HV1 packet must be sent every other slot, since in every HV1 packet (1/3)×30×8 = 80 bits of user data are sent. (1/3) is the FEC used in HV1, and 30x8 is the number of bits in a 30 byte payload. One packet is sent every 2×0.625ms time-slots, which is equal to 1.25 milliseconds, 0.625 ms being the length of each slot. The user bit rate is thus 80/1.25 bits/ms = 64 kbit/s. Since a voice link is full duplex, the other remaining alternate empty slots are required for the reverse link. This allocation of forward and reverse packets to time-slots is shown in Figure 4(a).

[0065] HV2 packets carry twice the number of user bits as HV1 packets and hence only one forward and one reverse packet is required for every four slots, as shown in Figure 4(b).

[0066] HV3 packets carry twice the number of user bits as HV1 packets and hence only one forward and one reverse packet is required for every six slots, as shown in Figure 4(c). Thus even if there were two HV3 links active, there would still be required only four time-slots in every six time-slots, leaving two time-slots in every six free.

[0067] As a DV packet, similar to a HV1 packet, carries only 10 user bytes, a DV packet must similarly be transmitted every other slot to achieve a rate of 64 kbit/s.

[0068] Hence in combination with a single HV1 or DV voice link, no IEEE 802.11 data traffic can be transmitted or received without reducing the voice quality of the transmission.

[0069] With a single HV2 link, or HV3 links, two slots are available for IEEE 802.11 traffic. With a single HV3 link, 4 slots are available for IEEE 802.11 traffic.

[0070] Working within these parameters set by the Bluetooth transmission system, it is necessary to determine what IEEE 802.11 user bit rate is possible, given the available time slots. As discussed further hereinbelow, this depends to a certain extent on the overhead of the IEEE802.11 packet.

[0071] IEEE 802.11 packets have either a short or a long preamble, of 96 or 192 μs respectively. The IEEE 802.11 packet payload is transmitted at a rate of one byte in every symbol time with a duration of 8/11-th μs. This gives a bit rate of 11 Mbit/s. The payload contains a 24 byte header and a 32 bit (4 byte) CRC field, which takes 28 × (8/11) = 20.3 μs to send in total. A SIFS (Short Interframe Space) time of 10 μs after correct reception of a packet, the recipient transmits an acknowledgement packet, which consists of a header of 96 or 192 μs. The payload contains MAC protocol control information of 14 bytes that take 14×8/11 = 10.2 μs to transmit. Figure 5 depicts an IEEE 802.11 packet transmission.

[0072] As shown in Figure 6, an IEEE 802.11 forward data packet 500 consists of a preamble 504, a MAC header 506 and a data field 508. If received correctly, the receiver, responds with an acknowledgement packet 502 after a SIFS period. The latter packet consists of a preamble 510 and an acknowledgement field 512 comprising MAC information.

[0073] There are thus 4 scenarios to consider: there are two possible IEEE preamble lengths (96 and 192 μs); and there are either two or four Bluetooth "idle" periods (two and four slots).

[0074] The scenario where two Bluetooth slots are available for transmission for IEEE transmissions having a long preamble is considered.

[0075] The overhead due to preambles, SIFS, and MAC overhead amounts to [2 × 192] + 10 + [(28+14) × (8/11)] = 424.5 μs. Of the two idle slots, it is permissible only to use 625 + 366 = 991 μs according to the Bluetooth specification. This is to leave 625 - 366 = 259 μs to allow the radio system to hop to the frequency of the next slot. Subtract 424.5 from 991, to get 566.5, which is the time left for actual data transmission at 11 Mbit/s. In this time 566.5 / (8/11) = 779 IEEE 802.11 bytes can be transmitted. This data can be transmitted every 4 slots. Hence the effective bit rate is equal to (8 × 779)/(4 × 625) = 2.5 Mbit/s.

[0076] The scenario where four Bluetooth slots are available for transmission for IEEE transmissions having a long preamble is now considered.

[0077] If four Bluetooth slots are available, then the time for payload transmission is equal to payload time 625 × 3 + 366 - 424.5 = 1817. This Equates to 1817 / (8/11) = 2498 IEEE 802.11 CCK bytes. The equivalent bit rate is now (8 × 2498)/(6 × 625) = 5.33 Mbit/s

[0078] If the calculations are repeated for short IEEE 802.11 preambles, the bit rates are 3.33 Mbit/s for an HV2 connection or for two HV3 connections. For a single HV3 connection the bit rate is 5.89 Mbit/s. The results are summarised in Table 1.

Table 1

IEEE 802.11 throughput	Two Slots	Four Slots
Short preamble	3.33 Mbit/s	5.89 Mbit/s

Table 1 (continued)

IEEE 802.11 throughput	Two Slots	Four Slots
long preamble	2.49 Mbit/s	5.33 Mbit/s

[0079] Table 1 shows IEEE 802.11 user throughputs if IEEE 802.11 packets are transmitted in slots that are left idle by Bluetooth. If there is one HV2 connection or two HV3 connections, there are 2 idle slots to transmit. If there is one HV3 connection, there are 4 idle slots to transmit. If there is on HV1 or DV1 connection there are no idle slots. If there is no SCO connection at all, then all slots are available for transmission, and the theoretical IEEE 802.11 maximum of 11 Mbit/s can be achieved.

[0080] If a Bluetooth ACL packet must be transmitted, the interoperability device 106 simply holds back IEEE 802.11 packets. As the ACL packets are none real time data packets, they can be held back. When a Bluetooth ACL packet is to be transmitted, an IEEE 802.11 packet transmission will not be in progress, as the ACL connection would be in PARK mode if an IEEE transmission was in progress, as discussed hereinabove.

[0081] In an alternative formulation, if a Bluetooth ACL packet transmission or reception is in progress, the IEEE 802.11 transmission is held back until the Bluetooth transmission/reception is completed. Then the Bluetooth ACL connection is put in HOLD or PARK mode, and the IEEE802.11 transmission can be scheduled and organised around SCO transmissions, as described above.

[0082] Optionally, the interoperability device has a further mode in which it will not allow the IEEE 802.11 devices and Bluetooth device to receive in parallel. By not allowing this, only one radio will be operating at a given time, which implies that the radio hardware can be reused. This again results in an architecture as shown in Figure 2. In this mode Bluetooth SCO slots are always received. If neither the Bluetooth nor the IEEE 802.11 transmitter need to transmit, the common receiver listens to either Bluetooth or IEEE 802.11 packets, according to an algorithm.

[0083] Such an algorithm may be static; for instance the receiver listens to IEEE 802.11 in odd slots and to Bluetooth packets in even slots. Also given the distribution of traffic between Bluetooth and IEEE802.11, the algorithm could give preference to one over the other.

[0084] Finally, the receiver may have a dual synchronisation mode, where it listens to the channel, detects on the fly what type of packet is in the medium (Bluetooth or IEEE 802.11), and reports this to the receiver, which will switch to the appropriate reception mode.

[0085] Both IEEE 802.11 and Bluetooth Packets may be longer than a single slot. In that case the receiver attempts to receive the packet until completion.

[0086] In a typical embodiment of the invention, the MAC controller of the IEE802.11 device and the baseband controller of the Bluetooth device may be implemented in separate, dedicated processor chips. The interoperability device's functionality may be implemented in an additional chip. Alternatively, the functionality of the interoperability device can be added to the controller chips of either the Bluetooth or the IEE802.11 device. In a still further alternative, it is possible to integrate the IEEE 802.11 MAC control functions and the Bluetooth control function in a single chip and add the interoperability functionality to the same chip as well. Other arrangements of chips and division of interoperability functionality are also possible.

[0087] Figure 6 illustrates an example of a "system on a chip" implementation of a combined IEEE 802.11 MAC controller and a Bluetooth Baseband controller. The chip 600 includes a DMA (Direct Memory Access) 610, an interrupt controller (Int. Ctrl) 612, timers 614, RAM (Random Access Memory) 616 all connected to a CPU (central processor unit) 622 via an internal bus 624, which elements are all required for both the IEEE 802.11 and Bluetooth functions. An external bus (Ext. Bus) block 608 is also required for both the IEEE 802.11 and Bluetooth functions, and is connected to the CPU 622 via internal bus 624 and to an external flash memory and/or ROM via lines 626. A USB (Universal Serial Bus) block 606, connected to internal bus 624, is used to interface the Bluetooth transceiver and optionally the IEEE 802.11 transceiver to a host PC via connections 628. The (mini) PCI block 602, connected to the internal bus 624, is used to interface between the host PC (via connections 628) and the IEEE 802.11 transceiver. A PCI based interface between host PC and Bluetooth is not yet defined but is foreseen. The UART block is also connected to the internal bus 624 and to the external connections 628.

[0088] The CPU micro-controller 622 runs firmware that implements the IEEE 802.11 MAC and Bluetooth baseband functions. A Bluetooth Link Controller block 618 and an IEEE 802.11 MAC support block 620 are connected to the CPU via the internal bus 624, and operate in conjunction with the CPU 622 to implement hardware assist functions for both the Bluetooth and IEEE 802.11 transceivers respectively.

[0089] The Bluetooth Link Controller 618 is connected to the Bluetooth physical layer functional elements (not shown) via connections 632, and similarly the IEEE 802.1 MAC support block 620 is connected to the IEEE 802.11 physical layer functional elements (not shown) via connections 634

Claims

1. A device incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, wherein the device further includes a control means adapted to control the first and second radio systems such that such that only one or the other radio system may transmit at any one time.

2. The device of claim 1 wherein the first radio system is a Bluetooth system and the second radio system is an IEEE 802.11 system.

3. The device of claim 1 or claim 2 wherein the device is additionally controlled such that when one device is transmitting the other device cannot receive or transmit.

4. The device of any one of claims 1 to 3 wherein the device is additionally controlled such that one device is receiving the other device cannot receive or transmit.

5. The device of claim 1 or claim 2, wherein the control means comprises a switching means, the switching means being adapted to switch on and off the first and second radio systems.

6. The device of claim 1 or claim 2, wherein the control means comprises a multiplexing means adapted to time multiplex transmissions from the first and second radio systems.

7. The device of claim 2, wherein the control means comprises a multiplexing means adapted to time multiplex transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

8. The device of claim 7, wherein the Bluetooth transmissions are through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four.

9. The device of claim 7, wherein the Bluetooth transmissions are through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six.

10. The device of claim 7, wherein the Bluetooth transmissions are through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

11. The device of claim 2 wherein the control means prevents transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission.

12. The device of claim 2 wherein the control means prevents transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

13. The device of any one of claims 1 to 12 in which the first and second radio systems share a common physical layer.

14. A method of incorporating a first radio system operating at a first range of frequencies of operation and a second radio system operating at a second range of frequencies of operation, wherein at least a part of said first and second range of frequencies overlap, into a single device, wherein the first and second radio systems are controlled such that only one or the other radio system may transmit at any one time.

15. The method of claim 14 wherein the first radio system is a Bluetooth system and the second radio system is an IEEE 802.11 system.

16. The method of claim 14 or 15 further comprising controlling the radio systems such that when one radio system is transmitting the other device cannot receive or transmit.

17. The method of any one of claims 14 to 16 further comprising controlling the radio systems such that one device is receiving the other device cannot receive or transmit.

18. The method of claim 14 or 15 wherein the radio systems are controlled by switching on and off the first and second

radio systems.

19. The device of claim 14 or claim 15 wherein the radio systems are controlled by time multiplexing transmissions from the first and second radio systems.

20. The method of claim 15, comprising time multiplexing transmissions from the Bluetooth and IEEE 802.11 radio systems, the IEEE 802.11 and Bluetooth transmissions being multiplexed into Bluetooth time-slots.

21. The method of claim 20, wherein the Bluetooth transmissions are through a single HV2 SCO link connection, the IEEE 802.11 transmissions being in two time-slots in every four.

22. The method of claim 20, wherein the Bluetooth transmissions are through a single HV3 SCO link connection, the IEEE 802.11 transmissions being in four time-slots in every six.

23. The method of claim 20, wherein the Bluetooth transmissions are through two HV3 SCO link connections, the IEEE 802.11 transmissions being in two time-slots in every six.

24. The method of claim 15 further comprising preventing transmission of IEEE 802.11 packets during a Bluetooth ACL packet transmission.

25. The method of claim 15 further comprising preventing transmission of Bluetooth ACL packets during an IEEE 802.11 packet transmission.

26. The method of any one of claims 14 to 25 in which the first and second radio systems share a common physical layer.

FIG. 1

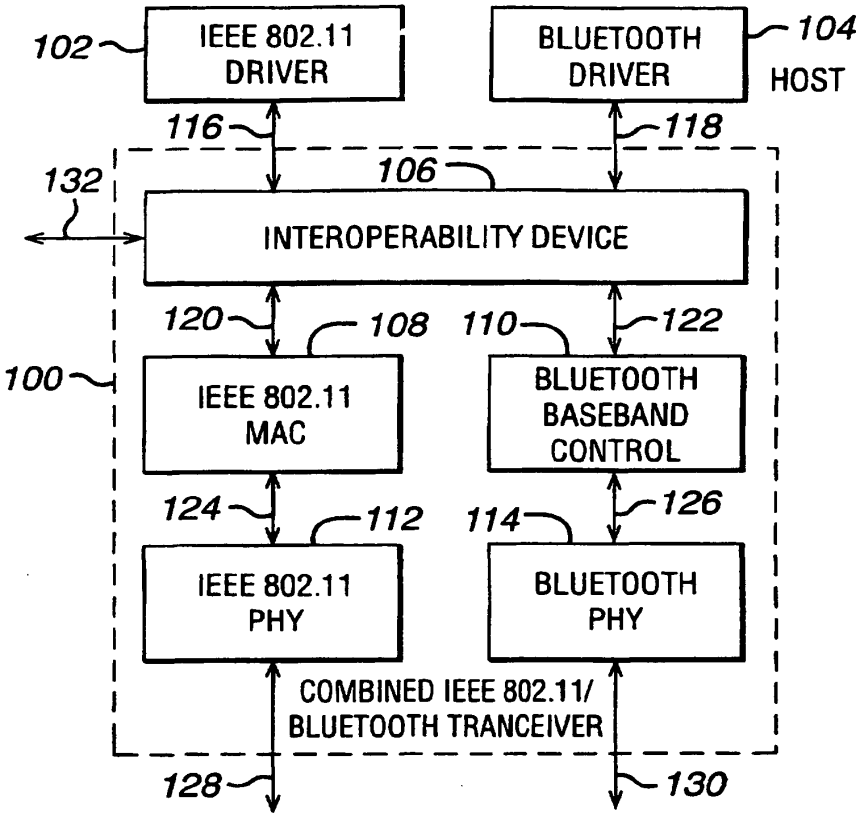


FIG. 3

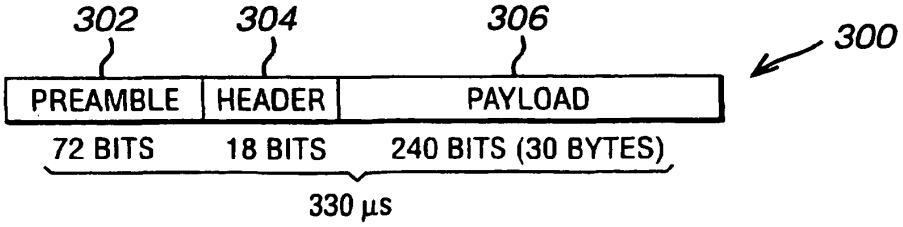


FIG. 2

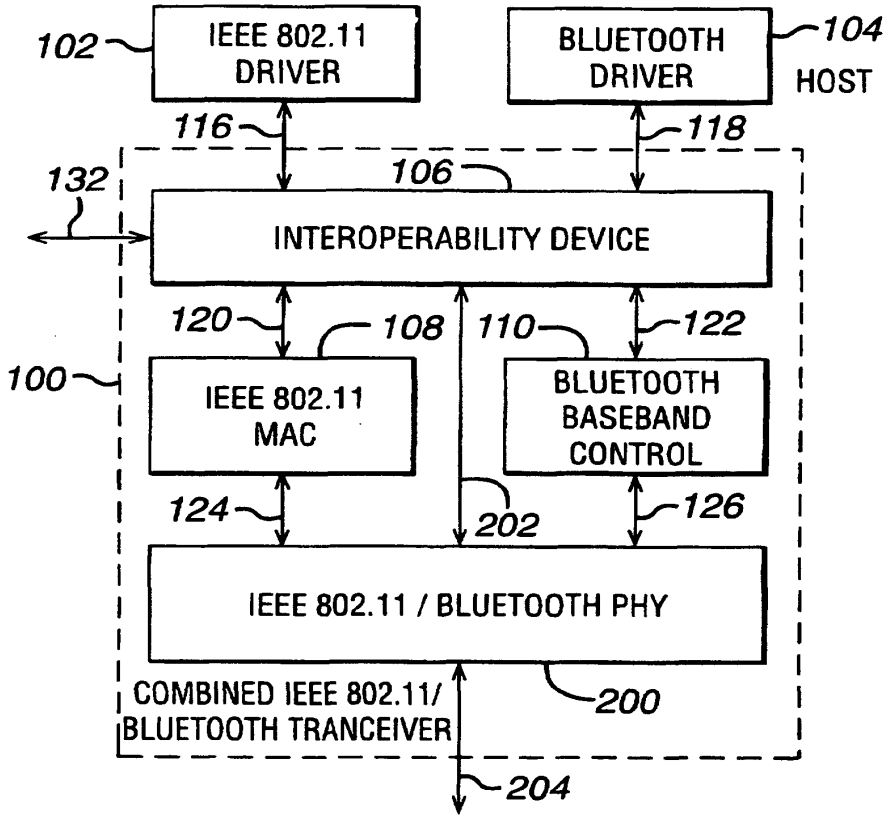


FIG. 5

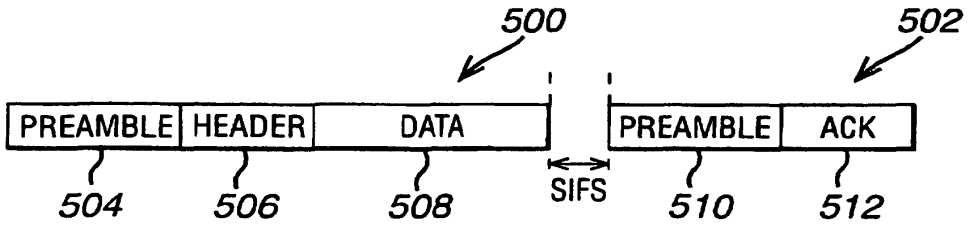


FIG. 4

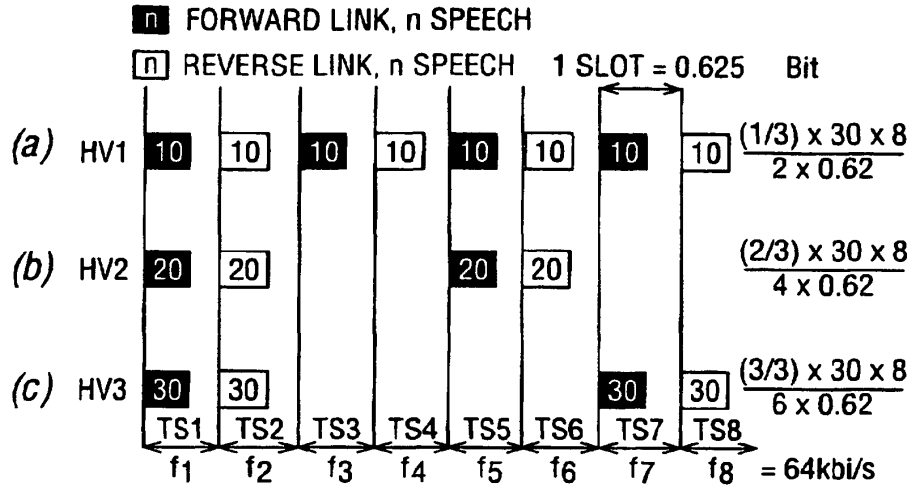
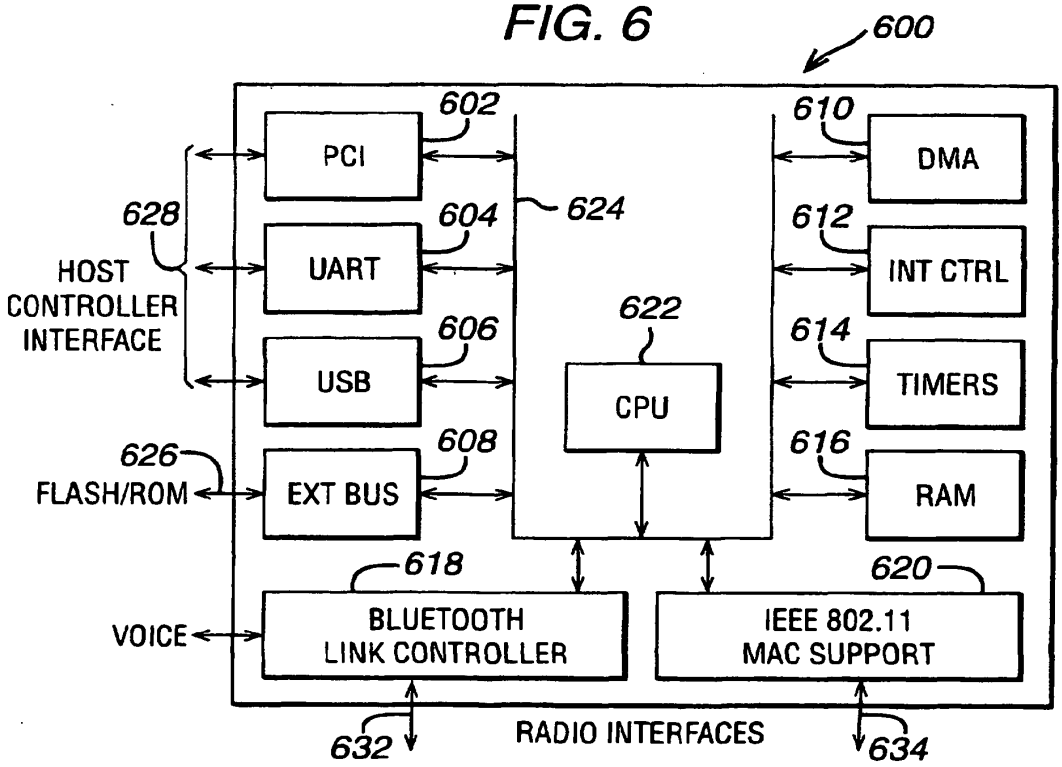


FIG. 6



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 0397

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	US 5 960 344 A (MAHANY RONALD L) 28 September 1999 (1999-09-28)	1,14	H04L12/28 H04L12/56
A	* column 4, line 36 - column 5, line 30 * * column 9, line 66 - column 10, line 21 *	3-5, 16-18	
X	US 5 903 548 A (DELAMATER JEFF) 11 May 1999 (1999-05-11)	1,14	
A	* column 2, line 64 - column 3, line 23 * * column 3, line 48 - line 61 * * column 4, line 45 - line 55 * * column 5, line 17 - line 48 * * column 8, line 7 - column 9, line 6 *	3-5,13, 16-18,26	
A	WO 99 29126 A (JOERESSEN OLAF J ;NOKIA MOBILE PHONES LTD (FI)) 10 June 1999 (1999-06-10) * page 1, line 25 - line 29 * * page 4, line 4 - line 12 *	1,2, 7-12, 14-16, 20-26	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
H04L H04Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 June 2000	Heinrich, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 0397

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-06-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5960344 A	28-09-1999	US 5546397 A	13-08-1996
		AU 1374795 A	10-07-1995
		WO 9517724 A	29-06-1995
US 5903548 A	11-05-1999	NONE	
WO 9929126 A	10-06-1999	AU 1500299 A	16-06-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

PTO/SB/06 (08-03)
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: 10/089959

CLAIMS AS FILED – PART I

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))					$____	OR		$____
TOTAL CLAIMS (37 CFR 1.16(c))	11	minus 20 =	*	x $____ =		OR	x $____ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	3	minus 3 =	*	x $____ =		OR	x $____ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))				+ $____ =		OR	+ $____ =	
				TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

2/25/04

AMENDMENT		(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(c))	* 11	Minus	** 20	= ____	x $____ =		OR	x $____ =	
	Independent (37 CFR 1.16(b))	* 3	Minus	*** 3	= ____	x $____ =		OR	x $____ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
	Total (37 CFR 1.16(c))	*	Minus	**	=	x $____ =		OR	x $____ =	
	Independent (37 CFR 1.16(b))	*	Minus	***	=	x $____ =		OR	x $____ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
	Total (37 CFR 1.16(c))	*	Minus	**	=	x $____ =		OR	x $____ =	
	Independent (37 CFR 1.16(b))	*	Minus	***	=	x $____ =		OR	x $____ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

7590 09/22/2004

Corporate Patent Counsel
Philips Electronics North America Corporation
Tarrytown, NY 10591

EXAMINER	
TRAN, CONGVAN	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 09/22/2004

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)	
	10/089,959	WALKE ET AL.	
	Examiner	Art Unit	
	CongVan Tran	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 *22 June 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) *1-11* 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) *1-11* 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 *7/18/02*.
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

1. 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 1-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Ala-Laurila et al. (6,587,680).

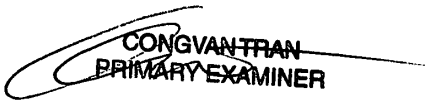
Regarding claims 1, 10-11, Ala-Laurila discloses a communication system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, a control station being provided which controls the alternate use of the frequency band (see fig.1, elements 12, 14, 28, col.6, lines 26-40 and its description).

Regarding claims 2-9, Ala-Laurila further discloses in that the control station controls the access to the frequency band for stations working in accordance with the first radio interface standard and in that the control station renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band (see fig.1, element 22, col.7, lines 31-45 and its description).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CongVan Tran whose telephone number is 703-305-4024. The examiner can normally be reached on Monday-Thursday.

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).



CongVan Tran
Examiner
Art Unit 2683

TCU
Sept. 17, 2004.

Notice of References Cited	Application/Control No. 10/089,959	Applicant(s)/Patent Under Reexamination WALKE ET AL.	
	Examiner CongVan Tran	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-6,501,741	12-2002	Mikkonen et al.	370/310
	B	US-6,587,680	07-2003	Ala-Laurila et al.	455/411
	C	US-6,052,594	04-2000	Chuang et al.	455/450
	D	US-6,580,700	06-2003	Pinard et al.	370/332
	E	US-6,377,782	04-2002	Bishop et al.	455/3.01
	F	US-6,792,286	09-2004	Bharath et al.	455/554.2
	G	US-6,728,244	04-2004	Takabatake, Yoshiaki	370/392
	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
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	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.

Form PTO-1449 (REV. 7-80) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	Atty. Docket No. PHDE 000238	Serial No. 10/089,959
	Applicant BERNHARD WALKE ET AL	
INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Filing Date APRIL 4, 2002	Group 2681

U.S. PATENT DOCUMENTS

Ex. Int		Document Number	Date	Name	Class	Sub-class	Filing Date If Approp.
a	AA	5 7 1 0 7 6 6	12/1995	SCHWENDEMAN	370	329	
	AB						
	AC						
	AD						
	AE						
	AF						

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Sub-class	Trans. Yes	Trans. No
a	AG	W O 9 9 2 3 7 9 0	10/1998	PCT (WORLD)	H04L	12/28		X
a	AH	1 1 1 9 1 3 7 A 1	01/2000	EUROPE	H04L	12/28		X
	AI							
	AJ							
	AK							

OTHER (Including Author, Title, Date, Pertinent Pages, Etc.)

	AL	
	AM	
	AN	

Examiner [signature] Date Considered 9/16/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with M 609; Draw line through citation if not in conformance and not considere Include a copy of this form with next communication to applicant.

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10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

7590 09/22/2004

Corporate Patent Counsel
Philips Electronics North America Corporation
Tarrytown, NY 10591

EXAMINER	
TRAN, CONGVAN	

ART UNIT	PAPER NUMBER
2683	

DATE MAILED: 09/22/2004

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	CongVan Tran	2683	

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- 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 June 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) *1-11* 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) *1-11* 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 *7/18/02*.
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

1. 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 1-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Ala-Laurila et al. (6,587,680).

Regarding claims 1, 10-11, Ala-Laurila discloses a communication system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, a control station being provided which controls the alternate use of the frequency band (see fig.1, elements 12, 14, 28, col.6, lines 26-40 and its description).

Regarding claims 2-9, Ala-Laurila further discloses in that the control station controls the access to the frequency band for stations working in accordance with the first radio interface standard and in that the control station renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band (see fig.1, element 22, col.7, lines 31-45 and its description).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CongVan Tran whose telephone number is 703-305-4024. The examiner can normally be reached on Monday-Thursday.

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).

CONGVAN TRAN
PRIMARY EXAMINER

CongVan Tran
Examiner
Art Unit 2683

TCU
Sept. 17, 2004.

Notice of References Cited	Application/Control No. 10/089,959	Applicant(s)/Patent Under Reexamination WALKE ET AL.	
	Examiner CongVan Tran	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-6,501,741	12-2002	Mikkonen et al.	370/310
	B	US-6,587,680	07-2003	Ala-Laurila et al.	455/411
	C	US-6,052,594	04-2000	Chuang et al.	455/450
	D	US-6,580,700	06-2003	Pinard et al.	370/332
	E	US-6,377,782	04-2002	Bishop et al.	455/3.01
	F	US-6,792,286	09-2004	Bharath et al.	455/554.2
	G	US-6,728,244	04-2004	Takabatake, Yoshiaki	370/392
	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.

JUL 18 2002
PATENT & TRADEMARK OFFICE

Sheet 1 of 1

Form PTO-1449 (REV. 7-80) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

Atty. Docket No.	Serial No.
PHDE 000238	10/089,959
Applicant: BERNHARD WALKE ET AL	
Filing Date: APRIL 4, 2002	Group: 2681

RECEIVED
JUL 22 2002
Technology Center 2600

INFORMATION DISCLOSURE CITATION
(Use several sheets if necessary)

U.S. PATENT DOCUMENTS

Ex. Int		Document Number	Date	Name	Class	Sub-class	Filing Date If Approp.
a	AA	5 7 1 0 7 6 6	12/1995	SCHWENDEMAN	370	329	
	AB						
	AC						
	AD						
	AE						
	AF						

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Sub-class	Trans. Yes	Trans. No
a	AG	W O 9 9 2 3 7 9 0	10/1998	PCT (WORLD)	H04L	12/28		X
a	AH	1 1 1 9 1 3 7 A 1	01/2000	EUROPE	H04L	12/28		X
	AI							
	AJ							
	AK							

OTHER (Including Author, Title, Date, Pertinent Pages, Etc.)

	AL	
	AM	
	AN	

Examiner: [signature] Date Considered: 9/16/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with M 609; Draw line through citation if not in conformance and not considere Include a copy of this form with next communication to applicant.

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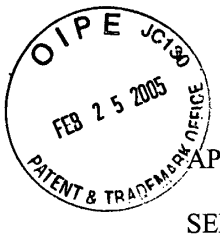
2683 899



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Bernhard Walke et al.		
SERIAL NO.:	10/089,959	EXAMINER:	Congvan Tran
FILED:	April 4, 2002	ART UNIT:	2683
FOR:	METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND		

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22313-1450

AMENDMENT

Dear Sir:

In response to the Office Action dated September 22, 2004, the Applicants hereby petitions for a two-month extension of time and requests amendment of the above-identified application as follows:

IN THE CLAIMS:

1. (Original) An interface-control protocol method for a radio system which has at least one frequency band that is provided for the alternate use by a first and a second radio interface standard, the radio system comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

2. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station controls the access to the frequency band for stations working in accordance with the first radio interface standard and in that the control station renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band.

3. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station determines the respective duration in which the stations working in accordance with the second radio interface standard are allowed to utilize the frequency band.

4. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station sends a broadcast signal informing the stations of a time duration in which the frequency band can be used by stations working in accordance with the second radio interface standard.

5. (Currently Amended) ~~A~~ The method as claimed in claim 3, ~~characterized in that~~ wherein the duration of operation in accordance with the first and second radio interface standards is laid down only approximately while the respective standards are violated regularly or from time to time.

6. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station terminates the use of the radio interface in accordance with the second radio interface standard by transmitting in accordance with the first radio interface standard, without taking account of resulting interference in stations working in accordance with the second radio interface standard.

7. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station controls the access to the frequency band by stations working in accordance with the first radio interface standard and in that duration and type of control of the radio interface in accordance with the second radio interface standard is determined by a further station and transmitted to the control station.

8. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station, in addition to functions in accordance with the second radio interface standard, also carries out functions which cause radio systems in accordance with the second radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

9. (Currently Amended) ~~A~~ The method as claimed in claim 1, ~~characterized in that~~ wherein the control station also carries out functions which cause radio systems in accordance with the first radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

10. (Original) A wireless network comprising at least one frequency band provided for the alternate use by a first and a second radio interface standard, the wireless network comprising stations which work in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, a control station being provided which controls the alternate use of the frequency band.

11. (Original) A control station for a wireless network, the control station being provided for controlling the alternate use of a frequency band by stations which work in accordance with a first radio interface standard and stations which work in accordance with a second radio interface standard.

REMARKS

Claims 1-11 are pending in the application. Claims 2-9 have been amended to put them in better form.

Reconsideration of all grounds of rejection in the Office Action, and allowance of all of the pending claims are respectfully requested in light of the following remarks.

Base claim 1, 10, and 11 stand rejected under 35 U.S.C.§102(e) as allegedly anticipated by Ala-Laurila et al. (U.S. 6,587,680). The Office Action indicates that features cited in the base claims are shown in Ala-Laurila et al. by citing elements 12, 14 and 28 of FIG. 1 and element 22 of FIG. 1 and its description at Col. 7, lines 31-45.

The features recited in base claims provide significant advantages to make efficient use of radio transmission channels. The invention allows different radio systems to coexist and to simultaneously transmit very close together in the same spectrum, by providing a control station to control the alternate use of the frequency band, as recited in base claims. More specifically, the central station informs a first wireless network device when and how long it is allowed to utilize the common frequency band when the second network device is not transmitting (Page 7, lines 14-20).

Ala-Laurila et al, as read by applicant, relates to a method/apparatus for re-establishing an existing security association during a handover from an old access point to a new access point in a radio communications system such as an IEEE 802.11 or a HIPERLAN. Operation cited in Ala-Laurila et al. increases handover performance, and minimize the delay associated with re-negotiating the security association between a new AP and a mobile terminal.

Ala-Laurila et al. fails to teach, show or suggest a central station being provided to control the alternate access by a first wireless network and a second wireless network to the common frequency band, as specifically cited in base claims. The Office Action is wrongly equating the coexistence of different radio networks in the present invention to the arrangement of FIG. 1 in Ala-Laurila et al. More specifically, the Office Action refers to a comparator 32 used to identify the operable-mode to mean that Ala-Laurila et al. supports two different networks (page 7, lines 31-45). As stated in the background section of Ala-Laurila et al (Column 3, lines 44-67), a determination is needed prior to permitting both ends of the communication pair, i.e., mobile unit and access point, to operate in either the proprietary mode or other conventional operation mode, such is IEEE 802.11 standard. Thus, the central unit 22 of Ala-Laurila et al. perform different function than the present invention.

It is well settled that a reference that does not teach or suggest all of the features of a claimed invention cannot anticipate that invention. Since Jackson does not teach or suggest all of the features of base claims, as recited above, applicant respectfully submits that these claims are allowable and patentable under 35 U.S.C. § 102.

Claims 2-9 in this application are each dependent from one or the other of base claims discussed above and are, therefore, believed allowable and patentable under 35 U.S.C. § 102 for the same reasons.

For all the foregoing reasons, it is respectfully submitted that all the present claims are patentable in view of the cited references. A Notice of Allowance is respectfully requested.

Respectfully submitted,

Russell Gross
Registration No. 40,007

Date: February 22, 2005

By: Steve Cha
Attorney for Applicant
Registration No. 44,069

Mail all correspondence to:
Russell Gross, Registration No. 40,007
US PHILIPS CORPORATION
P.O. Box 3001
Briarcliff Manor, NY 10510-8001
Phone: (914) 333-9608
Fax: (914) 332-0615

Certificate of Mailing Under 37 CFR 1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to MAIL STOP AMENDMENT, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA. 22313 on February 22, 2005.

Steve Cha, Reg. No. 44,069
(Name of Registered Rep.)

(Signature and Date)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT	:	Bernhard Walke et al.		
SERIAL NO.	:	10/089,959	EXAMINER	: Congvan Tran et al.
FILED	:	April 4, 2002	ART UNIT	: 2683
FOR	:	METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND		

PETITION FOR TWO-MONTH EXTENSION OF TIME

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants hereby request that the period for responding to the Office Action, now set to expire on December 22, 2004, be extended by two (2) months, so as to expire on February 22, 2005.

As Applicants are associated with a large entity, a check in the amount of $450.00 is enclosed to cover the two-month extension herein requested.

Favorable action on this Request for Extension of Time is courteously solicited.

Respectfully submitted,
Russell Gross
Registration No. 40,007

Date: February 22, 2005

By: Steve Cha
Attorney for Applicant
Registration No. 44,069

Mail all correspondence to:
Russell Gross, Registration No. 40,007
US PHILIPS CORPORATION
P.O. Box 3001
Briarcliff Manor, NY 10510-8001
Phone: (914) 333-9624
Fax: (914) 332-0615

Certificate of Mailing Under 37 CFR 1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to MAIL STOP AMENDMENT, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA. 22313 on February 22, 2005.

Steve Cha, Reg. No. 44,069
(Name of Registered Rep.)

(Signature and Date)

Please type a plus sign (+) inside this box → [+]

PTO/SB/122 (10-00)
Approved for use through 10/31/2002. OMB 0651-0035
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

CHANGE OF CORRESPONDENCE ADDRESS
Application

Address to:
Assistant Commissioner for Patents
Washington, D.C. 20231

Application Number	10/089,959
Filing Date	April 4, 2002
First Named Inventor	Bernhard Walke
Group Art Unit	2683
Examiner Name	Congvan Tran
Attorney Docket Number	DE000238

Please change the Correspondence Address for the above-identified application to:

☒ Customer Number 24737 → *24737*
Type Customer Number here
PATENT TRADEMARK OFFICE

OR

☐ **Firm or Individual Name**					
Address					
Address					
City		**State**		**ZIP**	
Country					
Telephone		**Fax**			

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

I am the :

☐ Applicant.

☐ Assignee of record of the entire interest.
Certificate under 37 CFR 3.73(b) is enclosed.

☒ Attorney or agent of record.

☐ Registered practioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number _____

Typed or Printed Name: Russell Gross, Reg. 40,007

Signature: Russell Gross

Date: 3/10/05

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 1 forms are submitted.

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.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

24737 7590 05/25/2005

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
TRAN, CONGVAN	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 05/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/089,959	WALKE ET AL.	
	Examiner	Art Unit	
	CongVan Tran	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 *25 February 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) *1-11* 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) *1-11* 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 Arguments

1. In response to applicant's argument regarding claims 1, 10, and 11, that the reference fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "fails to teach, show or suggest a central station being provided to control the alternate access by a first wireless network and a second wireless network to the common frequency band, as specifically cited in base claims") are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Therefor, the previous rejection is sustained.

Claim Rejections - 35 USC § 102

2. 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.

3. Claims 1-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Ala-Laurila et al. (6,587,680).

Regarding claims 1, 10-11, Ala-Laurila discloses a communication system comprising stations which operate in accordance with a first radio interface standard

and/or a second radio interface standard, a control station being provided which controls the alternate use of the frequency band (see fig.1, elements 12, 14, 28, col.6, lines 26-40 and its description).

Regarding claims 2-9, Ala-Laurila further discloses in that the control station controls the access to the frequency band for stations working in accordance with the first radio interface standard and in that the control station renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band (see fig.1, element 22, col.7, lines 31-45 and its description).

Conclusion

4. **THIS ACTION IS MADE FINAL.** 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 mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CongVan Tran whose telephone number is 571-272-7871. The examiner can normally be reached on Monday-Thursday.

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 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).

CongVan Tran
Primary Examiner
Art Unit 2683

May 18, 2005

Index of Claims

Application No.	Applicant(s)	
10/089,959	WALKE ET AL.	
Examiner	**Art Unit**	
CongVan Tran	2683	

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date								
Final	Original	5/18/05								
	1	√								
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Bernhard Walke et al.		
SERIAL NO.:	10/089,959	EXAMINER:	CongVan Tran
FILED:	April 4, 2002	ART UNIT:	2683
FOR:	METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND		

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER FINAL REJECTION

Dear Sir:

In response to the Final Office Action dated May 25, 2005, the Applicant hereby requests amendment of the above-identified application as follows:

IN THE CLAIMS:
Kindly replace the claims of record with the following full set of claims:

1. (Currently amended) An interface-control protocol method for a radio system which has at least one common frequency band that is provided for [[the]] alternate use by a first and a second radio interface standard, the radio system comprising:

stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and

a control station ~~being provided~~ which controls the alternate use of the frequency band.

2. (Currently amended) The method as claimed in claim 1, wherein the control station controls the access to the common frequency band for stations working in accordance with the first radio interface standard and ~~in that the control station~~ renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band.

3. (Previously presented) The method as claimed in claim 1, wherein the control station determines the respective duration in which the stations working in accordance with the second radio interface standard are allowed to utilize the frequency band.

4. (Currently amended) The method as claimed in claim 1, wherein the control station sends a broadcast signal informing the stations of a time duration in which the common frequency band can be used by stations working in accordance with the second radio interface standard.

5. (Previously presented) The method as claimed in claim 3, wherein the duration of operation in accordance with the first and second radio interface standards is laid down only approximately while the respective standards are violated regularly or from time to time.

6. (Previously presented) The method as claimed in claim 1, wherein the control station terminates the use of the radio interface in accordance with the second radio interface standard by transmitting in accordance with the first radio interface standard, without taking account of resulting interference in stations working in accordance with the second radio interface standard.

7. (Currently amended) The method as claimed in claim 1, wherein the control station controls the access to the common frequency band by stations working in accordance with the first radio interface standard and in that duration and type of control of the radio interface in accordance with the second radio interface standard is determined by a further station and transmitted to the control station.

8. (Previously presented) The method as claimed in claim 1, wherein the control station, in addition to functions in accordance with the second radio interface standard, also carries out functions which cause radio systems in accordance with the second radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

9. (Previously presented) The method as claimed in claim 1, wherein the control station also carries out functions which cause radio systems in accordance with the first radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

10. (Currently amended) A wireless network comprising at least one common frequency band provided for [[the]] alternate use by a first and a second radio interface standard, the wireless network comprising:

stations which work in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, and

a control station ~~being provided~~ which controls the alternate use of the common frequency band.

11. (Currently amended) A control station for a wireless network, the control station ~~being provided for~~ controlling the alternate use of a common frequency band by stations which work in accordance with a first radio interface standard and stations which work in accordance with a second radio interface standard.

REMARKS

Entry of this Amendment and reconsideration are respectfully requested in view of the amendments made to the claims and for the remarks made herein.

Claims 1 - 11 are pending and stand rejected. Claims 1, 2, 4, 7, 10 and 11 have been amended.

Claims 1-11 stand rejected under 35 USC 102(e) as allegedly being anticipated by Ala-Laurila (USP no. 6,587,680).

Applicant respectfully disagrees with, and explicitly traverses, the reason for rejecting the claims. However, in the interest of advancing the prosecution of this matter, independent claims 1, 10 and 11 have been amended to more clearly state the invention.

More specifically, claims 1, 10 and 11 have been amended to recite that a common frequency band is utilized for alternate use by a first or a second interface protocol. No new matter has been added. Support for the amendment may be found on at least page 3, lines 13-14, which state in part, "a control station is provided which controls the alternate use of the common frequency band of the two radio interface standards."

Ala-Laurila, on the other hand, discloses the re-establishment of a security association when a communication handover event occurs in a radio communication system such as IEEE 082.11 [sic] or a HIPERLAN, wherein the existing security association is maintained when the communication handover occurs. (see Abstract).

Contrary to the statements found in the Office Action, Ala-Laurila fails to describe "at least one common frequency band that is provided for alternate use by a first and a second radio interface standard," as is described in claim 1. Rather, Ala-Laurila teaches a system that uses either one interface or another interface based on the devices requesting service. See for example, col. 3, line 54 -col. 4, line 5, which state, in part, "[p]roprietary functions have been proposed with permit improved quality of communications as compared to operation pursuant to the existing IEEE 802.11 standard... However, both ends of a communication pair ... must be capable of operation in the proprietary mode. If both ends ... are not together operable pursuant to the proprietary mode, conventional operation pursuant to the IEEE 802.11 standard is required." Hence, Ala-Laurila

discloses a method where either one interface or another is used based on the interface of the communication devices and further fails to disclose a common frequency band for the alternate use of the first and second interface.

A claim is anticipated only if each and every element recited therein is expressly or inherently described in a single prior art reference. Ala-Laurila cannot be said to anticipate the present invention, because Ala-Laurila fails to disclose each and every element recited.

Applicant, accordingly, submits that the reason for the rejection of claim 1 has been overcome and can no longer be sustained. Applicant respectfully requests withdrawal of the rejection and allowance of the claim.

With regard to independent claim s 10 and 11, these claims recite subject matter similar to that recited in claim 1 and were rejected for the same reason used in rejecting claim 1. Thus, for the amendments made to these clams, which are similar to the amendments made with regard to claim 1, and for the remarks made in response to the rejection of claim 1, which are also applicable in response to the rejection of claims 10 and 11, and are reasserted, as if in full, herein, in response to the rejection of claims 10 and 11, applicant submits that the reason for rejecting these claims has been overcome and the rejection can no longer be sustained. Applicant respectfully requests withdrawal of the rejection and allowance of the claims.

With regard the remaining claims these claims ultimately depend from the independent claim 1, which has been shown to contain subject matter not disclosed by, and, hence, allowable over, the reference cited. Accordingly, these claims are also allowable by virtue of their dependency from an allowable base claim.

Applicant, accordingly, respectfully requests withdrawal of the rejection and allowance of the claims.

Although the last Office Action was made final, this amendment should be entered. No matter has been added to the claims that would require comparison with the prior art or any further review. Accordingly, pursuant to MPEP 714.13, applicant's amendments should only require a cursory review by the examiner. The amendment therefore should be entered without requiring a showing under 37 CFR 1.116(b).

For all the foregoing reasons, it is respectfully submitted that all the present claims are patentable in view of the cited references. A Notice of Allowance is respectfully requested.

Respectfully submitted,

Russell Gross
Registration No. 40,007

Date: July 12, 2005

By: Steve Cha
Attorney for Applicant
Registration No. 44,069

Mail all correspondence to:
Russell Gross, Registration No. 40,007
US PHILIPS CORPORATION
P.O. Box 3001
Briarcliff Manor, NY 10510-8001
Phone: (914) 333-9624
Fax: (914) 332-0615

Certificate of Mailing Under 37 CFR 1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to MAIL STOP on July 12, 2005.

Steve Cha, Reg. No. 44,069
(Name of Registered Rep.)

(Signature and Date)

PTO/SB/06 (08-03)
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: 10/089959

CLAIMS AS FILED – PART I

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))					$	OR		$
TOTAL CLAIMS (37 CFR 1.16(c))	11	minus 20 =	*	x $ =		OR	x $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	3	minus 3 =	*	x $ =		OR	x $ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))				+ $ =		OR	+ $ =	
				TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

2/25/04

AMENDMENT		(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(c))	* 11	Minus	** 20	=	x $ =		OR	x $ =	
	Independent (37 CFR 1.16(b))	* 3	Minus	*** 3	=	x $ =		OR	x $ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

7/15/05

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
	Total (37 CFR 1.16(c))	* 11	Minus	** 20	= 0	x $ =		OR	x $ =	
	Independent (37 CFR 1.16(b))	* 3	Minus	*** 3	= 0	x $ =		OR	x $ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
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	Independent (37 CFR 1.16(b))	*	Minus	***	=	x $ =		OR	x $ =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		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.

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.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

24737 7590 08/10/2005

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
TRAN, CONGVAN	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 08/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 10/089,959	**Applicant(s)** WALKE ET AL.	
	Examiner CongVan Tran	**Art Unit** 2683	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 15 July 2005 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☐ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____ months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: *The newly added limitations raise new issue that would require consideration and /or search*. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☒ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: *1-11*.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08 or PTO-1449) Paper No(s). _____
13. ☐ Other: _____.

CONGVAN TRAN
PRIMARY EXAMINER

CongVan Tran
Primary Examiner
Art Unit: 2683

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

To Commissioner For Patents
Please enter the following submission and withdraw the finality of the proceeding office action or withdraw any pending appeal and reopen prosecution before the Examiner.

Application Number	10/089,959
Filing Date	April 4, 2002
First Named Inventor	Walke
Group Art Unit	2683
Examiner Name	Congvan Tran
Attorney Docket Number	DE000238

This is an RCE under 37 C.F.R. § 1.114 of the above-identified application (which is made prior to: payment of issue fee; abandonment; notice of appeal to the CAFC; or commencement of civil action under 35 U.S.C. 145 or 146.)

1. Submission required under 37 C.F.R. § 1.114

a. [X] Previously submitted

i. [X] Consider the amendment(s)/reply under 37 C.F.R. § 1.116 previously filed on July 12, 2005
(Any unentered amendment(s) referred to above will be entered).

ii. [ ] Consider the arguments in the Appeal Brief or Reply Brief previously field on _____

iii. [ ] Other _____

b. [ ] Enclosed

i. [ ] Amendment/Reply

ii. [ ] Affidavit(s)Declaration(s)

iii. [ ] Information Disclosure Statement (IDS)

iv. [ ] Other _____ (may not be a brief)

08/23/2005 KBETEMA1 00000041 141270 10089959
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2. Miscellaneous

a. [ ] Suspension of action on the above-identified application is requested under 37 C.F.R. §1.103(c) for a period of _____ months. (May not exceed 3 months; Fee required per 37 C.F.R. § 1.117(i)

b. [ ] Other _____

3. Fees

a. [X] The Commissioner For Patents is hereby authorized to charge all required fees except the issue fee or credit any overpayments, to Deposit Account No. 14-1270

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print Type)	Russell Gross	Registration No. (Attorney/Agent)	40,007
Signature	Russell Gross	Date	8/19/05

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this is being deposited with the U.S. Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner For Patents, Box RCE, Alexandria, VA 22313-1450, or facsimile transmitted to the U.S. Patent and Trademark Office tel# : 571-273-8300 on the date below:

Name (Print Type)	Elissa DeLuccy		
Signature	Elissa DeLuccy	Date	Aug. 19, 2005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OIC to enter per RCE
HG
8/30/05

APPLICANT:	Bernhard Walke et al.		
SERIAL NO.:	10/089,959	EXAMINER:	CongVan Tran
FILED:	April 4, 2002	ART UNIT:	2683
FOR:	METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND		

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER FINAL REJECTION

Dear Sir:

In response to the Final Office Action dated May 25, 2005, the Applicant hereby requests amendment of the above-identified application as follows:

FW

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.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

24737 7590 11/01/2005

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
TRAN, CONGVAN	
ART UNIT	**PAPER NUMBER**
2688	

DATE MAILED: 11/01/2005

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)	
	10/089,959	WALKE ET AL.	
	Examiner	Art Unit	
	CongVan Tran	2688	

-- 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 _____.

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) 1-11 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) 1,3,4 and 9-11 is/are rejected.

7)☐ Claim(s) 2 and 5-8 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

1. This office action is response to Amendment after final filed Aug. 19, 2005.

2. **Examiner** has been called **Applicant's representative** twice on Oct. 21 and Oct. 26, 2005 to expedite the case. However, Examiner received no response.

Continued Examination Under 37 CFR 1.114

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on Aug. 24, 2005 has been entered.

Claim Rejections - 35 USC § 102

4. 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.

5. Claims 1, 3-4, 9-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Sayers et al. (6,687,243).

Regarding claims 1, 3-4, 9-11, Sayers discloses a method and apparatus for integrated wireless communications in private and public network environments,

comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and a control station which controls the alternate use of the frequency band (see fig.1, elements 11s, 14, 15, 24s 29, col.4, line 66-col.5, line 67, and its description).

6. Claims 1, 3-4, 9-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Pecen et al. (6,631,259).

Regarding claims 1, 3-4, 9-11, Sayers discloses a method and apparatus for integrated wireless communications in private and public network environments, comprising stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and a control station which controls the alternate use of the frequency band (see figs.1-2, elements 106, 108, 110, 112, col.1, lines 54-65, col.2, lines 49-59, and its description).

Allowable Subject Matter

7. Claims 2, 5-8 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.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CongVan Tran whose telephone number is 571-272-7871. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on 571-272-7495. 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).

CONGVAN TRAN
PRIMARY EXAMINER

CongVan Tran
Primary Examiner
Art Unit 2688

Oct. 27, 2005.

Notice of References Cited	Application/Control No. 10/089,959	Applicant(s)/Patent Under Reexamination WALKE ET AL.	
	Examiner CongVan Tran	Art Unit 2688	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,631,259 B2	10-2003	Pecen et al.	455/426.1
	B	US-6,687,243 B1	02-2004	Sayers et al.	370/356
	C	US-6,735,452 B1	05-2004	Foster et al.	455/562.1
	D	US-6,754,200 B1	06-2004	Nishimura et al.	370/349
	E	US-6,310,866 B1	10-2001	Kronestedt et al.	370/330
	F	US-5,239,662 A	08-1993	Danielson et al.	709/246
	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
10/089,959	WALKE ET AL.
Examiner	**Art Unit**
CongVan Tran	2688

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date									
Final	Original	10/26/05									
	1	√									
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	3	√									
	4	√									
	5	O									
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Atty. Docket:

WALKE ET AL. DE 000238

Serial No.: 10/089,959 Group Art Unit: 2688

Filed: April 4, 2002 Examiner: C. Tran

Title: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

Commissioner for Patents
Alexandria, VA 22313-1450

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[X] transmitted by facsimile to the U.S. Patent and Trademark Office AT 571-273-8300

On: Nov. 17, 2005

By: Elissa DeLucy

AMENDMENT

Sir:

In response to the office action dated November 1, 2005, please amend the application as follows:

IN THE CLAIMS:

Please amend the claims as follows:

1. (Currently amended) An interface-control protocol method for a radio system which has at least one common frequency band that is provided for alternate use by a first and a second radio interface standard, the radio system comprising:

stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and

a control station which controls the alternate use of the frequency band,

wherein the control station controls the access to the common frequency band for stations working in accordance with the first radio interface standard and renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band.

2. (Cancelled).

3. (Previously presented) The method as claimed in claim 1, wherein the control station determines the respective duration in which the stations working in accordance with the second radio interface standard are allowed to utilize the frequency band.

4. (Previously presented) The method as claimed in claim 1, wherein the control station sends a broadcast signal informing the stations of a time duration in which the common frequency band can be used by stations working in accordance with the second radio interface standard.

5. (Previously presented) The method as claimed in claim 3, wherein the duration of operation in accordance with the first and second radio interface standards is laid down only approximately while the respective standards are violated regularly or from time to time.

6. (Currently amended) ~~The method as claimed in claim 1~~An interface-control protocol method for a radio system which has at least one common frequency band that is provided for alternate use by a first and a second radio interface standard, the radio system comprising:

stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and

a control station which controls the alternate use of the frequency band,

wherein the control station terminates the use of the radio interface in accordance with the second radio interface standard by transmitting in accordance with the first radio interface standard, without taking account of resulting interference in stations working in accordance with the second radio interface

standard.

7. (Currently amended) ~~The method as claimed in claim 1~~An interface-control protocol method for a radio system which has at least one common frequency band that is provided for alternate use by a first and a second radio interface standard, the radio system comprising:

stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and

a control station which controls the alternate use of the frequency band,

wherein the control station controls the access to the common frequency band by stations working in accordance with the first radio interface standard and in that duration and type of control of the radio interface in accordance with the second radio interface standard is determined by a further station and transmitted to the control station.

8. (Currently amended) ~~The method as claimed in claim 1~~An interface-control protocol method for a radio system which has at least one common frequency band that is provided for alternate use by a first and a second radio interface standard, the radio system comprising:

stations which operate in accordance with a first radio interface standard and/or a second radio interface standard, and

a control station which controls the alternate use of the frequency band,

wherein the control station, in addition to functions in accordance with the second radio interface standard, also carries out functions which cause radio systems in accordance with the second radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

9. (Previously presented) The method as claimed in claim 1, wherein the control station also carries out functions which cause radio systems in accordance with the first radio interface standard to interpret the radio channel as interfered and to seize another radio channel for its own operation.

10. (Currently amended) A wireless network comprising at least one common frequency band provided for alternate use by a first and a second radio interface standard, the wireless network comprising:

stations which work in accordance with a first radio interface standard and/or in accordance with a second radio interface standard, and

a control station which controls the alternate use of the common frequency band,

wherein the control station controls the access to the common frequency band for stations working in accordance with the first radio interface standard and renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band.

11. (Cancelled).

REMARKS

It is noted with great appreciation that the Examiner has found allowable subject matter in Claims 2 and 5-8.

Herein, the subject matter of cancelled claim 2 has been incorporated in Claims 1 and 10. Claims 6-8 have also been rewritten in independent form. Further, Claim 11 has been cancelled.

In view of the above, it is respectfully submitted that the present application is in condition for allowance. Therefore, entry of this Amendment is respectfully requested so that the present application may proceed to issue.

The Commissioner is hereby authorized to credit any overpayment or charge any fee (except the issue fee) to Account No. 14-1270.

Respectfully submitted,

By _____
Russell Gross, Reg. 40,007
Attorney
(914) 333-9631

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NOV 17 2005

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

To Commissioner For Patents
Please enter the following submission and withdraw the finality of the proceeding office action or withdraw any pending appeal and reopen prosecution before the Examiner.

Application Number	10/114,505
Filing Date	April 2, 2002
First Named Inventor	Rakish Taori
Group Art Unit	2655
Examiner Name	Huyen X. Vo
Attorney Docket Number	NL010234

This is an RCE under 37 C.F.R. § 1.114 of the above-identified application (which is made prior to: payment of issue fee; abandonment; notice of appeal to the CAFC; or commencement of civil action under 35 U.S.C. 145 or 146.)

1. Submission required under 37 C.F.R. § 1.114

a. [X] Previously submitted

i. [X] Consider the amendment(s)/reply under 37 C.F.R. § 1.116 previously filed on November 8, 2005
(Any unentered amendment(s) referred to above will be entered).

ii. [ ] Consider the arguments in the Appeal Brief or Reply Brief previously field on _____

iii. [ ] Other _____

b. [ ] Enclosed

i. [ ] Amendment/Reply

ii. [ ] Affidavit(s)Declaration(s)

iii. [ ] Information Disclosure Statement (IDS)

iv. [ ] Other _____ (may not be a brief)

2. Miscellaneous

a. [ ] Suspension of action on the above-identified application is requested under 37 C.F.R. §1.103(c) for a period of _____ months. (May not exceed 3 months; Fee required per 37 C.F.R. § 1.117(i)

b. [ ] Other _____

3. Fees

a. [X] The Commissioner For Patents is hereby authorized to charge all required fees except the issue fee or credit any overpayments, to Deposit Account No. 14-1270

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print Type)	Russell Gross	Registration No. (Attorney/Agent)	40,007
Signature		Date	11/17/05

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Name (Print Type)	Elissa DeLuccy		
Signature	Elissa DeLuccy	Date	11/17/05

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Atty. Docket:

WALKE ET AL. DE 000238

Serial No.: 10/089,959 Group Art Unit: 2688

Filed: April 4, 2002 Examiner: C. Tran

Title: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

Commissioner for Patents
Alexandria, VA 22313-1450

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[X] transmitted by facsimile to the U.S. Patent and Trademark Office AT 571-273-8300

On: Nov. 17, 2005

By: Elissa DeLucy

A M E N D M E N T

Sir:

In response to the office action dated November 1, 2005, please amend the application as follows:

REMARKS

It is noted with great appreciation that the Examiner has found allowable subject matter in Claims 2 and 5-8.

Herein, the subject matter of cancelled claim 2 has been incorporated in Claims 1 and 10. Claims 6-8 have also been rewritten in independent form. Further, Claim 11 has been cancelled.

In view of the above, it is respectfully submitted that the present application is in condition for allowance. Therefore, entry of this Amendment is respectfully requested so that the present application may proceed to issue.

The Commissioner is hereby authorized to credit any overpayment or charge any fee (except the issue fee) to Account No. 14-1270.

Respectfully submitted,

By _____
Russell Gross, Reg. 40,007
Attorney
(914) 333-9631

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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: 10/089959

APPLICATION AS FILED – PART I

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))							
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))							
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	x =		OR	x =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	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))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

11-17-05

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))	* 9	Minus	** 20	= 0	x =		OR	x =	
Independent (37 CFR 1.16(h))	* 5	Minus	*** 3	= 2	x =		OR	x200 =	400.00
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	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
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.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

24737 7590 12/06/2005

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
TRAN, CONGVAN	
ART UNIT	PAPER NUMBER
2688	

DATE MAILED: 12/06/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

TITLE OF INVENTION: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	03/06/2006

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 REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

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 should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. 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.

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. 07/05) 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)

24737 7590 12/06/2005

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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.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

TITLE OF INVENTION: METHOD, NETWORK AND CONTROL STATION FOR THE TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	03/06/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRAN, CONGVAN	2688	455-434000

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 enclosed:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):
- ☐ A check in the amount of the fee(s) is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized by charge the required fee(s), 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).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above. 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.

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

24737 7590 12/06/2005

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P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
TRAN, CONGVAN	
ART UNIT	PAPER NUMBER
2688	

DATE MAILED: 12/06/2005

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 411 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 411 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 (703) 305-8283.

PTOL-85 (Rev. 07/05) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	10/089,959	WALKE ET AL.	
	Examiner	Art Unit	
	CongVan Tran	2688	

-- 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 *amendment filed on 11/17/05*.

2. ☒ The allowed claim(s) is/are *1 and 3-10 have been renumbered to 1-4, 6-8, 5, 9 respectively*.

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-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

CongVan Tran
Primary Examiner
Art Unit: 2688

CONGVAN TRAN
PRIMARY EXAMINER

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/089,959	WALKE ET AL.	
	Examiner	Art Unit	
	CongVan Tran	2688	

ISSUE CLASSIFICATION

ORIGINAL						CROSS REFERENCE(S)							
CLASS				SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)							
455				434	455	553.1	434.2						
INTERNATIONAL CLASSIFICATION					370	466	467						
H	0	4	Q	7/20									
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				/									
				/									
				/									

(Assistant Examiner) (Date)

(Legal Instruments Examiner) 12/05/05 (Date)

CONGVAN TRAN
PRIMARY EXAMINER

(Primary Examiner) (Date)

Total Claims Allowed: 9

O.G. Print Claim(s)	O.G. Print Fig.
1	1

☐ 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
1	1		31		61		91		121		151		181
	~~2~~		32		62		92		122		152		182
2	3		33		63		93		123		153		183
3	4		34		64		94		124		154		184
4	5		35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7		37		67		97		127		157		187
8	8		38		68		98		128		158		188
5	9		39		69		99		129		159		189
9	10		40		70		100		130		160		190
	~~11~~		41		71		101		131		161		191
	12		42		72		102		132		162		192
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	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
10/089,959	WALKE ET AL.	
Examiner	**Art Unit**	
CongVan Tran	2688	

SEARCHED			
Class	Subclass	Date	Examiner
455	434 435.2 438 414.4 432.2 207	12/1/2005	CT
	553.1 22		
	314		
370	395.52	12/2/2005	CT
	395.53		
	464-469		
	395.5		

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
455	**553** **435.2**	12/2/2005	**CT**
370	466 467		

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
search updated	12/2/2005	CT

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P.O. Box 1450
Alexandria, Virginia 22313-1450
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Bib Data Sheet

CONFIRMATION NO. 1142

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/089,959	04/04/2002 RULE	455	2688	PHDE000238

APPLICANTS

Bernhard Walke, Wuerselen, GERMANY;

Stefan Mangold, Aachen, GERMANY;

** CONTINUING DATA **********

This application is a 371 of PCT/EP01/09258 08/08/2001

** FOREIGN APPLICATIONS **********

GERMANY 10039532.5 08/08/2000

Foreign Priority claimed ☑ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☑ no ☐ Met after Allowance Verified and Acknowledged Examiner's Signature Initials	STATE OR COUNTRY GERMANY	SHEETS DRAWING 3	TOTAL CLAIMS 11	INDEPENDENT CLAIMS 3

ADDRESS
24737
PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR , NY
10510

TITLE

Method, network and control station for the two-way alternate control of radio systems of different standards in the same frequency band

FILING FEE RECEIVED 1440	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)

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/089,959	WALKE ET AL.
Examiner	**Art Unit**
CongVan Tran	2688

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	+	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	12/2/05
1	1	=
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Claim		Date
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Claim		Date
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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)

24737 7590 12/06/2005

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

01/04/2006 HDEMESS2 00000028 141270 10089959

01 FC:1501 1400.00 DA
02 FC:1504 300.00 DA

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.

Elissa DeLucey	(Depositor's name)
Elissa DeLucey	(Signature)
Jan. 4, 2006	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,959	04/04/2002	Bernhard Walke	PHDE000238	1142

TITLE OF INVENTION: METHOD, NETWORK AND CONTROL STATION FOR THE-TWO-WAY ALTERNATE CONTROL OF RADIO SYSTEMS OF DIFFERENT STANDARDS IN THE SAME FREQUENCY BAND

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	03/06/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRAN, CONGVAN	2688	455-434000

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: KONINKLIJKE PHILIPS ELECTRONICS N.V.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Eindhoven, The Netherlands

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 enclosed:
☑ Issue Fee
☑ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☑ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 14-1270 (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).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
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 12/16/05

Typed or printed name Russell Gross Registration No. 40,007

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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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 Central District of California on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
8:18-cv-01279	7/24/2018	Central District of California

PLAINTIFF	DEFENDANT
Uniloc 2017 LLC, Uniloc Licensing USA LLC and Uniloc USA, Inc.	Microsoft Corporation

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,016,676	3/21/2006	Uniloc 2017 LLC
2	6,993,049	1/31/2006	Uniloc 2017 LLC
3	7,167,487	1/23/2007	Uniloc 2017 LLC
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		
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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**

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 Eastern District of Texas Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:18-cv-00380-JRG	8/29/2018	Eastern District of Texas Marshall Division
PLAINTIFF UNILOC 2017 LLC, and UNILOC LICENSING USA LLC		DEFENDANT VERIZON COMMUNICATIONS INC., CELLCO PARTNERSHIP INC. D/B/A VERIZON WIRELESS, VERIZON BUSINESS NETWORK SERVICES, INC., and VERIZON DIGITAL MEDIA SERVICES, INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,075,917	7/11/2006	Uniloc 2017 LLC
2	6,664,891	12/16/2003	Uniloc 2017 LLC
3	6,519,005	2/11/2003	Uniloc 2017 LLC
4	7,016,676	3/21/2006	Uniloc 2017 LLC
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		
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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**

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 Eastern District of Texas Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:18-cv-00379-JRG	8/29/2018	Eastern District of Texas Marshall Division

PLAINTIFF	DEFENDANT
UNILOC 2017 LLC and UNILOC LICENSING USA LLC	AT&T INC., AT&T CORPORATION, AT&T SERVICES, INC., AT&T MOBILITY LLC, and AT&T COMMUNICATIONS, LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,901,272	5/31/2005	Uniloc 2017 LLC
2	6,519,005	2/11/2003	Uniloc 2017 LLC
3	7,016,676	3/21/2006	Uniloc 2017 LLC
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
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In the above—entitled case, the following decision has been rendered or judgement issued:

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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	U.S. DISTRICT COURT
2:18-cv-	10/29/2018	Eastern District of Texas

PLAINTIFF	DEFENDANT
UNILOC 2017 LLC and UNILOC LICENSING USA LLC	GOOGLE LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,016,676	3/21/2006	Uniloc 2017 LLC
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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:18-cv-	10/29/2018	Eastern District of Texas

PLAINTIFF	DEFENDANT
UNILOC 2017 LLC and UNILOC LICENSING USA LLC	GOOGLE LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:18-cv-00495	11/17/2018	Eastern District of Texas

PLAINTIFF	DEFENDANT
UNILOC 2017 LLC and UNILOC USA, INC.	GOOGLE LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,016,676	3/21/2006	Uniloc 2017 LLC
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