FILE HISTORY

US 5,915,210

PATENT:	5,915,210
INVENTORS:	Cameron, Dennis Wayne Roehr, Jr., Walter Charles Bhagat, Jai P. Garahi, Masood Hays, William D. Ackerman, David W.
TITLE:	Method and system for providing multicarrier simulcast transmission
APPLICATION NO:	US1997899476A
FILED:	24 JUL 1997
ISSUED:	22 JUN 1999
COMPILED:	08 MAR 2013

60245 U.S. PTO
08/899476
07/24/97

Class	Subclass	ISSUE CLASSIFICATION

SCANNED 6

5915210

5915210

UTILITY SERIAL NUMBER	PATENT DATE JUN 2 2 ~~1998~~ 1999	PATENT NUMBER

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/899,476	07/24/97	455	059	2611	

APPLICANTS: DENNIS WAYNE CAMERON, JACKSON, MS; WALTER CHARLES ROEHR JR., RESTON, VA; JAI P. BHAGAT, JACKSON, MS; MASOOD GARAHI, MADISON, MS; WILLIAM D. HAYS, JACKSON, MS; DAVID W. ACKERMAN, WASHINGTON, DC.

BEST COPY

CONTINUING DATA********************

VERIFIED   THIS APPLN IS A CON OF   08/760,457 12/06/96 ABN
which is ~~AND~~ A CON OF   07/973,918 11/12/92 PAT   5,590,403

YES

FOREIGN/PCT APPLICATIONS**********

VERIFIED

NONE

CERTIFICATE
NOV 23 1999
OF CORRECTION

FOREIGN FILING LICENSE GRANTED 09/10/97

Foreign priority claimed / 35 USC 119 conditions met / Verified and Acknowledged / Examiner's initials	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
☐ yes ☑ no / ☐ yes ☑ no	→	MS	29	18	2	$770.00	3680.0083-05

ADDRESS:
FINNEGAN HENDERSON FARABOW GARRETT
AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

TITLE: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

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

PARTS OF APPLICATION FILED SEPARATELY

J Kiddick
Applications Examiner

NOTICE OF ALLOWANCE MAILED		CLAIMS ALLOWED	
4-16-98	Assistant Examiner	Total Claims: 19	Print Claim: 1

ISSUE FEE			DRAWING		
Amount Due: 1320.00	Date Paid	Thanh Cong Le 4-10-98 THANH CONG LE PRIMARY EXAMINER GROUP 2700 Primary Examiner	Sheets Drwg.: 29	Figs. Drwg.: 40	Print Fig.: 6
Label Area		PREPARED FOR ISSUE	ISSUE BATCH NUMBER: D05		

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Form PTO-436A
(Rev. 8/92)

SCAN 6 DMW
QC RG JJ

(FACE)

ISSUE CLASSIFICATION	Class	Subclass
	455	59

[redacted]

TEAM 6

UTILITY SERIAL NUMBER 08/760457	PATENT DATE	PATENT NUMBER

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/760,457	12/06/96 RULE 60	455	59	2611	Le, T.

APPLICANTS

DENNIS W. CAMERON, JACKSON, MS; WALTER C. ROEHR JR., RESTON, VA; JAI P. BHAGAT, JACKSON, MS; MASOOD GARAHI, MADISON, MS; WILLIAM D. HAYS, JACKSON, MS; DAVID W. ACKERMAN, WASHINGTON, DC.

CONTINUING DATA*******************
VERIFIED THIS APPLN IS A CON OF 07/973,918 11/12/92 PAT 5,590,403

YES TL

FOREIGN/PCT APPLICATIONS**********
VERIFIED

NONE TL

FOREIGN FILING LICENSE GRANTED 02/12/97

Foreign priority claimed ☐ yes ☑ no 35 USC 119 conditions met ☑ yes ☑ no Verified and Acknowledged Examiner's Initials	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
		MS	29	1	1	$770.00	03680.0083-0

ADDRESS

FINNEGAN HENDERSON FARABOW
GARRETT AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

TITLE

METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

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

PARTS OF APPLICATION FILED SEPARATELY

Applications Examiner

NOTICE OF ALLOWANCE MAILED		CLAIMS ALLOWED	
4-25-97	THANH LE Assistant Examiner	Total Claims 18	Print Claim 1

ISSUE FEE			DRAWING		
Amount Due $1,290.00	Date Paid	Reinhard J. Eisenzopf 3-13-97 Supervisory Patent Examiner Group 2600 Primary Examiner	Sheets Drwg. 29	Figs. Drwg. 40	Print Fig. 6
			ISSUE BATCH NUMBER M25		

Label Area

PREPARED FOR ISSUE

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Form PTO-436A
(Rev. 8/92)

(FACE)

08/760,457

METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

Transaction History

Date	Transaction Description
12-06-1996	Incoming Letter Pertaining to the Drawings
12-06-1996	Preliminary Amendment
12-06-1996	Preliminary Amendment
01-03-1997	Initial Exam Team nn
02-21-1997	Application Captured on Microfilm
03-07-1997	Case Docketed to Examiner in GAU
04-25-1997	Mail Notice of Allowance
04-25-1997	Notice of Allowance Data Verification Completed
04-25-1997	Mail Examiner's Amendment
04-25-1997	Examiner's Amendment Communication
03-25-1998	Mail Abandonment for Failure to Correct Drawings/Oath
03-25-1998	Abandonment for Failure to Correct Drawings/Oath/NonPub Request
04-09-1998	Abandonment for Purposes of Filing an FWC - File Combined with Child Application

5,915,210

METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

Transaction History

Date	Transaction Description
07-24-1997	Preliminary Amendment
08-21-1997	Initial Exam Team nn
08-26-1997	IFW Scan & PACR Auto Security Review
09-12-1997	Amendment after Notice of Allowance (Rule 312)
09-12-1997	Information Disclosure Statement (IDS) Filed
09-12-1997	Information Disclosure Statement (IDS) Filed
09-15-1997	Application Dispatched from OIPE
12-19-1997	Information Disclosure Statement (IDS) Filed
12-19-1997	Information Disclosure Statement (IDS) Filed
04-09-1998	Case Docketed to Examiner in GAU
04-16-1998	Mail Notice of Allowance
04-16-1998	Notice of Allowance Data Verification Completed
04-16-1998	Mail Examiner's Amendment
04-16-1998	Examiner's Amendment Communication
06-16-1998	Issue Fee Payment Verified
06-16-1998	Mailroom Date of Drawing(s)
06-19-1998	Application Ordered to Match Drawing(s)
06-19-1998	Drawing(s) Received at Publications
06-24-1998	Application Received to Match Drawing(s)
07-28-1998	Drawing(s) Processing Completed
07-28-1998	Drawing(s) Matched to Application
09-15-1998	Date Forwarded to Examiner
09-23-1998	Mail Response to 312 Amendment (PTO-271)
09-23-1998	Response to Amendment under Rule 312
01-06-1999	Mailroom Date of Drawing(s)
01-08-1999	Drawing(s) Received at Publications
06-11-1999	Issue Notification Mailed
06-22-1999	Recordation of Patent Grant Mailed
10-27-1999	Post Issue Communication - Certificate of Correction

08/760457

PATENT APPLICATION

08760457

APPROVED FOR LICENSE ☑

INITIALS JAN 29 1997

CONTENTS

Date Entered or Counted			Date Received or Mailed
	1.	~~Application~~ ______ papers.	
	2.	~~Pre Amdt A~~	12/6/96
	3.	~~Pre Amdt B~~	12/6/96
	4.	~~Ltr. to Draftsman~~	12/6/96
3/13/97	5.	~~Notice of Aband~~	4-25-97
	6.	Notice of Abandonment	3/25/98
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60245 U.S. PTO
08/899476
07/24/97

PATENT APPLICATION

08899476

APPROVED FOR LICENSE

INITIALS

CONTENTS

Date Entered or Counted			Date Received or Mailed
		Application papers.	
	7.	PreAmdt C	7/24/97
4-13-98	8.	Notice of Allowability	4-16-98
6/26/98	9.	Formal Drawings (30 shts) set 6	6/16/98
	10.	Notice of Drawing Requirement	7/23/98
	11.	I.D.S. w/ref	9/12/97
	12.	I.D.S. w/ref	12/19/97
	13.	Amdt D (Rule 312)	9/12/97
9/21/98	14.	Notice of Entry	9-23-98 SC
	15.	PTO Grant JUN 2 2 1999	
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APPLICATION SERIAL NUMBER

08/899,476

APPLICANT'S NAME (PLEASE PRINT)

CAMERON et al

IF REISSUE, ORIGINAL PATENT NUMBER

INTERNATIONAL CLASSIFICATION

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ORIGINAL CLASSIFICATION

CLASS	SUBCLASS
455	59

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
455	102	103		

GROUP ART UNIT: 2745

ASSISTANT EXAMINER (PLEASE STAMP OR PRINT FULL NAME)

PRIMARY EXAMINER (PLEASE STAMP OR PRINT FULL NAME) THANH CONG LE

PTO 270 (REV. 5-91)

ISSUE CLASSIFICATION SLIP

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

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POSITION		ID NO.	DATE
CLASSIFIER		12	1/29/97
EXAMINER		412	2-10-97
TYPIST		NK	2/12
VERIFIER 251	2/12	441	2/15
CORPS CORR.			
SPEC. HAND			
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DRAFTING			

INDEX OF CLAIMS

Claim Final	Claim Original	Date 3/10/97
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1	2	=
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2	8	=
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SYMBOLS

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

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POSITION		ID NO.	DATE
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INDEX OF CLAIMS

Claim		Date							
Final	Original	4/6/98							
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SYMBOLS

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

(LEFT INSIDE)

SEARCHED

Class	Sub.	Date	Exmr.
455	12.1 33.1 34.1 53.1 54.1 54.2 57.2 59 56.1 62 63 67.1 101 102 103	3/10/97	TL
375	260 267 299	3/10/97	TL
370	343 344		

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
455	59 102 103	3/10/97	TL

SEARCH NOTES

	Date	Exmr.
J. Dwyer (QAS) Double patenting rejection (non-satisfactory)	3/7/97	TL
D. Vo (Class 375)	3/10/97	TL
H. Vu (Clas 370	3/10/97	TL

(RIGHT OUTSIDE)

[redacted]

SEARCHED

Class	Sub.	Date	Exmr.
455	502 503 507 509 515 516 517 524 59 60 62 63 67.1 67.3 67.6 101 102 103	4/8/98	TL
375	260 267 299	4/8/98	TL
370	343 344	4/8/98	TL

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
455	59 102 103	4/10/98	TL

SEARCH NOTES

	Date	Exmr.
none	4/8/98	TL

(RIGHT OUTSIDE)

US005915210A

United States Patent [19]

Cameron et al.

[11] Patent Number: 5,915,210

[45] Date of Patent: Jun. 22, 1999

[54] **METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION**

[75] Inventors: **Dennis Wayne Cameron**, Jackson, Miss.; **Walter Charles Roehr, Jr.**, Reston, Va.; **Jai P. Bhagat**, Jackson, Miss.; **Masood Garahi**, Madison, Miss.; **William D. Hays**, Jackson, Miss.; **David W. Ackerman**, Washington, D.C.

[73] Assignee: **Destineer Corporation**, Jackson, Miss.

[21] Appl. No.: **08/899,476**

[22] Filed: **Jul. 24, 1997**

Related U.S. Application Data

[63] Continuation of application No. 08/760,457, Dec. 6, 1996, abandoned, which is a continuation of application No. 07/973,918, Nov. 12, 1992, Pat. No. 5,590,403.

[51] **Int. Cl.**^{6} **H04B 1/50**

[52] **U.S. Cl.** **455/59**; 455/102; 455/103

[58] **Field of Search** 455/502, 503, 455/507, 509, 515, 516, 517, 524, 59, 60, 62, 63, 67.1, 67.3, 67.6, 101, 102, 103; 375/260, 267, 299; 370/343, 344

[56] **References Cited**

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WO 90/04314	4/1990	European Pat. Off. .	
WO91/18458	11/1991	WIPO	455/101
WO92/11707	7/1992	WIPO	455/33.1

Primary Examiner—Thanh Cong Le

Attorney, Agent, or Firm—Finnegan, Henderson, Farabow, Garrett & Dunner

[57] **ABSTRACT**

A two-way communication system for communication betweeen a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers include in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in suimulcast during both systemwide and zone boundaries to maximize information throughout. The preferred mobile unit inlcudes a noise detector circuit to prevent unwanted transmissions. The system network further provides an adaptive registration feature for mobile units which controls the registration operation by the mobile units to maximize information throughout.

19 Claims, 30 Drawing Sheets

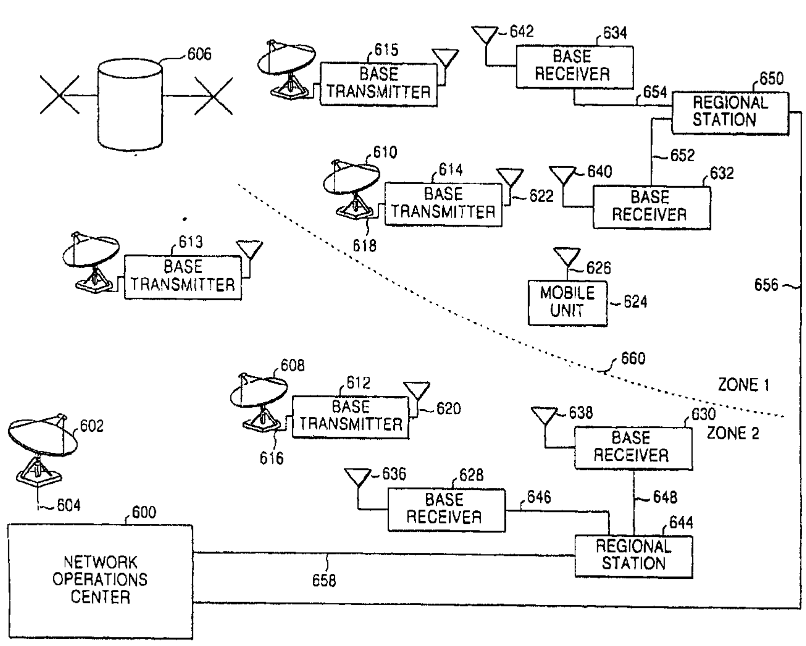
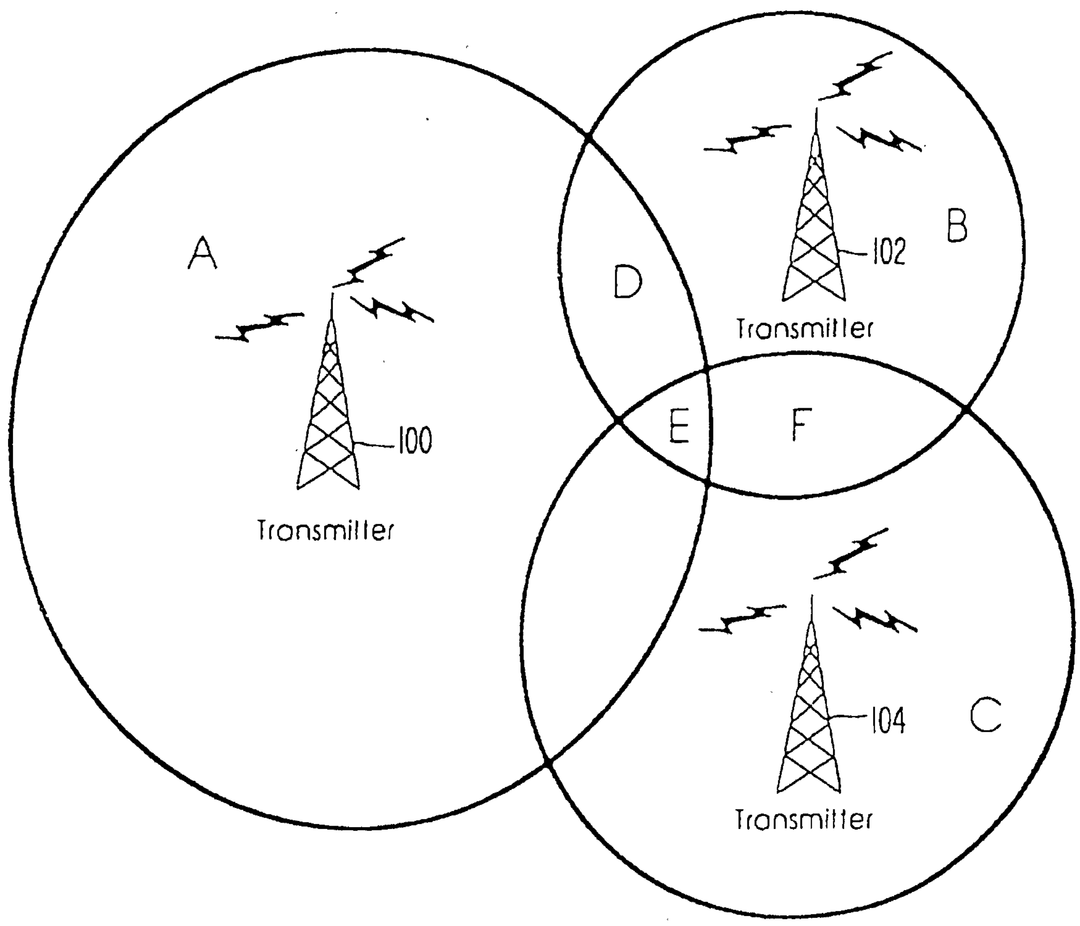


FIG. 1
PRIOR ART



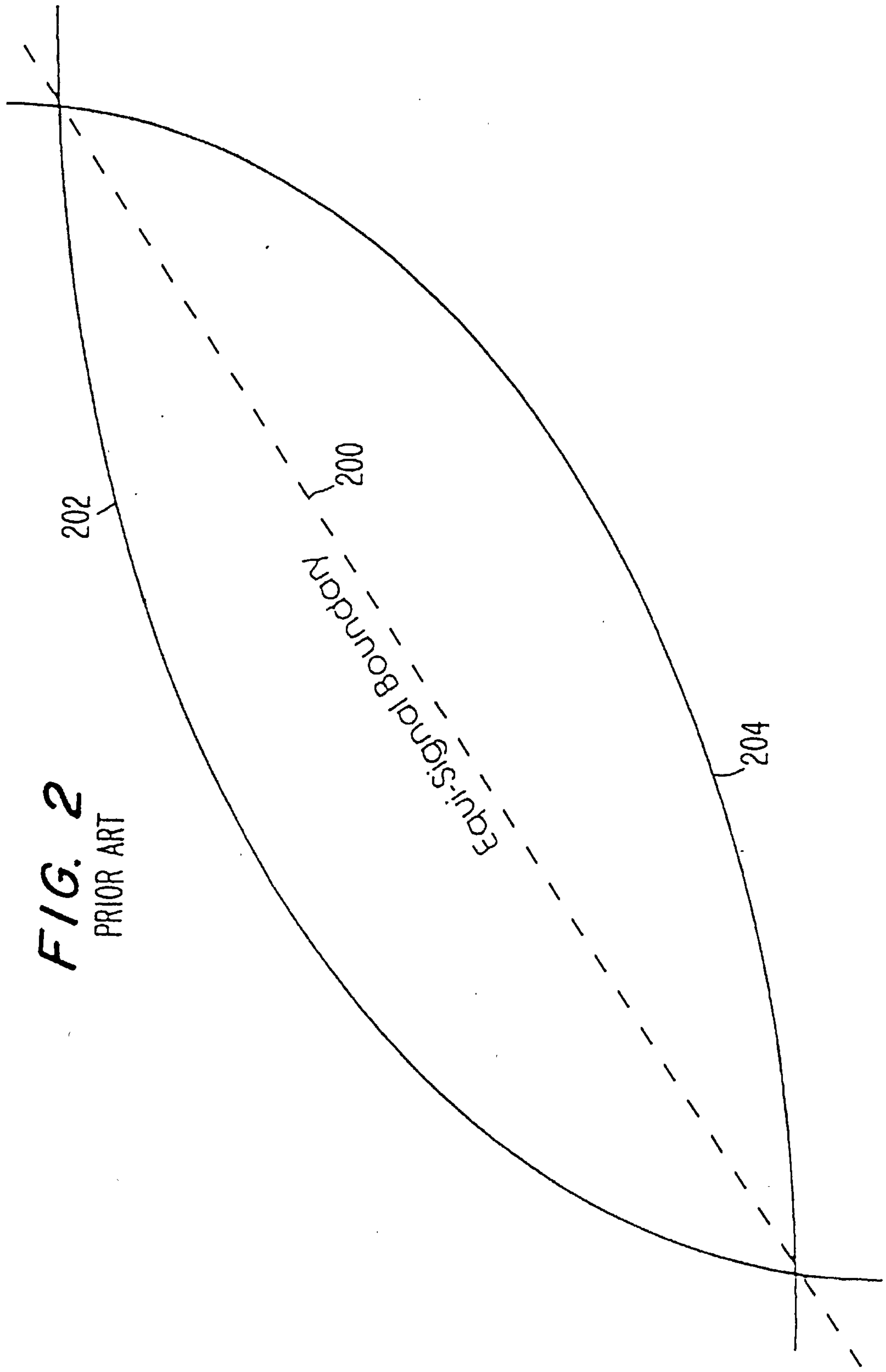


FIG. 2
PRIOR ART

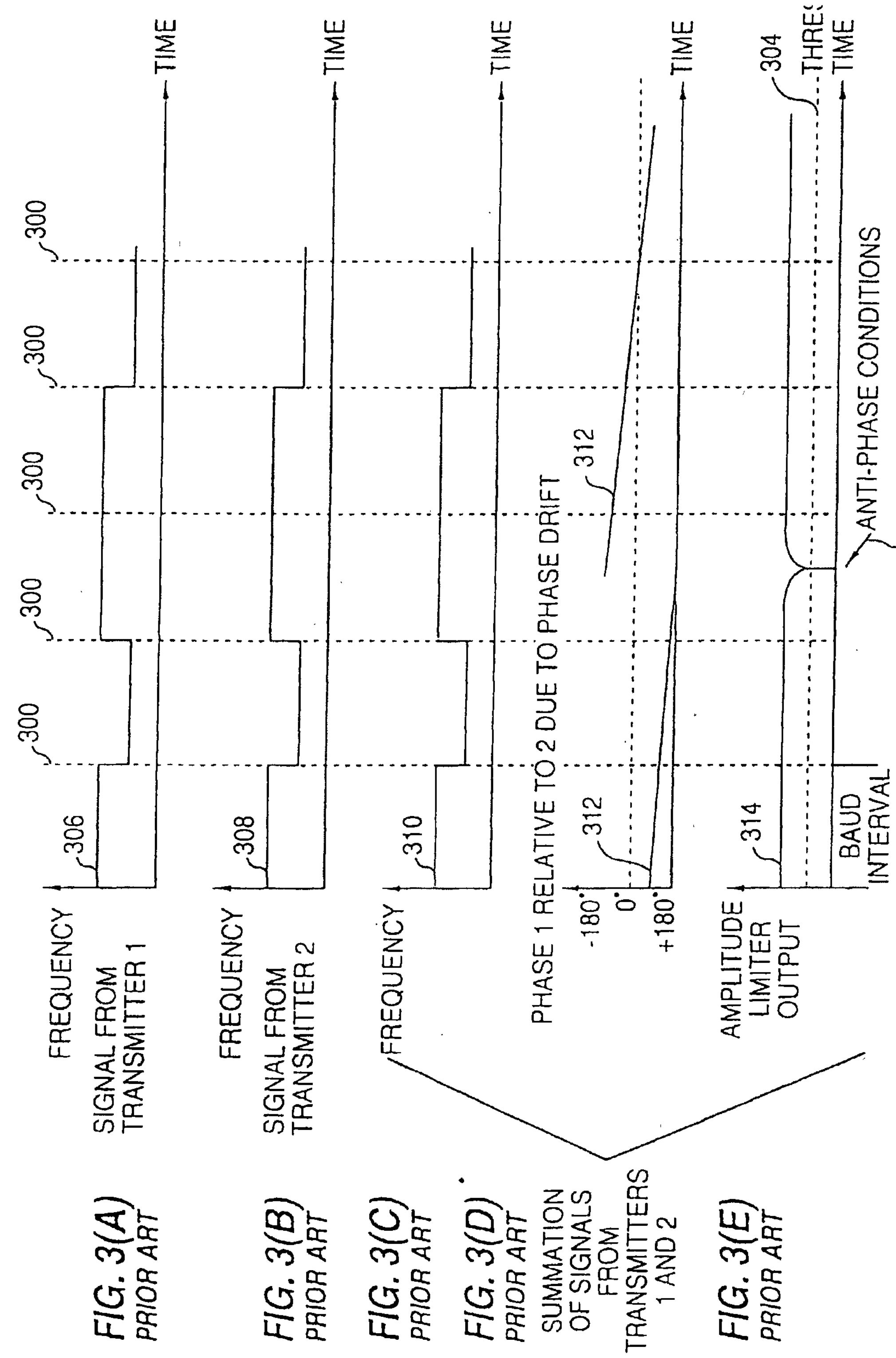


FIG. 3(A) PRIOR ART

FIG. 3(B) PRIOR ART

FIG. 3(C) PRIOR ART

FIG. 3(D) PRIOR ART

FIG. 3(E) PRIOR ART

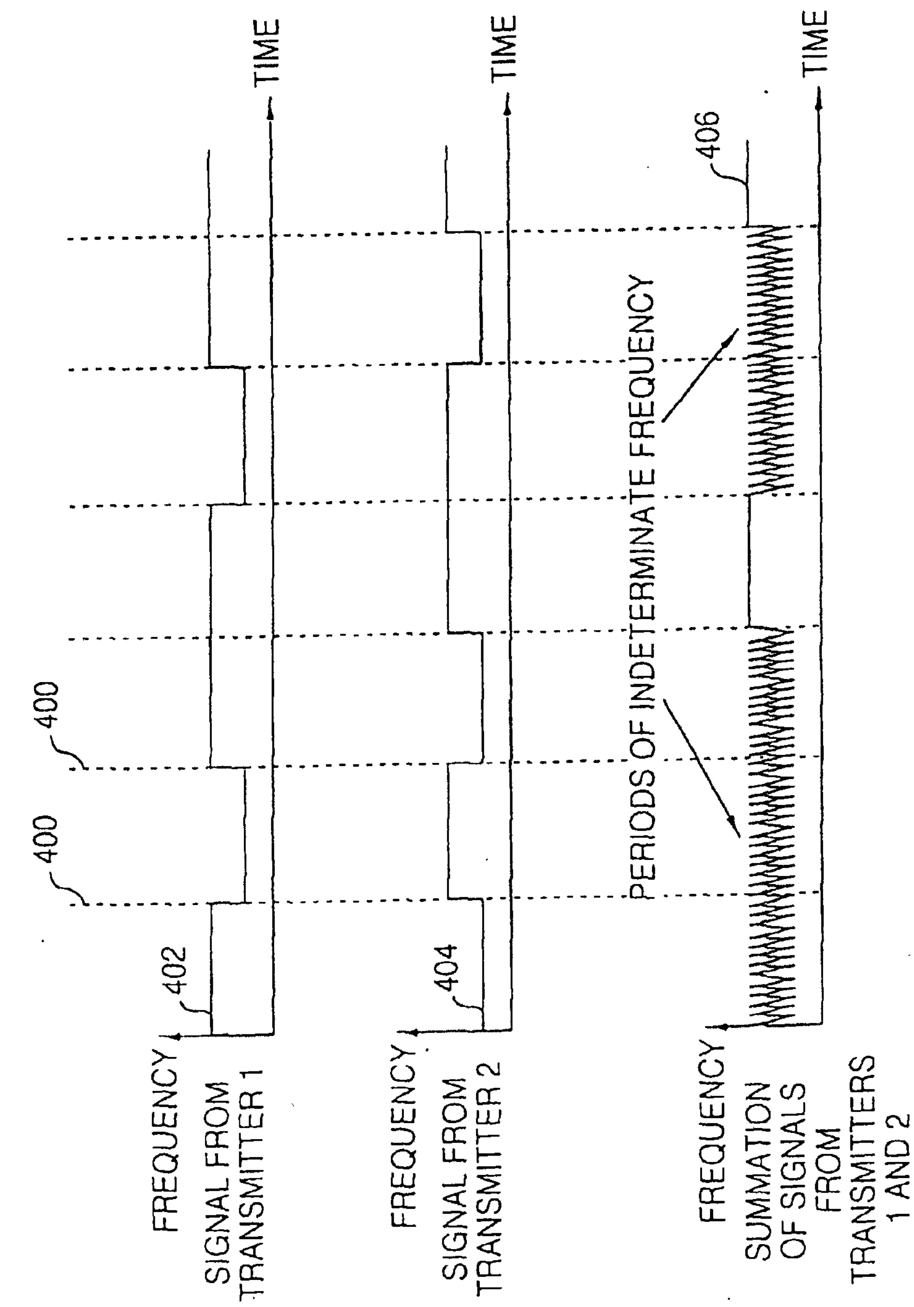


FIG. 4(A) PRIOR ART

FIG. 4(B) PRIOR ART

FIG. 4(C) PRIOR ART

FIG. 5 PRIOR ART

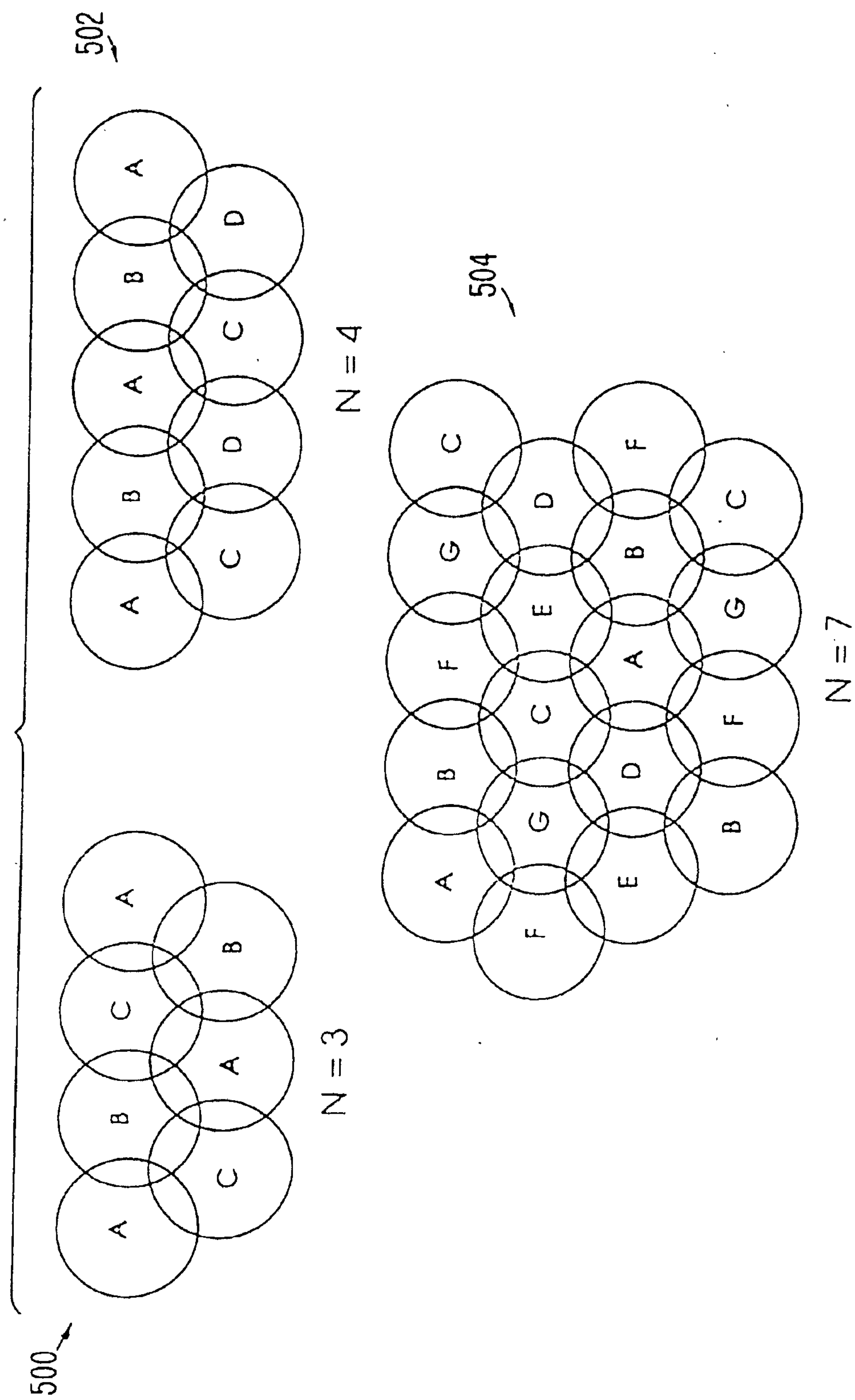
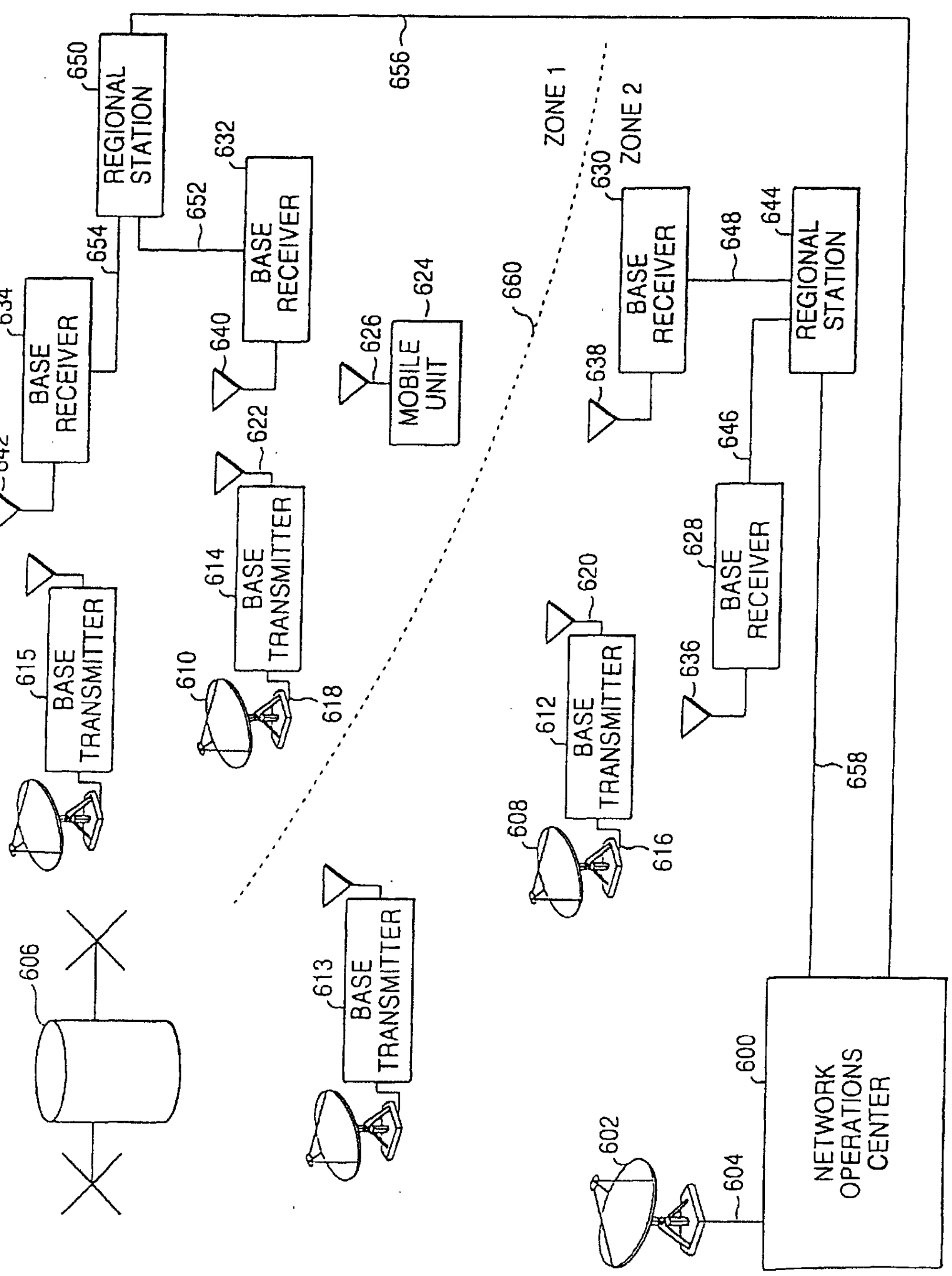


FIG. 6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650
656
ZONE 1
ZONE 2
660
BASE RECEIVER
632
652
654
634
MOBILE UNIT
624
626
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642
622
BASE TRANSMITTER
614
615
610
618
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NETWORK OPERATIONS CENTER
600
602
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FIG. 7

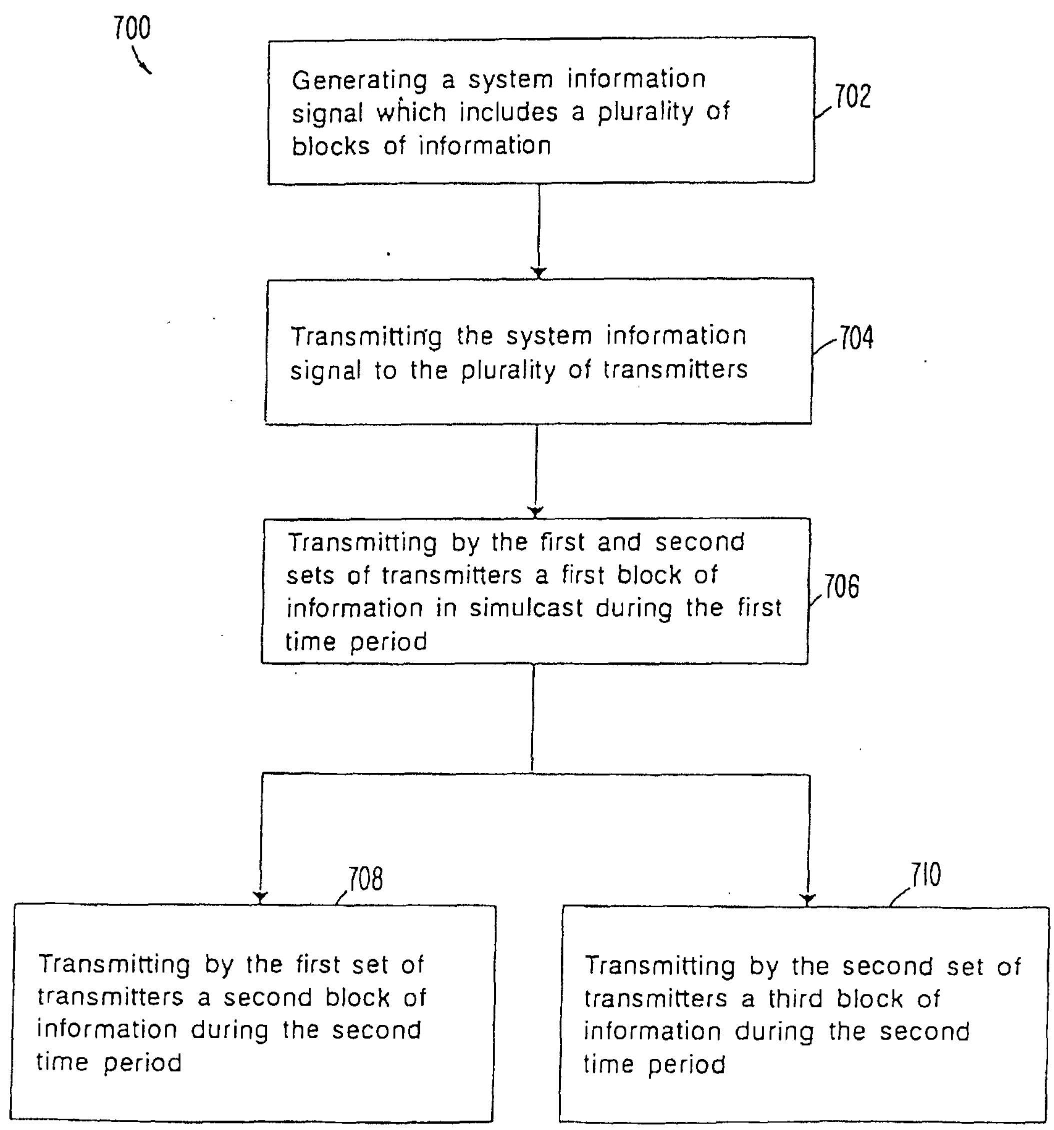

700
Generating a system information signal which includes a plurality of blocks of information
702
Transmitting the system information signal to the plurality of transmitters
704
Transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period
706
708
Transmitting by the first set of transmitters a second block of information during the second time period
710
Transmitting by the second set of transmitters a third block of information during the second time period

FIG. 8

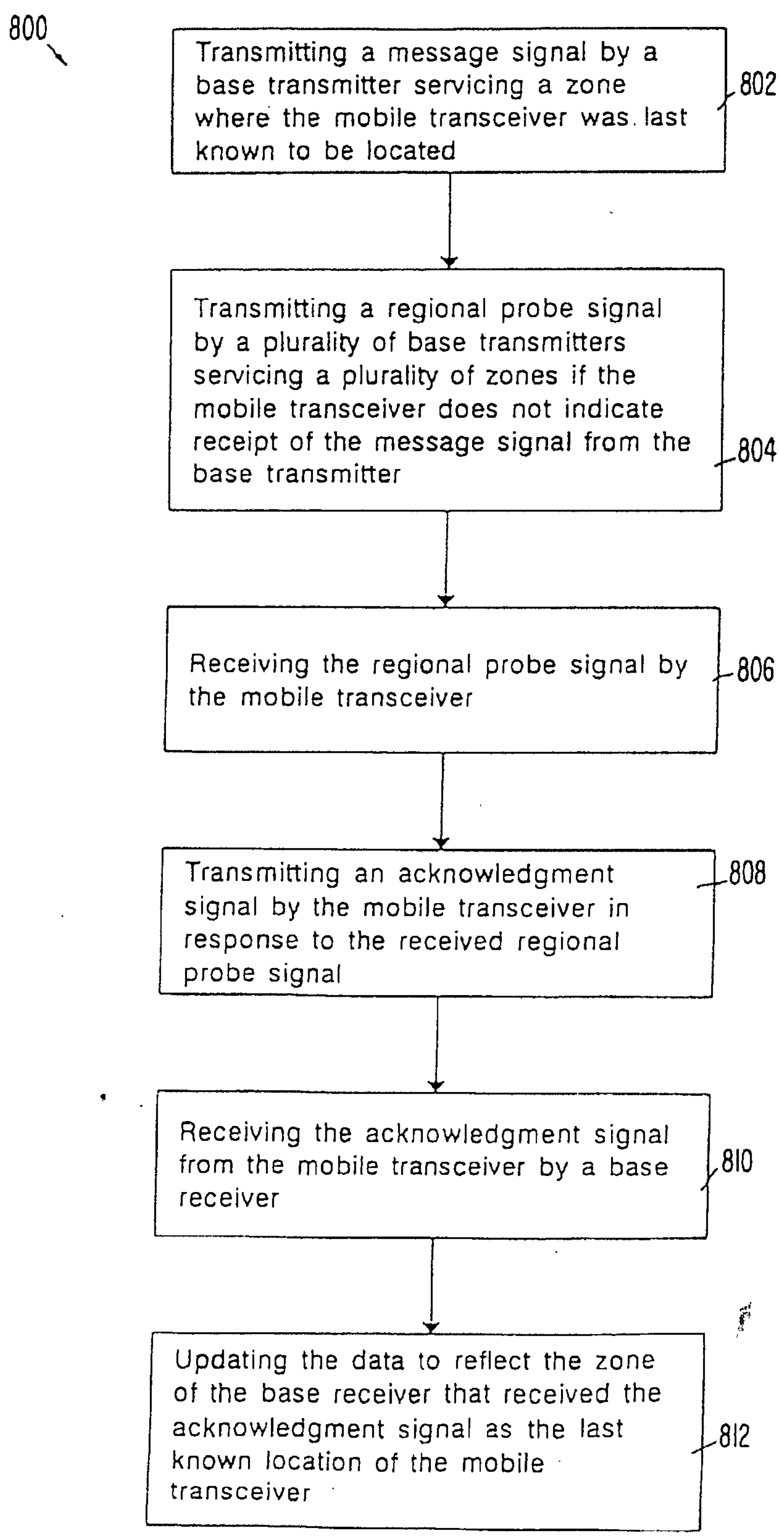
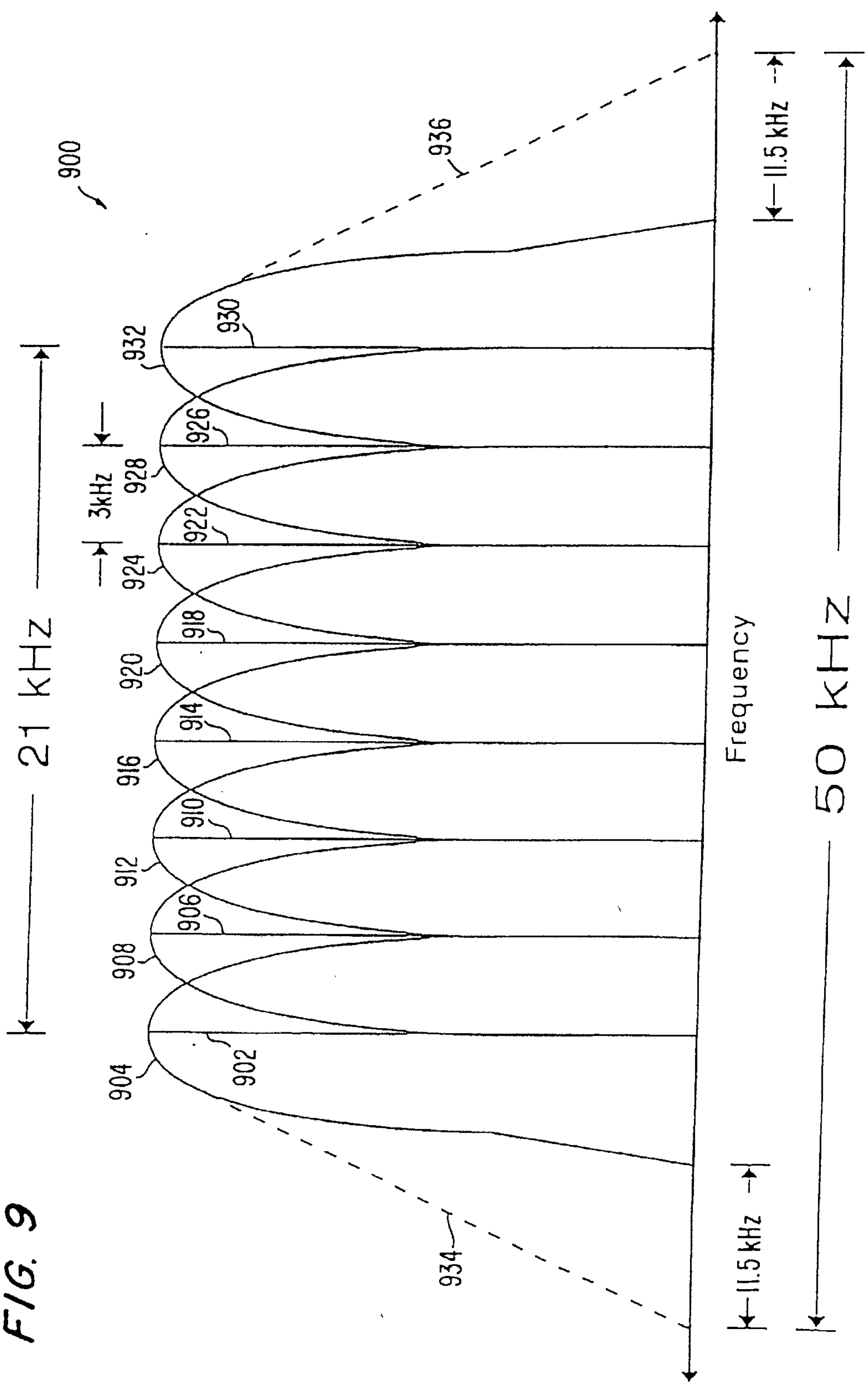

800
Transmitting a message signal by a base transmitter servicing a zone where the mobile transceiver was last known to be located
802
Transmitting a regional probe signal by a plurality of base transmitters servicing a plurality of zones if the mobile transceiver does not indicate receipt of the message signal from the base transmitter
804
Receiving the regional probe signal by the mobile transceiver
806
Transmitting an acknowledgment signal by the mobile transceiver in response to the received regional probe signal
808
Receiving the acknowledgment signal from the mobile transceiver by a base receiver
810
Updating the data to reflect the zone of the base receiver that received the acknowledgment signal as the last known location of the mobile transceiver
812

FIG. 9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3kHz
11.5 kHz
11.5 kHz
50 kHz
Frequency
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904
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FIG. 10

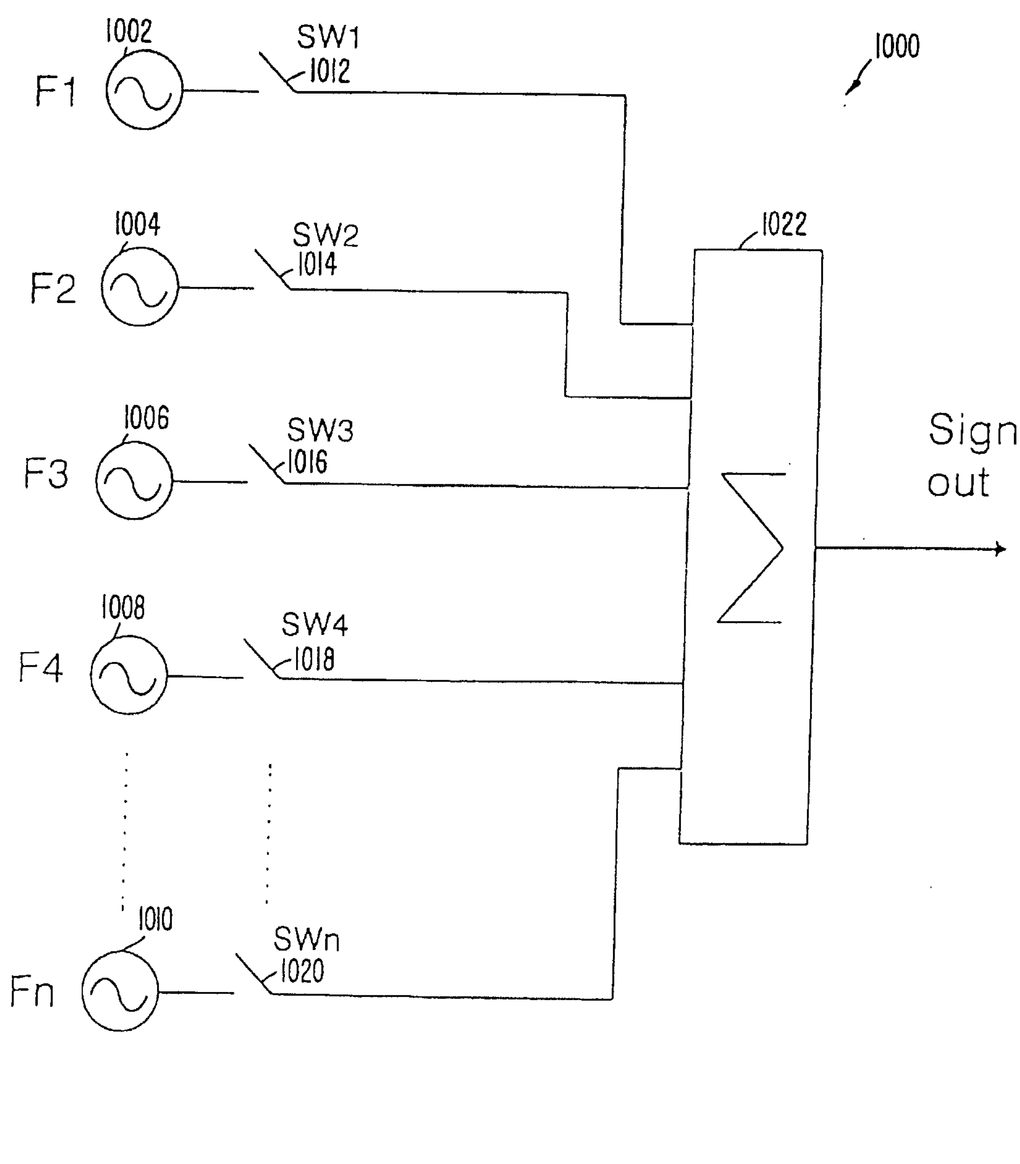
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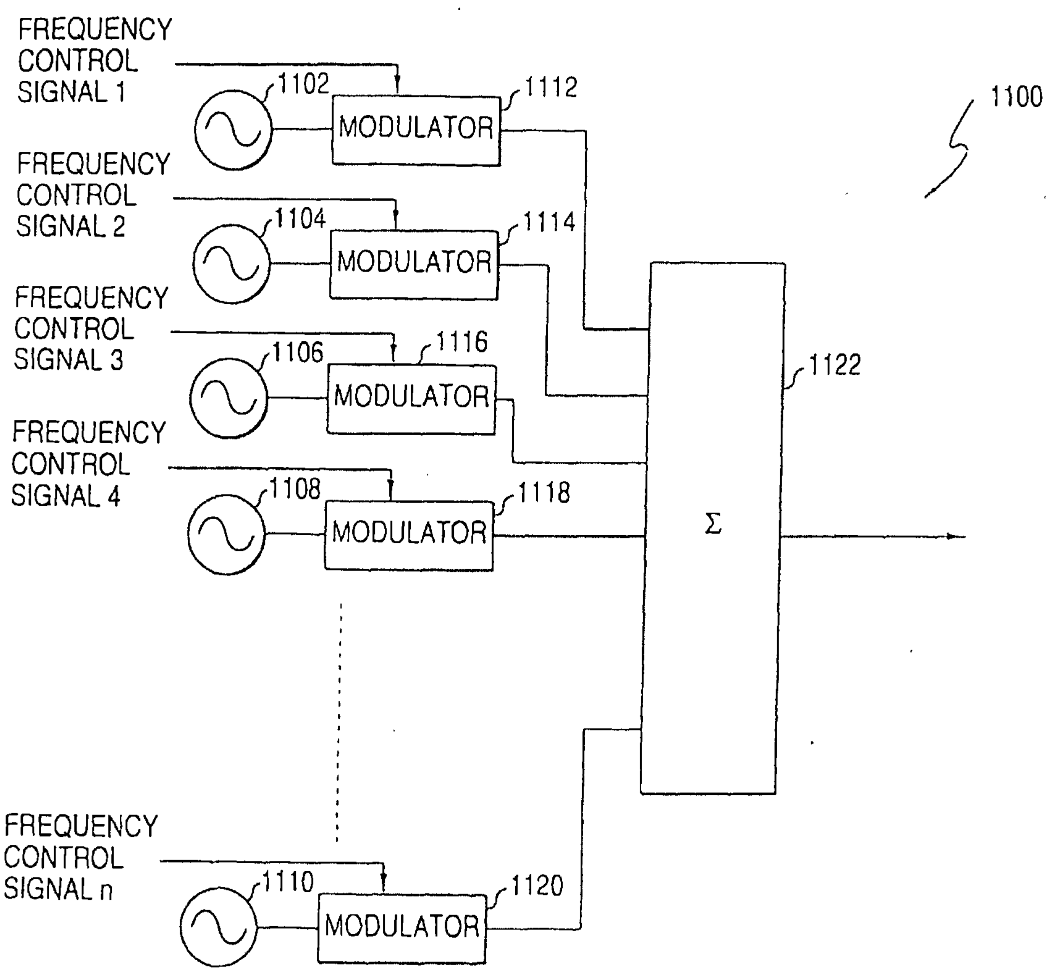
FIG. 11



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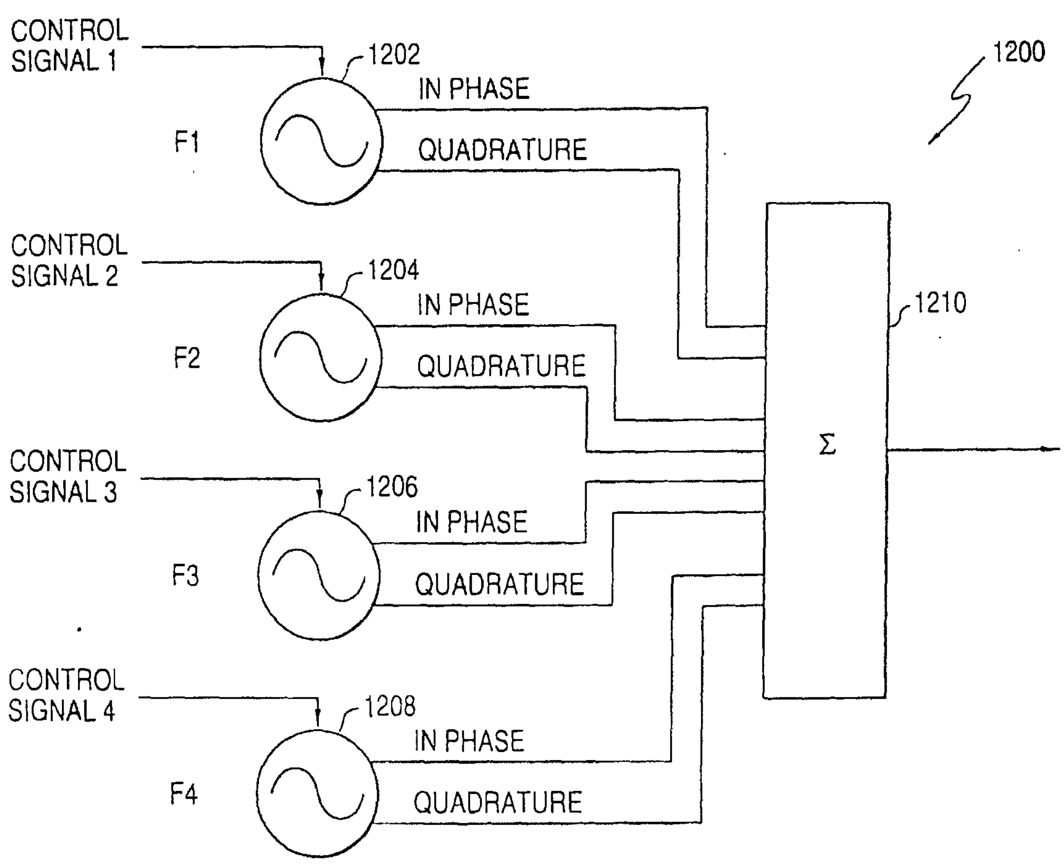
1106
1116
MODULATOR
1122
FREQUENCY CONTROL SIGNAL 4
1108
MODULATOR
1118
Σ
FREQUENCY CONTROL SIGNAL n
1110
MODULATOR
1120

FIG. 12



FOUR CARRIER QUADRATURE MODULATOR

FIG. 13

Base Transmitter

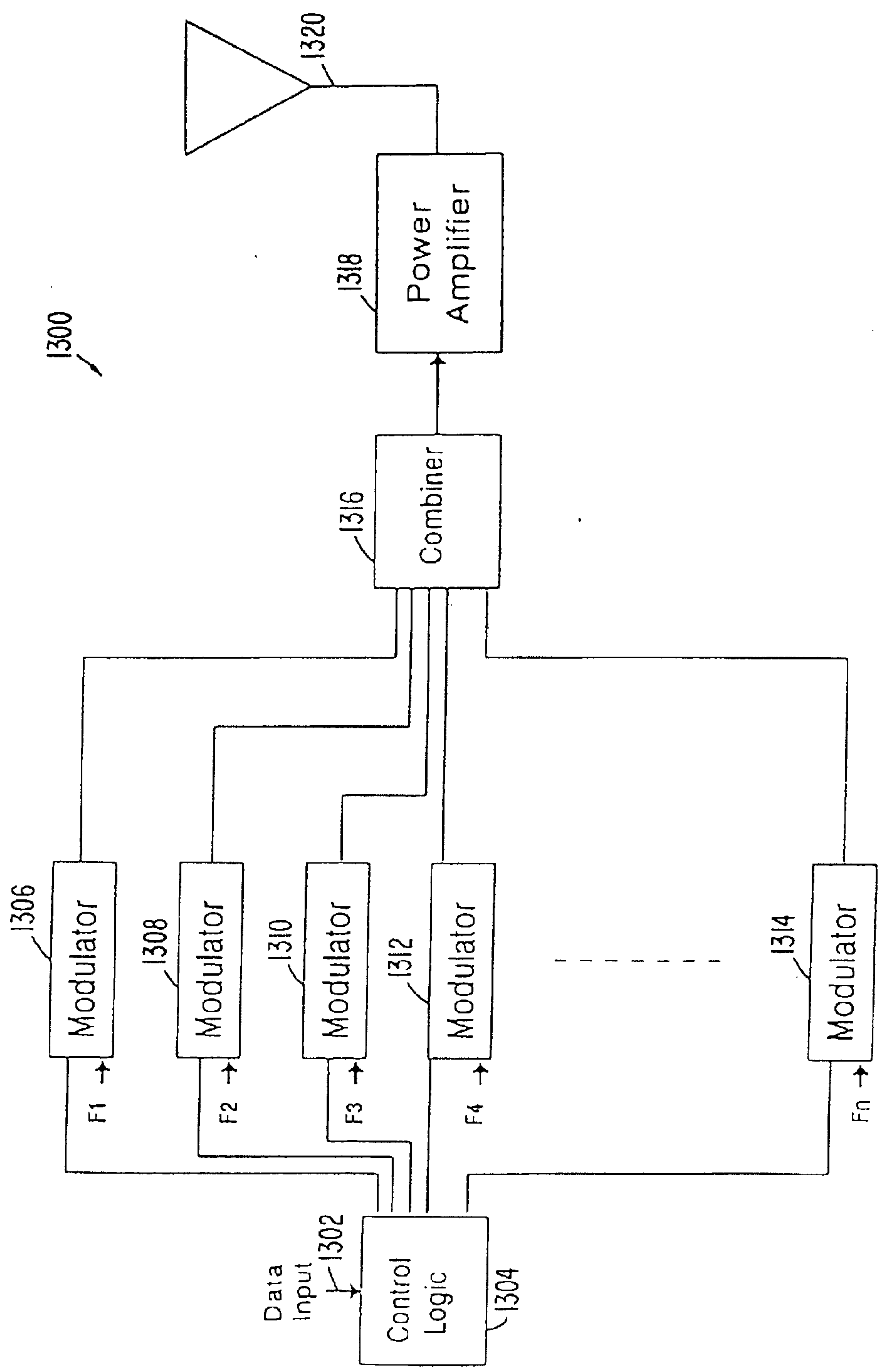
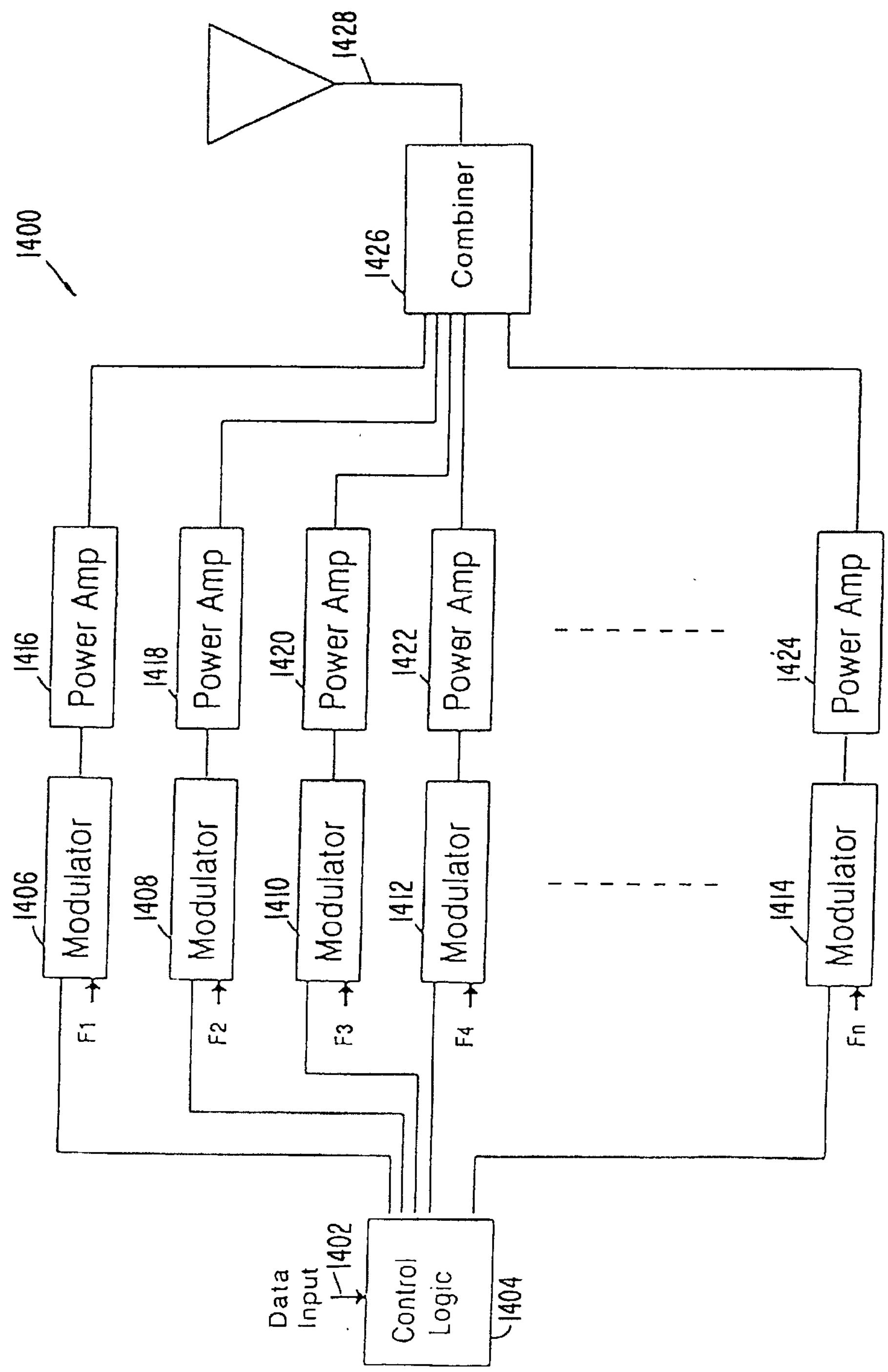


FIG. 14

Base Transmitter



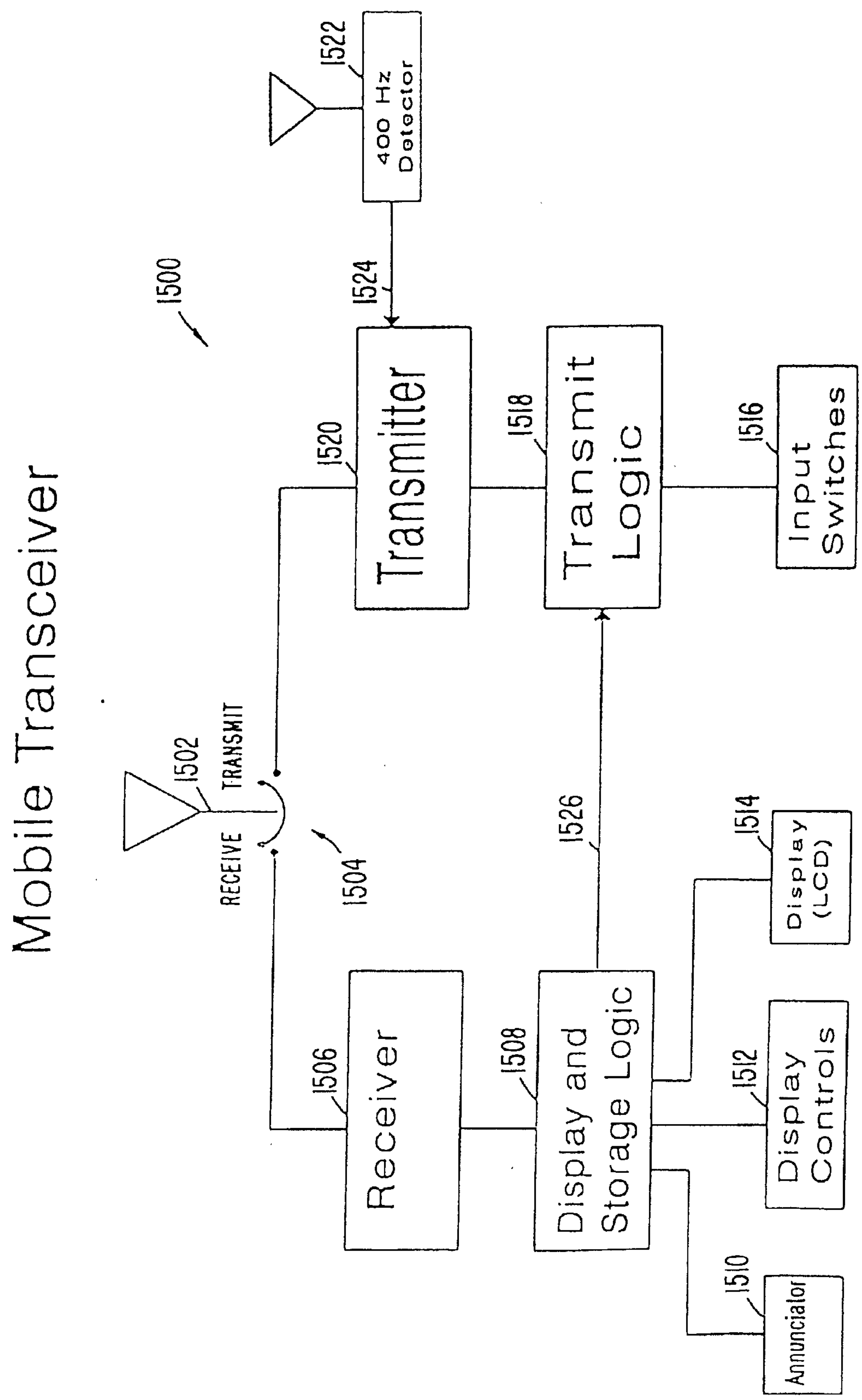

Mobile Transceiver
1500
1502
TRANSMIT
RECEIVE
1504
1506
Receiver
1508
Display and Storage Logic
1510
Annunciator
1512
Display Controls
1514
Display (LCD)
1516
Input Switches
1518
Transmit Logic
1520
Transmitter
1522
400 Hz Detector
1524
1526

FIG. 15

FIG. 16

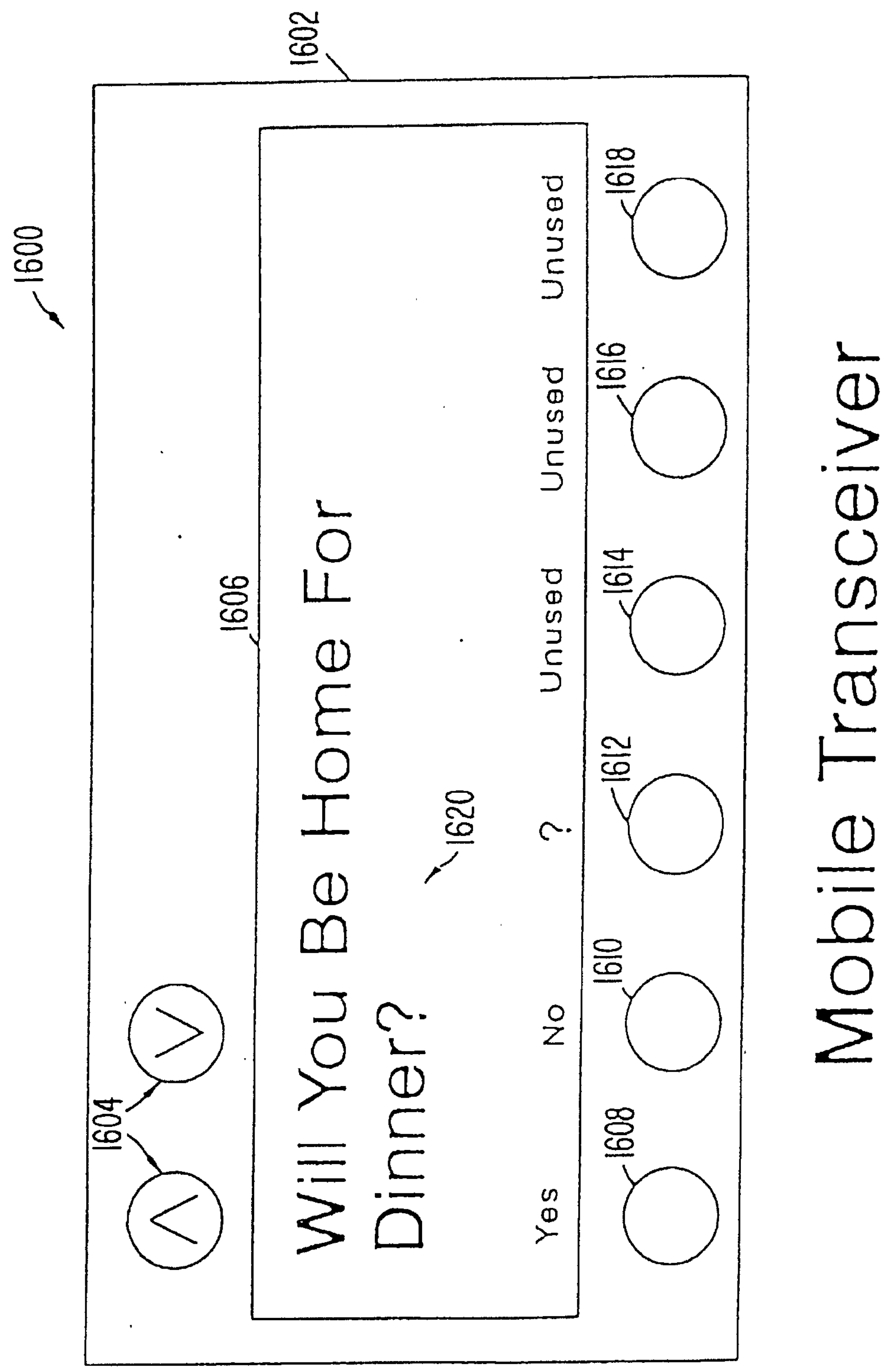
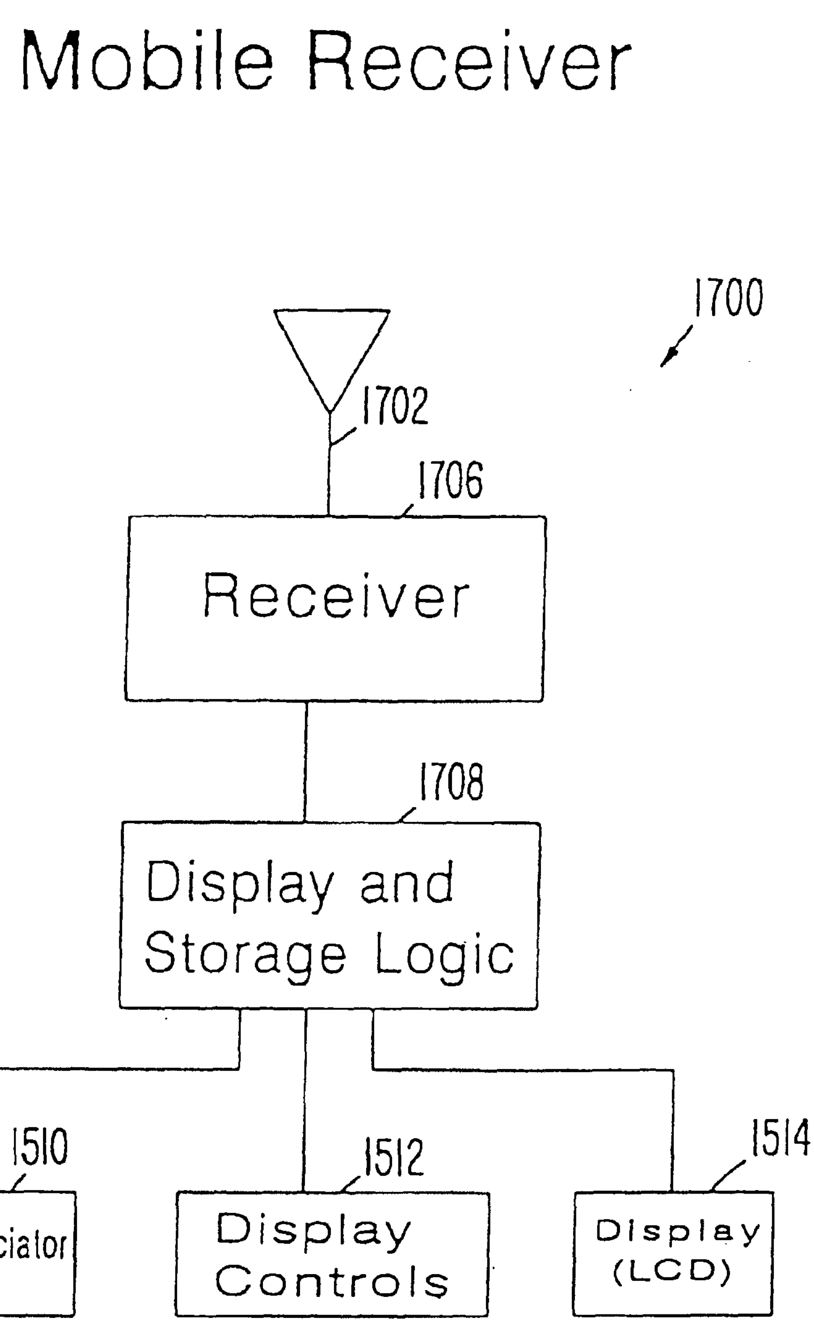

1600
1602
1604
1606
Will You Be Home For Dinner?
1620
Yes
No
?
Unused
Unused
Unused
1608
1610
1612
1614
1616
1618
Mobile Transceiver

FIG. 17


Mobile Receiver
1700
1702
1706
Receiver
1708
Display and Storage Logic
1510
1512
1514
Annunciator
Display Controls
Display (LCD)

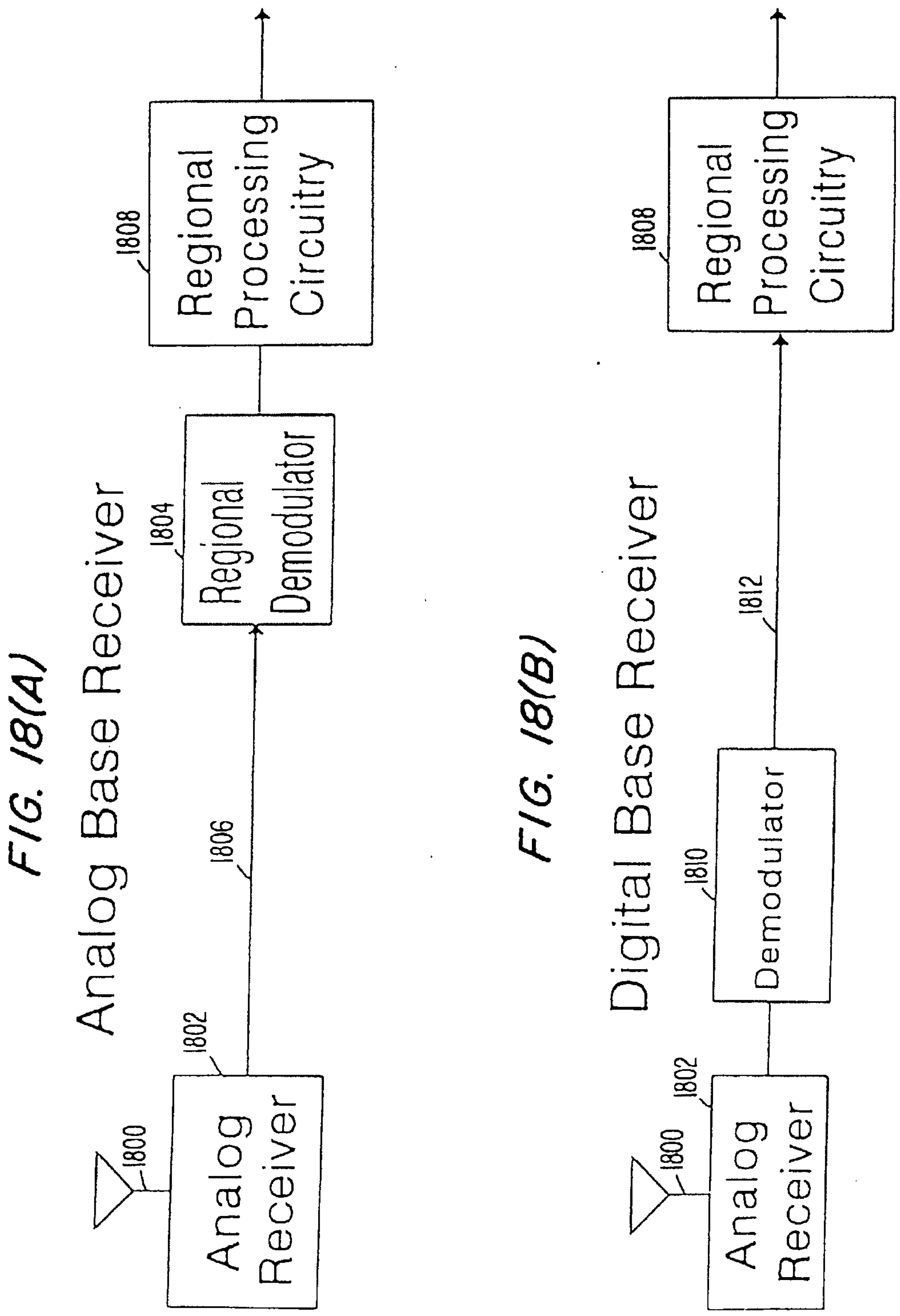
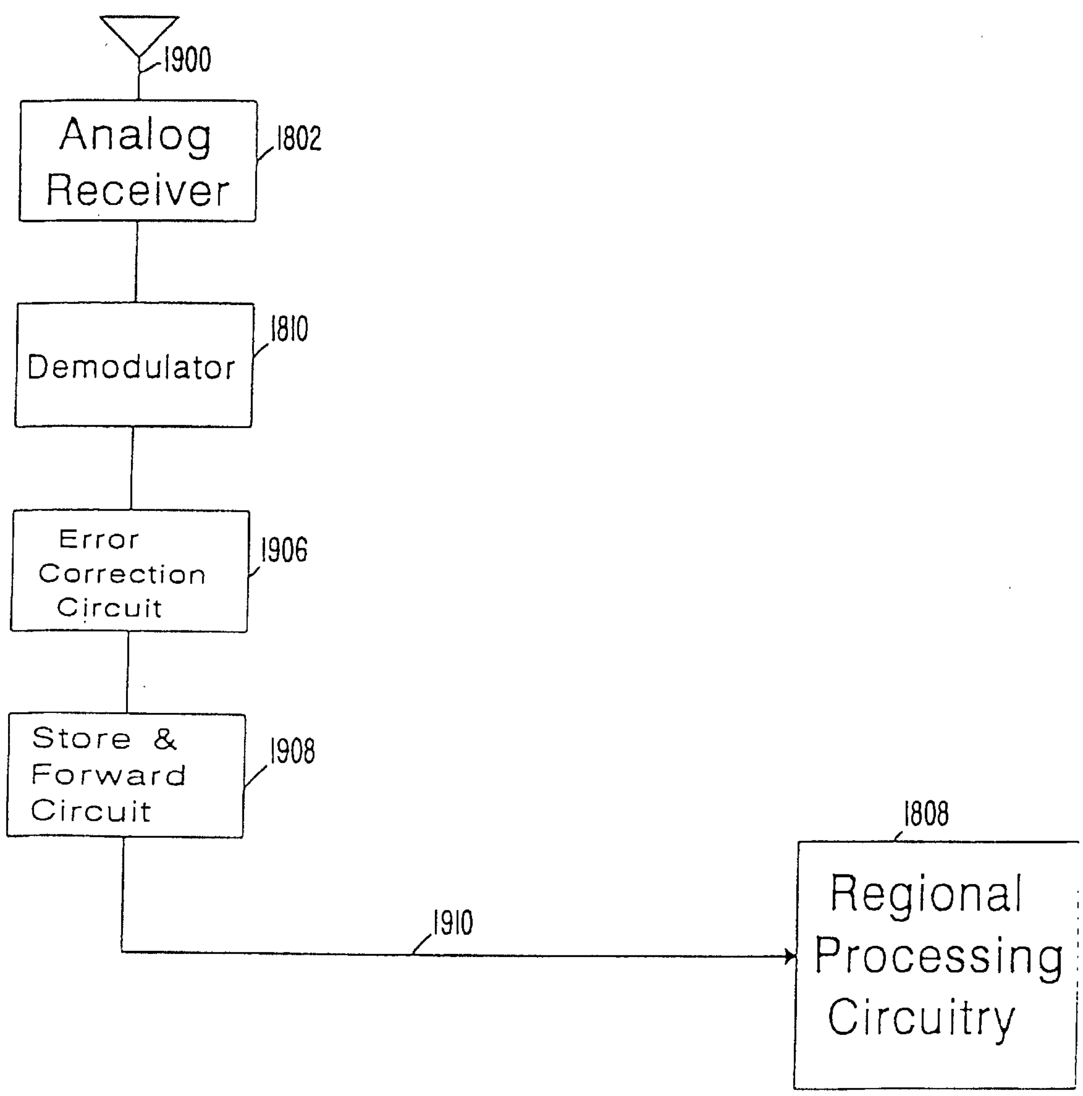


FIG. 18(A)

FIG. 18(B)

FIG. 19



1900
Analog Receiver
1802
Demodulator
1810
Error Correction Circuit
1906
Store & Forward Circuit
1908
1808
1910
Regional Processing Circuitry

FIG. 20

Network Operations Center

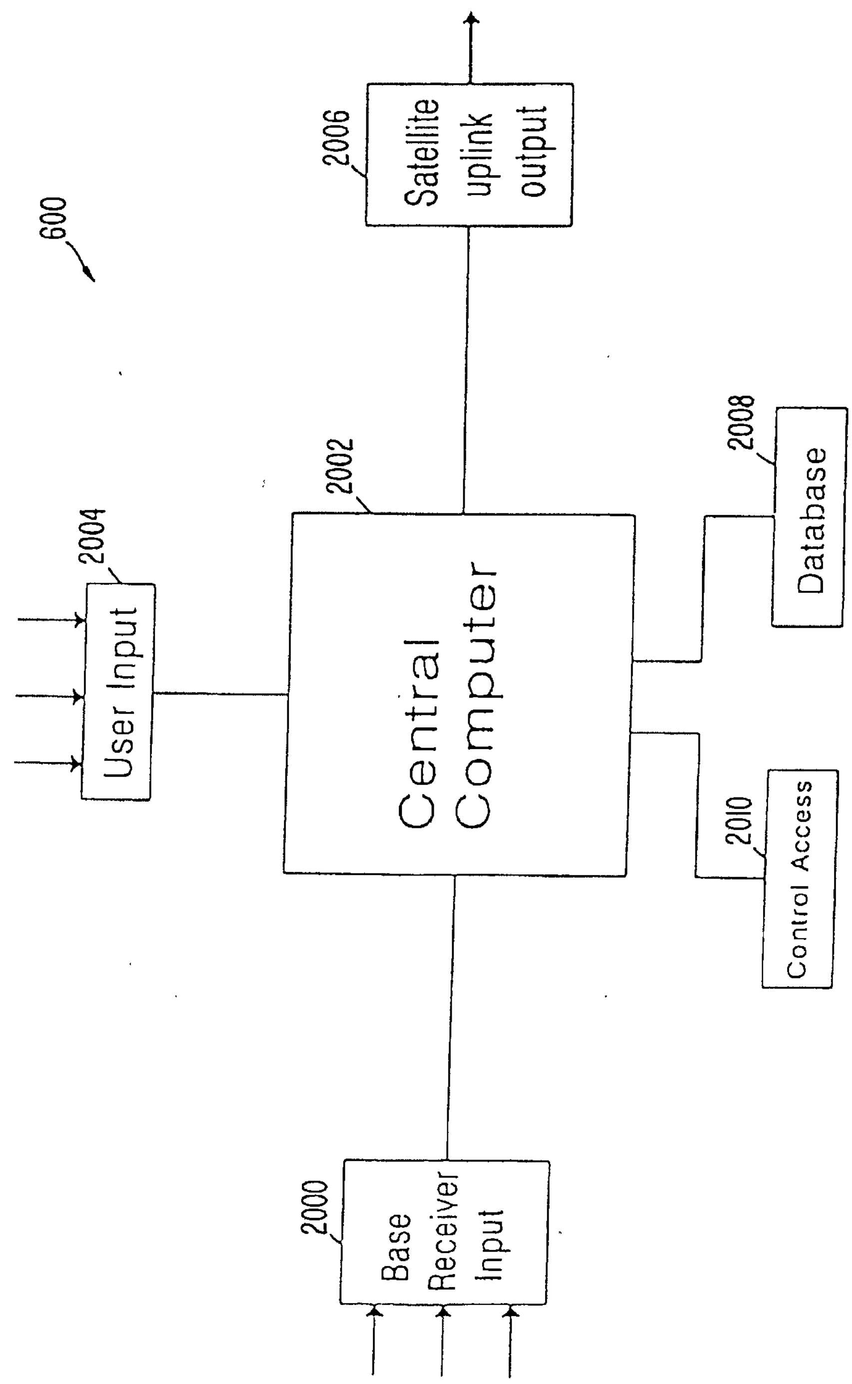
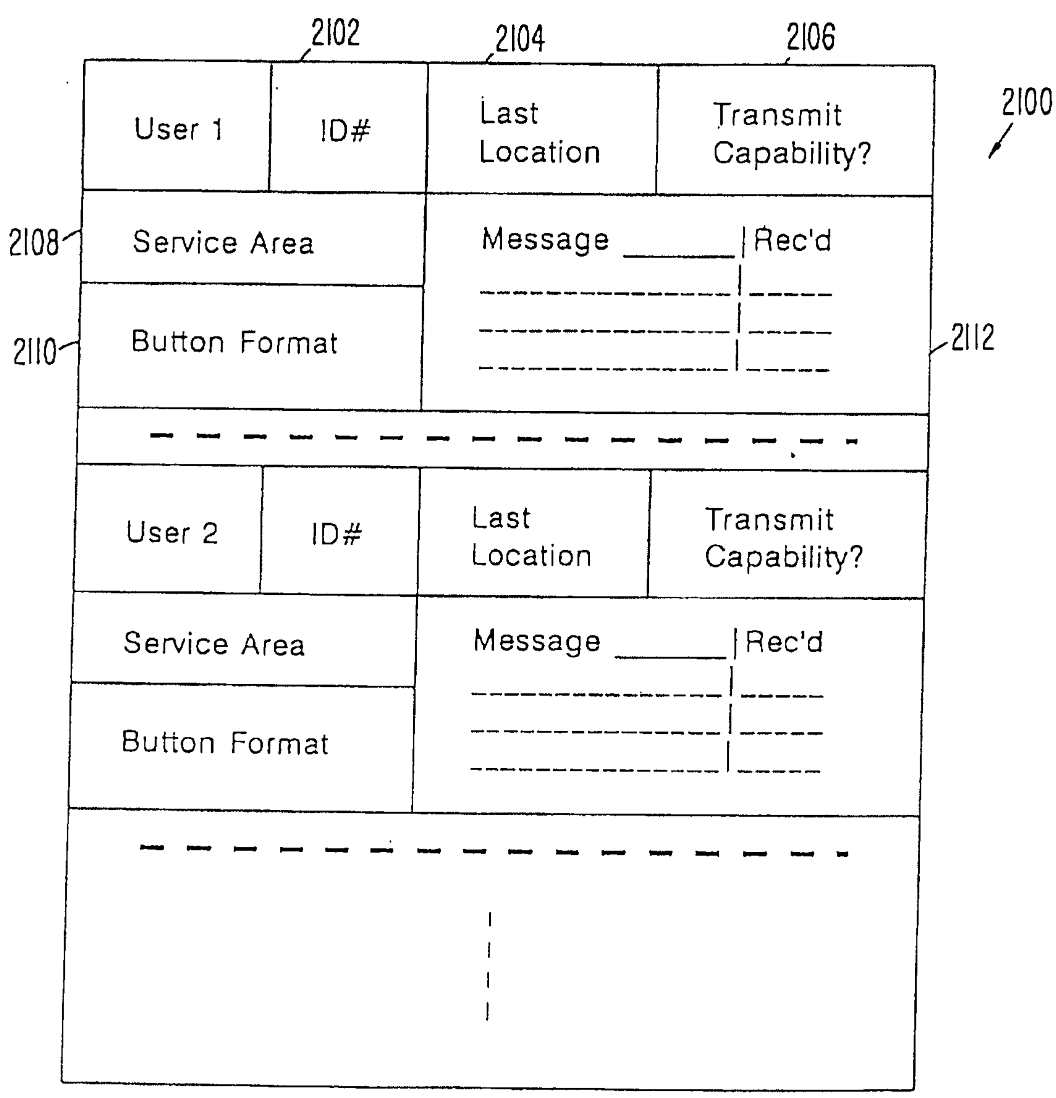


FIG. 21



User Database

FIG. 22

2200

2202	2204	2206	2208	2210
User 1	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 2	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 3	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 4	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
		▪ ▪ ▪		

Traffic Database

FIG. 23

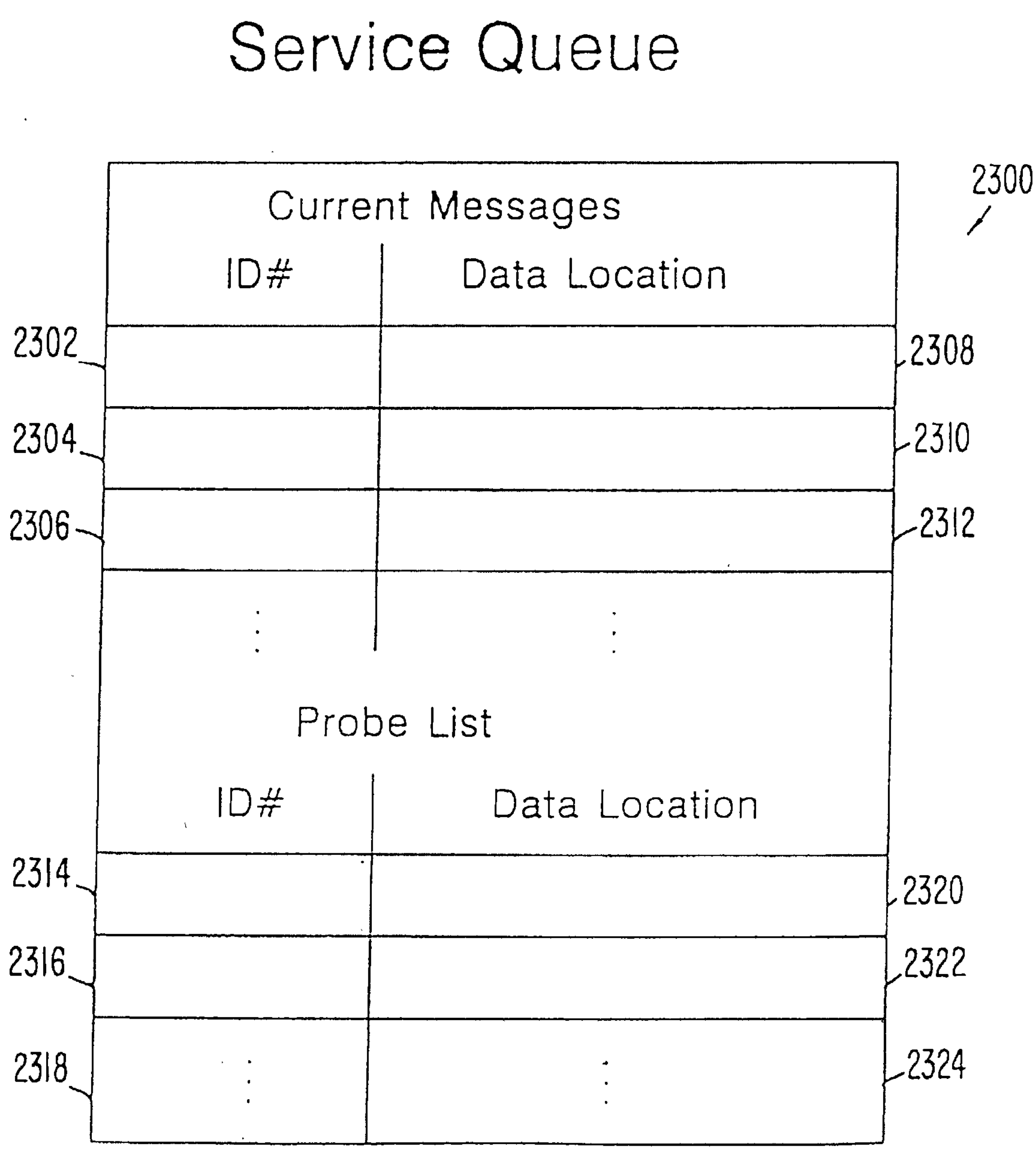

Service Queue
2300
Current Messages
ID#
Data Location
2302
2304
2306
2308
2310
2312
Probe List
ID#
Data Location
2314
2316
2318
2320
2322
2324

FIG. 24

2400

2402	2404	2406	2408
Base Transmitter 1	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 2	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 3	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 4	Zonal Assignment	Base Receivers in Coverage Area	Other Data
	▪ ▪ ▪		

Base Transmitter Database

FIG. 25

Zone Dithering

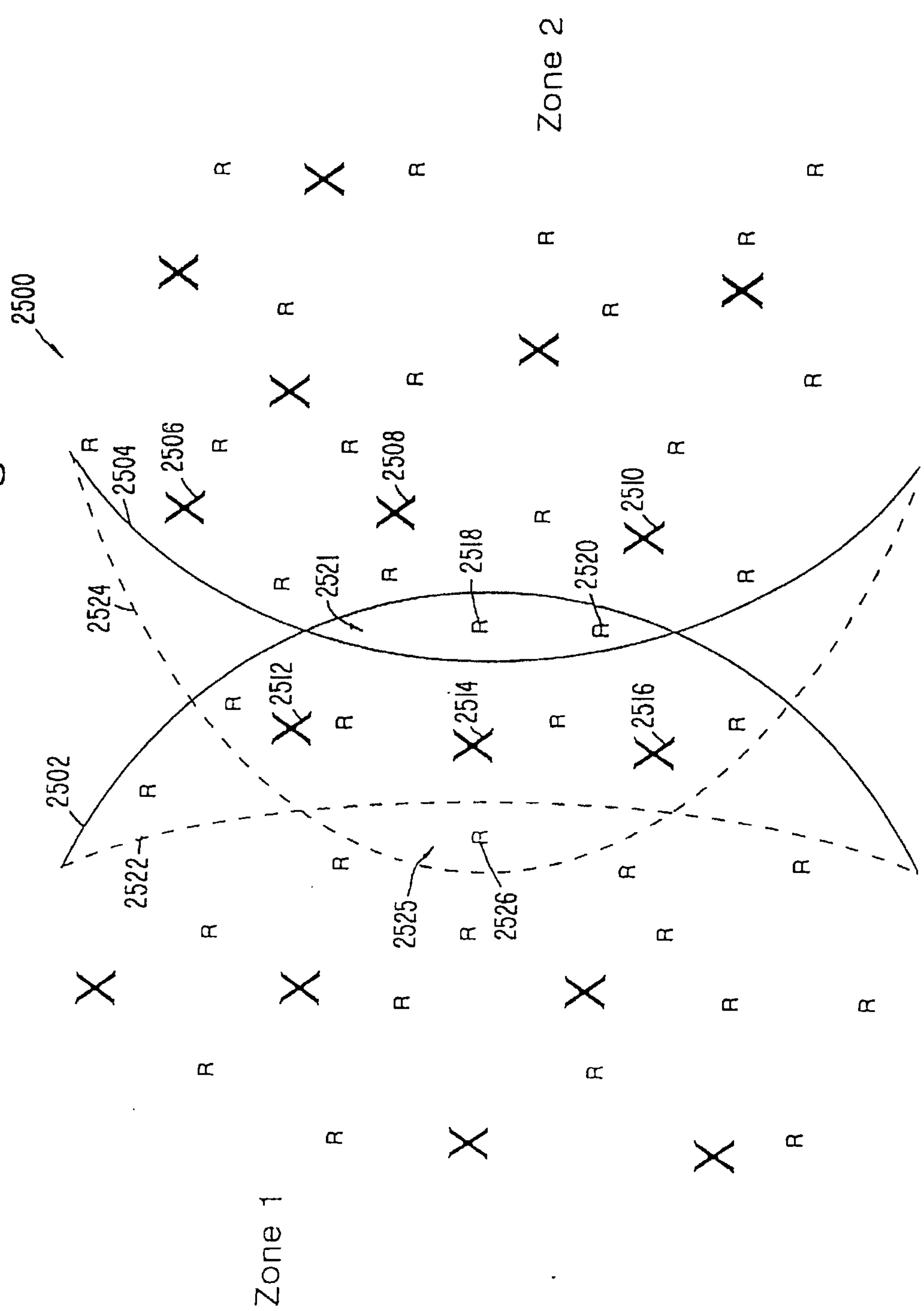
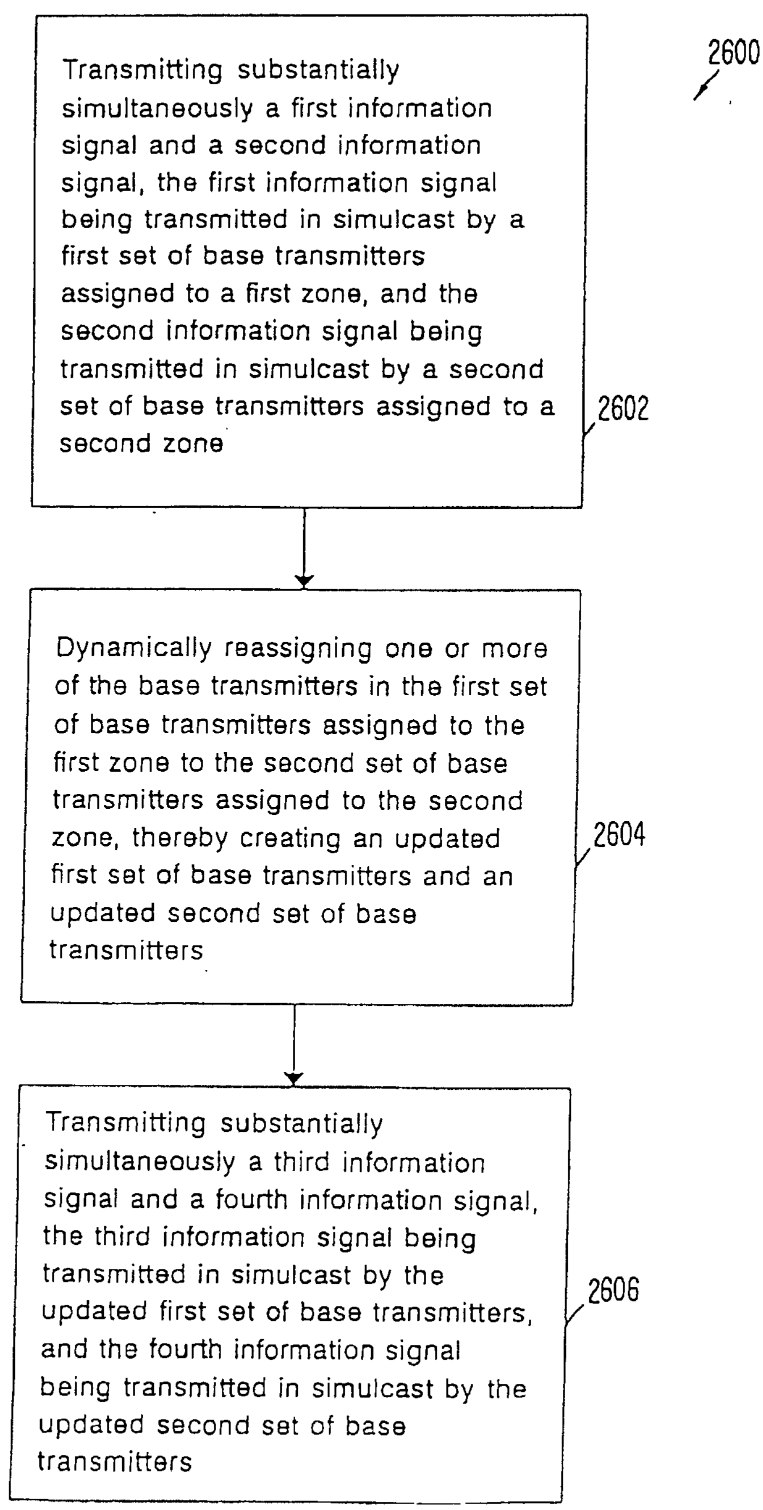


FIG. 26


2600
Transmitting substantially simultaneously a first information signal and a second information signal, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone
2602
Dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone, thereby creating an updated first set of base transmitters and an updated second set of base transmitters
2604
Transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters
2606

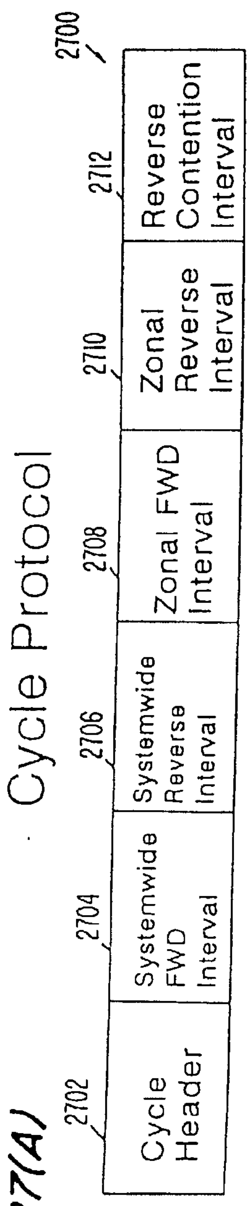


FIG. 27(A)

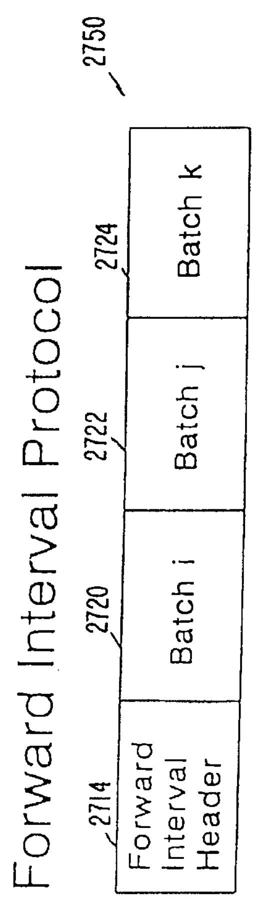


FIG. 27(B)

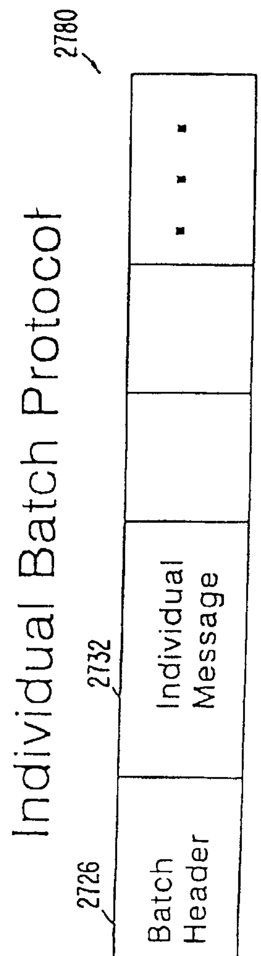


FIG. 27(C)

FIG. 28(A)

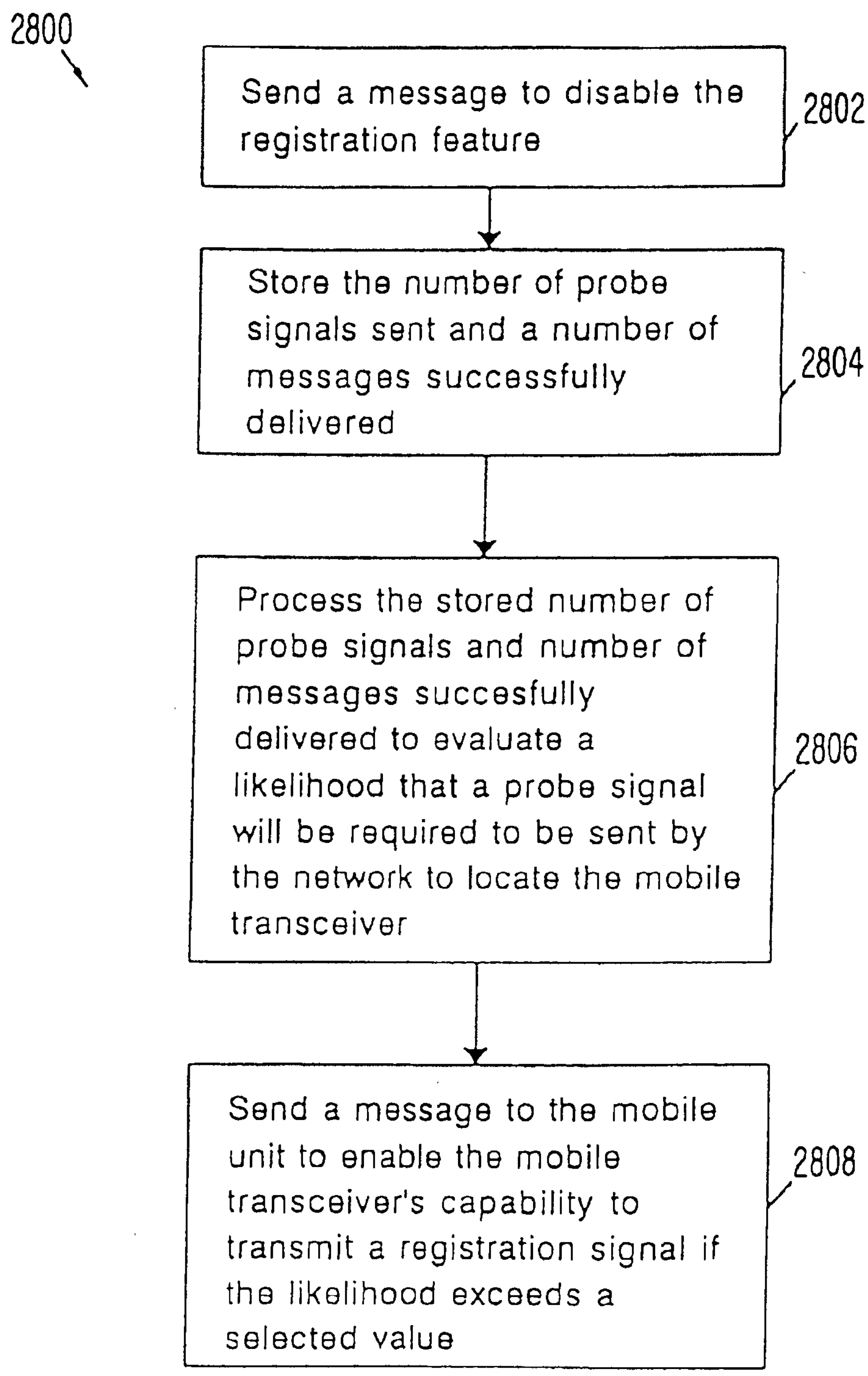

2800
Send a message to disable the registration feature
2802
Store the number of probe signals sent and a number of messages successfully delivered
2804
Process the stored number of probe signals and number of messages succesfully delivered to evaluate a likelihood that a probe signal will be required to be sent by the network to locate the mobile transceiver
2806
Send a message to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2808

FIG. 28(B)

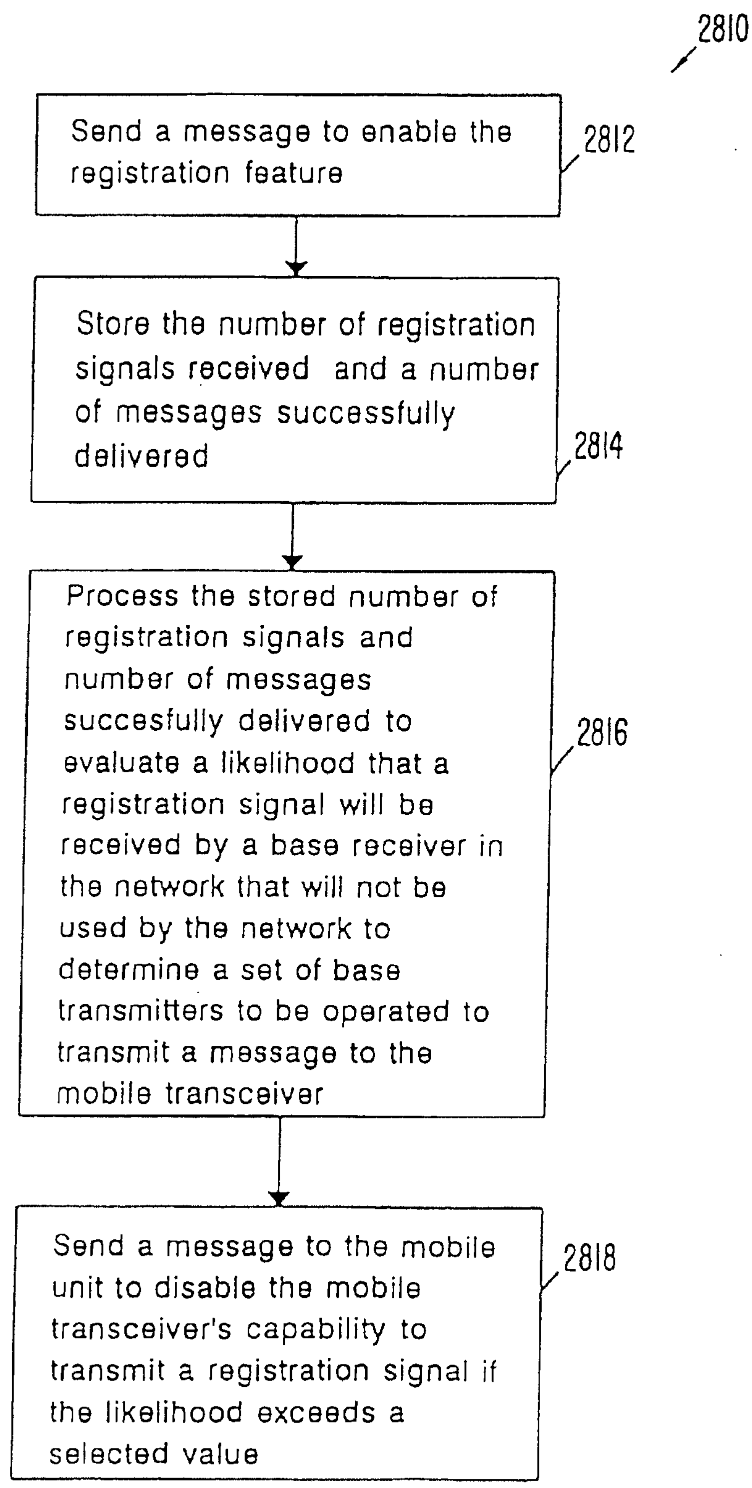

2810
Send a message to enable the registration feature
2812
Store the number of registration signals received and a number of messages successfully delivered
2814
Process the stored number of registration signals and number of messages succesfully delivered to evaluate a likelihood that a registration signal will be received by a base receiver in the network that will not be used by the network to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver
2816
Send a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2818

FIG. 29(B)

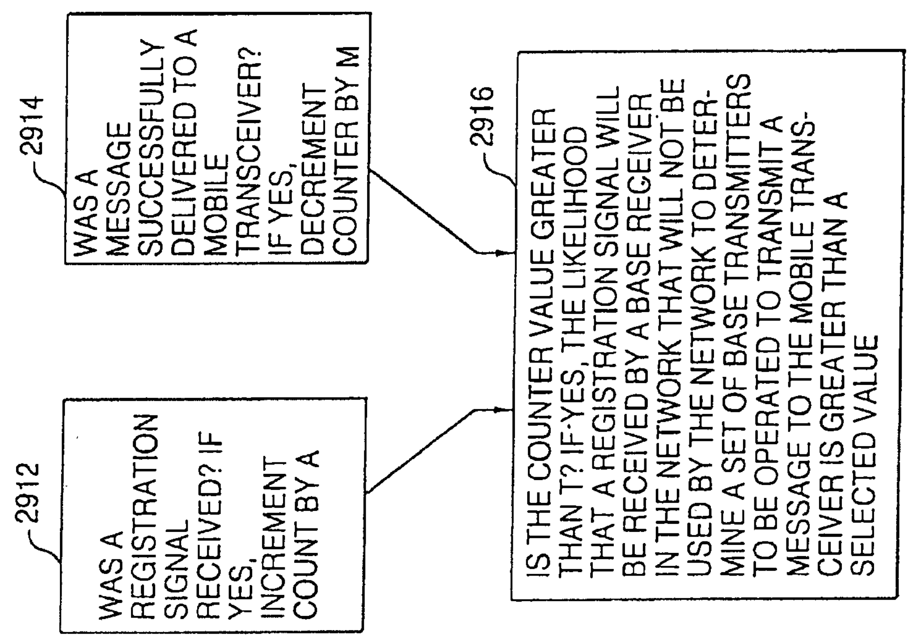
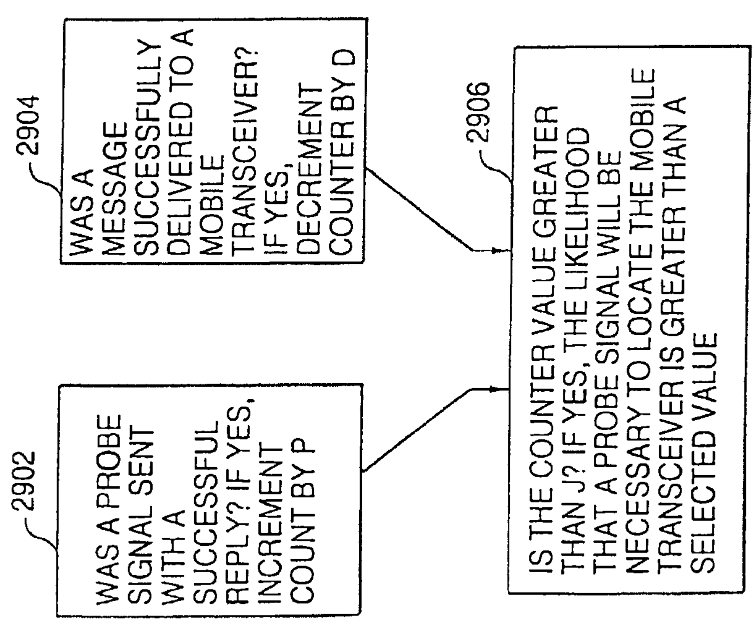


FIG. 29(A)



METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

This application is a continuation of application Ser. No. 08/760,457, filed Dec. 6, 1996, now abandoned, which is a Rule 60 continuation of prior application Ser. No. 07/973,918, filed Nov. 12, 1992, now U.S. Pat. No. 5,590,403.

BACKGROUND OF THE INVENTION

A. Field of the Invention

The present invention relates to methods and systems for providing two-way communication capability between a central network and a mobile unit over a relatively large area, and more particularly to such methods and systems which allow for rapid communication of large messages and efficient use of system resources.

B. Description of the Related Art

Conventional two-way portable/mobile wireless messaging systems often provide a variety of services to subscribers. Conventional messaging systems in particular provide one-way services using store and forward techniques to mobile receivers carried by the subscriber. A fundamental goal of two-way messaging systems is to provide a network of interconnected transmitters and receivers which provides sufficient transmitted signal strength and receive capability to uniformly cover a geographic region. Some conventional messaging systems provide the message to the user on a small viewing screen on the mobile unit.

However, such conventional systems often suffer from problems associated with low system throughput, evidenced by slow message delivery and message size limitations and do not provide an acknowledgment feature wherein the mobile unit transmits an acknowledgment signal to the system to acknowledge receipt of the message from the system. Generally, system throughput refers to overall communication capability of a system as defined by the total amount of message data from the system to the mobile units transferred by the system during a given period of time divided by the frequency bandwidth necessary to transmit the message data and may be measured in bits transferred per Hz. Further, such conventional systems suffer from technical problems preventing consistent wide area coverage and would require extremely wide portions of valuable frequency bandwidth to achieve acceptable system throughput rates.

Simulcast technology in communication systems was originally developed to extend transmitter coverage beyond that which could be obtained from a single transmitter. Over time, however, simulcasting has evolved into a technique capable of providing continuous coverage to a large area.

Generally, simulcast technology provides multiple transmitters, operating on substantially the same frequencies and transmitting the same information positioned to cover extended areas. As shown in FIG. **1**, transmitter **100** generally provides coverage over area A, D, and E, transmitter **102** generally provides coverage over area B, D, and E, and transmitter **104** generally provides coverage over area C, E, and F. In some cases, the coverage area of a first transmitter may be entirely enclosed within the coverage area of another transmitter, such as in building interiors and valleys. In areas where one (and only one) transmitter dominates (e.g., areas A, B, and C in FIG. **1**), simulcast is effective because the other transmitters do not significantly affect receivers in those areas.

However, in "overlap" areas D, E, and F shown in FIG. **1**, where the signals from two or more transmitters are approximately equal, problems can arise because destructive interference of signals occurs in these overlap areas such as areas D, E, and F. Destructive interference occurs when the two signals are equal in magnitude and 180° out of phase and completely cancel each other. While there were some successes, reliable design procedures were not available.

Attempting to precisely synchronize the carrier frequencies of all simulcast transmitters does not overcome the problem because points (i.e. nodes) at which destructive summing occurred persisted for long periods of time. At such points, a mobile receiver can not receive the simulcast signal.

Deliberately offsetting the carrier frequencies of adjacent transmitters can ensure that destructive interference does not persist at one point for an extended period of time. The slight errors in frequency displayed by high quality reference oscillators (e.g., 20 hertz errors in 100 MHz signals or a few parts in **107**) render deliberate offsetting unnecessary. Further, merely offsetting the carrier frequencies could not guarantee acceptable quality demodulation because proper alignment of the modulating signals in time is also required.

FIG. **2** displays the situation at, for example, point D in FIG. **1** when modulating waveforms are synchronized and includes coverage boundary **202** from a first transmitter and a second transmitter coverage boundary **204** from a second adjacent transmitter. An equi-signal boundary **200** exists where the signals from the first and second transmitters have approximately equal signal strengths. A more realistic equi-signal boundary would take into account natural and man-made topography and propagation conditions, and therefore would probably not be a straight line.

FIGS. **3** and **4** generally illustrate various signals as they may occur at or near the equi-signal boundary **200** as shown in FIG. **2**. In particular, FIGS. **3** and **4** illustrate various aspects of modulation synchronization and how altering transmission parameters may affect the synchronization. In general, there are at least three sources which cause the signals from the first transmitter and the second transmitter to be out of synchronization: (1) timing shifts in the delivery of the modulating waveform to each of the transmitters; (2) timing shifts internal to each transmitter; and (3) timing shifts caused by propagation distances and anomalies. From the perspective of a receiver located in an overlap area, these three sources of timing shifts combine to produce an overall timing shifts between the received signals from the first and second transmitters. In current commercial practice, the summation of these three components results in time shifts of about 200 microseconds. The timing shift present in simulcast systems disadvantageously limits the baud rate at which information may be transferred. In general, FIGS. **3** and **4** will also illustrate how timing shifts prevents high baud rate transmissions.

A time line representation of a signal **306** from a first transmitter is shown in FIG. **3**(A) and a signal **308** from a second transmitter is shown in FIG. **3**(B), both from the perspective of a receiver located in an overlap area. Vertical dashed lines **300** represent baud intervals on the time axis. As can be seen from FIGS. **3**(A) and (B), the signals **306** and **308** are frequency modulated between a high and a low frequency value and the signals **306** and **308** are exactly in phase. As will be appreciated, the timing shift between signals **306** and **308** must be small when compared to the baud interval shown in FIGS. **3**(A) and (B) since signals **306** and **308** are in synchronization. Of course, as the baud interval decreases, the timing shifts will likely cause signals **306** and **308** to be out of synchronization.

FIGS. 3(C), (D), and (E) show the summation of these two signals **306** and **308** at an equi-signal boundary, such as boundary **200** in FIG. **2**. FIG. 3(C) shows a composite signal **310** indicating that the frequency information remains unchanged, FIG. **3**(D) shows a linear graph **312** of the relative phase difference caused by a slight carrier frequency difference between the signals from the first transmitter and the second transmitter. FIG. 3(E) shows a composite amplitude signal **314**. A noise threshold is indicated by the horizontal dashed line **304** in FIG. 3(E).

Of interest, FIG. **3**(E) shows the composite amplitude signal **314** dipping below the noise threshold **304** at an anti-phase condition **302** (e.g., when the relative phase angle is ±180°, as shown in FIG. **3**(D)). As can be seen from FIG. 3(E), the anti-phase condition **302** caused by the slight phase shift between transmitter **1** and transmitter **2** will not cause any loss of data because the anti-phase condition persists for only a small portion of the baud interval.

The slight offset of the carrier frequencies between the first and second transmitters causes a slow drift of the relative phase of the two signals, as shown in FIG. **3**(D). When the signals are ±180° out of phase, the temporary dip in the amplitude signal may cause the loss of a few bits in the composite signal, at worst. These errors can be counteracted with a conventional error correcting code, such as is commonly known.

FIG. 4 shows a set of similar signals to those in FIG. **3**, but wherein the signal **402** from the first transmitter is offset from, or out of synchronization with, the signal **404** from the second transmitter by a full baud. In particular, signal **404** lags signal **402** by one baud interval. As previously discussed, the offset of signals **402** and **404** may be caused by various timing shifts in the delivery of both signals **402** and **404** to a receiver in an overlap area. FIGS. 4(A) and (B) illustrate the extreme case where the sum of these timing shifts is equal to the baud interval shown by dashed lines **400**. As can be seen in FIG. 4(C), composite signal **406** includes a period of indeterminate frequency which undesirably covers several entire baud intervals and, therefore, successful demodulation is impossible during those baud intervals. If the baud interval were increased to minimize the effect of these timing shifts, data loss would be less likely. Therefore, it can be seen that the baud rate at which good data transfer can be accomplished is limited by the timing shifts between signals delivered to receivers in overlap areas.

Through these examples, it can be seen that high degrees of modulation synchronization make it possible to obtain good data demodulation in a simulcast system. However, the baud rate limitation of simulcast systems is a significant drawback and limits system throughput.

An alternative to simulcast for wide area coverage is assignment of orthogonal, non-overlapping subdivisions of the available system capacity to adjacent areas. Subdivisions can be made in time (e.g., broadcasting the information on the same frequency in different time slots to adjacent areas), or in frequency (e.g., broadcasting the information simultaneously on different frequencies in adjacent areas). There are several problems with such orthogonal systems, however. First, orthogonal assignments require tuning the receiver to the assigned frequency or time channel for the area in which the receiver currently resides. In the broadcast services every traveler has experienced the frustration of finding the correct channel for their favorite programs. Simulcast operation avoids the need for scanning and re-tuning as the mobile unit moves between areas. Such scanning and re-tuning also disadvantageously increases mobile unit power consumption.

Second, and more serious, the orthogonal assignment approach drastically reduces the system throughput capacity as measured in bits per Hz because anywhere from 3 to 7, or possibly more, orthogonal assignments are required to obtain continuous area coverage in most conventional orthogonal systems. This waste of capacity is somewhat recouped if the same information is not needed throughout the service area because a given piece of information is sent only to those cells where it is needed.

Conventional cellular radio service is a typical example of an orthogonal system. In cellular, the same frequencies are reused in spatially separated cells to allow different data to be transmitted to different mobile units. An example of three cellular arrangements is shown in FIG. **5** where the number of cells (N) is equal to 3, 4, and 7. Each cell (i.e., A, B, C, . . .) in conventional cellular service usually only includes a single transmitter and operates in a different frequency or time division within the communication protocol. As shown in FIG. **5**, cellular service generally locates transmitters utilizing the same division (all the "A" transmitters) far enough apart to reduce the likelihood of interference between such transmitters. As the number of cells increases, the likelihood of interference decreases. For example, with N=3 as shown by arrangement **500** in FIG. **3**, the distance between the coverage area of "A" cells is about ½ cell width, with N=4 in arrangement **502**, the distance between the coverage areas of "A" cells is slightly larger, and with N=7 in arrangement **504** the distance between "A" cells is larger than the width of one cell.

However, as the number of cells increases, the length of the individual time intervals per cell decreases for time division multiplexed systems, thereby decreasing the systems total information transfer. In frequency division systems, more cells undesirably increases the frequency bandwidth required. Therefore, system throughput in bits per Hz is decreased as the number of cells increases. Furthermore, cellular systems often require an electronic "handshake" between system and mobile unit to identify the specific cell (i.e. transmitter) in which the mobile unit is located to allow capacity reuse.

II. SUMMARY OF THE INVENTION

The systems and methods of the present invention have a wide variety of objects and advantages. The systems and methods of the present invention have as a primary object to provide a communication system with wide area coverage and high message throughput while minimizing frequency bandwidth usage.

It is an object of the invention to provide a simulcast communication system with a high data transfer rate which does not exceed the baud rate limitations of simulcast transmission.

It is a further object of the present invention to provide a communication system which provides for superior data communication integrity.

Yet another object of the invention is to provide a mobile transceiver unit which prevents unnecessary RF interference, particularly on commercial aircraft. Still further, it is an object of the invention to provide a zone based communication system which may dynamically redefine zone boundaries to improve information throughput.

Another object of the invention is to provide a zone based simulcast communication system which can effectively communicate with both mobile transceiver units located near the center of each zone as well as mobile transceiver units located within the overlap areas between two or more zones.

Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practicing the invention. The objects and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

To achieve the objects and in accordance with the purpose of the invention, as embodied and broadly described herein, the invention is directed to a method for information transmission by a plurality of transmitters to provide broad communication capability over a region of space, the information transmission occurring during at least both a first time period and a second time period and the plurality of transmitters being divided into at least a first and second set of transmitters, the method comprising the steps of (a) generating a system information signal which includes a plurality of blocks of information, (b) transmitting the system information signal to the plurality of transmitters, (c) transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period, (d) transmitting by the first set of transmitters a second block of information during the second time period, and (e) transmitting by the second set of transmitters a third block of information during the second time period.

In another embodiment, the invention is directed to a multi-carrier simulcast transmission system for transmitting in a desired frequency band a message contained in an information signal, the system comprising a first transmitter means for transmitting an information signal by generating a first plurality of carrier signals within the desired frequency band and by modulating the first plurality of carrier signals to convey the information signal, and a second transmitter means, spatially separated from the first transmitter, for transmitting the information signal in simulcast with the first transmitter by generating a second plurality of carrier signals at substantially the same frequencies as the first plurality of carrier signals and by modulating the second plurality of carrier signals to convey the information signal.

In another embodiment, the invention is directed to a communication method implemented in a computer controlled communication network for locating a mobile transceiver within a region of space, the region of space being divided into a plurality of zones with each zone serviced by at least one base transmitter and at least one base receiver, the network storing data corresponding to a zone where the mobile transceiver was last known to be located, the communication method comprising the steps of (a) transmitting a message signal by a base transmitter servicing a zone where the mobile transceiver was last known to be located, (b) transmitting a systemwide probe signal by a plurality of base transmitters servicing a plurality of zones if the mobile transceiver does not indicate receipt of the message signal from the base transmitter, (c) receiving the regional probe signal by the mobile transceiver, (d) transmitting an acknowledgment signal by the mobile transceiver in response to the received regional probe signal, (e) receiving the acknowledgment signal from the mobile transceiver by a base receiver, and (f) updating the data to reflect the zone of the base receiver that received the acknowledgment signal as the last known location of the mobile transceiver.

In yet another embodiment, the invention is directed to a method of communicating messages between a plurality of base transmitters and mobile receivers within a region of space divided into a plurality of zones with each zone having at least one base transmitter assigned thereto, the communication method comprising the steps of (a) transmitting substantially simultaneously a first information signal and a second information signal to communicate messages to the mobile receivers, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone, (b) dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone as a function of the messages to be communicated in an area, thereby creating an updated first set of base transmitters and an updated second set of base transmitters, and (c) transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters to communicate additional messages to said mobile receivers.

In another embodiment, the invention is directed to a mobile transceiver unit for transmitting messages to and receiving messages from a network comprising input means for allowing the user to input a user message to the unit, transmitter means for transmitting a radio frequency signal including the user message from the mobile unit to the network, receiver means for receiving radio frequency signals having a message from the network, signal detector means for detecting at least one type of electromagnetic signal generated external to the mobile unit and the network, and a circuit, connecting the signal detector means to the transmitter means, for disabling the transmitter means upon detection of the electromagnetic signal, thereby preventing unwanted radio frequency transmission.

In another embodiment, the invention is directed to a communication method for controlling a mobile transceiver which may communicate with a communication network controlled by a computer, the network including a plurality of base transmitters for transmitting messages from the network to the mobile transceiver and base receivers for receiving messages from the mobile transceiver, the mobile transceiver being capable of sending a registration signal to be received by a base receiver in the network to identify the mobile transceiver's location and the plurality of base transmitters in the network being capable of sending a probe signal to the mobile transceiver to cause the mobile transceiver to transmit a signal to a base receiver to identify its location, the method comprising the steps of (a) sending a message from the network to the mobile transceiver to disable the mobile transceiver's capability to transmit a registration signal, (b) storing the number of probe signals sent by the network to the mobile transceiver during a first period of time and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time, (c) processing by the computer the stored number of probe signals and number of messages successfully delivered to evaluate a likelihood that a probe signal will be required to be sent by the network to locate the mobile unit to deliver a message, and (d) sending a message to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood exceeds a selected value.

Finally, in another embodiment, the invention is directed to a communication method for controlling a mobile transceiver which may communicate with a communication network controlled by a computer, the network including a plurality of base transmitters for transmitting messages to the mobile transceiver and base receivers for receiving messages from the mobile transceiver, the mobile transceiver being capable of sending a registration signal to be received by a base receiver in the network to identify the mobile transceiver's location, the network using received registration signals to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver, the method comprising the steps of (a) sending a message from the network to the mobile transceiver to enable the mobile transceiver's capability to transmit a registration signal, (b) storing the number of registration signals from the mobile transceiver to the network during a first period of time and the number of messages successfully delivered to the mobile transceiver by the network during a period of time, (c) processing the stored number of registration signals and number of messages successfully delivered to evaluate a likelihood that a registration signal from said mobile unit will not be used by the network to determine a set of base transmitters, and (d) sending a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

III. BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several embodiments of the invention and together with the description, serve to explain the principles of the invention.

FIG. **1** is a schematic diagram of an arrangement of simulcast transmitters;

FIG. **2** is a schematic diagram of uniform smooth earth propagation;

FIG. **3** is a schematic diagram of synchronized modulated waveforms;

FIG. **4** is a schematic diagram of modulated waveforms offset a full baud;

FIG. **5** is a schematic diagram of cellular system coverage;

FIG. **6** is a schematic diagram of a communication system;

FIG. **7** is a flow chart of a preferred method of communication;

FIG. **8** is a flow chart of a preferred method of sending a regional probe signal;

FIG. **9** is a schematic diagram of a frequency spectrum for multi-carrier modulation;

FIG. **10** is a schematic diagram of an on/off keying modulator;

FIG. **11** is a schematic diagram of a frequency shift keying modulator;

FIG. **12** is a schematic diagram of a four carrier quadrature modulator;

FIG. **13** is a schematic diagram of a first embodiment of a base transmitter;

FIG. **14** is a schematic diagram of a second embodiment of a base transmitter;

FIG. **15** is a schematic diagram of a mobile transceiver;

FIG. **16** is a pictorial representation of a mobile transceiver;

FIG. **17** is a schematic diagram of a mobile receiver;

FIG. **18**(A) is a schematic diagram of an analog base receiver;

FIG. **18**(B) is a schematic diagram of a digital base receiver;

FIG. **19** is a schematic diagram of a base receiver with a store and forward feature;

FIG. **20** is a schematic diagram of a network operations center;

FIG. **21** is a schematic diagram of a database structure;

FIG. **22** is a schematic diagram of a traffic database;

FIG. **23** is a schematic diagram of a service queue;

FIG. **24** is a schematic diagram of a base transmitter database;

FIG. **25** is a schematic diagram of dynamically changing zonal assignments;

FIG. **26** is a flow chart of a preferred method of dynamically zonal reassignment;

FIG. **27**(A) is a schematic diagram of the cycle protocol;

FIG. **27**(B) is a schematic diagram of the forward batch interval protocol;

FIG. **27**(C) is a schematic diagram of the individual batch protocol;

FIG. **28**(A) is a flow chart of a preferred method to enable the registration feature of a mobile unit;

FIG. **28**(B) is a flow chart of a preferred method to disable the registration feature of a mobile unit;

FIG. **29**(A) is a flow chart of a preferred evaluation method used to enable the registration feature; and

FIG. **29**(B) is a flow chart of a preferred method used to disable the registration feature.

IV. DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments and exemplary embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

A. Overview of The System Hardware

FIG. **6** shows an overview of the major elements of a preferred communication system according to the present invention. As shown therein, the communication system includes a network operations center **600** which is connected to a satellite uplink **602** via data path **604**. A satellite uplink is used to provide data to satellite **606**. Satellite **606** redirects the received data to several satellite downlink stations including station **608** and station **610**. Conventional satellite technology allows for nominal data transfer rates of 24 M bits/second. Further, conventional satellite technology allows for accurate delivery of data to stations **608** and **610**, which allows for precise synchronization between the signals broadcast in simulcast by the stations **608** and **610**. It should be understood that stations **608** and **610** may optionally receive identical data, or may individually receive different data simultaneously from the satellite **606**.

Satellite downlink stations **608** and **610** are connected to spatially separated base transmitters **612** and **614** via data paths **616** and **618**, respectively. Base transmitter **612** is connected to antenna **620**, and base transmitter **614** is connected to antenna **622**. Preferably, the base transmitters of the present system have a power output capability of about 350 watts, which will provide an effective transmitter coverage area of several tens of miles. Each zone preferably includes multiple transmitter stations shown as, for example, base transmitters **613** and **615** in FIG. **6** as will be evident from the following discussion.

Mobile unit **624** is connected to antenna **626** and, in the preferred embodiment, is a small, portable unit capable of being carried easily by a user and therefore is similar to conventional pagers in those aspects. More preferably, the mobile unit has both receive and transmit capability, with a nominal transmit power output of about 1 watt.

The communication system includes several base receivers **628, 630, 632**, and **634** each connected to antennas **636, 638, 640**, and **642**, respectively. Base receivers **628** and **630** are connected to a regional station **644** via data paths **646** and **648**, respectively. Base receivers **632** and **634** are connected to regional station **650** via data paths **652** and **654**, respectively. Base transmitters **612, 614** preferably have a large transmit power output capability to provide coverage to the mobile unit in areas to which communication is typically difficult, such as building interiors, and to extend the coverage area of each transmitter. An appropriate number of base receivers should be dispersed throughout the geographic area to reliably receive the signals from the mobile unit. Due to the difference in output power between base transmitters and mobile units, an overall ratio of 10 base receivers to 1 base transmitter may be appropriate, and the 2 to 1 ratio shown in FIG. **6** is merely shown for ease of illustration.

Regional station **650** is connected to the network operations center **600** via data path **656** and regional station **644** is connected to the network operations center **600** via data path **658**. The data paths **656** and **658** preferably include low cost phone lines, but may include any convenient and appropriate data transfer technology. Generally, the communication system of the present invention roughly divides various regions of space into portions called zones. Each zone must have one or preferably more base transmitters assigned to it. Zone boundaries are roughly defined by the transmitter coverage areas of the base transmitters assigned to that zone. For example, FIG. **6** shows a dashed zone dividing line **660** roughly dividing a zone **1** from a zone **2**. Zone **1** includes base transmitter **614**, base receivers **632** and **634**, regional station **650**, and mobile unit **624**. Zone **2** includes base transmitter **612**, base receivers **628** and **630**, and regional station **644**. Dashed line **660** only roughly defines the boundary between zones because precise boundaries do not exist. For example, to insure adequate coverage of the region, as shown in FIG. **1**, the range of both transmitter **614** should at least cover the region above dashed line **660**, and preferably should extend somewhat below dashed line **660**. Similarly, the range of base transmitter **612** should at least cover the region below dashed line **660**, and preferably should extend somewhat above dashed line **660**. As can be seen, an overlap of transmitter coverage may occur in the vicinity of dashed line **660**.

Referring back to FIG. **2**, it can be seen that boundary **202** and boundary **204** overlap in an area near the equi-signal **200** and between these boundaries which may be termed an "overlap area." In FIG. **6**, dashed line **660** is drawn near the may be defined as the equi-signal boundary between base transmitter **614** and base transmitter **612**. Of course, dashed line **660** does not represent the overlap area that may occur between base transmitter **614** and base transmitter **612**.

As explained in the Background of the Invention section, if base transmitters **612** and **614** are broadcasting identical signals on the same frequencies in simulcast, good reception by a receiver located near the dashed line **660**, and possibly in an overlap area (not shown), can be achieved. Simulcast thus may provide uniform transmitter coverage for the region shown in FIG. **6**. However, if base transmitter **612** is broadcasting a first information signal and base transmitter **614** is broadcasting a different, second information signal on identical frequencies simultaneously, it will likely be difficult for a receiver located in the overlap area to receive either the first or the second information signal. In this instance, the overlap area may be referred to as an interference area because a receiver in this area would receive a composite signal, including the first and second information signal, that would likely be unusable.

The following will be an exemplary discussion of the various interactions of the elements of the communication system when delivering a message to mobile unit **624**. In accordance with the invention, a preferred method **700** of this interaction is shown in

FIG. **7**. Network operations center **600** generates a system information signal of several blocks of information as shown in step **702**. The blocks of information include an electronic message to be delivered to the mobile unit **624**.

In step **704**, the system information signal is transmitted to the base transmitters. In particular the network operations center **600** provide the system information signal and appropriate other data to the satellite uplink **602** via data path **604** for transmission to the satellite **606**. The data is then received and retransmitted by satellite **606** to satellite downlink stations **608** land **610**. The data received by satellite downlink **608** is provided to base transmitter **612** through data path **616**, and the data received by satellite downlink **610** is provided to base transmitter **614** through data path **618**.

At this point, the exemplary communication system shown in FIG. **6** may transfer the message to the mobile unit during one of two time intervals. In the first time interval, both base transmitter **612** and base transmitter **614** transmit data via antenna **620** and antenna **622**, respectively, in simulcast to be received by mobile unit **624**, which corresponds to step **706** in FIG. **7**. This first alternative may be useful to deliver the message if, for example, the location of mobile unit **624** in zone **1** or zone **2** is unknown and broad coverage is desired.

In the second time interval, base transmitter **614** transmits a block of information including the message data to mobile unit **624** and base transmitter **612** transmits another block of information, which corresponds to steps **708** and **710** of FIG. **7**. This second alternative may be useful if, for example, the mobile unit **624** is liknown to be located in zone **1** and out of range of base transmitter **612**. Delivery of the message to mobile unit **624** during the second time interval is advantageous because during message delivery to the mobile unit **624** by base transmitter **614**, base transmitter **612** could be delivering a different message to a different mobile unit (not shown). As can be seen, this second alternative would increase information throughput and system efficiency.

If the mobile unit **624** has properly received the message via antenna **626**, then the mobile unit **624** may generate a return signal Hand broadcast that signal via antenna **626**. The return signal may be received by any or several of the base receivers **628, 630, 632**, or **634**. For example, the return signal could be received by base receiver **632** through antenna **640** if antenna **640** is located closer to the mobile units than any other antenna **636, 638**, or **642**. In this case, the base receiver would receive the return signal and provide it to regional station **650** through data path **652**. The regional station would then provide the return signal to the network operations center **600** through data path **656** for further processing as appropriate. It should be understood that a return signal may include either an autonomous acknowledgment signal which indicates that the mobile unit accurately received the message or a user generated reply signal.

If the mobile unit **624** does not completely receive the message, it can generate and broadcast a negative acknowledge signal. The negative acknowledge signals when delivered to the network operations center **600**, indicates that retransmission of the message is necessary.

It should be understood that the exemplary system shown in FIG. **6** includes a modest number of elements for ease of explanation. It is envisioned that the system of the present invention include a large number of base transmitters, base receivers, regional stations, and mobile units with a substantial number of base transmitters assigned to each zone and all base transmitters assigned to a particular zone operating in simulcast. Further, it is envisioned that the present system could advantageously support a large number of zones to cover a wide geographic area.

B. Overview of the Zonal Simulcast Concepts

The preferred systems and methods of the present invention variously use simulcast techniques within individual zones and over several or all of the zones. As previously noted, zones are generally defined by the coverage areas of the one or more base transmitters. The network operations center **600** assigns each base transmitter in the system to a zone. For example, in FIG. **6**, base transmitter **614** is assigned to zone **1**, and the base transmitter **612** is assigned to zone **2** by the network operations center **600**. To maximize information throughput, the systems and methods of the present invention dynamically control zonal assignments and the use of simulcast techniques.

In general, the communication system of the present invention operates by repeating a communication cycle to achieve desired information transfer, which is more fully discussed infra. The communication cycle is divided into a systemwide time interval and a zonal time interval. In the systemwide time interval, the base transmitters from at least several zones are operated in simulcast to simultaneously transmit identical information to a large geographic area. It should be understood that the systemwide time merely two or more zones.

Broadly speaking, the communication system need not know the location of a mobile unit to transmit to it during the systemwide time interval. Therefore, the systemwide time interval can be used to send a "probe" signal that requests a particular mobile unit to broadcast an acknowledgment signal to allow the system to determine its approximate location by determining which base receiver receives the acknowledgment signal. Probe signals, thereby, may be used to track the locations of mobile units, or to uncover the location of "lost" mobile units.

In the zonal time interval, each base transmitter assigned to a particular zone transmits identical information in simulcast. However, for mobile units at or near the interference areas between adjacent zones, poor communication to those mobile units is likely during the zonal time interval because transmitters in adjacent zones will be simultaneously transmitting different data on the same, or substantially the same, frequencies. The zonal time interval provides good communication capability for mobile units not located near the zonal boundaries and allows the system to "reuse" identical frequencies in adjacent zones. Furthermore, if zonal boundaries are selected to be located in areas where mobile units are not likely to be located, i.e. unpopulated areas, the likelihood of providing good communication capabilities to a large percentage of mobile units can be increased.

As can be seen, from a system perspective, it is desirable to communicate with the mobile units in the zonal time interval because information throughput is maximized by reusing the transmission frequency band in the several zones. In other words, using the zonal time interval allows communication with a large number of mobile units in a short amount of time. Accordingly, communication during the systemwide time interval should be minimized because message transmission during this interval requires a large amount of system resources be dedicated to that message.

For mobile units located near the boundaries between zones where interference is likely during the zonal time interval, good communication capability can be achieved for these units during the systemwide time interval. In the preferred systems and methods, when a mobile unit fails to acknowledge a message sent during the zonal time interval or provides a negative acknowledgement, the network operations center sends a probe signal during a subsequent systemwide time interval to determine the location of that mobile unit. If the location of the mobile unit indicates that a likely reason for the failure of the mobile unit to receive the message is caused by inter-zonal interference, the network operations center may simply retransmit the message during the systemwide time interval. In other instances, the failure to successfully deliver a message may be simply caused by the mobile unit being located in a weak signal area within a zone. In these instances, the system may retransmit the message during the zonal time interval using an appropriate error correcting code or using a stronger error correcting code.

Alternatively, the network operations center may determine from the probe signal that the mobile unit is simply located in a different zone than the zone that the message was first sent. In this case, the network operations center preferably causes the message to be retransmitted in the appropriate zone without again using a portion of the valuable systemwide time interval.

In accordance with the invention, a preferred method **800** for sending a probe signal is shown in FIG. **8**. In step **802**, a message signal is transmitted by a base transmitter servicing a zone where the mobile transceiver was last known to be located. In particular, this may be preferably an attempt by the network to deliver a message to the mobile transceiver.

If the mobile transceiver does not indicate receipt of the message signal from the base transmitter transmitted in step **802**, the network assumes that the mobile transceiver has not received the message and transmits a probe signal by a plurality of base transmitters servicing a plurality of zones in step **804**. The mobile transceiver receives the probe signal in step **806**.

Upon receipt of the probe signal by the mobile transceiver, the mobile transceiver transmits an acknowledgment signal in step **1808**. A base receiver receives the acknowledgment signal from the mobile transceiver in step **810**.

Finally the data, such as the last location field **2104** shown in user database **2100**, is updated to reflect the zone of the base receiver, or receivers, that receives the acknowledgment signal as the last known location of the mobile transceiver in step **812**.

C. The Multi-Carrier Modulation Transmission Format

The base transmitters of the communication system, such as base transmitters **612** and **614** shown in FIG. **6**, preferably utilize a multi-carrier modulation format as will now be described. In general, a multi-carrier modulation format envisions the simultaneous transmission of several closely spaced carrier frequencies within a desired frequency band, each individually modulated to convey an information signal. The multi-carrier modulation format advantageously allows for high data transfer rates by providing good bit rate transmission rates while keeping below the baud rate limitations of simulcast transmission techniques.

FIG. **9** shows a frequency representation **900** of an eight carrier modulation format. Carrier frequency **902** is shown with side bands **904**, carrier frequency **906** is shown with side bands **908**, carrier frequency **910** is shown with side bands **912**, carrier frequency **914** is shown with side bands **916**, carrier frequency **918** is shown with side bands **920**, carrier frequency **922** is shown with side bands **924**, carrier frequency **926** is shown with side bands **928**, and carrier frequency **930** is shown with side bands **932**.

It should be understood that although this exemplary figure shows an eight carrier signal modulation format, other different numbers of carrier frequencies may be considered for use in the systems and methods of the present invention.

In this exemplary embodiment, the carrier frequencies are spaced 3 KHz apart within a desired frequency band of 50 KHz. Dashed line skirts **934** and **936** represent minimum frequency roll off levels, such as may be required by Federal Communication Commission regulations, to prevent overlap interference into adjacent frequency bands.

Because eight unique data streams may be modulated onto the respective eight carrier signals in this embodiment, the data transfer rate of the transmission from the base transmitters can be greatly increased, while keeping the baud rate within acceptable ranges for simulcast transmission. It should also be understood that in accordance with good simulcast practice, the respective carrier frequencies between adjacent base transmitters, such as base transmitter **612** and base transmitter **614** in FIG. **6**, should be slightly offset to prevent sustained nodes or "dead spots" where destructive interference between the signals from each transmitter provides an unusable composite signal, as was explained in the background section of this application. This frequency offset is preferably on the order of 10–20 hertz.

As previously discussed, each carrier signal may be individually modulated to convey a data stream. The following will discuss alternative techniques for modulating a plurality of carriers in accordance with the systems and methods of the present, invention.

1. Modulated On/Off Keying

Perhaps the simplest modulation scheme conceptually is modulated on/off keying (MOOK). FIG. **10** shows a schematic representation of a MOOK modulator **1000**. The MOOK modulator **1000** includes a plurality of carrier frequency generating devices, such as frequency generator **1002** generating frequency F1, frequency generator **1004** generating frequency F2, frequency generator **1006** generating frequency F3, frequency generator **1008** generating frequency F4, and frequency generator **1010** generating frequency Fn. As shown in FIG. **10**, the MOOK modulator **1000** may include any number (i.e. n) of frequency generators, but eight carrier frequencies are preferred, as shown in FIG. **9**.

The output from each of the carrier frequency generators **102**, **104**, **106**, **108**, and **110** is applied to a plurality of respective switches SW1 **812**, SW2 **814**, SW3 **816**, SW4 **818**, and SWn **820**. The output from each switch is provided to a combiner **1022**.

Each of the switches SWl **812**, Sw2 **814**, SW3 **816**, Sw4 **818**, and SWn **820** opens and closes under the control of a control logic system (not shown) to effect the MOOK modulation. The control logic system (not shown) causes the desired switches to variously iclose and open, thereby conveying an n-bit binary word. Each carrier frequency transmits a binary "one" if the respective switch is closed and a binary "zero" if the respective switch is

The summer **1022** combines the modulated carrier frequencies to provide a multi-carrier modulated output signal that conveys an n-bit binary word.

2. Binary Frequency Shift Keying Modulation

An alternative multi-carrier modulation scheme including frequency shift keying (FSK) techniques may be implemented by the modulator shown in FIG. **11**. A frequency shift keying modulator **1100** includes a first frequency source **1102**, a second frequency source **1104**, a third frequency source **1106**, a fourth frequency source **1108**, and an nth frequency source **1110**. The output from each frequency source is provided to a respective modulator **1112**, **1114**, **1116**, **1118**, and **1120**.

A control logic system (not shown) provides a frequency control signal to each modulator to frequency shift modulate the carrier frequencies. In particular, the control logic system (not shown) provides frequency control signal **1** to modulator **1112**, frequency control signal **2** to modulator **1114**, frequency control signal **3** to modulator **1116**, frequency signal **4** to modulator **1118**, land frequency control signal n to modulator **1120**. In binary frequency shift keying (BFSK), the respective frequency control signals provide data corresponding to a binary "one" or "zero" which causes the respective modulators to modulate a first or second frequency onto the carrier signal.

A summer **1122** combines the modulated carrier frequencies to produce an output signal.

3. M'ary Frequency Shift Keying Modulation

A modulation scheme related to binary frequency shift keying is M'ary frequency shift keying. M'ary frequency shift keying modulates three or more different frequencies onto the respective carrier signals. In quaternary frequency shift keying, for example, two bits of information may be instantaneously conveyed on a single carrier frequency. Similarly, **8**'ary frequency shift keying may instantaneously convey three bits of information per carrier frequency.

Referring again to FIG. **11**, M'ary frequency shift keying may be implemented by providing modulators **1112**, **1114**, **1116**, **1118**, and **1120** with the capability to modulate M different frequencies onto the carrier signal. Accordingly, the various frequency control signals must provide data indicating which of the M frequencies is to be modulated onto the carrier signal. For example, in quaternary frequency shift keying, the frequency control signals must each include two bits of information to indicate which of the four different frequencies are to be modulated onto the carrier frequency.

The summer **1122** combines the modulated carrier frequencies to produce an output signal.

4. Quadrature Amplitude Multi-Carrier Modulation

Yet another alternative modulation technique for a multicarrier transmission format is shown in FIG. **12**. A quadrature modulator **1200** includes a first quadrature carrier generator **1202**, a second quadrature carrier generator **1204**, a third quadrature carrier generator **1206**, and a fourth quadrature carrier generator **1208**. As is well known, quadrature modulators lin general each produce an in-phase carrier signal and a quadrature carrier signal that is ±90° out of phase with reference to the in-phase signal. Of course, any number of quadrature carrier generators could be envisioned, depending upon data transfer and throughput needs. FIG. **12** shows four quadrature carrier generations which effectively correspond to eight unique modulator signals. Therefore, quadrature amplitude multi-carrier modulation may preferably reduce the width of the frequency band necessary to achieve a desired data transfer rate.

Each quadrature carrier generator **1202**, **1204**, **1206**, and **1208** receives a control signal from a control logic system (not shown) which provides the data to be modulated onto the quadrature carrier signals. In a simple implementation, the quadrature carrier generators may amplitude modulate the in-phase and quadrature phase output signals to convey two bits of information. The in-phase and quadrature signals output from each quadrature carrier generators **1202**, **1204**, **1206**, and **1208** are provided to a summer **1210** which combines the signals to produce an output signal.

5. Permutation Frequency Shift Kevinq (PFSK)

PFSK may be implemented through control logic systems similar to that used in a MOOK or an M'ary FSK modulation scheme. In PFSK, every baud has a fixed number of carrier signals present, preferably any 4 of the possible 8. In a PFSK arrangement, a constant average transmitter power is advantageously delivered and the receiver only need decide which 4 carrier frequencies contain the most energy. In the case of MOOK, the receiver must attempt to determine on a subchannel-by-subchannel basis the presence or absence of a signal. This aspect of PFSK may simplify mobile receiver design.

Compared to a binary or M'ary FSK modulation schemes, a higher number of bits may be delivered per baud with PFSK. For example, PFSK may generate signals that independent FSK subchannels could never generate, such as all four carriers being the four highest frequencies, and therefore it can be seen that PFSK may advantageously increase information transfer rates.

D. The Base Transmitter

Each base transmitter unit, such as base transmitter **612** or **614** shown in FIG. **6**, receives transmitter control data and message data transmitted from the satellite **606**. FIG. **13** shows a first preferred embodiment of a base transmitter **1300** in accordance with the present invention. The base transmitter **1300** receives data from the satellite downlink connected to data input **1302** which provides this data to a control logic system **1304** to control the operation of the base transmitter unit. The control logic **1304** provides a control signal to a plurality of modulators **1306**, **1308**, **1310**, **1312**, and **1314**. Modulator **1306** produces a carrier signal F1, modulator **1308** produces a carrier signal F2, modulator **1310** produces a carrier signal F3, modulator **1312** produces a carrier signal F4, and modulator **1314** produces a carrier signal Fn.

For example, the control logic may generate appropriate control signals to modulate the carrier signals in a MOOK, BFSK, M'ary FSK, PFSK, or quadrature amplitude modulation scheme, as previously discussed. Each modulator then provides the modulated output signal to a combiner **1316** which combines each of the several modulated carrier frequencies into a single output signal.

The single signal is then applied to a power amplifier **1318** to amplify this signal to an appropriate level. The power amplifier **1318** may, for example, produce a nominal output signal of 350 watts to antenna **1320**. In this embodiment, power amplifier **11318** preferably has extremely linear characteristics to prevent formation of intermodulation products, and to insure that these intermodulation products do not cause signals to be generated at undesirable frequencies. Antenna **1320** broadcasts the desired signal from power amplifier **1318**.

FIG. **14** shows a second preferred embodiment of a base transmitter unit. The second embodiment comprises a base transmitter **1400** which includes a satellite downlink connected to data input **1402**, control logic **1404**, and several modulators **1406**, **1408**, **1410**, **1412**, and **1414**. Each modulator receives an appropriate control signal from the control logic **1404**, as previously discussed with respect to base transmitter **1300**.

The output from each of modulators **1406**, **1408**, **1410**, **1412**, and **1414** in base transmitter **1400** is provided to respective power amplifiers **1416**, **1418**, **1420**, **1422**, and **1424** to provide an appropriate power output level for transmission, such as 350 watts aggregate.

The output from each of power amplifiers **1416**, **1418**, **1420**, **1422**, and **1424** is provided to combiner **1426** to combine the modulated carrier signals into a single output signal which is provided to antenna **1428** for broadcast.

E. The Mobile Unit

The mobile unit may be a small, portable mobile transceiver, such as pictorially represented in FIG. **16**. Referring now to FIG. **15**, the mobile transceiver **1500** shown therein includes a receiver section for receiving signals from the base transmitters of the system, and a transmitter section for transmitting replies, or other messages, to the base receivers of the system.

In particular, the mobile transceiver **1500** includes an antenna **1502** which is connected to a transmit/receive switch **1504** to switch the antenna between the transmit and receive sections of the mobile transceiver **1500**. A receiver **1506** is provided to receive the messages from the base transmitter. Of course, the receiver must be appropriately designed to receive the multi-carrier signals from the base transmitters and must be appropriately designed to demodulate the particular modulation scheme utilized. For example, appropriate analog filters and appropriate demodulators could be used. In the preferred embodiment, the receiver performs a transform, such as a fast fourier transform, on the received signal to separate the data from the various carriers in the multi-carrier modulation format.

The receiver **1506** is connected to a display and storage logic section **1508** to process the received signal. An annunciator **1510** to alert the user that a message has been received is connected to and controlled by the display and storage logic **1508**. The annunciator **1510** may commonly include a sound producing device such as a beeper, or a vibrator, or a flashing light.

A set of display controls **1512** to control the display of the mobile transceiver **1500** is connected to the display and storage logic **1508**. A display **1514**, preferably an LCD display, is also connected to the display and storage logic **1508** to display messages and various other information to the user.

Display and storage logic **1508** is connected to transmit logic **1518** via connection **1526**. Display and storage logic **1508** may generate an autonomous acknowledge signal which causes the transmitter **1520** to broadcast an appropriately modulated RF signal. As previously discussed, it is desirable for the mobile transceiver to transmit an acknowledge signal if the message was properly received by the mobile unit, or alternatively to transmit a negative acknowledge signal if the message was only partially received. The negative acknowledge signal indicates that the network operations center should rebroadcast the message to the mobile unit.

Preferably, the rebroadcast of the message to the mobile unit should occur with an appropriate error correcting code which may be decoded by the mobile unit to insure complete and accurate reception of the message. Of course, error correcting codes should be used only when necessary because their use slows data transfer and increases the complexity of the mobile unit. Other types of autonomous replies may also be useful, for example, to indicate to the network operations center that the user has not viewed the message even though the mobile unit properly received it, such as when the mobile transceiver is unattended by the user.

A set of input switches **1516** is provided to allow the user to:

input a reply to a received message, or to otherwise generate a message to be transmitted by the mobile transceiver. The input switches are connected to transmit logic **1518** which decodes the signal from the input switches **1516** to generate an output signal to the transmitter **1520**. The transmitter **1520** generates an appropriately modulated RF signal to be broadcast by antenna **1502**.

The mobile transceiver **1500** also preferably includes a noise detector **1522**. The noise detector **1522** provides an output signal upon sensing through antenna **1502** a threshold level signal. The noise detector **1522** provides an output signal to disable the transmitter **1520** via connection **1524**, and to thereby prevent unwanted transmission by the mobile unit.

Noise detector **1522** preferably is set to detect electromagnetic signals which are generated externally to the communication system and which are indicative of a condition when transmissions by the mobile unit are undesirable. For example, the noise detector **1522** could be designed to serve a threshold level of noise at 400 Hz. When the user enters a commercial aircraft, which commonly uses 400 hertz power supply, the receipt of this noise by the noise detector **1522** would then disable the transmit capability of the mobile transceiver **1500** during operation of the aircraft to prevent any unnecessary or unwanted interference with the operations of the aircraft by autonomous or intentional transmissions by the mobile transceiver **1500**.

The display and storage logic **1508** of the mobile transceiver **1500** further preferably includes a timing circuit (not shown) which may be used to turn the receiver section **1506** on or off, as desired. The timing circuit (not shown) advantageously allows the mobile transceiver to "power down" during periods of time when messages are not anticipated to be transmitted. For example, in a preferred communication protocol, the receiver could simply power up at the beginning of each cycle to receive data to determine if a message will be transmitted to that mobile transceiver during that cycle or when information concerning message availability will be transmitted. If the mobile transceiver is to receive a message, the timing circuit could power up at the appropriate time to receive the message, and then power down after receipt. The timing circuit, therefore, advantageously prolongs the battery life of the mobile transceiver **1500**. Of course, it should be understood that the timing circuit could control the other elements of the mobile transceiver, such as the display **1514**, and the transmit logic **1518**.

In an alternate implementation, the receiver **1506** may adaptively change its demodulation techniques to accommodate various formats. For example, each zone may advantageously use a different modulation format depending on message traffic levels, and other considerations. In particular, the receiver may receive a signal indicating the modulation scheme utilized in a given zone via a modulation format message contained in an overhead portion of the data stream. The demodulation of FSK, M'ary FSK, PFSK, and MOOK formats all begin with the determination of the energy levels detected at each of the carrier frequencies, and thus require identical processing of the received RF energy. The logic (not shown) in the receiver interprets the meaning of these measured energy levels based upon the modulation scheme selected as indicated by the received modulation format message. In this manner simpler and more economical transmitters, with a decreased capacity for information transfer, can be used in zones that have decreased traffic loads and more expensive, high-throughput transmitters can be used only in those areas where they are needed.

A pictorial representation of the mobile transceiver is shown in FIG. **16**. The mobile transceiver **1600** shown therein includes a case **1602**, a pair of display control buttons **1604**, a display **1606**, and a set of six reply buttons **1608**, **1610**, **1612**, **1614**, **1616**, and **1618**. As indicated previously, display **1606** is preferably an LCD display and a set of display control buttons **1604** may be used to scroll text up or down on the display **1606**. The message "will you be home for dinner?" is shown on display **1606**.

The set of six reply buttons **1608**, **1610**, **1612**, **1614**, **1616**, land **1618** provide a flexible system for user generated replies to received messages. The display and storage logic **1508** provides information immediately above each button indicating a possible reply message by the user. In the simple example shown in FIG. **16**, the user may reply "yes," "no," or "?" to the message **620** displayed on the screen **1606**. The transmit logic **1518** generates an appropriate signal based upon which button the user presses. In this simple scenario, buttons **1614**, **1616**, and **1618** are unused.

In alternate applications, up to six possible reply messages may be shown on the screen **1606**. Of course, other particularized applications may be envisioned for the reply feature of the mobile transceiver **1500**. For example, if the user is a stockbroker, the display **1606** could display the terms "buy," "sell," or "hold" above the appropriate buttons. A variety of other applications may be envisioned.

With the six button reply option provided by mobile transceiver **1500**, a three bit message may be transmitted by the mobile transceiver to the base receivers. The two remaining states of the three bit message may be used by the transmit logic **11518** for the autonomous acknowledgment signal which indicates that the message has been properly received, and for the autonomous negative acknowledgment signal which indicates that the message has not been completely or properly received.

Of course, the mobile transceiver **1500** shown in FIG. **16** could be configured differently to provide more or less reply buttons, different display control buttons, and different display formats as desired or needed by the user.

Further, the mobile transceiver **1500** could additionally include a data output port (not shown) for connection to other electronic devices of the user. For example, the mobile transceiver could be connected through an output port to a laptop or palmtop PC, or could be incorporated therein. The PC could display the message on its screen, thereby obviating the need for the display **1606**, and the keyboard could be used to generate any appropriate reply messages from the user, thereby obviating need for the reply buttons and allowing free form messages to be sent by the mobile transceiver. A user selected reply would be transferred to the mobile transceiver **1500** from the PC for transmission to the base receiver.

Alternatively, the mobile transceiver could be connected to a voice data replay device, such as a speaker, thereby allowing the user to receive messages from a voice mailbox, for example. Of course, a voice data generation device, such as a microphone, could be connected to the mobile transceiver **1500** to allow the user to reply to the voice mail message he has received or to initiate voice data communication from the mobile transceiver to the base receivers. Similarly, facsimile transmissions could be supported.

An alternate embodiment of the mobile unit includes only receive capabilities, but does not include any transmit capabilities. FIG. **17** shows a mobile receiver **1700**. The various components of the mobile receiver generally correspond in functionality to the similar elements shown in FIG. **15**. Of course, the mobile receiver **1700** cannot generate replies, which includes user initiated replies, an autonomous acknowledgment signals or negative acknowledgment signals, because of the lack of transmit capability. Also, the location of this alternate embodiment cannot be tracked by the network control center because of the lack of transmit capability. Generally, because of these reasons, the-mobile receiver **1700** embodiment of the mobile unit is less preferable than the mobile transceiver embodiment **1500**. Further, it should be appreciated that the mobile transceiver embodiment may include circuitry for generating various autonomous responses without interaction by the user.

F. The Base Receiver

The base receivers of the present system receive the low power output signal from the mobile transceiver unit. As is shown in FIG. **6**, mobile receivers are dispersed throughout the geographic service area. Base receivers need not be associated with zonal boundaries per se, but will always be located to service at least one zone, of course. A few base receivers may exist in the overlap region between zones.

During transmission of the return signal by the mobile transceiver unit, it is possible that several base receivers could receive this return signal. In this instance, the network operations center **600** preferably selects the data from the base receiver with the highest received signal strength (i.e. the signal with the lowest probability of errors) to maximize the likelihood of receiving accurate data. The signal strength approach is preferred and can be satisfactorily implemented if the base receiver locations are carefully selected to insure adequate signal strength reception from the mobile transceiver units and to minimize the overlap between base receiver coverage areas. Alternately, the network operations center **600** could use "voting" techniques by comparing each data set from the several base receivers to arrive at the most likely return signal data using conventional voting receiver technology.

FIG. **18**(A) shows a first embodiment of an analog base receiver. Analog receiver **1802** is connected to an antenna **1800**. The analog receiver **1802** simply receives the signal from the antenna **1800** and removes the modulated waveform from the carrier frequency and outputs this waveform in analog format to a regional demodulator **1804** via data path **1806**. Data path **1806** is preferably a 4 KHz analog telephone channel.

The regional demodulator **1804** receives signals from several analog receivers included in several base receivers. Preferably, the regional demodulator **1804** is located in the regional station, such as regional station **650** shown in FIG. **6**. The demodulated signal from the regional demodulator **1804** is then transferred to the regional processing circuitry **1808**, and then onto the network operations center **600**.

The analog receiver **1802** could generate identification data to be transmitted with each received message so the network operations center **600** can determine the source of each message received. Alternatively, and preferably, dedicated communication paths are used for each base receiver and therefore, the source of the message can be inferred from the communication path that is activated.

FIG. **18**(B) shows a digital base receiver embodiment which includes an antenna **1800** attached to an analog receiver **1802**. As in the previously discussed embodiment, the analog receiver **1802** removes the modulated waveform from the carrier signal transmitted by the mobile transceiver unit. The analog receiver **1802** outputs the modulated waveform to a demodulator **1810** included in the base receiver. The demodulator **1810** produces a digital output signal corresponding to the data stream transmitted by the mobile transceiver unit. The demodulator **1810** provides the digital output signal to the regional processing circuitry **1808** in the regional station via data path **1812**. Data path **1812** may be any conventional data path which can satisfactorily convey the digital data from the demodulator **1810** to the regional processing center **1808**. The regional processing circuitry **1808** then passes the data to the network operations center **600**.

FIG. **19** shows a digital base receiver including error correction and store and forward features. An antenna **1900** is connected to an analog receiver **1802** which is connected to a demodulator **1810**, as previously described with reference to FIG. **18**(B). The demodulated digital signal is output from demodulator **1810** to error correction circuitry **1906** which may perform error correction algorithms to insure the integrity of the return signal received from the mobile transceiver unit. Of course, the error correction circuitry should decode and correct data which have been compatibly encoded by the mobile transceiver.

The error corrected data output from the error correction circuitry **1906** is provided to a store and forward circuit **1908**. The store and forward circuit **1908** stores the received data to allow it to be transmitted later at a convenient time and at a convenient data transmission rate.

For example, in the present system it is likely that the return signal traffic received by the base receiver will occur in short bursts at a relatively high data transfer rate. However, it is also likely that the average data transfer rate from the base receivers is substantially lower than the instantaneous data transfer rate during traffic bursts. The store and forward circuit **1908** may preferably act as a buffer to allow the return signal data to be communicated from the store and forward circuit **1908** to the regional processing circuitry **1808** at a lower (and less expensive) data transfer rate. Store and forward circuit **1908** is, therefore, preferably connected to regional processing circuitry **1808** via data path **1910** which may include a low cost telephone line.

G. The Network Operations Center

1. Overview

The network operations center **600** is shown in schematic form in FIG. **20**. The network operations center **600** includes a base receiver input system **2000** which receives data from the various regional stations throughout the system (e.g., regional stations **644** and **650**) via various data paths, such as data paths **656** and **658** as shown in FIG. **6**. The data received by the base receiver input system **2000** includes reply data from users with various control data. Base receiver input system **2000** may include appropriate conventional signal processing equipment. Control data may include data identifying the base receiver (i.e. location of the mobile unit) which received the associated reply. Preferably, the base receiver input section **2000** receives data from the regional stations via phone lines. However, other appropriate data paths may be considered.

The base receiver input system **2000** then provides the received data to a central computer **2002**. The central computer **2002** may also receive input from a user input system **2004**. For example, the user input system **2004** may receive data from users via phone lines who may access and interact with the central computer via voice, DTMF, or modem transmission and may include appropriate conventional signal processing equipment. A user may interact with the central computer **2002** to modify his service, to initiate or receive messages, or to perform other desirable functions.

Generally, the central computer **2002** processes the data received from the base receiver input system **2000** and from the user input system **2004** to perform various operations on the data, ito update various database entries for use by the central computer **2002**, and to generate data for transmission to a satellite uplink output system **2006**.

It should be understood that, although FIG. **20** shows the central computer as existing at a single location in the network operations center **600**, a distributed computing system may be used to perform the necessary functionality of the central computer **2002**. Presently, however, a single location for the central computer **2002** is preferred.

Satellite uplink output system **2006** receives data from the central computer **2002** and provides it to satellite **606**, shown in FIG. **6**, for transmission to base transmitters within the system (e.g., base transmitters **612** and **614** in FIG. **6**).

The central computer **2002** is also connected to a database system **2008** which stores various data such as message data, user status data, system status data, and message status data, for example, for use by the central computer **2002** in processing.

Also, a control access **2010** is provided to allow systems engineers or programmers to access the central computer **2002** to observe and modify its operations and system performance.

2. Database Structure

The database **2008** of the network operations center includes several database structures necessary for the operation of the system. While a preferred partitioning of these databases is described below, it should be understood that other partitionings could be considered, such as moving the various "user traffic" fields from the traffic statistics database to the user database.

a. The User Database

For example, the user database structure shown in FIG. **21** includes a record for each user of the system who possesses a mobile unit. The record for user **1 2100** includes various fields, such as an ID number field **2102** which indicates a unique number associated with that particular user. The transmit capability field **2106** indicates whether the mobile unit assigned to the user has the capability to transmit. The last location field **2104** includes data which indicates the last known location of the user. The last location field may be updated when the central computer recognizes that a new base receiver has received a return signal from the mobile unit, thereby indicating the mobile unit has moved since the last return signal. Of course, if the mobile unit only includes a mobile receiver without transmit capability, the last location field **2104** cannot be updated and the mobile unit may be given a default location.

The service area field **2108** includes data corresponding to the area in which the user has subscribed to. For example, if a user desires service in geographic areas less than the total system service area, the central computer could use the data in the service area field **2108** to cause only selected base transmitters to attempt to transmit messages to a mobile unit.

The button format field **2110** includes data indicating the format of reply buttons the user may access on the mobile transceiver. Of course, for mobile units with only receive capabilities, the button format field will not be used.

The message field **2112** includes data representing one or more messages which are intended for the user. A receive flag is set when the central computer has received data indicating that the message has been received by the mobile unit via an acknowledgment signal. If the mobile unit does not have transmit capability, the receive flag is set upon transmission of the message by the appropriate base transmitters. The user database structure may include other fields for each user of the communication system of the present invention as needed to provide various desired services.

b. The Receiver Database

Database **2008** of FIG. **20** includes a receiver database (not shown) which includes an entry with several associated fields for each base receiver in the system. A first field for each base receiver preferably includes the total number of mobile units which have last communicated with this receiver. A second field for each base receiver preferably includes a list of base transmitters which may cover all or a portion of the receiver coverage area of that base receiver.

c. Traffic Statistics Database

Database **2008** of FIG. **20** should also include preferably a traffic statistics database as shown in FIG. **22** which includes various fields containing statistics calculated by the central computer **2002** concerning traffic patterns for the system. For example, the traffic database **2200** preferably includes a user field **2202** for data indicating a user of the network. Several fields are preferably associated with the user field **2202**. Field **2204** includes data representing the number of probe signals sent by the network to locate the mobile unit associated with the user field **2202**. Field **2206** includes data representing the number of registration signals received by the network from the mobile unit associated with the user field **2202**. Field **2208** includes data representing the number of messages from the network that have been successfully delivered to the mobile unit associated with the user field **2202**. Field **2210** may be used for other traffic related data, such as data indicating the average traffic per cycle, and data indicating a time average (i.e. for the last hour) traffic amount.

Further, the traffic database **2200** could include fields (not shown) for data concerning overall system performance and, in particular, each zone in the network. Such area specific traffic data may be useful in optimizing system performance by allowing intelligent redefinition of zonal boundaries.

d. The Service Queue

Database **2008** of FIG. **20** also includes a service queue **2300** as shown in FIG. **20**. The service queue **2300** includes a current messages queue and a probe list queue. The current messages queue includes a system wide list of messages to be delivered by the system. The current messages queue includes, for example, a series of ID number fields **2302**, **2304**, and **2306** with associated data location fields **2308**, **2310**, and **2312**, respectively. The data location fields **2308**, **2310**, and **2312** include pointers to the appropriate fields in the user database structure shown in FIG. **21**. The ID number fields **2302**, **2304**, and **2306** include data indicating the ID number of the user to which the message is to be delivered.

In operation, the central computer retrieves the ID number **2302** and data location **2308** from the top of the current messages queue and retrieves the appropriate data from the user database **2100** to process and transmit a message to the user.

The probe list queue includes a ID number fields **2314**, **2316**, and **2318** and data location fields **2320**, **2322**, and **2324** similar in form to those in the current messages queue. The probe list queue contains a list of users which the system has previously attempted unsuccessfully to deliver a message to. In other words, the users listed in the probe list are considered to be "lost" by the system. The central computer **2002** then initiates a probe routine for the ID number **2314** and data location **2320** located at the top of the probe list.

After successful execution of the probe routine, the last location field **2304** in the user database structure **2100** will have been updated to provide an accurate last location of the user from the base receiver that received the mobile unit's acknowledgment to the probe signal. After the last location field **2304** has been updated, the message can then be replaced in the current messages queue for delivery to the user via the appropriate base transmitters located near the mobile unit.

Preferably, the network operations center gives priority to the delivery of all messages in the current message queue, and then sends probe signals to the users listed in the probe list queue after delivery has been attempted for all messages in the current message queue. If the message volume in the current message queue remains high for an extended period of time, the network operations center preferably begins to periodically send probe signals to the users listed in the Probe List, even though undelivered messages remain in the current messages queue. For example, in this instance of persistent filled current messages queue, the network operation center preferably transmits three probe signals in every cycle transmitted.

e. Base Transmitter Assignment List

The database **2008** of the network operations center also includes a base transmitter database **2400** as shown in FIG. **24**. The base transmitter database **2400** includes a zonal assignment field **2404** for data representing a zone assignment associated with a base transmitter field **2402** in the system. Also, a field **2406** for data representing the base receivers in the transmitter coverage area, and a field **2408** for other data associated with a base transmitter, are associated with base transmitter field **2402**. As can be seen in FIG. **24**, each base transmitter in the network has a base transmitter field and associated fields as described above.

In normal operating conditions of the system with low amounts of message traffic being transmitted, each base transmitter will remain assigned to its particular zone. However, the systems and methods of the present invention provide for dynamically changing the zonal assignments of various base transmitters to improve information throughput. These dynamic zone allocation concepts dynamically reassign base transmitters to new zones generally based upon the volume of messages transmitted during the systemwide time interval, and more particularly based upon the localized volume of messages to mobile units. In general, dynamic zone allocation may be used to deliver messages to mobile units in overlap areas (i.e. "zonal dithering"), or to balance the volume of message traffic between zones.

FIG. **25** is useful to explain these concepts. Various base transmitters, each designated as an "X," are dispersed throughout a region of space shown in FIG. **25**. Also, various base receivers are dispersed throughout this region of space **2500**, each being designated by an "R." The normal zonal boundary for zone **1** in FIG. **25** is shown by solid line **2502**. A normal boundary for zone **2** is represented by solid line **2504** during normal load traffic operation conditions. As can be seen, base transmitters **2506**, **2508**, and **2510** are located near the zonal boundary of zone **2**, and base transmitters **2512**, **2514**, and **2516** are located near the boundary of zone **1**. Base receivers **2518** and **2520** are located in an overlap area **2521** between zones **1** and **2**. As previously discussed, mobile units located in this overlap area **2521** near base receivers **2518** and **2520** must be communicated with during the systemwide time interval because of the interference created during the zonal time interval by adjacent base transmitters.

During normal, low to moderate volume system operations, the zonal overlap area **2521**, i.e., interference area, near base receivers **2518** and **2520** will preferably have a small number of mobile units located therein. Therefore, communication with these mobile units will not significantly consume system resources by occasionally communicating with them during the systemwide time interval.

However, if the traffic volume from the overlap area **2521** near base receivers **2518** and **2520** increases, such as because additional mobile units enter this overlap area **2521**, the handling of this traffic in the systemwide time interval can significantly consume system resources. For example, communication with a large number of mobile units during the systemwide time interval may significantly delay delivery of messages to units in this and other regions.

In this instance, the zonal boundaries are changed to remove this high traffic region from a zonal overlap area. For example, system efficiency is restored if the zone **1** boundary were moved to dashed line **2522** and the zone **2** boundary were moved to dashed line **2524**.

The central computer **2002** may dynamically accomplish this zonal redefinition by assigning one or more base transmitters to a new zone to reduce systemwide time interval messages. In the present example shown in FIG. **25**, the central computer updates the base transmitter zonal assignment list to reassign base transmitters **2512**, **2514**, and **2516** to zone **2** while removing these base transmitters from zone **1**. In view of this zonal edefinition, the new zone **1** boundary is shown by dashed line **2522**, and the new zone **2** boundary is shown by dashed line **2524**. The high traffic region near base receivers **2518** and **2520** is now squarely within zone **2** and messages to these units may be efficiently delivered during subsequent zonal time interval(s).

In accordance with the invention, a preferred method **2600** for accomplishing zonal redefinition is shown in FIG. **26**. In accordance with the method, step **2602** provides for transmitting substantially simultaneously a first information signal and a second information signal, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone. For example, as shown in FIG. **25**, the base transmitters in zone **1** defined by boundary line **2502** could be the first set of base transmitters, and the base transmitters located in zone **2** defined by boundary line **2504** could be the second set of base transmitters.

Step **2604** of the method provides for dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone, thereby creating an updated first set of base transmitters and an updated second set of base transmitters. For example, base transmitters **2512**, **2514**, and **2516** could be reassigned from zone **1** to zone **2**. As shown in FIG. **25**, new zonal boundaries would be defined by dashed lines **2512** for zone **1** and **2524** for zone **2**.

Step **2606** provides transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters. For example, as shown in FIG. **25**, the base transmitters assigned to zone **1** defined by dashed line **2522** (i.e. not including base transmitters **2512**, **2514**, and **2516**) could transmit during a subsequent communication cycle a third information signal, and base transmitters in zone **2** defined by dashed line **2524** (i.e. including base transmitters **2512**, **2514**, and **2516**) could transmit a fourth information signal during that same subsequent communication cycle.

Further, it is desirable that during the redefinition of the zonal boundaries, it is insured that the new overlap area **2525** near base receiver **2526** and between dashed lines **2522** and **2524** is an area that is not likely to produce, or is not currently producing a high volume of message traffic. Generally, zonal boundaries should be preferably redefined to maximize information throughput by minimizing the data that must be transferred during the systemwide time interval. A network manager could review the overall traffic patterns and tendencies to determine an optimum redefinition of zonal boundaries. Of course, the central computer **2002** could also implement an algorithm accessing the traffic statistics database **2200** to determine optimal zonal boundary redefinition.

In a preferred embodiment in the instance where an entire region is saturated with mobile units, such as a large metropolitan area repetitive reassignments of base transmitters may be used to reduce message traffics during the systemwide time interval. There may exist no appropriate overlap area, such as overlap area **2525**, with a low traffic level to facilitate a long term reassignment of base transmitters with the resulting redefinition of zonal boundaries. In this case, the preferred embodiment alternates between a first and second set of zonal boundaries over each communication cycle and does not attempt to deliver messages during the systemwide time interval.

For example, in FIG. **25** this preferred embodiment would utilize the zonal boundaries defined by lines **2502** and **2504** during a first zonal time interval and would not attempt to deliver messages to mobile units in overlap area **2521**. In a subsequent cycle, this preferred embodiment redefines the zonal boundaries to dashed lines **2522** and **2524** and delivers messages to the mobile units in previous overlap area **2521** during the zonal time interval using zone **2** base transmitters. During this cycle, the network would not attempt to deliver messages to mobile units in overlap area **2525**. In yet a later cycle, this preferred embodiment would switch back to zonal boundaries **2502** and **2504** which would allow message delivery to mobile units in the now previous overlap area **2525** during the zonal time interval using zone **1** base transmitters. As can be seen, alternating between a first and second set of zonal boundaries advantageously reduces the need for communication during the systemwide time interval, but slows message delivery somewhat by only allowing communication to mobile units in overlap areas during zonal time intervals on alternating communication cycles.

H. The Preferred System Communication Protocol

The system communication protocol is preferably a time division protocol organized within repetitive communication cycles of preferably 30 seconds in duration.

The blocks of data transmitted by the network are preferably formed by a bit interleaving process to prevent loss of data during bursts of interference. Bit interleaving may be envisioned as stacking two or more blocks of data (which read from left to right), and then transmitting a bit stream in a column-by-column, top-to-bottom sequence. As can be seen, a burst of interference will likely only cause the loss of a few bits per word at most, which can be corrected by error correction techniques, rather than the loss of entire words. Of course, the mobile unit must appropriately deinterleave the data prior to processing.

FIG. **27** generally illustrates a variety of preferred time intervals which may variously be used for communication between the system and various sets and subsets of mobile units. An adaptable schedule for these time intervals is preferably generated, and may be revised according to system demands. The scheduling of the time intervals advantageously allows a mobile unit to "power down" during inactive time periods when the mobile unit will not transmit or receive any messages, thereby conserving battery power. Similarly, messages or information for delivery to a subset of the total number of mobile units will preferably be transmitted during time intervals which minimize the delivery of those messages or information to unintended mobile units not included in the subset to further conserve battery power.

A preferred cycle protocol **2700** is shown in FIG. **27(A)**. The cycle protocol **2700** includes a cycle header time interval **2702**, a systemwide forward (FWD) batch time interval **2704**, a systemwide response time interval **2706**, a zonal forward (FWD) batch time interval **2708**, a zonal reverse time interval **2710**, and a reverse contention time interval **2712**. Other arrangements, such as moving the systemwide reverse interval next to the zonal reverse interval may be considered if transmitter turn on time is significant.

The cycle protocol generally schedules time slots for systemwide and zonal forward channel information transfer from the network to the mobile units and for systemwide and zonal reverse channel information transfer from the mobile transceiver units to the network. Briefly, the cycle header **2702** field includes overhead or "housekeeping" information, the systemwide forward batch field **2704** and the zonal forward batch field **2708** provide forward communication capability through the base transmitters to the mobile units in a systemwide time interval and a zonal time interval, respectively. The systemwide response field **2706** and zonal reverse field **2710** provide a return signal period for the mobile transceivers to respond to messages generated during the systemwide and zonal forward batch periods **2504** and **2508**, respectively. Finally, the reverse contention **2712** field allows the mobile transceiver to initiate access to the network.

Each of the fields shown, except the cycle header **2702** field, is preferably variable in duration, and may be changed by the central computer **2002**, depending on message traffic requirements. The beginning of the cycle is synchronized by the central computer to a time standard and preferably coincides with the start of minute or half minute intervals. Each mobile unit preferably includes timing circuitry, as previously described, which allows for the mobile unit to power up at the beginning of each cycle to receive communication.

For each cycle, the central computer **2002** calculates the amount of time required for each field to maximize information throughput by the network. For example, for the cycle protocol **2700** shown in FIG. 27(A), the central computer will calculate the amount of time necessary for the systemwide forward batch field **2704**, the systemwide response interval **2706**, the zonal forward interval **2708**, the zonal reverse interval **2710**, and the reverse contention interval **2712**. The cycle header **2702** will preferably include timing offset data which will indicate the timing offset from the cycle header until the beginning of the systemwide response interval **2706**, the beginning of the zonal forward interval **2708**, the beginning of the zonal reverse interval **2710**, and the beginning of the reverse contention interval **2712**.

The cycle header **2702** starts preferably with an **8** digit long preamble (not shown) for digit synchronization purposes. The preamble allows for the mobile unit to synchronize its timing circuitry with the network. For example, the timing circuitry of the mobile unit could become offset from the network due to commonly caused inaccuracies. The preamble is followed by a "start of header" string of four digits and all timing offsets within the cycle are calculated as a number of predefined intervals beginning from the start of the last header digit. The start of header string is followed by an **8** digit string grouped into two words, each of which is protected against errors by encoding it using a forward error correcting code, preferably a Bose, Chaudhuri, and Hocquenghem (BCH) code or a Reed Solomon code. These error correcting codes add additional digits to the information digits in a code word, where the additional digits are a specific function of the information digits, so that if certain common error events occur, a decoding step involving all of the transmitted digits, both information and additional, can recover the original information digits. The first code word will contain a count of the current cycles executed for that day. The second code word will contain the necessary timing offsets for the beginning of the time intervals in the cycle protocol **2700**. Further information regarding error correcting codes may be found in Gallagher, "Information Theory and Reliable Communication," Wiley 1968, which is hereby incorporated by reference.

The systemwide forward batch **2704** field generally includes a zonal header time interval including overhead information and a series of 64 batches. Also, the zonal forward interval **2710** similarly includes a zonal header time interval with overhead information and a series of 64 batches. Each batch is a string of data containing information specifically directed to a single group of mobile units. Each batch preferably contains information directed to a certain class of mobile units with the classes divided by the types of service provided. For example, a first batch could be directed to all mobile transceiver units, and a second batch could be directed to all mobile r eceiver units. Further, each batch may contain several messages, each intended for different mobile units within the particular class of unit to which that batch is directed. Generally, FIG. 27(B) shows the forward batch interval protocol **2750** preferred for both the systemwide forward interval **2704** and the zonal forward interval **2708**.

The systemwide forward interval **2704** is preferably used only for sending a probe signal to a mobile transceiver unit which does not respond to zonal messages (i.e. a "lost" unit). However, when necessary, the systemwide forward interval **2704** may be used to deliver messages to mobile units located in overlap areas. The ID number, or address, of the lost mobile unit is preferably followed by data indicating a timing offset which is a time delay amount until the beginning of the time slot designated for the return signal of that mobile unit. An alternative implementation, which may be useful for mobile units that have not responded for a period of time, could have mobile units that have received a probe signal respond during the reverse contention interval.

After the end of the broadcast on the systemwide forward batch time interval **2704**, all network base transmitters shut down until the beginning of the zonal forward batch time interval **2708**.

The forward batch interval protocol **2750** includes a forward channel header interval **2714** which includes data to allow the timing circuitry of the mobile units to synchronize themselves with the incoming data stream. The forward channel header **2714** also preferably includes data indicating a timing offset scheduling a reverse channel time interval for each batch, as may be required. Of course, the forward channel header **2714** for the systemwide forward interval **2704** would indicate a timing offset for reverse channel transmission during the systemwide response interval **2706**, and the forward channel header **2714** for the zonal forward interval **2708** would indicate a timing offset for reverse channel transmission during the zonal reverse interval **2710**.

The forward channel header **2714** further includes a data stream to the mobile unit listing which of the 64 batches will follow and the timing offsets indicating when those batches will be transmitted. Again, this feature advantageously allows the mobile unit to "power down" during the systemwide and zonal forward intervals **2704** and **2708** until the appropriate time for receiving its batch information, thereby conserving the battery power of the mobile unit. The remaining fields batch i **2720**, batch j **2722**, and batch k **2724** are the individual batches directed to the mobile units.

It should be understood that different classes of mobile units can follow different desirable batch protocols, depending on the type of service, processing power, battery capacity, or other factors.

The individual batch protocol **2780** is shown in FIG. 27(C). The batch header field **2726** is similar to the header fields discussed above for FIGS. 27(A) and (B). The batch header **2726** includes a list of particular mobile units to receive messages within the batch and includes timing offsets indicating when such messages will be broadcast. Further, the batch header **2726** includes data indicating a timing offset scheduling a reverse channel interval in the system reverse interval, the zonal reverse interval, or the reverse contention interval, as appropriate. Again, this information allows the mobile unit to extend its battery life because the mobile unit need only power up at the appropriate time to receive or transmit the appropriate message. Further, it is preferred that the reverse channel timing offset data be transmitted using error correction codes to insure accurate receipt thereof by the mobile unit. Accurate receipt of the reverse channel timing offset data will prevent unwanted or untimely transmissions by the mobile unit and insure that a mobile unit may properly transmit a negative acknowledgment signal if it fails to properly receive an unencoded message.

The individual message interval **2732** includes the individual message intended for a particular mobile unit or units. The duration of each message and number of messages within a batch may be varied by the network operations center **600** and is traffic dependent.

Each mobile unit with transmit capability that has received a message in the immediately previous systemwide forward interval **2704** or the zonal forward interval **2708** will have an appropriate time slot for transmission scheduled in the systemwide response interval **2706**, or the zonal reverse interval **2710**, respectively. The timing circuit in the mobile transceiver unit determines the assigned time slot for transmission. For example, if the mobile unit simply intends to transmit an acknowledgment signal, which indicates that the mobile unit has properly received the message from the network, an **8** bit preamble followed by the address of that mobile unit need only be transmitted and a **3** bit acknowledgment. However, if a more extensive reply from the mobile unit is required, additional data could be transferred during this time slot. In particular, long reverse messages could be scheduled in response to a request from the mobile unit sent during the contention interval **2712**, as discussed hereafter.

Due to the low power transmit capability of the mobile transceiver units, there is an increased likelihood of data transmission errors for reply signals. The extended Golay code for error protection may be utilized for reverse channel messages from mobile transceiver units to the network.

The systemwide response interval **2706** and the zonal reverse interval **2710** provide communication capability from the mobile transceiver units to the network (i.e. the reverse channel).

Still further, a preferred embodiment accommodates mobile terminals with extensive reverse message generation capabilities (e.g., a laptop computer connected to a radio transceiver) by allowing for contention messages that request extended reverse channel time for the transmission of a long reverse message. The reverse contention interval **2712** is located after the zonal reverse interval **2710** and provides for unscheduled messages from the mobile unit to the network. For example, the mobile transceiver unit could send a message to the network during the reverse contention interval **2712** indicating that the user no longer wishes to receive messages, thereby terminating service. Also, the user could transmit a message to the network during the reverse contention interval **2712** indicating that the user now desires to reestablish services and begin receiving messages from the network. Further, a "registration signal," which is discussed infra, could be transmitted during the reverse contention interval **2712**.

The reverse contention interval preferably utilizes a so-called "slotted ALOHA" protocol, which allows the mobile unit to randomly select a predefined time slot within the contention interval to transmit a message. A mobile station wanting to transmit will first divide the contention interval into slots, preferably 5.33 ms in length, and then choose randomly any of them to start transmitting. The slotted ALOHA protocol is preferred because of the low likelihood of data "collisions" (i.e. **2** or more mobile units transmitting during the same time slot).

I. Registration of the Mobile Unit

Because the network operations center **600** stores the location of each mobile unit in the system in the user database **2100**, it is preferred that each mobile transceiver unit have the capability to "register" with the network operations center **600** by sending a registration signal to a base receiver into the network to update the location data.

The mobile transceiver unit preferably registers by simply transmitting its identification number to a base receiver, which forwards this data and data representing the location of the base receiver to the network operations center **600**.

The mobile transceiver preferably registers upon crossing zonal boundaries to alert the network operation center that the mobile transceiver has left one zone and entered another. For example, the mobile unit could receive information from the nearest base transmitter identifying which zone that base transmitter is assigned to at the beginning of each communication cycle. Upon receipt of such information from a base transmitter indicating that a nearby base transmitter is assigned to a new zone, the mobile transceiver then preferably transmits a registration signal.

The mobile transceiver unit may also transmit a registration signal in other desirable instances. For example, if the mobile transceiver unit has moved away from the transmitter coverage areas of the network for a period of time, the mobile transceiver unit may preferably transmit a registration signal upon returning to a coverage area. The display and storage logic **1508** of the mobile transceiver unit preferably recognizes that the unit has left the coverage area of the network upon failure to receive data from a base transmitter in the network during the cycle header time interval **2702**, for example. The mobile unit may leave the coverage area of a base transmitter of the network when the user takes the unit out of the country, or enters the basement of a building, for example.

The mobile unit may also preferably transmit a registration signal when power is restored to the mobile unit after having power removed, such as after being turned off by the user. Of course, the power may be restored to the unit by replacing or recharging a dead battery, which may also cause transmission of a registration signal.

In general, the network must balance the need for frequent registrations by the mobile transceiver units, and the desirable result of accurately knowing the location of each mobile unit, thereby preventing the need for probe signals, with the undesirable overhead costs of too frequent registration, which sacrifices data throughput by utilizing valuable transmit time.

In the preferred embodiment, the central computer **2002** of the network operations center **600** can achieve desirable performance by implementing one or more algorithms to evaluate the need for registration by a mobile unit, and then appropriately controlling the registration performance of that mobile unit. If the central computer determines that registration of a particular mobile unit is useful, then the mobile unit preferably should receive a message from the network to cause the mobile unit to send registration signals at appropriate times. Conversely, if the central computer determines that the registration signals from the mobile unit are too frequently not useful, the mobile unit preferably should receive a message from the network to cause the mobile unit not to transmit registration signals.

To implement this feature, the mobile transceiver unit further preferably includes a registration flag (not shown) in the display and storage logic section **1508**. If the registration flag is set, the display and storage logic section **1508** causes the mobile transceiver to autonomously send a registration signal to the network operations center on a desired basis. If the registration flag is not set, the display and storage logic section **1508** prevents any registration signals from being sent.

The registration flag may be set or removed upon command from the network operations center by transmission of an appropriate signal from a base transmitter near the mobile unit. A variety of algorithms, possibly regarding individual users or groups of users, can be used to determine whether or not the registration flag should be set. It should be appreciated that the present invention provides two distinct algorithms for implementing these registration concepts depending upon whether the registration flag is set or not in the mobile unit (i.e. the state of the mobile unit).

FIG. **28**(A) shows a flow chart describing a preferred method **2800** for implementing the registration concepts of the present invention wherein the registration feature of the mobile unit is disabled. In step **2802**, the network sends a message to disable the registration feature (i.e. set the registration flag to zero) of the mobile unit to disable the mobile transceiver's capability to transmit a registration signal. As can be seen, step **2802** determines the initial state for the method set forth in FIG. **28**(A).

In step **2804**, the network stores the number of probe signals sent to the mobile transceiver during a first period of time, and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time. Preferably, the first and second time intervals are identical. The traffic statistics database **2200** of the database **2008** is preferably used to store the number of probe signals and successful messages for each mobile unit. As explained hereinafter, these two statistics from the operation of the network are preferably used to determine whether registration by the mobile unit is useful.

In step **2806**, the stored number of probe signals and number of messages successfully delivered is processed to evaluate a likelihood that a probe signal will be required to be set by the network to locate the mobile unit to deliver a message. The preferred embodiment of the invention processes the stored number lof probe signals and messages successfully delivered in accordance with the method set forth in FIG. **29**(A).

To Referring now to FIG. **29**(A), therein is shown a series of substeps which are preferably performed during the implementation of the processing step **2804** shown in FIG. **28**(A). In particular, steps **2902** and **2904** are event driven and only proceed to the next step after an input has been received by the network. Step **2902** determines if the network sent a probe signal to a lost mobile transceiver unit and if a reply to the probe signal was received by a base receiver in the network. If this event occurs, a counter (not shown) is incremented by a value P by the central computer **2002**.

In step **2904**, if a message was successfully delivered to a mobile transceiver, preferably including an acknowledgment signal return from the mobile transceiver to the network, the counter (not shown) in the central computer **2002** is decremented by a value D.

After the occurrence of either of the events tested for in step **2902** or step **2904**, the algorithm proceeds to step **2906**. In step **2906**, if the counter value is greater than a predetermined value J, this indicates that the likelihood that a probe signal will be necessary to locate the mobile transceiver is greater than a selected value.

As can be seen, the process of substeps in FIG. **29**(A) balances the frequency of probe signals sent to a particular unit against the number of successfully delivered messages to that unit. If the system must send a large number of probe signals, it would be useful to enable the registration feature by setting the registration flag on that mobile unit to enable the registration feature. In contrast, if many messages have been successfully delivered without requiring a probe signal, it is unnecessary to enable the registration feature by setting the registration flag.

In step **2808**, a message is sent to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood in step **2804** exceeds a selected value. As can be seen, step **2808** preferably sets the registration flag in the mobile transceiver unit.

FIG. **28**(B) shows a flow chart describing a method **2810** for implementing the registration concepts of the present invention wherein the registration feature of the mobile unit is enabled.

In step **2812**, the network sends a message to enable the registration feature (i.e. set the registration flag to 1) of the mobile unit to enable the mobile transceiver's capability to transmit a registration signal. As can be seen, step **2812** determines the initial state for the method set forth in FIG. **28**(B).

In step **2814**, the network stores the number of registration signals received by the network during a first period of time, and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time. Preferably, the first and second time intervals are identical. The traffic statistics database **2200** of the database **2008** is preferably used to store the number of registration signals and successful messages for each mobile unit. As explained Thereinafter, these two statistics from the operation of the network are preferably used to determine whether the registration by the mobile unit is useful.

In step **2816**, the stored number of registration signals and number of messages successfully delivered is processed to evaluate the likelihood that a registration signal will be received by a base receiver in the network that will not be used by the network to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver. The preferred embodiment of the invention processes the stored number of registration signals received and number of messages successfully delivered in accordance with the method set forth in FIG. **29**(B).

Referring now to FIG. **29**(B), therein is shown a series of substeps which are preferably performed during the implementation of the processing step **2814** shown in FIG. **28**(B). In particular, steps **2912** and **2914** are event driven and only proceed to the next step after an input has been received by the network. Step **2912** determines if a registration signal was received by a base receiver in the network. If so, a counter (not shown) in the central computer **2002** is incremented by a value A. In step **2914**, if a message was successfully delivered to a mobile transceiver, preferably including an acknowledgment signal return from the mobile transceiver to the system, the counter (not shown) in the central computer **2002** is decremented by a value M.

It should be understood that the counter referred to with regard to steps **2912** and **2914** is different then the counter referred to with regard to steps **2902** and **2904** since each counter only necessary when the registration feature is enabled or disabled in the mobile transceiver. However, the same physical or logical device may be used to implement both counters.

After the occurrence of either events in the step **2912** or step **2914**, the algorithm proceeds to step **2916**. In step **2916**, the process determines if the counter value is greater than a predetermined value T. The value of T can be varied to meet the needs of a particular network. When the counter value exceeds T, it is indicated that the likelihood that a registration signal from that mobile unit will not be used by the network to determine a new set of base transmitters, and therefore the registration status for that mobile unit needs to be changed to disable the registration feature.

In other words, the process in FIG. **29**(B) balances the frequency of registration signals sent by a particular unit against the number of successfully delivered messages to that unit. As can be seen, if the mobile unit sends a large number of registration signals without the system using these registration signals, it would be useful to have the registration feature on that mobile unit disabled. In contrast, if many messages have been successfully delivered without too many registration signals being sent by the mobile unit, it is unnecessary for the registration feature to be disabled.

In step **2818**, a message is sent to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood in step **2814** exceeds a selected value. As can be seen, step **2818** may preferably remove the registration flag in the mobile transceiver unit.

Of course, it should be understood that the variables P, D, and J used in FIG. **29**(A), and the variables A, M, and T used in FIG. **29**(B) can be adjusted as desired to enhance system performance, as will be apparent to one of ordinary skill in the art. The counters can be implemented with so-called "reflective boundaries" so that if a counter reaches a minimum value (e.g., zero), it will continuously reset to that minimum value when further decremented.

It will be apparent to those skilled in the art that various modifications and variations can be made in the systems and methods of the present invention without departing from the scope or spirit of the invention.

Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

1. A multi-carrier simulcast transmission system for transmitting in a desired frequency band at least one message contained in an information signal, the system comprising:

a first transmitter configured to transmit a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal substantially not represented by others of the first plurality of carrier signals; and

a second transmitter, spatially separated from the first transmitter, configured to transmit a second plurality of carrier signals in simulcast with the first plurality of carrier signals, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals.

2. The multi-carrier simulcast transmission system of claim **1**, wherein the first transmitter comprises a plurality of transmitters located in a first area, and the second transmitter comprises a plurality of transmitters located in a second area.

3. The multi-carrier simulcast transmission system of claim **1**, wherein the first and second pluralities of carrier signals are evenly spaced within the desired frequency band.

4. The multi-carrier simulcast transmission system of claim **3**, wherein the first and second pluralities of carrier signals are spaced approximately every 3 KHz, and wherein the desired frequency band is approximately 50 KHz wide.

5. The multi-carrier simulcast transmission system of claim **1**, wherein each of the first and second pluralities of carrier signals comprise eight carrier signals.

6. The multi-carrier simulcast transmission system of claim **1**, wherein the first and second pluralities of carrier signals include an identical number of carrier signals, and wherein each carrier signal in the first plurality corresponds to and is slightly frequency shifted **10**-**20** Hz from the respective carrier signal in the second plurality.

7. The multi-carrier simulcast transmission system of claim **1**, wherein the first transmitter comprises means for modulating the first plurality of carrier signals using a modulation scheme, and the second transmitter comprises means for modulating the second plurality of carrier signals using the modulation scheme.

8. The multi-carrier simulcast transmission system of claim **7**, wherein the modulation scheme is selected from the group including: modulated on/off keying, binary frequency shift keying, M'ary frequency shift keying, and quadrature amplitude modulation.

9. The multi-carrier simulcast transmission system of claim **2**, further comprising:

a network operations center configured to generate the information signal, the network operations center including a receiver for receiving data input to the network operations center, a database for storing data, a central computer connected to the receiver and the database for processing the input data and the database data to generate the information signal, and a satellite uplink connected to the central computer for broadcasting the information signal; and

a satellite for receiving the information signal from the network operations center and for retransmitting the information signal to the first and second transmitters, wherein each of the first and second transmitters comprises satellite downlink means and base transmitter means.

10. In a multi-carrier simulcast transmission system, a method for transmitting in a desired frequency band [a] at least one message contained in an information signal, the method comprising the steps of:

generating a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal substantially not represented by others of the first pluarlity of carrier signals;

generating a second plurality of carrier signals within the desired frequency band, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals;

transmitting the first plurality of carrier signals from a first transmitter;

transmitting the second plurality of carrier signals from a second transmitter in simulcast with transmission of the first plurality of carrier signals from the first transmitter.

11. The method of claim **10**, wherein the first and second pluralities of carrier signals are evenly spaced within the desired frequency band.

12. The method of claim 10, wherein the first and second pluralities of carrier signals are spaced approximately every 3 KHz, and wherein the desired frequency band is approximately 50 KHz wide.

13. The method of claim 10, wherein the first and second pluralities of carrier signals each comprise eight carrier signals.

14. The method of claim 10, wherein the first and second pluralities of carrier the first plurality corresponds to and is slightly frequency shifted 10–20 Hz from the respective carrier signal in the second plurality.

15. The method of claim 10, wherein at least one of the first and second pluralities of carrier signals is modulated according to a modulation scheme selected from the group including: modulated on/off keying, binary frequency shift keying, M'ary frequency shift keying, and quadrature amplitude modulation.

16. The method of claim 10, wherein the step of generating the first plurality of carrier signals comprises the substep of modulating the first plurality of carrier signals using a modulation scheme.

17. The method of claim 10, wherein the step of generating a second plurality of carrier signals comprises the substep of modulating the second plurality of carrier signals using a modulation scheme.

18. The method of claim 10, wherein the step of generating a second plurality of carrier signals comprises the substep of generating the second plurality of carrier signals at frequencies slightly offset from the first plurality of carrier signals.

19. A multi-carrier simulcast transmission system for transmitting in a desired frequency band at least one message contained in an information signal, the system comprising:

means for transmitting a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal substantially not represented by others of the first plurality of carrier signals; and

means for transmitting a second plurality of carrier signals in simulcast with the first plurality of carrier signals, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,915,210

DATED : June 22, 1999

INVENTOR(S) : CAMERON et al.

It is certified that error appears in the above-indentified patent and that said Letters Patent Is hereby corrected as shown below:

Claim 10, column 34, line 46, delete "[a]".

Claim 14, column 35, line 9, after "carrier" insert therefor --signals include an identical number of carrier signals, and wherein each carrier signal in--.

Signed and Sealed this

Twenty-third Day of November, 1999

Attest:

Q. TODD DICKINSON

Attesting Officer *Acting Commissioner of Patents and Trademarks*

BAR CODE LABEL	U.S. PATENT APPLICATION		
SERIAL NUMBER 08/760,457	FILING DATE 12/06/96 RULE 60	CLASS 455	GROUP ART UNIT 2611

APPLICANT

DENNIS W. CAMERON, JACKSON, MS; WALTER C. ROEHR JR., RESTON, VA; JAI P. BHAGAT, JACKSON, MS; MASOOD GARAHI, MADISON, MS; WILLIAM D. HAYS, JACKSON, MS; DAVID W. ACKERMAN, WASHINGTON, DC.

CONTINUING DATA*******************
VERIFIED THIS APPLN IS A CON OF 07/973,918 11/12/92 PAT 5,590,403

FOREIGN/PCT APPLICATIONS**********
VERIFIED

FOREIGN FILING LICENSE GRANTED 02/12/97

STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS	FILING FEE RECEIVED	ATTORNEY DOCKET NO.
MS	29	1	1	$770.00	03680.0083-0

ADDRESS

FINNEGAN HENDERSON FARABOW
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TITLE

METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

This is to certify that annexed hereto is a true copy from the records of the United States Patent and Trademark Office of the application which is identified above.

By authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

Date   Certifying Officer

BAR CODE LABEL

U.S. PATENT APPLICATION

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT
08/760,457	12/06/96 RULE 60	455	2611

APPLICANT

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MS	29	1	1	$770.00	03680.0083-0

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TITLE

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By authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

Date Certifying Officer

PATENT APPLICATION SERIAL NO. 08/760457

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

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DEC 6
PAT. & TRADEMARK OFF.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

ASSISTANT COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Attorney Docket No. 03680.0083-04000

Prior Application:
Art Unit: 2611
Examiner: T. Le

SIR: This is a request for filing a

Continuation under 37 C.F.R. § 1.60 of pending prior application Serial No. 07/973,918 filed November 12, 1992 of Dennis Cameron et al. for A NATIONWIDE COMMUNICATION SYSTEM.

1. [XX] Enclosed is a complete copy of the prior application including the oath or Declaration and drawings, if any, as originally filed. I hereby verify that the attached papers are a true copy of prior application Serial No. 07/973,918 as originally filed on November 12, 1992.

2. [ ] Cancel claims ______________________ (At least one original independent claimmust be retained for filing purposes.)

3. [XX] A Preliminary Amendment is enclosed.

4. [XX] The filing fee is calculated on the basis of the claims existing in the prior application as amended at 2 and 3 above.

(1) For	(2) Number Filed	(3) Number Extra	(4) Rate	(5) Basic Fee $770
Total Claims	18-20=	0	x $ 22.00	$0
Independent Claims	2-3=	0	x $ 78.00	$0
Multiple Dependent Claim(s) (if applicable)			+$250.00	$0
			Total =	$770.00
			Reduction by ½ for filing by small entity	-
			TOTAL FILING FEE =	$770.00

5. [XX] A check in the amount of $770 to cover the filing fee is enclosed.

6. [XX] The Commissioner is hereby authorized to charge any fees which may be required including fees due under 37 C.F.R. § 1.1.6 and any other fees due under 37 C.F.R. § 1.17, or credit any overpayment during the pendency of this application to deposit Account No. 06-0916.

7. [XX] Amend the specification by inserting before the first line, the sentence:

A1

¶ This is a continuation of ~~application~~ Serial No. 07/973,918, filed November 12, 1992, now U.S. Pat. No. 5,590,403

8. [ ] New ~~formal~~ drawings are enclosed.

9. [XX] The prior application is assigned of record to: Destineer Corporation.

10. [ ] Priority of application Serial No. _______________, filed on __________ _____ in _______________ (country) is claimed under 35 U.S.C. § 119.

11. [ ] A verified statement claiming small entity status is [ ] enclosed or [ ] is on file in the prior application.

12. [XX] The power of attorney in the prior application is to at least one of the following: FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P., Reg. No. 22,540, Douglas B. Henderson, Reg. No. 20,291; Ford F. Farabow, Jr., Reg. No. 20,630; Arthur S. Garrett, Reg. No. 20,338; Donald R. Dunner, Reg. No. 19,073; Brian G. Brunsvold, Reg. No. 22,593; Tipton D. Jennings, IV, Reg. No. 20,645; Jerry D. Voight, Reg. No. 23,020; Laurence R. Hefter, Reg. No. 20,827; Kenneth E. Payne, Reg. No. 23,098; Herbert H. Mintz, Reg. No. 26,691; C. Larry O'Rourke, Reg. No. 26,014; Albert J. Santorelli, Reg. No. 22,610; Michael C. Elmer, Reg. No. 25,857; Richard H. Smith, Reg. No. 20,609; Stephen L. Peterson, Reg. No. 26,325; John M. Romary, Reg. No. 26,331; Bruce C. Zotter, Reg. No. 27,680; Dennis P. O'Reilley, Reg. No. 27,932; Allen M. Sokal, Reg. No. 26,695; Robert D. Bajefsky, Reg. No. 25,387; Richard L. Stroup, Reg. No. 28,478; David W. Hill, Reg. No. 28,220; Thomas L. Irving, Reg. No. 28,619; Charles E. Lipsey, Reg. No. 28,165; Thomas W. Winland, Reg. No. 27,605; Basil J. Lewris, Reg. No. 28,818; Martin I. Fuchs, Reg. No. 28,508; E. Robert Yoches, Reg. No. 30,120; Barry W. Graham, Reg. No. 29,924; Susan Haberman Griffen, Reg. No. 30,907; Richard B. Racine, Reg. No. 30,415; Thomas H. Jenkins, Reg. No. 30,857; Robert E. Converse, Jr., Reg. No. 27,432; Clair X. Mullen, Jr., Reg. No. 20,348; Christopher P. Foley, Reg. No. 31,354; John C. Paul, Reg. No. 30,413; Roger D. Taylor, Reg. No. 28,992; David M. Kelly, Reg. No. 30,953; Kenneth J. Meyers, Reg. No. 25,146; Carol P. Einaudi, Reg. No. 32,220; Walter Y. Boyd, Jr., Reg. No. 31,738; Steven M. Anzalone, Reg. No. 32,095; Jean B. Fordis, Reg. No. 32,984; Barbara C. McCurdy, Reg. No. 32,120; James K. Hammond,

Reg. No. 31,964; Richard V. Burgujian, Reg. No. 31,744; J. Michael Jakes, Reg. No. 32,824; and Allen M. Lo, Reg. No. 37,059.

13. [XX] The power appears in the original declaration of the prior application.

14. [ ] Since the power does not appear in the original declaration, a copy of the power in the prior application is enclosed.

15. [XX] Please address all correspondence to FINNEGAN, HENDERSON, FARABOW, GARRETT AND DUNNER, L.L.P., 1300 I Street, N.W., Washington, D.C. 20005-3315.

16. [ ] Recognize as associate attorney ____________________.

17. [XX] Also enclosed is a Petition Under 37 C.F.R. § 1.48(b).

PETITION FOR EXTENSION. If any extension of time is necessary for the filing of this application, including any extension in the parent application, serial no. 07/973,918 filed November 12, 1992, for the purpose of maintaining copendency between the parent application and this application, and such extension has not otherwise been requested, such as extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Allen M. Lo
Allen M. Lo
Reg. No.: 37,059

Date: December 6, 1996

08/760457

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

ASSISTANT COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Attorney Docket No. 03680.0083-04000

Prior Application:
Art Unit: 2611
Examiner: T. Le

SIR: This is a request for filing a

Continuation under 37 C.F.R. § 1.60 of pending prior application Serial No. 07/973,918 filed November 12, 1992 of Dennis Cameron et al. for A NATIONWIDE COMMUNICATION SYSTEM.

1. [XX] Enclosed is a complete copy of the prior application including the oath or Declaration and drawings, if any, as originally filed. I hereby verify that the attached papers are a true copy of prior application Serial No. 07/973,918 as originally filed on November 12, 1992.

2. [ ] Cancel claims ______________________ (At least one original independent claimmust be retained for filing purposes.)

3. [XX] A Preliminary Amendment is enclosed.

4. [XX] The filing fee is calculated on the basis of the claims existing in the prior application as amended at 2 and 3 above.

(1) For	(2) Number Filed	(3) Number Extra	(4) Rate	(5) Basic Fee $770
Total Claims	18-20=	0	x $ 22.00	$0
Independent Claims	2-3=	0	x $ 78.00	$0
Multiple Dependent Claim(s) (if applicable)			+$250.00	$0
			Total =	$770.00
			Reduction by ½ for filing by small entity	-
			TOTAL FILING FEE =	$770.00

5. [XX] A check in the amount of $770 to cover the filing fee is enclosed.

6. [XX] The Commissioner is hereby authorized to charge any fees which may be required including fees due under 37 C.F.R. § 1.1.6 and any other fees due under 37 C.F.R. § 1.17, or credit any overpayment during the pendency of this application to deposit Account No. 06-0916.

7. [XX] Amend the specification by inserting before the first line, the sentence:

   -- This is a continuation of application Serial No. 07/973,918, filed November 12, 1992.--

8. [ ] New formal drawings are enclosed.

9. [XX] The prior application is assigned of record to: Destineer Corporation.

10. [ ] Priority of application Serial No. ______________, filed on __________ _____ in ______________ (country) is claimed under 35 U.S.C. § 119.

11. [ ] A verified statement claiming small entity status is [ ] enclosed or [ ] is on file in the prior application.

12. [XX] The power of attorney in the prior application is to at least one of the following: FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P., Reg. No. 22,540, Douglas B. Henderson, Reg. No. 20,291; Ford F. Farabow, Jr., Reg. No. 20,630; Arthur S. Garrett, Reg. No. 20,338; Donald R. Dunner, Reg. No. 19,073; Brian G. Brunsvold, Reg. No. 22,593; Tipton D. Jennings, IV, Reg. No. 20,645; Jerry D. Voight, Reg. No. 23,020; Laurence R. Hefter, Reg. No. 20,827; Kenneth E. Payne, Reg. No. 23,098; Herbert H. Mintz, Reg. No. 26,691; C. Larry O'Rourke, Reg. No. 26,014; Albert J. Santorelli, Reg. No. 22,610; Michael C. Elmer, Reg. No. 25,857; Richard H. Smith, Reg. No. 20,609; Stephen L. Peterson, Reg. No. 26,325; John M. Romary, Reg. No. 26,331; Bruce C. Zotter, Reg. No. 27,680; Dennis P. O'Reilley, Reg. No. 27,932; Allen M. Sokal, Reg. No. 26,695; Robert D. Bajefsky, Reg. No. 25,387; Richard L. Stroup, Reg. No. 28,478; David W. Hill, Reg. No. 28,220; Thomas L. Irving, Reg. No. 28,619; Charles E. Lipsey, Reg. No. 28,165; Thomas W. Winland, Reg. No. 27,605; Basil J. Lewris, Reg. No. 28,818; Martin I. Fuchs, Reg. No. 28,508; E. Robert Yoches, Reg. No. 30,120; Barry W. Graham, Reg. No. 29,924; Susan Haberman Griffen, Reg. No. 30,907; Richard B. Racine, Reg. No. 30,415; Thomas H. Jenkins, Reg. No. 30,857; Robert E. Converse, Jr., Reg. No. 27,432; Clair X. Mullen, Jr., Reg. No. 20,348; Christopher P. Foley, Reg. No. 31,354; John C. Paul, Reg. No. 30,413; Roger D. Taylor, Reg. No. 28,992; David M. Kelly, Reg. No. 30,953; Kenneth J. Meyers, Reg. No. 25,146; Carol P. Einaudi, Reg. No. 32,220; Walter Y. Boyd, Jr., Reg. No. 31,738; Steven M. Anzalone, Reg. No. 32,095; Jean B. Fordis, Reg. No. 32,984; Barbara C. McCurdy, Reg. No. 32,120; James K. Hammond,

Reg. No. 31,964; Richard V. Burgujian, Reg. No. 31,744; J. Michael Jakes, Reg. No. 32,824; and Allen M. Lo, Reg. No: 37,059.

13. [XX] The power appears in the original declaration of the prior application.

14. [ ] Since the power does not appear in the original declaration, a copy of the power in the prior application is enclosed.

15. [XX] Please address all correspondence to FINNEGAN, HENDERSON, FARABOW, GARRETT AND DUNNER, L.L.P., 1300 I Street, N.W., Washington, D.C. 20005-3315.

16. [ ] Recognize as associate attorney ____________________.

17. [XX] Also enclosed is a Petition Under 37 C.F.R. § 1.48(b).

PETITION FOR EXTENSION. If any extension of time is necessary for the filing of this application, including any extension in the parent application, serial no. 07/973,918 filed November 12, 1992, for the purpose of maintaining copendency between the parent application and this application, and such extension has not otherwise been requested, such as extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Allen M. Lo
Allen M. Lo
Reg. No.: 37,059

Date: December 6, 1996

UNITED STATES PATENT APPLICATION

OF

DENNIS CAMERON, WALT ROEHR,
RADE PETROVIC, JAI Bhagat ~~BAGGAT,~~ MA~~S~~SOOD GARAHI,
WILLIAM D. HAYS, and DAVID W. ACKERMAN

FOR

A NATIONWIDE COMMUNICATION SYSTEM

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899,476

I. BACKGROUND OF THE INVENTION

A. Field of the Invention

The present invention relates to methods and systems for providing two-way communication capability between a central network and a mobile unit over a relatively large area, and more particularly to such methods and systems which allow for rapid communication of large messages and efficient use of system resources.

B. Description of the Related Art

Conventional two-way portable/mobile wireless messaging systems often provide a variety of services to subscribers. Conventional messaging systems in particular provide one-way services using store and forward techniques to mobile receivers carried by the subscriber. A fundamental goal of two-way messaging systems is to provide a network of interconnected transmitters and receivers which provides sufficient transmitted signal strength and receive capability to uniformly cover a geographic region. Some conventional messaging systems provide the message to the user on a small viewing screen on the mobile unit.

However, such conventional systems often suffer from problems associated with low system throughput, evidenced by slow message delivery and message size limitations and do not provide an acknowledgment feature wherein the mobile unit transmits an acknowledgment signal to the system to acknowledge receipt of the message from the system. Generally, system throughput refers to

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the overall communication capability of a system as defined by the total amount of message data from the system to the mobile units transferred by the system during a given period of time divided by the frequency bandwidth necessary to transmit the message data and may be measured in bits transferred per Hz. Further, such conventional systems suffer from technical problems preventing consistent wide area coverage and would require extremely wide portions of valuable frequency bandwidth to achieve acceptable system throughput rates.

Simulcast technology in communication systems was originally developed to extend transmitter coverage beyond that which could be obtained from a single transmitter. Over time, however, simulcasting has evolved into a technique capable of providing continuous coverage to a large area.

Generally, simulcast technology provides multiple transmitters, operating on substantially the same frequencies and transmitting the same information positioned to cover extended areas. As shown in Fig. 1, transmitter 100 generally provides coverage over area A, D, and E, transmitter 102 generally provides coverage over area B, D, and E, and transmitter 104 generally provides coverage over area C, E, and F. In some cases, the coverage area of a first transmitter may be entirely enclosed within the coverage area of another transmitter, such as in building interiors and valleys. In areas where one (and only one) transmitter dominates (e.g., areas A, B, and C in Fig. 1), simulcast is effective because the other transmitters do not significantly affect receivers in those areas.

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However, in "overlap" areas D, E, and F shown in Fig. 1, where the signals from two or more transmitters are approximately equal, problems can arise because destructive interference of signals occurs in these overlap areas such as areas D, E, and F. Destructive interference occurs when the two signals are equal in magnitude and 180° out of phase and completely cancel each other. While there were some successes, reliable design procedures were not available.

Attempting to precisely synchronize the carrier frequencies of all simulcast transmitters does not overcome the problem because points (i.e. nodes) at which destructive summing occurred persisted for long periods of time. At such points, a mobile receiver can not receive the simulcast signal.

Deliberately offsetting the carrier frequencies of adjacent transmitters can ensure that destructive interference does not persist at one point for an extended period of time. The slight errors in frequency displayed by high quality reference oscillators (e.g., 20 hertz errors in 100 MHz signals or a few parts in 10^7) render deliberate offsetting unnecessary. Further, merely offsetting the carrier frequencies could not guarantee acceptable quality demodulation because proper alignment of the modulating signals in time is also required.

Fig. 2 displays the situation at, for example, point D in Fig. 1 when modulating waveforms are synchronized and includes coverage boundary 202 from a first transmitter and a second transmitter coverage boundary 204 from a second adjacent transmitter. An equi-signal boundary 200 exists where the signals

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from the first and second transmitters have approximately equal signal strengths. A more realistic equi-signal boundary would take into account natural and man-made topography and propagation conditions, and therefore would probably not be a straight line.

Figs. 3 and 4 generally illustrate various signals as they may occur at or near the equi-signal boundary 200 as shown in Fig. 2. In particular, Figs. 3 and 4 illustrate various aspects of modulation synchronization and how altering transmission parameters may affect the synchronization. In general, there are at least three sources which cause the signals from the first transmitter and the second transmitter to be out of synchronization: (1) timing shifts in the delivery of the modulating waveform to each of the transmitters; (2) timing shifts internal to each transmitter; and (3) timing shifts caused by propagation distances and anomalies. From the perspective of a receiver located in an overlap area, these three sources of timing shifts combine to produce an overall timing shifts between the received signals from the first and second transmitters. In current commercial practice, the summation of these three components results in time shifts of about 200 microseconds. The timing shift present in simulcast systems disadvantageously limits the baud rate at which information may be transferred. In general, Figs. 3 and 4 will also illustrate how timing shifts prevents high baud rate transmissions.

A time line representation of a signal 306 from a first transmitter is shown in Fig. 3(A) and a signal 308 from a second transmitter is shown in Fig. 3(B), both from the perspective of a

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receiver located in an overlap area. Vertical dashed lines 300 represent baud intervals on the time axis. As can be seen from Figs. 3(A) and (B), the signals 306 and 308 are frequency modulated between a high and a low frequency value and the signals 306 and 308 are exactly in phase. As will be appreciated, the timing shift between signals 306 and 308 must be small when compared to the baud interval shown in Figs. 3(A) and (B) since signals 306 and 308 are in synchronization. Of course, as the baud interval decreases, the timing shifts will likely cause signals 306 and 308 to be out of synchronization.

Figs. 3(C), (D), and (E) show the summation of these two signals 306 and 308 at an equi-signal boundary, such as boundary 200 in Fig. 2. Fig. 3(C) shows a composite signal 310 indicating that the frequency information remains unchanged, Fig. 3(D) shows a linear graph 312 of the relative phase difference caused by a slight carrier frequency difference between the signals from the first transmitter and the second transmitter. Fig. 3(E) shows a composite amplitude signal 314. A noise threshold is indicated by the horizontal dashed line 304 in Fig. 3(E).

Of interest, Fig. 3(E) shows the composite amplitude signal 314 dipping below the noise threshold 304 at an anti-phase condition 302 (e.g., when the relative phase angle is ± 180°, as shown in Fig. 3(D)). As can be seen from Fig. 3(E), the anti-phase condition 302 caused by the slight phase shift between transmitter 1 and transmitter 2 will not cause any loss of data because the anti-phase condition persists for only a small portion of the baud interval.

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The slight offset of the carrier frequencies between the first and second transmitters causes a slow drift of the relative phase of the two signals, as shown in Fig. 3(D). When the signals are ± 180° out of phase, the temporary dip in the amplitude signal may cause the loss of a few bits in the composite signal, at worst. These errors can be counteracted with a conventional error correcting code, such as is commonly known.

Fig. 4 shows a set of similar signals to those in Fig. 3, but wherein the signal 402 from the first transmitter is offset from, or out of synchronization with, the signal 404 from the second transmitter by a full baud. In particular, signal 404 lags signal 402 by one baud interval. As previously discussed, the offset of signals 402 and 404 may be caused by various timing shifts in the delivery of both signals 402 and 404 to a receiver in an overlap area. Figs. 4(A) and (B) illustrate the extreme case where the sum of these timing shifts is equal to the baud interval shown by dashed lines 400. As can be seen in Fig. 4(C), composite signal 406 includes a period of indeterminate frequency which undesirably covers several entire baud intervals and, therefore, successful demodulation is impossible during those baud intervals. If the baud interval were increased to minimize the effect of these timing shifts, data loss would be less likely. Therefore, it can be seen that the baud rate at which good data transfer can be accomplished is limited by the timing shifts between signals delivered to receivers in overlap areas.

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Through these examples, it can be seen that high degrees of modulation synchronization make it possible to obtain good data demodulation in a simulcast system. However, the baud rate limitation of simulcast systems is a significant drawback and limits system throughput.

An alternative to simulcast for wide area coverage is assignment of orthogonal, non-overlapping subdivisions of the available system capacity to adjacent areas. Subdivisions can be made in time (e.g., broadcasting the information on the same frequency in different time slots to adjacent areas), or in frequency (e.g., broadcasting the information simultaneously on different frequencies in adjacent areas). There are several problems with such orthogonal systems, however. First, orthogonal assignments require tuning the receiver to the assigned frequency or time channel for the area in which the receiver currently resides. In the broadcast services every traveler has experienced the frustration of finding the correct channel for their favorite programs. Simulcast operation avoids the need for scanning and re-tuning as the mobile unit moves between areas. Such scanning and re-tuning also disadvantageously increases mobile unit power consumption.

Second, and more serious, the orthogonal assignment approach drastically reduces the system throughput capacity as measured in bits per Hz because anywhere from 3 to 7, or possibly more, orthogonal assignments are required to obtain continuous area coverage in most conventional orthogonal systems. This waste of capacity is somewhat recouped if the same information is not

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needed throughout the service area because a given piece of information is sent only to those cells where it is needed.

Conventional cellular radio service is a typical example of an orthogonal system. In cellular, the same frequencies are reused in spatially separated cells to allow different data to be transmitted to different mobile units. An example of three cellular arrangements is shown in Fig. 5 where the number of cells (N) is equal to 3, 4, and 7. Each cell (i.e., A, B, C, . . .) in conventional cellular service usually only includes a single transmitter and operates in a different frequency or time division within the communication protocol. As shown in Fig. 5, cellular service generally locates transmitters utilizing the same division (all the "A" transmitters) far enough apart to reduce the likelihood of interference between such transmitters. As the number of cells increases, the likelihood of interference decreases. For example, with N=3 as shown by arrangement 500 in Fig. 3, the distance between the coverage area of "A" cells is about ½ cell width, with N=4 in arrangement 502, the distance between the coverage areas of "A" cells is slightly larger, and with N=7 in arrangement 504 the distance between "A" cells is larger than the width of one cell.

However, as the number of cells increases, the length of the individual time intervals per cell decreases for time division multiplexed systems, thereby decreasing the systems total information transfer. In frequency division systems, more cells undesirably increases the frequency bandwidth required. Therefore, system throughput in bits per Hz is decreased as the

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number of cells increases. Furthermore, cellular systems often require an electronic "handshake" between system and mobile unit to identify the specific cell (i.e. transmitter) in which the mobile unit is located to allow capacity reuse.

II. SUMMARY OF THE INVENTION

The systems and methods of the present invention have a wide variety of objects and advantages. The systems and methods of the present invention have as a primary object to provide a communication system with wide area coverage and high message throughput while minimizing frequency bandwidth usage.

It is an object of the invention to provide a simulcast communication system with a high data transfer rate which does not exceed the baud rate limitations of simulcast transmission.

It is a further object of the present invention to provide a communication system which provides for superior data communication integrity.

Yet another object of the invention is to provide a mobile transceiver unit which prevents unnecessary RF interference, particularly on commercial aircraft.

Still further, it is an object of the invention to provide a zone based communication system which may dynamically redefine zone boundaries to improve information throughput.

Another object of the invention is to provide a zone based simulcast communication system which can effectively communicate with both mobile transceiver units located near the center of each zone as well as mobile transceiver units located within the overlap areas between two or more zones.

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Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practicing the invention. The objects and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

To achieve the objects and in accordance with the purpose of the invention, as embodied and broadly described herein, the invention is directed to a method for information transmission by a plurality of transmitters to provide broad communication capability over a region of space, the information transmission occurring during at least both a first time period and a second time period and the plurality of transmitters being divided into at least a first and second set of transmitters, the method comprising the steps of (a) generating a system information signal which includes a plurality of blocks of information, (b) transmitting the system information signal to the plurality of transmitters, (c) transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period, (d) transmitting by the first set of transmitters a second block of information during the second time period, and (e) transmitting by the second set of transmitters a third block of information during the second time period.

In another embodiment, the invention is directed to a multi-carrier simulcast transmission system for transmitting in a desired frequency band a message contained in an information signal, the system comprising a first transmitter means for

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transmitting an information signal by generating a first plurality of carrier signals within the desired frequency band and by modulating the first plurality of carrier signals to convey the information signal, and a second transmitter means, spatially separated from the first transmitter, for transmitting the information signal in simulcast with the first transmitter by generating a second plurality of carrier signals at substantially the same frequencies as the first plurality of carrier signals and by modulating the second plurality of carrier signals to convey the information signal.

In another embodiment, the invention is directed to a communication method implemented in a computer controlled communication network for locating a mobile transceiver within a region of space, the region of space being divided into a plurality of zones with each zone serviced by at least one base transmitter and at least one base receiver, the network storing data corresponding to a zone where the mobile transceiver was last known to be located, the communication method comprising the steps of (a) transmitting a message signal by a base transmitter servicing a zone where the mobile transceiver was last known to be located, (b) transmitting a systemwide probe signal by a plurality of base transmitters servicing a plurality of zones if the mobile transceiver does not indicate receipt of the message signal from the base transmitter, (c) receiving the regional probe signal by the mobile transceiver, (d) transmitting an acknowledgment signal by the mobile transceiver in response to the received regional probe signal, (e) receiving the acknowledgment signal from the

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mobile transceiver by a base receiver, and (f) updating the data to reflect the zone of the base receiver that received the acknowledgment signal as the last known location of the mobile transceiver.

In yet another embodiment, the invention is directed to a method of communicating messages between a plurality of base transmitters and mobile receivers within a region of space divided into a plurality of zones with each zone having at least one base transmitter assigned thereto, the communication method comprising the steps of (a) transmitting substantially simultaneously a first information signal and a second information signal to communicate messages to the mobile receivers, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone, (b) dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone as a function of the messages to be communicated in an area, thereby creating an updated first set of base transmitters and an updated second set of base transmitters, and (c) transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base

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transmitters to communicate additional messages to said mobile receivers.

In another embodiment, the invention is directed to a mobile transceiver unit for transmitting messages to and receiving messages from a network comprising input means for allowing the user to input a user message to the unit, transmitter means for transmitting a radio frequency signal including the user message from the mobile unit to the network, receiver means for receiving radio frequency signals having a message from the network, signal detector means for detecting at least one type of electromagnetic signal generated external to the mobile unit and the network, and a circuit, connecting the signal detector means to the transmitter means, for disabling the transmitter means upon detection of the electromagnetic signal, thereby preventing unwanted radio frequency transmission.

In another embodiment, the invention is directed to a communication method for controlling a mobile transceiver which may communicate with a communication network controlled by a computer, the network including a plurality of base transmitters for transmitting messages from the network to the mobile transceiver and base receivers for receiving messages from the mobile transceiver, the mobile transceiver being capable of sending a registration signal to be received by a base receiver in the network to identify the mobile transceiver's location and the plurality of base transmitters in the network being capable of sending a probe signal to the mobile transceiver to cause the mobile transceiver to transmit a signal to a base receiver to

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identify its location, the method comprising the steps of (a) sending a message from the network to the mobile transceiver to disable the mobile transceiver's capability to transmit a registration signal, (b) storing the number of probe signals sent by the network to the mobile transceiver during a first period of time and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time, (c) processing by the computer the stored number of probe signals and number of messages successfully delivered to evaluate a likelihood that a probe signal will be required to be sent by the network to locate the mobile unit to deliver a message, and (d) sending a message to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood exceeds a selected value.

Finally, in another embodiment, the invention is directed to a communication method for controlling a mobile transceiver which may communicate with a communication network controlled by a computer, the network including a plurality of base transmitters for transmitting messages to the mobile transceiver and base receivers for receiving messages from the mobile transceiver, the mobile transceiver being capable of sending a registration signal to be received by a base receiver in the network to identify the mobile transceiver's location, the network using received registration signals to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver, the method comprising the steps of (a) sending a message from the network to the mobile transceiver to enable the mobile

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transceiver's capability to transmit a registration signal, (b) storing the number of registration signals from the mobile transceiver to the network during a first period of time and the number of messages successfully delivered to the mobile transceiver by the network during a period of time, (c) processing the stored number of registration signals and number of messages successfully delivered to evaluate a likelihood that a registration signal from said mobile unit will not be used by the network to determine a set of base transmitters, and (d) sending a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

III. BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several embodiments of the invention and together with the description, serve to explain the principles of the invention.

Fig. 1 is a schematic diagram of an arrangement of simulcast transmitters;

Fig. 2 is a schematic diagram of uniform smooth earth propagation;

Fig. 3 is a schematic diagram of synchronized modulated waveforms;

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Fig. 4 is a schematic diagram of modulated waveforms offset a full baud;

Fig. 5 is a schematic diagram of cellular system coverage;

Fig. 6 is a schematic diagram of a communication system;

Fig. 7 is a flow chart of a preferred method of communication;

Fig. 8 is a flow chart of a preferred method of sending a regional probe signal;

Fig. 9 is a schematic diagram of a frequency spectrum for multi-carrier modulation;

Fig. 10 is a schematic diagram of an on/off keying modulator;

Fig. 11 is a schematic diagram of a frequency shift keying modulator;

Fig. 12 is a schematic diagram of a four carrier quadrature modulator;

Fig. 13 is a schematic diagram of a first embodiment of a base transmitter;

Fig. 14 is a schematic diagram of a second embodiment of a base transmitter;

Fig. 15 is a schematic diagram of a mobile transceiver;

Fig. 16 is a pictorial representation of a mobile transceiver;

Fig. 17 is a schematic diagram of a mobile receiver;

Fig. 18(A) is a schematic diagram of an analog base receiver;

Fig. 18(B) is a schematic diagram of a digital base receiver;

Fig. 19 is a schematic diagram of a base receiver with a store and forward feature;

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File History Content Report

The following content is missing from the original file history record obtained from the United States Patent and Trademark Office. No additional information is available.

Document Date - 1996-12-06

Document Title - Specification

Page(s) - 17

IV. DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments and exemplary embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

A. Overview of The System Hardware

Fig. 6 shows an overview of the major elements of a preferred communication system according to the present invention. As shown therein, the communication system includes a network operations center 600 which is connected to a satellite uplink 602 via data path 604. A satellite uplink is used to provide data to satellite 606. Satellite 606 redirects the received data to several satellite downlink stations including station 608 and station 610. Conventional satellite technology allows for nominal data transfer rates of 24 M bits/second. Further, conventional satellite technology allows for accurate delivery of data to stations 608 and 610, which allows for precise synchronization between the signals broadcast in simulcast by the stations 608 and 610. It should be understood that stations 608 and 610 may optionally receive identical data, or may individually receive different data simultaneously from the satellite 606.

Satellite downlink stations 608 and 610 are connected to spatially separated base transmitters 612 and 614 via data paths 616 and 618, respectively. Base transmitter 612 is connected to antenna 620, and base transmitter 614 is connected to antenna 622. Preferably, the base transmitters of the present system have a

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power output capability of about 350 watts, which will provide an effective transmitter coverage area of several tens of miles. ~~Although not shown in Fig. 6, each~~ Each zone preferably includes multiple transmitter stations as will be evident from the following discussion.

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Mobile unit 624 is connected to antenna 626 and, in the preferred embodiment, is a small, portable unit capable of being carried easily by a user and therefore is similar to conventional pagers in those aspects. More preferably, the mobile unit has both receive and transmit capability, with a nominal transmit power output of about 1 watt.

The communication system includes several base receivers 628, 630, 632, and 634 each connected to antennas 636, 638, 640, and 642, respectively. Base receivers 628 and 630 are connected to a regional station 644 via data paths 646 and 648, respectively. Base receivers 632 and 634 are connected to regional station 650 via data paths 652 and 654, respectively. Base transmitters 612, 614 preferably have a large transmit power output capability to provide coverage to the mobile unit in areas to which communication is typically difficult, such as building interiors, and to extend the coverage area of each transmitter. An appropriate number of base receivers should be dispersed throughout the geographic area to reliably receive the signals from the mobile unit. Due to the difference in output power between base transmitters and mobile units, an overall ratio of 10 base receivers to 1 base transmitter may be appropriate, and the 2 to 1 ratio shown in Fig. 6 is merely shown for ease of illustration.

Regional station 650 is connected to the network operations center 600 via data path 656 and regional station 644 is connected to the network operations center 600 via data path 658. The data paths 656 and 658 preferably include low cost phone lines, but may include any convenient and appropriate data transfer technology.

Generally, the communication system of the present invention roughly divides various regions of space into portions called zones. Each zone must have one or preferably more base transmitters assigned to it. Zone boundaries are roughly defined by the transmitter coverage areas of the base transmitters assigned to that zone. For example, Fig. 6 shows a dashed zone dividing line 660 roughly dividing a zone 1 from a zone 2. Zone 1 includes base transmitter 614, base receivers 632 and 634, regional station 650, and mobile unit 624. Zone 2 includes base transmitter 612, base receivers 628 and 630, and regional station 644. Dashed line 660 only roughly defines the boundary between zones because precise boundaries do not exist. For example, to insure adequate coverage of the region, as shown in Fig. 1, the range of both transmitter 614 should at least cover the region above dashed line 660, and preferably should extend somewhat below dashed line 660. Similarly, the range of base transmitter 612 should at least cover the region below dashed line 660, and preferably should extend somewhat above dashed line 660. As can be seen, an overlap of transmitter coverage may occur in the vicinity of dashed line 660.

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Referring back to Fig. 2, it can be seen that boundary 202 and boundary 204 overlap in an area near the equi-signal 200 and between these boundaries which may be termed an "overlap area." In Fig. 6, dashed line 660 is drawn near the may be defined as the equi-signal boundary between base transmitter 614 and base transmitter 612. Of course, dashed line 660 does not represent the overlap area that may occur between base transmitter 614 and base transmitter 612.

As explained in the Background of the Invention section, if base transmitters 612 and 614 are broadcasting identical signals on the same frequencies in simulcast, good reception by a receiver located near the dashed line 660, and possibly in an overlap area (not shown), can be achieved. Simulcast thus may provide uniform transmitter coverage for the region shown in Fig. 6. However, if base transmitter 612 is broadcasting a first information signal and base transmitter 614 is broadcasting a different, second information signal on identical frequencies simultaneously, it will likely be difficult for a receiver located in the overlap area to receive either the first or the second information signal. In this instance, the overlap area may be referred to as an interference area because a receiver in this area would receive a composite signal, including the first and second information signal, that would likely be unusable.

The following will be an exemplary discussion of the various interactions of the elements of the communication system when delivering a message to mobile unit 624. In accordance with the invention, a preferred method 700 of this interaction is shown in

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Fig. 7. Network operations center 600 generates a system information signal of several blocks of information as shown in step 702. The blocks of information include an electronic message to be delivered to the mobile unit 624.

In step 704, the system information signal is transmitted to the base transmitters. In particular the network operations center 600 provide the system information signal and appropriate other data to the satellite uplink 602 via data path 604 for transmission to the satellite 606. The data is then received and retransmitted by satellite 606 to satellite downlink stations 608 and 610. The data received by satellite downlink 608 is provided to base transmitter 612 through data path 616, and the data received by satellite downlink 610 is provided to base transmitter 614 through data path 618.

At this point, the exemplary communication system shown in Fig. 6 may transfer the message to the mobile unit during one of two time intervals. In the first time interval, both base transmitter 612 and base transmitter 614 transmit data via antenna 620 and antenna 622, respectively, in simulcast to be received by mobile unit 624, which corresponds to step 706 in Fig. 7. This first alternative may be useful to deliver the message if, for example, the location of mobile unit 624 in zone 1 or zone 2 is unknown and broad coverage is desired.

In the second time interval, base transmitter 614 transmits a block of information including the message data to mobile unit 624 and base transmitter 612 transmits another block of information, which corresponds to steps 708 and 710 of Fig. 7. This second

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alternative may be useful if, for example, the mobile unit 624 is known to be located in zone 1 and out of range of base transmitter 612. Delivery of the message to mobile unit 624 during the second time interval is advantageous because during message delivery to the mobile unit 624 by base transmitter 614, base transmitter 612 could be delivering a different message to a different mobile unit (not shown). As can be seen, this second alternative would increase information throughput and system efficiency.

If the mobile unit 624 has properly received the message via antenna 626, then the mobile unit 624 may generate a return signal and broadcast that signal via antenna 626. The return signal may be received by any or several of the base receivers 628, 630, 632, or 634. For example, the return signal could be received by base receiver 632 through antenna 640 if antenna 640 is located closer to the mobile units than any other antenna 636, 638, or 642. In this case, the base receiver would receive the return signal and provide it to regional station 650 through data path 652. The regional station would then provide the return signal to the network operations center 600 through data path 656 for further processing as appropriate. It should be understood that a return signal may include either an autonomous acknowledgment signal which indicates that the mobile unit accurately received the message or a user generated reply signal.

If the mobile unit 624 does not completely receive the message, it can generate and broadcast a negative acknowledge signal. The negative acknowledge signals when delivered to the

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network operations center 600, indicates that retransmission of the message is necessary.

It should be understood that the exemplary system shown in Fig. 6 includes a modest number of elements for ease of explanation. It is envisioned that the system of the present invention include a large number of base transmitters, base receivers, regional stations, and mobile units with a substantial number of base transmitters assigned to each zone and all base transmitters assigned to a particular zone operating in simulcast. Further, it is envisioned that the present system could advantageously support a large number of zones to cover a wide geographic area.

B. Overview of the Zonal Simulcast Concepts

The preferred systems and methods of the present invention variously use simulcast techniques within individual zones and over several or all of the zones. As previously noted, zones are generally defined by the coverage areas of the one or more base transmitters. The network operations center 600 assigns each base transmitter in the system to a zone. For example, in Fig. 6, base transmitter 614 is assigned to zone 1, and the base transmitter 612 is assigned to zone 2 by the network operations center 600. To maximize information throughput, the systems and methods of the present invention dynamically control zonal assignments and the use of simulcast techniques.

In general, the communication system of the present invention operates by repeating a communication cycle to achieve desired information transfer, which is more fully discussed infra. The

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communication cycle is divided into a systemwide time interval and a zonal time interval. In the systemwide time interval, the base transmitters from at least several zones are operated in simulcast to simultaneously transmit identical information to a large geographic area. It should be understood that the systemwide time merely two or more zones.

Broadly speaking, the communication system need not know the location of a mobile unit to transmit to it during the systemwide time interval. Therefore, the systemwide time interval can be used to send a "probe" signal that requests a particular mobile unit to broadcast an acknowledgment signal to allow the system to determine its approximate location by determining which base receiver receives the acknowledgment signal. Probe signals, thereby, may be used to track the locations of mobile units, or to uncover the location of "lost" mobile units.

In the zonal time interval, each base transmitter assigned to a particular zone transmits identical information in simulcast. However, for mobile units at or near the interference areas between adjacent zones, poor communication to those mobile units is likely during the zonal time interval because transmitters in adjacent zones will be simultaneously transmitting different data on the same, or substantially the same, frequencies. The zonal time interval provides good communication capability for mobile units not located near the zonal boundaries and allows the system to "reuse" identical frequencies in adjacent zones. Furthermore, if zonal boundaries are selected to be located in areas where mobile units are not likely to be located, i.e. unpopulated areas,

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the likelihood of providing good communication capabilities to a large percentage of mobile units can be increased.

As can be seen, from a system perspective, it is desirable to communicate with the mobile units in the zonal time interval because information throughput is maximized by reusing the transmission frequency band in the several zones. In other words, using the zonal time interval allows communication with a large number of mobile units in a short amount of time. Accordingly, communication during the systemwide time interval should be minimized because message transmission during this interval requires a large amount of system resources be dedicated to that message.

For mobile units located near the boundaries between zones where interference is likely during the zonal time interval, good communication capability can be achieved for these units during the systemwide time interval. In the preferred systems and methods, when a mobile unit fails to acknowledge a message sent during the zonal time interval or provides a negative acknowledgment, the network operations center sends a probe signal during a subsequent systemwide time interval to determine the location of that mobile unit. If the location of the mobile unit indicates that a likely reason for the failure of the mobile unit to receive the message is caused by inter-zonal interference, the network operations center may simply retransmit the message during the systemwide time interval. In other instances, the failure to successfully deliver a message may be simply caused by the mobile unit being located in a weak signal area within a zone. In these

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instances, the system may retransmit the message during the zonal time interval using an appropriate error correcting code or using a stronger error correcting code.

Alternatively, the network operations center may determine from the probe signal that the mobile unit is simply located in a different zone than the zone that the message was first sent. In this case, the network operations center preferably causes the message to be retransmitted in the appropriate zone without again using a portion of the valuable systemwide time interval.

In accordance with the invention, a preferred method 800 for sending a probe signal is shown in Fig. 8. In step 802, a message signal is transmitted by a base transmitter servicing a zone where the mobile transceiver was last known to be located. In particular, this may be preferably an attempt by the network to deliver a message to the mobile transceiver.

If the mobile transceiver does not indicate receipt of the message signal from the base transmitter transmitted in step 802, the network assumes that the mobile transceiver has not received the message and transmits a probe signal by a plurality of base transmitters servicing a plurality of zones in step 804. The mobile transceiver receives the probe signal in step 806.

Upon receipt of the probe signal by the mobile transceiver, the mobile transceiver transmits an acknowledgment signal in step 808. A base receiver receives the acknowledgment signal from the mobile transceiver in step 810.

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Finally, the data, such as the last location field 2104 shown in user database 2100, is updated to reflect the zone of the base receiver, or receivers, that receives the acknowledgment signal as the last known location of the mobile transceiver in step 812.

C. <u>The Multi-Carrier Modulation Transmission Format</u>

The base transmitters of the communication system, such as base transmitters 612 and 614 shown in Fig. 6, preferably utilize a multi-carrier modulation format as will now be described. In general, a multi-carrier modulation format envisions the simultaneous transmission of several closely spaced carrier frequencies within a desired frequency band, each individually modulated to convey an information signal. The multi-carrier modulation format advantageously allows for high data transfer rates by providing good bit rate transmission rates while keeping below the baud rate limitations of simulcast transmission techniques.

Fig. 9 shows a frequency representation 900 of an eight carrier modulation format. Carrier frequency 902 is shown with side bands 904, carrier frequency 906 is shown with side bands 908, carrier frequency 910 is shown with side bands 912, carrier frequency 914 is shown with side bands 916, carrier frequency 918 is shown with side bands 920, carrier frequency 922 is shown with side bands 924, carrier frequency 926 is shown with side bands 928, and carrier frequency 930 is shown with side bands 932.

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It should be understood that although this exemplary figure shows an eight carrier signal modulation format, other different numbers of carrier frequencies may be considered for use in the systems and methods of the present invention.

In this exemplary embodiment, the carrier frequencies are spaced 3 KHz apart within a desired frequency band of 50 KHz. Dashed line skirts 934 and 936 represent minimum frequency roll off levels, such as may be required by Federal Communication Commission regulations, to prevent overlap interference into adjacent frequency bands.

Because eight unique data streams may be modulated onto the respective eight carrier signals in this embodiment, the data transfer rate of the transmission from the base transmitters can be greatly increased, while keeping the baud rate within acceptable ranges for simulcast transmission. It should also be understood that in accordance with good simulcast practice, the respective carrier frequencies between adjacent base transmitters, such as base transmitter 612 and base transmitter 614 in Fig. 6, should be slightly offset to prevent sustained nodes or "dead spots" where destructive interference between the signals from each transmitter provides an unusable composite signal, as was explained in the background section of this application. This frequency offset is preferably on the order of 10-20 hertz.

As previously discussed, each carrier signal may be individually modulated to convey a data stream. The following will discuss alternative techniques for modulating a plurality of

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carriers in accordance with the systems and methods of the present invention.

1. Modulated On/Off Keying

Perhaps the simplest modulation scheme conceptually is modulated on/off keying (MOOK). Fig. 10 shows a schematic representation of a MOOK modulator 1000. The MOOK modulator 1000 includes a plurality of carrier frequency generating devices, such as frequency generator 1002 generating frequency F1, frequency generator 1004 generating frequency F2, frequency generator 1006 generating frequency F3, frequency generator 1008 generating frequency F4, and frequency generator 1010 generating frequency Fn. As shown in Fig. 10, the MOOK modulator 1000 may include any number (i.e. n) of frequency generators, but eight carrier frequencies are preferred, as shown in Fig. 9.

The output from each of the carrier frequency generators 102, 104, 106, 108, and 110 is applied to a plurality of respective switches SW1 812, SW2 814, SW3 816, SW4 818, and SWn 820. The output from each switch is provided to a combiner 1022.

Each of the switches SW1 812, SW2 814, SW3 816, SW4 818, and SWn 820 opens and closes under the control of a control logic system (not shown) to effect the MOOK modulation. The control logic system (not shown) causes the desired switches to variously close and open, thereby conveying an n-bit binary word. Each carrier frequency transmits a binary "one" if the respective switch is closed and a binary "zero" if the respective switch is open.

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The summer 1022 combines the modulated carrier frequencies to provide a multi-carrier modulated output signal that conveys an n-bit binary word.

2. Binary Frequency Shift Keying Modulation

An alternative multi-carrier modulation scheme including frequency shift keying (FSK) techniques may be implemented by the modulator shown in Fig. 11. A frequency shift keying modulator 1100 includes a first frequency source 1102, a second frequency source 1104, a third frequency source 1106, a fourth frequency source 1108, and an nth frequency source 1110. The output from each frequency source is provided to a respective modulator 1112, 1114, 1116, 1118, and 1120.

A control logic system (not shown) provides a frequency control signal to each modulator to frequency shift modulate the carrier frequencies. In particular, the control logic system (not shown) provides frequency control signal 1 to modulator 1112, frequency control signal 2 to modulator 1114, frequency control signal 3 to modulator 1116, frequency signal 4 to modulator 1118, and frequency control signal n to modulator 1120. In binary frequency shift keying (BFSK), the respective frequency control signals provide data corresponding to a binary "one" or "zero" which causes the respective modulators to modulate a first or second frequency onto the carrier signal.

A summer 1122 combines the modulated carrier frequencies to produce an output signal.

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3. M'ary Frequency Shift Keying Modulation

A modulation scheme related to binary frequency shift keying is M'ary frequency shift keying. M'ary frequency shift keying modulates three or more different frequencies onto the respective carrier signals. In quaternary frequency shift keying, for example, two bits of information may be instantaneously conveyed on a single carrier frequency. Similarly, 8'ary frequency shift keying may instantaneously convey three bits of information per carrier frequency.

Referring again to Fig. 11, M'ary frequency shift keying may be implemented by providing modulators 1112, 1114, 1116, 1118, and 1120 with the capability to modulate M different frequencies onto the carrier signal. Accordingly, the various frequency control signals must provide data indicating which of the M frequencies is to be modulated onto the carrier signal. For example, in quaternary frequency shift keying, the frequency control signals must each include two bits of information to indicate which of the four different frequencies are to be modulated onto the carrier frequency.

The summer 1122 combines the modulated carrier frequencies to produce an output signal.

4. Quadrature Amplitude Multi-Carrier Modulation

Yet another alternative modulation technique for a multi-carrier transmission format is shown in Fig. 12. A quadrature modulator 1200 includes a first quadrature carrier generator 1202, a second quadrature carrier generator 1204, a third quadrature carrier generator 1206, and a fourth quadrature

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carrier generator 1208. As is well known, quadrature modulators in general each produce an in-phase carrier signal and a quadrature carrier signal that is +/- 90° out of phase with reference to the in-phase signal. Of course, any number of quadrature carrier generators could be envisioned, depending upon data transfer and throughput needs. Fig. 12 shows four quadrature carrier generations which effectively correspond to eight unique modulator signals. Therefore, quadrature amplitude multi-carrier modulation may preferably reduce the width of the frequency band necessary to achieve a desired data transfer rate.

Each quadrature carrier generator 1202, 1204, 1206, and 1208 receives a control signal from a control logic system (not shown) which provides the data to be modulated onto the quadrature carrier signals. In a simple implementation, the quadrature carrier generators may amplitude modulate the in-phase and quadrature phase output signals to convey two bits of information. The in-phase and quadrature signals output from each quadrature carrier generators 1202, 1204, 1206, and 1208 are provided to a summer 1210 which combines the signals to produce an output signal.

5. <u>Permutation Frequency Shift Keying (PFSK)</u>

PFSK may be implemented through control logic systems similar to that used in a MOOK or an M'ary FSK modulation scheme. In PFSK, every baud has a fixed number of carrier signals present, preferably any 4 of the possible 8. In a PFSK arrangement, a constant average transmitter power is advantageously delivered and the receiver only need decide which 4 carrier frequencies contain

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the most energy. In the case of MOOK, the receiver must attempt to determine on a subchannel-by-subchannel basis the presence or absence of a signal. This aspect of PFSK may simplify mobile receiver design.

Compared to a binary or M'ary FSK modulation schemes, a higher number of bits may be delivered per baud with PFSK. For example, PFSK may generate signals that independent FSK subchannels could never generate, such as all four carriers being the four highest frequencies, and therefore it can be seen that PFSK may advantageously increase information transfer rates.

D. The Base Transmitter

Each base transmitter unit, such as base transmitter 612 or 614 shown in Fig. 6, receives transmitter control data and message data transmitted from the satellite 606. Fig. 13 shows a first preferred embodiment of a base transmitter 1300 in accordance with the present invention. The base transmitter 1300 receives data from the satellite downlink connected to data input 1302 which provides this data to a control logic system 1304 to control the operation of the base transmitter unit. The control logic 1304 provides a control signal to a plurality of modulators 1306, 1308, 1310, 1312, and 1314. Modulator 1306 produces a carrier signal F1, modulator 1308 produces a carrier signal F2, modulator 1310 produces a carrier signal F3, modulator 1312 produces a carrier signal F4, and modulator 1314 produces a carrier signal Fn.

For example, the control logic may generate appropriate control signals to modulate the carrier signals in a MOOK, BFSK, M'ary FSK, PFSK, or quadrature amplitude modulation scheme, as

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previously discussed. Each modulator then provides the modulated output signal to a combiner 1316 which combines each of the several modulated carrier frequencies into a single output signal.

The single signal is then applied to a power amplifier 1318 to amplify this signal to an appropriate level. The power amplifier 1318 may, for example, produce a nominal output signal of 350 watts to antenna 1320. In this embodiment, power amplifier 1318 preferably has extremely linear characteristics to prevent formation of intermodulation products, and to insure that these intermodulation products do not cause signals to be generated at undesirable frequencies. Antenna 1320 broadcasts the desired signal from power amplifier 1318.

Fig. 14 shows a second preferred embodiment of a base transmitter unit. The second embodiment comprises a base transmitter 1400 which includes a satellite downlink connected to data input 1402, control logic 1404, and several modulators 1406, 1408, 1410, 1412, and 1414. Each modulator receives an appropriate control signal from the control logic 1404, as previously discussed with respect to base transmitter 1300.

The output from each of modulators 1406, 1408, 1410, 1412, and 1414 in base transmitter 1400 is provided to respective power amplifiers 1416, 1418, 1420, 1422, and 1424 to provide an appropriate power output level for transmission, such as 350 watts aggregate.

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The output from each of power amplifiers 1416, 1418, 1420, 1422, and 1424 is provided to combiner 1426 to combine the modulated carrier signals into a single output signal which is provided to antenna 1428 for broadcast.

E. The Mobile Unit

The mobile unit may be a small, portable mobile transceiver, such as pictorially represented in Fig. 16. Referring now to Fig. 15, the mobile transceiver 1500 shown therein includes a receiver section for receiving signals from the base transmitters of the system, and a transmitter section for transmitting replies, or other messages, to the base receivers of the system.

In particular, the mobile transceiver 1500 includes an antenna 1502 which is connected to a transmit/receive switch 1504 to switch the antenna between the transmit and receive sections of the mobile transceiver 1500. A receiver 1506 is provided to receive the messages from the base transmitter. Of course, the receiver must be appropriately designed to receive the multi-carrier signals from the base transmitters and must be appropriately designed to demodulate the particular modulation scheme utilized. For example, appropriate analog filters and appropriate demodulators could be used. In the preferred embodiment, the receiver performs a transform, such as a fast fourier transform, on the received signal to separate the data from the various carriers in the multi-carrier modulation format.

The receiver 1506 is connected to a display and storage logic section 1508 to process the received signal. An annunciator 1510 to alert the user that a message has been received is connected to

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and controlled by the display and storage logic 1508. The annunciator 1510 may commonly include a sound producing device such as a beeper, or a vibrator, or a flashing light.

A set of display controls 1512 to control the display of the mobile transceiver 1500 is connected to the display and storage logic 1508. A display 1514, preferably an LCD display, is also connected to the display and storage logic 1508 to display messages and various other information to the user.

Display and storage logic 1508 is connected to transmit logic 1518 via connection 1526. Display and storage logic 1508 may generate an autonomous acknowledge signal which causes the transmitter 1520 to broadcast an appropriately modulated RF signal. As previously discussed, it is desirable for the mobile transceiver to transmit an acknowledge signal if the message was properly received by the mobile unit, or alternatively to transmit a negative acknowledge signal if the message was only partially received. The negative acknowledge signal indicates that the network operations center should rebroadcast the message to the mobile unit.

Preferably, the rebroadcast of the message to the mobile unit should occur with an appropriate error correcting code which may be decoded by the mobile unit to insure complete and accurate reception of the message. Of course, error correcting codes should be used only when necessary because their use slows data transfer and increases the complexity of the mobile unit. Other types of autonomous replies may also be useful, for example, to indicate to the network operations center that the user has not

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viewed the message even though the mobile unit properly received it, such as when the mobile transceiver is unattended by the user.

A set of input switches 1516 is provided to allow the user to input a reply to a received message, or to otherwise generate a message to be transmitted by the mobile transceiver. The input switches are connected to transmit logic 1518 which decodes the signal from the input switches 1516 to generate an output signal to the transmitter 1520. The transmitter 1520 generates an appropriately modulated RF signal to be broadcast by antenna 1502.

The mobile transceiver 1500 also preferably includes a noise detector 1522. The noise detector 1522 provides an output signal upon sensing through antenna 1502 a threshold level signal. The noise detector 1522 provides an output signal to disable the transmitter 1520 via connection 1524, and to thereby prevent unwanted transmission by the mobile unit.

Noise detector 1522 preferably is set to detect electromagnetic signals which are generated externally to the communication system and which are indicative of a condition when transmissions by the mobile unit are undesirable. For example, the noise detector 1522 could be designed to serve a threshold level of noise at 400 Hz. When the user enters a commercial aircraft, which commonly uses 400 hertz power supply, the receipt of this noise by the noise detector 1522 would then disable the transmit capability of the mobile transceiver 1500 during operation of the aircraft to prevent any unnecessary or unwanted interference with the operations of the aircraft by autonomous or intentional transmissions by the mobile transceiver 1500.

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The display and storage logic 1508 of the mobile transceiver 1500 further preferably includes a timing circuit (not shown) which may be used to turn the receiver section 1506 on or off, as desired. The timing circuit (not shown) advantageously allows the mobile transceiver to "power down" during periods of time when messages are not anticipated to be transmitted. For example, in a preferred communication protocol, the receiver could simply power up at the beginning of each cycle to receive data to determine if a message will be transmitted to that mobile transceiver during that cycle or when information concerning message availability will be transmitted. If the mobile transceiver is to receive a message, the timing circuit could power up at the appropriate time to receive the message, and then power down after receipt. The timing circuit, therefore, advantageously prolongs the battery life of the mobile transceiver 1500. Of course, it should be understood that the timing circuit could control the other elements of the mobile transceiver, such as the display 1514, and the transmit logic 1518.

In an alternate implementation, the receiver 1506 may adaptively change its demodulation techniques to accommodate various formats. For example, each zone may advantageously use a different modulation format depending on message traffic levels, and other considerations. In particular, the receiver may receive a signal indicating the modulation scheme utilized in a given zone via a modulation format message contained in an overhead portion of the data stream. The demodulation of FSK, M'ary FSK, PFSK, and MOOK formats all begin with the determination of the energy levels

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detected at each of the carrier frequencies, and thus require identical processing of the received RF energy. The logic (not shown) in the receiver interprets the meaning of these measured energy levels based upon the modulation scheme selected as indicated by the received modulation format message. In this manner simpler and more economical transmitters, with a decreased capacity for information transfer, can be used in zones that have decreased traffic loads and more expensive, high-throughput transmitters can be used only in those areas where they are needed.

A pictorial representation of the mobile transceiver is shown in Fig. 16. The mobile transceiver 1600 shown therein includes a case 1602, a pair of display control buttons 1604, a display 1606, and a set of six reply buttons 1608, 1610, 1612, 1614, 1616, and 1618. As indicated previously, display 1606 is preferably an LCD display and a set of display control buttons 1604 may be used to scroll text up or down on the display 1606. The message "will you be home for dinner?" is shown on display 1606.

The set of six reply buttons 1608, 1610, 1612, 1614, 1616, and 1618 provide a flexible system for user generated replies to received messages. The display and storage logic 1508 provides information immediately above each button indicating a possible reply message by the user. In the simple example shown in Fig. 16, the user may reply "yes," "no," or "?" to the message 1620 displayed on the screen 1606. The transmit logic 1518 generates an appropriate signal based upon which button the user

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presses. In this simple scenario, buttons 1614, 1616, and 1618 are unused.

In alternate applications, up to six possible reply messages may be shown on the screen 1606. Of course, other particularized applications may be envisioned for the reply feature of the mobile transceiver 1500. For example, if the user is a stockbroker, the display 1606 could display the terms "buy," "sell," or "hold" above the appropriate buttons. A variety of other applications may be envisioned.

With the six button reply option provided by mobile transceiver 1500, a three bit message may be transmitted by the mobile transceiver to the base receivers. The two remaining states of the three bit message may be used by the transmit logic 1518 for the autonomous acknowledgment signal which indicates that the message has been properly received, and for the autonomous negative acknowledgment signal which indicates that the message has not been completely or properly received.

Of course, the mobile transceiver 1500 shown in Fig. 16 could be configured differently to provide more or less reply buttons, different display control buttons, and different display formats as desired or needed by the user.

Further, the mobile transceiver 1500 could additionally include a data output port (not shown) for connection to other electronic devices of the user. For example, the mobile transceiver could be connected through an output port to a laptop or palmtop PC, or could be incorporated therein. The PC could display the message on its screen, thereby obviating the need for

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the display 1606, and the keyboard could be used to generate any appropriate reply messages from the user, thereby obviating need for the reply buttons and allowing free form messages to be sent by the mobile transceiver. A user selected reply would be transferred to the mobile transceiver 1500 from the PC for transmission to the base receiver.

Alternatively, the mobile transceiver could be connected to a voice data replay device, such as a speaker, thereby allowing the user to receive messages from a voice mailbox, for example. Of course, a voice data generation device, such as a microphone, could be connected to the mobile transceiver 1500 to allow the user to reply to the voice mail message he has received or to initiate voice data communication from the mobile transceiver to the base receivers. Similarly, facsimile transmissions could be supported.

An alternate embodiment of the mobile unit includes only receive capabilities, but does not include any transmit capabilities. Fig. 17 shows a mobile receiver 1700. The various components of the mobile receiver generally correspond in functionality to the similar elements shown in Fig. 15. Of course, the mobile receiver 1700 cannot generate replies, which includes user initiated replies, an autonomous acknowledgment signals or negative acknowledgment signals, because of the lack of transmit capability. Also, the location of this alternate embodiment cannot be tracked by the network control center because of the lack of transmit capability. Generally, because of these reasons, the mobile receiver 1700 embodiment of the mobile unit is

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less preferable than the mobile transceiver embodiment 1500. Further, it should be appreciated that the mobile transceiver embodiment may include circuitry for generating various autonomous responses without interaction by the user.

F. The Base Receiver

The base receivers of the present system receive the low power output signal from the mobile transceiver unit. As is shown in Fig. 6, mobile receivers are dispersed throughout the geographic service area. Base receivers need not be associated with zonal boundaries per se, but will always be located to service at least one zone, of course. A few base receivers may exist in the overlap region between zones.

During transmission of the return signal by the mobile transceiver unit, it is possible that several base receivers could receive this return signal. In this instance, the network operations center 600 preferably selects the data from the base receiver with the highest received signal strength (i.e. the signal with the lowest probability of errors) to maximize the likelihood of receiving accurate data. The signal strength approach is preferred and can be satisfactorily implemented if the base receiver locations are carefully selected to insure adequate signal strength reception from the mobile transceiver units and to minimize the overlap between base receiver coverage areas. Alternately, the network operations center 600 could use "voting" techniques by comparing each data set from the several base receivers to arrive at the most likely return signal data using conventional voting receiver technology.

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Fig. 18(A) shows a first embodiment of an analog base receiver. Analog receiver 1802 is connected to an antenna 1800. The analog receiver 1802 simply receives the signal from the antenna 1800 and removes the modulated waveform from the carrier frequency and outputs this waveform in analog format to a regional demodulator 1804 via data path 1806. Data path 1806 is preferably a 4 KHz analog telephone channel.

The regional demodulator 1804 receives signals from several analog receivers included in several base receivers. Preferably, the regional demodulator 1804 is located in the regional station, such as regional station 650 shown in Fig. 6. The demodulated signal from the regional demodulator 1804 is then transferred to the regional processing circuitry 1808, and then onto the network operations center 600.

The analog receiver 1802 could generate identification data to be transmitted with each received message so the network operations center 600 can determine the source of each message received. Alternatively, and preferably, dedicated communication paths are used for each base receiver and therefore, the source of the message can be inferred from the communication path that is activated.

Fig. 18(B) shows a digital base receiver embodiment which includes an antenna 1800 attached to an analog receiver 1802. As in the previously discussed embodiment, the analog receiver 1802 removes the modulated waveform from the carrier signal transmitted by the mobile transceiver unit. The analog receiver 1802 outputs the modulated waveform to a demodulator 1810 included in the base

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receiver. The demodulator 1810 produces a digital output signal corresponding to the data stream transmitted by the mobile transceiver unit. The demodulator 1810 provides the digital output signal to the regional processing circuitry 1808 in the regional station via data path 1812. Data path 1812 may be any conventional data path which can satisfactorily convey the digital data from the demodulator 1810 to the regional processing center 1808. The regional processing circuitry 1808 then passes the data to the network operations center 600.

Fig. 19 shows a digital base receiver including error correction and store and forward features. An antenna 1900 is connected to an analog receiver 1802 which is connected to a demodulator 1810, as previously described with reference to Fig. 18(B). The demodulated digital signal is output from demodulator 1810 to error correction circuitry 1906 which may perform error correction algorithms to insure the integrity of the return signal received from the mobile transceiver unit. Of course, the error correction circuitry should decode and correct data which have been compatibly encoded by the mobile transceiver.

The error corrected data output from the error correction circuitry 1906 is provided to a store and forward circuit 1908. The store and forward circuit 1908 stores the received data to allow it to be transmitted later at a convenient time and at a convenient data transmission rate.

For example, in the present system it is likely that the return signal traffic received by the base receiver will occur in short bursts at a relatively high data transfer rate. However, it

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is also likely that the average data transfer rate from the base receivers is substantially lower than the instantaneous data transfer rate during traffic bursts. The store and forward circuit 1908 may preferably act as a buffer to allow the return signal data to be communicated from the store and forward circuit 1908 to the regional processing circuitry 1808 at a lower (and less expensive) data transfer rate. Store and forward circuit 1908 is, therefore, preferably connected to regional processing circuitry 1808 via data path 1910 which may include a low cost telephone line.

G. The Network Operations Center

1. Overview

The network operations center 600 is shown in schematic form in Fig. 20. The network operations center 600 includes a base receiver input system 2000 which receives data from the various regional stations throughout the system (e.g., regional stations 644 and 650) via various data paths, such as data paths 656 and 658 as shown in Fig. 6. The data received by the base receiver input system 2000 includes reply data from users with various control data. Base receiver input system 2000 may include appropriate conventional signal processing equipment. Control data may include data identifying the base receiver (i.e. location of the mobile unit) which received the associated reply. Preferably, the base receiver input section 2000 receives data from the regional stations via phone lines. However, other appropriate data paths may be considered.

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The base receiver input system 2000 then provides the received data to a central computer 2002. The central computer 2002 may also receive input from a user input system 2004. For example, the user input system 2004 may receive data from users via phone lines who may access and interact with the central computer via voice, DTMF, or modem transmission and may include appropriate conventional signal processing equipment. A user may interact with the central computer 2002 to modify his service, to initiate or receive messages, or to perform other desirable functions.

Generally, the central computer 2002 processes the data received from the base receiver input system 2000 and from the user input system 2004 to perform various operations on the data, to update various database entries for use by the central computer 2002, and to generate data for transmission to a satellite uplink output system 2006.

It should be understood that, although Fig. 20 shows the central computer as existing at a single location in the network operations center 600, a distributed computing system may be used to perform the necessary functionality of the central computer 2002. Presently, however, a single location for the central computer 2002 is preferred.

Satellite uplink output system 2006 receives data from the central computer 2002 and provides it to satellite 606, shown in Fig. 6, for transmission to base transmitters within the system (e.g., base transmitters 612 and 614 in Fig. 6).

The central computer 2002 is also connected to a database system 2008 which stores various data such as message data, user status data, system status data, and message status data, for example, for use by the central computer 2002 in processing.

Also, a control access 2010 is provided to allow systems engineers or programmers to access the central computer 2002 to observe and modify its operations and system performance.

2. Database Structure

The database 2008 of the network operations center includes several database structures necessary for the operation of the system. While a preferred partitioning of these databases is described below, it should be understood that other partitionings could be considered, such as moving the various "user traffic" fields from the traffic statistics database to the user database.

a. The User Database

For example, the user database structure shown in Fig. 21 includes a record for each user of the system who possesses a mobile unit. The record for user 1 2100 includes various fields, such as an ID number field 2102 which indicates a unique number associated with that particular user. The transmit capability field 2106 indicates whether the mobile unit assigned to the user has the capability to transmit. The last location field 2104 includes data which indicates the last known location of the user. The last location field may be updated when the central computer recognizes that a new base receiver has received a return signal from the mobile unit, thereby indicating the mobile unit has moved since the last return signal. Of course, if the mobile unit only

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includes a mobile receiver without transmit capability, the last location field 2104 cannot be updated and the mobile unit may be given a default location.

The service area field 2108 includes data corresponding to the area in which the user has subscribed to. For example, if a user desires service in geographic areas less than the total system service area, the central computer could use the data in the service area field 2108 to cause only selected base transmitters to attempt to transmit messages to a mobile unit.

The button format field 2110 includes data indicating the format of reply buttons the user may access on the mobile transceiver. Of course, for mobile units with only receive capabilities, the button format field will not be used.

The message field 2112 includes data representing one or more messages which are intended for the user. A receive flag is set when the central computer has received data indicating that the message has been received by the mobile unit via an acknowledgment signal. If the mobile unit does not have transmit capability, the receive flag is set upon transmission of the message by the appropriate base transmitters. The user database structure may include other fields for each user of the communication system of the present invention as needed to provide various desired services.

b. <u>The Receiver Database</u>

Database 2008 of Fig. 20 includes a receiver database (not shown) which includes an entry with several associated fields for each base receiver in the system. A first field for each base

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receiver preferably includes the total number of mobile units which have last communicated with this receiver. A second field for each base receiver preferably includes a list of base transmitters which may cover all or a portion of the receiver coverage area of that base receiver.

c. Traffic Statistics Database

Database 2008 of Fig. 20 should also include preferably a traffic statistics database as shown in Fig. 22 which includes various fields containing statistics calculated by the central computer 2002 concerning traffic patterns for the system. For example, the traffic database 2200 preferably includes a user field 2202 for data indicating a user of the network. Several fields are preferably associated with the user field 2202. Field 2204 includes data representing the number of probe signals sent by the network to locate the mobile unit associated with the user field 2202. Field 2206 includes data representing the number of registration signals received by the network from the mobile unit associated with the user field 2202. Field 2208 includes data representing the number of messages from the network that have been successfully delivered to the mobile unit associated with the user field 2202. Field 2210 may be used for other traffic related data, such as data indicating the average traffic per cycle, and data indicating a time average (i.e. for the last hour) traffic amount.

Further, the traffic database 2200 could include fields (not shown) for data concerning overall system performance and, in particular, each zone in the network. Such area specific traffic

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data may be useful in optimizing system performance by allowing intelligent redefinition of zonal boundaries.

d. The Service Queue

Database 2008 of Fig. 20 also includes a service queue 2300 as shown in Fig. 20. The service queue 2300 includes a current messages queue and a probe list queue. The current messages queue includes a system wide list of messages to be delivered by the system. The current messages queue includes, for example, a series of ID number fields 2302, 2304, and 2306 with associated data location fields 2308, 2310, and 2312, respectively. The data location fields 2308, 2310, and 2312 include pointers to the appropriate fields in the user database structure shown in Fig. 21. The ID number fields 2302, 2304, and 2306 include data indicating the ID number of the user to which the message is to be delivered.

In operation, the central computer retrieves the ID number 2302 and data location 2308 from the top of the current messages queue and retrieves the appropriate data from the user database 2100 to process and transmit a message to the user.

The probe list queue includes a ID number fields 2314, 2316, and 2318 and data location fields 2320, 2322, and 2324 similar in form to those in the current messages queue. The probe list queue contains a list of users which the system has previously attempted unsuccessfully to deliver a message to. In other words, the users listed in the probe list are considered to be "lost" by the system. The central computer 2002 then initiates a probe routine

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for the ID number 2314 and data location 2320 located at the top of the probe list.

After successful execution of the probe routine, the last location field 2304 in the user database structure 2100 will have been updated to provide an accurate last location of the user from the base receiver that received the mobile unit's acknowledgment to the probe signal. After the last location field 2304 has been updated, the message can then be replaced in the current messages queue for delivery to the user via the appropriate base transmitters located near the mobile unit.

Preferably, the network operations center gives priority to the delivery of all messages in the current message queue, and then sends probe signals to the users listed in the probe list queue after delivery has been attempted for all messages in the current message queue. If the message volume in the current message queue remains high for an extended period of time, the network operations center preferably begins to periodically send probe signals to the users listed in the Probe List, even though undelivered messages remain in the current messages queue. For example, in this instance of persistent filled current messages queue, the network operation center preferably transmits three probe signals in every cycle transmitted.

e. <u>Base Transmitter Assignment List</u>

The database 2008 of the network operations center also includes a base transmitter database 2400 as shown in Fig. 24. The base transmitter database 2400 includes a zonal assignment field 2404 for data representing a zone assignment associated with

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a base transmitter field 2402 in the system. Also, a field 2406 for data representing the base receivers in the transmitter coverage area, and a field 2408 for other data associated with a base transmitter, are associated with base transmitter field 2402. As can be seen in Fig. 24, each base transmitter in the network has a base transmitter field and associated fields as described above.

In normal operating conditions of the system with low amounts of message traffic being transmitted, each base transmitter will remain assigned to its particular zone. However, the systems and methods of the present invention provide for dynamically changing the zonal assignments of various base transmitters to improve information throughput. These dynamic zone allocation concepts dynamically reassign base transmitters to new zones generally based upon the volume of messages transmitted during the systemwide time interval, and more particularly based upon the localized volume of messages to mobile units. In general, dynamic zone allocation may be used to deliver messages to mobile units in overlap areas (i.e. "zonal dithering"), or to balance the volume of message traffic between zones.

Fig. 25 is useful to explain these concepts. Various base transmitters, each designated as an "X," are dispersed throughout a region of space shown in Fig. 25. Also, various base receivers are dispersed throughout this region of space 2500, each being designated by an "R." The normal zonal boundary for zone 1 in Fig. 25 is shown by solid line 2502. A normal boundary for zone 2 is represented by solid line 2504 during normal load traffic

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operation conditions. As can be seen, base transmitters 2506, 2508, and 2510 are located near the zonal boundary of zone 2, and base transmitters 2512, 2514, and 2516 are located near the boundary of zone 1. Base receivers 2518 and 2520 are located in an overlap area 2521 between zones 1 and 2. As previously discussed, mobile units located in this overlap area 2521 near base receivers 2518 and 2520 must be communicated with during the systemwide time interval because of the interference created during the zonal time interval by adjacent base transmitters.

During normal, low to moderate volume system operations, the zonal overlap area 2521, i.e., interference area, near base receivers 2518 and 2520 will preferably have a small number of mobile units located therein. Therefore, communication with these mobile units will not significantly consume system resources by occasionally communicating with them during the systemwide time interval.

However, if the traffic volume from the overlap area 2521 near base receivers 2518 and 2520 increases, such as because additional mobile units enter this overlap area 2521, the handling of this traffic in the systemwide time interval can significantly consume system resources. For example, communication with a large number of mobile units during the systemwide time interval may significantly delay delivery of messages to units in this and other regions.

In this instance, the zonal boundaries are changed to remove this high traffic region from a zonal overlap area. For example, system efficiency is restored if the zone 1 boundary were moved to

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dashed line 2522 and the zone 2 boundary were moved to dashed line 2524.

The central computer 2002 may dynamically accomplish this zonal redefinition by assigning one or more base transmitters to a new zone to reduce systemwide time interval messages. In the present example shown in Fig. 25, the central computer updates the base transmitter zonal assignment list to reassign base transmitters 2512, 2514, and 2516 to zone 2 while removing these base transmitters from zone 1. In view of this zonal redefinition, the new zone 1 boundary is shown by dashed line 2522, and the new zone 2 boundary is shown by dashed line 2524. The high traffic region near base receivers 2518 and 2520 is now squarely within zone 2 and messages to these units may be efficiently delivered during subsequent zonal time interval(s).

In accordance with the invention, a preferred method 2600 for accomplishing zonal redefinition is shown in Fig. 26. In accordance with the method, step 2602 provides for transmitting substantially simultaneously a first information signal and a second information signal, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone. For example, as shown in Fig. 25, the base transmitters in zone 1 defined by boundary line 2502 could be the first set of base transmitters, and the base transmitters located in zone 2 defined by boundary line 2504 could be the second set of base transmitters.

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Step 2604 of the method provides for dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone, thereby creating an updated first set of base transmitters and an updated second set of base transmitters. For example, base transmitters 2512, 2514, and 2516 could be reassigned from zone 1 to zone 2. As shown in Fig. 25, new zonal boundaries would be defined by dashed lines 2512 for zone 1 and 2524 for zone 2.

Step 2606 provides transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters. For example, as shown in Fig. 25, the base transmitters assigned to zone 1 defined by dashed line 2522 (i.e. not including base transmitters 2512, 2514, and 2516) could transmit during a subsequent communication cycle a third information signal, and base transmitters in zone 2 defined by dashed line 2524 (i.e. including base transmitters 2512, 2514, and 2516) could transmit a fourth information signal during that same subsequent communication cycle.

Further, it is desirable that during the redefinition of the zonal boundaries, it is insured that the new overlap area 2525 near base receiver 2526 and between dashed lines 2522 and 2524 is an area that is not likely to produce, or is not currently producing a high volume of message traffic. Generally, zonal

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boundaries should be preferably redefined to maximize information throughput by minimizing the data that must be transferred during the systemwide time interval. A network manager could review the overall traffic patterns and tendencies to determine an optimum redefinition of zonal boundaries. Of course, the central computer 2002 could also implement an algorithm accessing the traffic statistics database 2200 to determine optimal zonal boundary redefinition.

In a preferred embodiment in the instance where an entire region is saturated with mobile units, such as a large metropolitan area repetitive reassignments of base transmitters may be used to reduce message traffics during the systemwide time interval. There may exist no appropriate overlap area, such as overlap area 2525, with a low traffic level to facilitate a long term reassignment of base transmitters with the resulting redefinition of zonal boundaries. In this case, the preferred embodiment alternates between a first and second set of zonal boundaries over each communication cycle and does not attempt to deliver messages during the systemwide time interval.

For example, in Fig. 25 this preferred embodiment would utilize the zonal boundaries defined by lines 2502 and 2504 during a first zonal time interval and would not attempt to deliver messages to mobile units in overlap area 2521. In a subsequent cycle, this preferred embodiment redefines the zonal boundaries to dashed lines 2522 and 2524 and delivers messages to the mobile units in previous overlap area 2521 during the zonal time interval using zone 2 base transmitters. During this cycle, the network

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would not attempt to deliver messages to mobile units in overlap area 2525. In yet a later cycle, this preferred embodiment would switch back to zonal boundaries 2502 and 2504 which would allow message delivery to mobile units in the now previous overlap area 2525 during the zonal time interval using zone 1 base transmitters. As can be seen, alternating between a first and second set of zonal boundaries advantageously reduces the need for communication during the systemwide time interval, but slows message delivery somewhat by only allowing communication to mobile units in overlap areas during zonal time intervals on alternating communication cycles.

H. The Preferred System Communication Protocol

The system communication protocol is preferably a time division protocol organized within repetitive communication cycles of preferably 30 seconds in duration.

The blocks of data transmitted by the network are preferably formed by a bit interleaving process to prevent loss of data during bursts of interference. Bit interleaving may be envisioned as stacking two or more blocks of data (which read from left to right), and then transmitting a bit stream in a column-by-column, top-to-bottom sequence. As can be seen, a burst of interference will likely only cause the loss of a few bits per word at most, which can be corrected by error correction techniques, rather than the loss of entire words. Of course, the mobile unit must appropriately deinterleave the data prior to processing.

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Fig. 27 generally illustrates a variety of preferred time intervals which may variously be used for communication between the system and various sets and subsets of mobile units. An adaptable schedule for these time intervals is preferably generated, and may be revised according to system demands. The scheduling of the time intervals advantageously allows a mobile unit to "power down" during inactive time periods when the mobile unit will not transmit or receive any messages, thereby conserving battery power. Similarly, messages or information for delivery to a subset of the total number of mobile units will preferably be transmitted during time intervals which minimize the delivery of those messages or information to unintended mobile units not included in the subset to further conserve battery power.

A preferred cycle protocol 2700 is shown in Figure 27(A). The cycle protocol 2700 includes a cycle header time interval 2702, a systemwide forward (FWD) batch time interval 2704, a systemwide response time interval 2706, a zonal forward (FWD) batch time interval 2708, a zonal reverse time interval 2710, and a reverse contention time interval 2712. Other arrangements, such as moving the systemwide reverse interval next to the zonal reverse interval may be considered if transmitter turn on time is significant.

The cycle protocol generally schedules time slots for systemwide and zonal forward channel information transfer from the network to the mobile units and for systemwide and zonal reverse channel information transfer from the mobile transceiver units to the network. Briefly, the cycle header 2702 field includes

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overhead or "housekeeping" information, the systemwide forward batch field 2704 and the zonal forward batch field 2708 provide forward communication capability through the base transmitters to the mobile units in a systemwide time interval and a zonal time interval, respectively. The systemwide response field 2706 and zonal reverse field 2710 provide a return signal period for the mobile transceivers to respond to messages generated during the systemwide and zonal forward batch periods 2504 and 2508, respectively. Finally, the reverse contention 2712 field allows the mobile transceiver to initiate access to the network.

Each of the fields shown, except the cycle header 2702 field, is preferably variable in duration, and may be changed by the central computer 2002, depending on message traffic requirements. The beginning of the cycle is synchronized by the central computer to a time standard and preferably coincides with the start of minute or half minute intervals. Each mobile unit preferably includes timing circuitry, as previously described, which allows for the mobile unit to power up at the beginning of each cycle to receive communication.

For each cycle, the central computer 2002 calculates the amount of time required for each field to maximize information throughput by the network. For example, for the cycle protocol 2700 shown in Fig. 27(A), the central computer will calculate the amount of time necessary for the systemwide forward batch field 2704, the systemwide response interval 2706, the zonal forward interval 2708, the zonal reverse interval 2710, and the reverse contention interval 2712. The cycle header 2702 will preferably

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include timing offset data which will indicate the timing offset from the cycle header until the beginning of the systemwide response interval 2706, the beginning of the zonal forward interval 2708, the beginning of the zonal reverse interval 2710, and the beginning of the reverse contention interval 2712.

The cycle header 2702 starts preferably with an 8 digit long preamble (not shown) for digit synchronization purposes. The preamble allows for the mobile unit to synchronize its timing circuitry with the network. For example, the timing circuitry of the mobile unit could become offset from the network due to commonly caused inaccuracies. The preamble is followed by a "start of header" string of four digits and all timing offsets within the cycle are calculated as a number of predefined intervals beginning from the start of the last header digit. The start of header string is followed by an 8 digit string grouped into two words, each of which is protected against errors by encoding it using a forward error correcting code, preferably a Bose, Chaudhuri, and Hocquenghem (BCH) code or a Reed Solomon code. These error correcting codes add additional digits to the information digits in a code word, where the additional digits are a specific function of the information digits, so that if certain common error events occur, a decoding step involving all of the transmitted digits, both information and additional, can recover the original information digits. The first code word will contain a count of the current cycles executed for that day. The second code word will contain the necessary timing offsets for the beginning of the time intervals in the cycle protocol 2700.

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Further information regarding error correcting codes may be found in Gallagher, "Information Theory and Reliable Communication," Wiley 1968, which is hereby incorporated by reference.

The systemwide forward batch 2704 field generally includes a zonal header time interval including overhead information and a series of 64 batches. Also, the zonal forward interval 2710 similarly includes a zonal header time interval with overhead information and a series of 64 batches. Each batch is a string of data containing information specifically directed to a single group of mobile units. Each batch preferably contains information directed to a certain class of mobile units with the classes divided by the types of service provided. For example, a first batch could be directed to all mobile transceiver units, and a second batch could be directed to all mobile receiver units. Further, each batch may contain several messages, each intended for different mobile units within the particular class of unit to which that batch is directed. Generally, Fig. 27(B) shows the forward batch interval protocol 2750 preferred for both the systemwide forward interval 2704 and the zonal forward interval 2708.

The systemwide forward interval 2704 is preferably used only for sending a probe signal to a mobile transceiver unit which does not respond to zonal messages (i.e. a "lost" unit). However, when necessary, the systemwide forward interval 2704 may be used to deliver messages to mobile units located in overlap areas. The ID number, or address, of the lost mobile unit is preferably followed by data indicating a timing offset which is a time delay amount

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until the beginning of the time slot designated for the return signal of that mobile unit. An alternative implementation, which may be useful for mobile units that have not responded for a period of time, could have mobile units that have received a probe signal respond during the reverse contention interval.

After the end of the broadcast on the systemwide forward batch time interval 2704, all network base transmitters shut down until the beginning of the zonal forward batch time interval 2708.

The forward batch interval protocol 2750 includes a forward channel header interval 2714 which includes data to allow the timing circuitry of the mobile units to synchronize themselves with the incoming data stream. The forward channel header 2714 also preferably includes data indicating a timing offset scheduling a reverse channel time interval for each batch, as may be required. Of course, the forward channel header 2714 for the systemwide forward interval 2704 would indicate a timing offset for reverse channel transmission during the systemwide response interval 2706, and the forward channel header 2714 for the zonal forward interval 2708 would indicate a timing offset for reverse channel transmission during the zonal reverse interval 2710.

The forward channel header 2714 further includes a data stream to the mobile unit listing which of the 64 batches will follow and the timing offsets indicating when those batches will be transmitted. Again, this feature advantageously allows the mobile unit to "power down" during the systemwide and zonal forward intervals 2704 and 2708 until the appropriate time for receiving its batch information, thereby conserving the battery

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power of the mobile unit. The remaining fields batch i 2720, batch j 2722, and batch k 2724 are the individual batches directed to the mobile units.

It should be understood that different classes of mobile units can follow different desirable batch protocols, depending on the type of service, processing power, battery capacity, or other factors.

The individual batch protocol 2780 is shown in Fig. 27(C). The batch header field 2726 is similar to the header fields discussed above for Figs. 27(A) and (B). The batch header 2726 includes a list of particular mobile units to receive messages within the batch and includes timing offsets indicating when such messages will be broadcast. Further, the batch header 2726 includes data indicating a timing offset scheduling a reverse channel interval in the system reverse interval, the zonal reverse interval, or the reverse contention interval, as appropriate. Again, this information allows the mobile unit to extend its battery life because the mobile unit need only power up at the appropriate time to receive or transmit the appropriate message. Further, it is preferred that the reverse channel timing offset data be transmitted using error correction codes to insure accurate receipt thereof by the mobile unit. Accurate receipt of the reverse channel timing offset data will prevent unwanted or untimely transmissions by the mobile unit and insure that a mobile unit may properly transmit a negative acknowledgment signal if it fails to properly receive an unencoded message.

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The individual message interval 2732 includes the individual message intended for a particular mobile unit or units. The duration of each message and number of messages within a batch may be varied by the network operations center 600 and is traffic dependent.

Each mobile unit with transmit capability that has received a message in the immediately previous systemwide forward interval 2704 or the zonal forward interval 2708 will have an appropriate time slot for transmission scheduled in the systemwide response interval 2706, or the zonal reverse interval 2710, respectively. The timing circuit in the mobile transceiver unit determines the assigned time slot for transmission. For example, if the mobile unit simply intends to transmit an acknowledgment signal, which indicates that the mobile unit has properly received the message from the network, an 8 bit preamble followed by the address of that mobile unit need only be transmitted and a 3 bit acknowledgment. However, if a more extensive reply from the mobile unit is required, additional data could be transferred during this time slot. In particular, long reverse messages could be scheduled in response to a request from the mobile unit sent during the contention interval 2712, as discussed hereafter.

Due to the low power transmit capability of the mobile transceiver units, there is an increased likelihood of data transmission errors for reply signals. The extended Golay code for error protection may be utilized for reverse channel messages from mobile transceiver units to the network.

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The systemwide response interval 2706 and the zonal reverse interval 2710 provide communication capability from the mobile transceiver units to the network (i.e. the reverse channel).

Still further, a preferred embodiment accommodates mobile terminals with extensive reverse message generation capabilities (e.g., a laptop computer connected to a radio transceiver) by allowing for contention messages that request extended reverse channel time for the transmission of a long reverse message. The reverse contention interval 2712 is located after the zonal reverse interval 2710 and provides for unscheduled messages from the mobile unit to the network. For example, the mobile transceiver unit could send a message to the network during the reverse contention interval 2712 indicating that the user no longer wishes to receive messages, thereby terminating service. Also, the user could transmit a message to the network during the reverse contention interval 2712 indicating that the user now desires to reestablish services and begin receiving messages from the network. Further, a "registration signal," which is discussed *infra*, could be transmitted during the reverse contention interval 2712.

The reverse contention interval preferably utilizes a so-called "slotted ALOHA" protocol, which allows the mobile unit to randomly select a predefined time slot within the contention interval to transmit a message. A mobile station wanting to transmit will first divide the contention interval into slots, preferably 5.33 ms in length, and then choose randomly any of them to start transmitting. The slotted ALOHA protocol is preferred

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because of the low likelihood of data "collisions" (i.e. 2 or more mobile units transmitting during the same time slot).

I. Registration of the Mobile Unit

Because the network operations center 600 stores the location of each mobile unit in the system in the user database 2100, it is preferred that each mobile transceiver unit have the capability to "register" with the network operations center 600 by sending a registration signal to a base receiver into the network to update the location data.

The mobile transceiver unit preferably registers by simply transmitting its identification number to a base receiver, which forwards this data and data representing the location of the base receiver to the network operations center 600.

The mobile transceiver preferably registers upon crossing zonal boundaries to alert the network operation center that the mobile transceiver has left one zone and entered another. For example, the mobile unit could receive information from the nearest base transmitter identifying which zone that base transmitter is assigned to at the beginning of each communication cycle. Upon receipt of such information from a base transmitter indicating that a nearby base transmitter is assigned to a new zone, the mobile transceiver then preferably transmits a registration signal.

The mobile transceiver unit may also transmit a registration signal in other desirable instances. For example, if the mobile transceiver unit has moved away from the transmitter coverage areas of the network for a period of time, the mobile transceiver

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unit may preferably transmit a registration signal upon returning to a coverage area. The display and storage logic 1508 of the mobile transceiver unit preferably recognizes that the unit has left the coverage area of the network upon failure to receive data from a base transmitter in the network during the cycle header time interval 2702, for example. The mobile unit may leave the coverage area of a base transmitter of the network when the user takes the unit out of the country, or enters the basement of a building, for example.

The mobile unit may also preferably transmit a registration signal when power is restored to the mobile unit after having power removed, such as after being turned off by the user. Of course, the power may be restored to the unit by replacing or recharging a dead battery, which may also cause transmission of a registration signal.

In general, the network must balance the need for frequent registrations by the mobile transceiver units, and the desirable result of accurately knowing the location of each mobile unit, thereby preventing the need for probe signals, with the undesirable overhead costs of too frequent registration, which sacrifices data throughput by utilizing valuable transmit time.

In the preferred embodiment, the central computer 2002 of the network operations center 600 can achieve desirable performance by implementing one or more algorithms to evaluate the need for registration by a mobile unit, and then appropriately controlling the registration performance of that mobile unit. If the central computer determines that registration of a particular mobile unit

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is useful, then the mobile unit preferably should receive a message from the network to cause the mobile unit to send registration signals at appropriate times. Conversely, if the central computer determines that the registration signals from the mobile unit are too frequently not useful, the mobile unit preferably should receive a message from the network to cause the mobile unit not to transmit registration signals.

To implement this feature, the mobile transceiver unit further preferably includes a registration flag (not shown) in the display and storage logic section 1508. If the registration flag is set, the display and storage logic section 1508 causes the mobile transceiver to autonomously send a registration signal to the network operations center on a desired basis. If the registration flag is not set, the display and storage logic section 1508 prevents any registration signals from being sent. The registration flag may be set or removed upon command from the network operations center by transmission of an appropriate signal from a base transmitter near the mobile unit. A variety of algorithms, possibly regarding individual users or groups of users, can be used to determine whether or not the registration flag should be set. It should be appreciated that the present invention provides two distinct algorithms for implementing these registration concepts depending upon whether the registration flag is set or not in the mobile unit (i.e. the state of the mobile unit).

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Fig. 28(A) shows a flow chart describing a preferred method 2800 for implementing the registration concepts of the present invention wherein the registration feature of the mobile unit is disabled. In step 2802, the network sends a message to disable the registration feature (i.e. set the registration flag to zero) of the mobile unit to disable the mobile transceiver's capability to transmit a registration signal. As can be seen, step 2802 determines the initial state for the method set forth in Fig. 28(A).

In step 2804, the network stores the number of probe signals sent to the mobile transceiver during a first period of time, and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time. Preferably, the first and second time intervals are identical. The traffic statistics database 2200 of the database 2008 is preferably used to store the number of probe signals and successful messages for each mobile unit. As explained hereinafter, these two statistics from the operation of the network are preferably used to determine whether registration by the mobile unit is useful.

In step 2806, the stored number of probe signals and number of messages successfully delivered is processed to evaluate a likelihood that a probe signal will be required to be set by the network to locate the mobile unit to deliver a message. The preferred embodiment of the invention processes the stored number of probe signals and messages successfully delivered in accordance with the method set forth in Fig. 29(A).

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Referring now to Fig. 29(A), therein is shown a series of substeps which are preferably performed during the implementation of the processing step 2804 shown in Fig. 28(A). In particular, steps 2902 and 2904 are event driven and only proceed to the next step after an input has been received by the network. Step 2902 determines if the network sent a probe signal to a lost mobile transceiver unit and if a reply to the probe signal was received by a base receiver in the network. If this event occurs, a counter (not shown) is incremented by a value P by the central computer 2002.

In step 2904, if a message was successfully delivered to a mobile transceiver, preferably including an acknowledgment signal return from the mobile transceiver to the network, the counter (not shown) in the central computer 2002 is decremented by a value D.

After the occurrence of either of the events tested for in step 2902 or step 2904, the algorithm proceeds to step 2906. In step 2906, if the counter value is greater than a predetermined value J, this indicates that the likelihood that a probe signal will be necessary to locate the mobile transceiver is greater than a selected value.

As can be seen, the process of substeps in Fig. 29(A) balances the frequency of probe signals sent to a particular unit against the number of successfully delivered messages to that unit. If the system must send a large number of probe signals, it would be useful to enable the registration feature by setting the registration flag on that mobile unit to enable the registration

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feature. In contrast, if many messages have been successfully delivered without requiring a probe signal, it is unnecessary to enable the registration feature by setting the registration flag.

In step 2808, a message is sent to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood in step 2804 exceeds a selected value. As can be seen, step 2808 preferably sets the registration flag in the mobile transceiver unit.

Fig. 28(B) shows a flow chart describing a method 2810 for implementing the registration concepts of the present invention wherein the registration feature of the mobile unit is enabled. In step 2812, the network sends a message to enable the registration feature (i.e. set the registration flag to 1) of the mobile unit to enable the mobile transceiver's capability to transmit a registration signal. As can be seen, step 2812 determines the initial state for the method set forth in Fig. 28(B).

In step 2814, the network stores the number of registration signals received by the network during a first period of time, and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time. Preferably, the first and second time intervals are identical. The traffic statistics database 2200 of the database 2008 is preferably used to store the number of registration signals and successful messages for each mobile unit. As explained hereinafter, these two statistics from the operation of the

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network are preferably used to determine whether the registration by the mobile unit is useful.

In step 2816, the stored number of registration signals and number of messages successfully delivered is processed to evaluate the likelihood that a registration signal will be received by a base receiver in the network that will not be used by the network to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver. The preferred embodiment of the invention processes the stored number of registration signals received and number of messages successfully delivered in accordance with the method set forth in Fig. 29(B).

Referring now to Fig. 29(B), therein is shown a series of substeps which are preferably performed during the implementation of the processing step 2814 shown in Fig. 28(B). In particular, steps 2912 and 2914 are event driven and only proceed to the next step after an input has been received by the network. Step 2912 determines if a registration signal was received by a base receiver in the network. If so, a counter (not shown) in the central computer 2002 is incremented by a value A.

In step 2914, if a message was successfully delivered to a mobile transceiver, preferably including an acknowledgment signal return from the mobile transceiver to the system, the counter (not shown) in the central computer 2002 is decremented by a value M.

It should be understood that the counter referred to with regard to steps 2912 and 2914 is different then the counter referred to with regard to steps 2902 and 2904 since each counter is only necessary when the registration feature is enabled or

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disabled in the mobile transceiver. However, the same physical or logical device may be used to implement both counters.

After the occurrence of either events in the step 2912 or step 2914, the algorithm proceeds to step 2916. In step 2916, the process determines if the counter value is greater than a predetermined value T. The value of T can be varied to meet the needs of a particular network. When the counter value exceeds T, it is indicated that the likelihood that a registration signal from that mobile unit will not be used by the network to determine a new set of base transmitters, and therefore the registration status for that mobile unit needs to be changed to disable the registration feature.

In other words, the process in Fig. 29(B) balances the frequency of registration signals sent by a particular unit against the number of successfully delivered messages to that unit. As can be seen, if the mobile unit sends a large number of registration signals without the system using these registration signals, it would be useful to have the registration feature on that mobile unit disabled. In contrast, if many messages have been successfully delivered without too many registration signals being sent by the mobile unit, it is unnecessary for the registration feature to be disabled.

In step 2818, a message is sent to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood in step 2814 exceeds a selected value. As can be seen, step 2818 may preferably remove the registration flag in the mobile transceiver unit.

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Of course, it should be understood that the variables P, D, and J used in Fig. 29(A), and the variables A, M, and T used in Fig. 29(B) can be adjusted as desired to enhance system performance, as will be apparent to one of ordinary skill in the art. The counters can be implemented with so-called "reflective boundaries" so that if a counter reaches a minimum value (e.g., zero), it will continuously reset to that minimum value when further decremented.

It will be apparent to those skilled in the art that various modifications and variations can be made in the systems and methods of the present invention without departing from the scope or spirit of the invention.

Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

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WHAT IS CLAIMED IS:

1. A method for information transmission by a plurality of transmitters to provide broad communication capability over a region of space, the information transmission occurring during at least both a first time period and a second time period and the plurality of transmitters being divided into at least a first and second set of transmitters, the method comprising the steps of:

(a) generating a system information signal which includes a plurality of blocks of information;

(b) transmitting the system information signal to the plurality of transmitters;

(c) transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period;

(d) transmitting by the first set of transmitters a second block of information during the second time period; and

(e) transmitting by the second set of transmitters a third block of information during the second time period.

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2. A multi-carrier simulcast transmission system for transmitting in a desired frequency band a message contained in an information signal, the system comprising:

first transmitter means for transmitting an information signal by generating a first plurality of carrier signals within the desired frequency band and by modulating the first plurality of carrier signals to convey the information signal; and

second transmitter means, spatially separated from the first transmitter, for transmitting the information signal in simulcast with the first transmitter by generating a second plurality of carrier signals at substantially the same frequencies as the first plurality of carrier signals and by modulating the second plurality of carrier signals to convey the information signal.

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3. A communication method implemented in a computer controlled communication network for locating a mobile transceiver within a region of space, the region of space being divided into a plurality of zones with each zone serviced by at least one base transmitter and at least one base receiver, the network storing data corresponding to a zone where the mobile transceiver was last known to be located, the communication method comprising the steps of:

(a) transmitting a message signal by a base transmitter servicing a zone where the mobile transceiver was last known to be located;

(b) transmitting a systemwide probe signal by a plurality of base transmitters servicing a plurality of zones if the mobile transceiver does not indicate receipt of the message signal from the base transmitter;

(c) receiving the regional probe signal by the mobile transceiver;

(d) transmitting an acknowledgment signal by the mobile transceiver in response to the received regional probe signal;

(e) receiving the acknowledgment signal from the mobile transceiver by a base receiver; and

(f) updating the data to reflect the zone of the base receiver that received the acknowledgment signal as the last known location of the mobile transceiver.

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4. A method of communicating messages between a plurality of base transmitters and mobile receivers within a region of space divided into a plurality of zones with each zone having at least one base transmitter assigned thereto, the communication method comprising the steps of:

(a) transmitting substantially simultaneously a first information signal and a second information signal to communicate messages to the mobile receivers, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone;

(b) dynamically reassigning one or more of the base transmitters in the first set of base transmitter assigned to the first zone to the second set of base transmitters assigned to the second zone as a function of the messages to be communicated in an area, thereby creating an updated first set of base transmitters and an updated second set of base transmitters; and

(c) transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters to communicate additional messages to said mobile receivers.

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5. A mobile transceiver unit for transmitting messages to and receiving messages from a network comprising:

input means for allowing the user to input a user message to the unit;

transmitter means for transmitting a radio frequency signal including the user message from the mobile unit to the network;

receiver means for receiving radio frequency signals having a message from the network;

signal detector means for detecting at least one type of electromagnetic signal generated external to the mobile unit and the network; and

a circuit, connecting the signal detector means to the transmitter means, for disabling the transmitter means upon detection of the electromagnetic signal, thereby preventing unwanted radio frequency transmission.

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6. A communication method for controlling a mobile transceiver which may communicate with a communication network controlled by a computer, the network including a plurality of base transmitters for transmitting messages from the network to the mobile transceiver and base receivers for receiving messages from the mobile transceiver, the mobile transceiver being capable of sending a registration signal to be received by a base receiver in the network to identify the mobile transceiver's location and the plurality of base transmitters in the network being capable of sending a probe signal to the mobile transceiver to cause the mobile transceiver to transmit a signal to a base receiver to identify its location, the method comprising the steps of:

(a) sending a message from the network to the mobile transceiver to disable the mobile transceiver's capability to transmit a registration signal;

(b) storing the number of probe signals sent by the network to the mobile transceiver during a first period of time and the number of messages successfully delivered to the mobile transceiver by the network during a second period of time;

(c) processing by the computer the stored number of probe signals and number of messages successfully delivered to evaluate a likelihood that a probe signal will be required to be sent by the network to locate the mobile unit to deliver a message; and

(d) sending a message to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the calculated likelihood exceeds a selected value.

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7. A communication method for controlling a mobile transceiver which may communicate with a communication network controlled by a computer, the network including a plurality of base transmitters for transmitting messages to the mobile transceiver and base receivers for receiving messages from the mobile transceiver, the mobile transceiver being capable of sending a registration signal to be received by a base receiver in the network to identify the mobile transceiver's location, the network using received registration signals to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver, the method comprising the steps of:

(a) sending a message from the network to the mobile transceiver to enable the mobile transceiver's capability to transmit a registration signal;

(b) storing the number of registration signals from the mobile transceiver to the network during a first period of time and the number of messages successfully delivered to the mobile transceiver by the network during a period of time;

(c) processing the stored number of registration signals and number of messages successfully delivered to evaluate a likelihood that a registration signal from said mobile unit will not be used by the network to determine a set of base transmitters; and

(d) sending a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value.

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DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that: my residence, ~~post office address~~ and citizenship are as stated below next to my name; that 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:

A NATIONWIDE COMMUNICATION SYSTEM

the specification of which is ☐ attached ~~and~~/or ☒ was filed on November 12, 1992 as Application Serial No. .... and ~~was~~ amended 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 listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE OF FILING	PRIORITY CLAIMED UNDER 35 U.S.C. 119
			☐ YES ☐ NO
			☐ YES ☐ NO

A. I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	DATE OF FILING	STATUS (Patented, Pending, Abandoned)

I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Finnegan, Henderson, Farabow, Garrett and Dunner, Reg. No. 22,540; Douglas B. Henderson, Reg. No. 20,291; Ford. F. Farabow, Jr., Reg. No. 20,630; Arthur S. Garrett, Reg. No. 20,338; Donald R. Dunner, Reg. No. 19,073; Brian G. Brunsvold, Reg. No. 22,593; Tipton D. Jennings, IV, Reg. No. 20,645; Jerry D. Voight, Reg. No. 23,020; Laurence R. Hefter, Reg. No. 20,827; Kenneth E. Payne, Reg. No. 23,098; Herbert H. Mintz, Reg. No. 26,691; C. Larry O'Rourke, Reg. No. 26,014; Albert J. Santorelli, Reg. No. 22,610; Michael C. Elmer, Reg. No. 25,857; Richard H. Smith, Reg. No. 20,609; Stephen L. Peterson, Reg. No. 26,325; John M. Romary, Reg. No. 26,331; Bruce C. Zotter, Reg. No. 27,680; Dennis P. O'Reilley, Reg. No. 27,932; Allen M. Sokal, Reg. No. 26,695; Robert D. Bajefsky, Reg. No. 25,387; Richard L. Stroup, Reg. No. 28,478; David W. Hill, Reg. No. 28,220; Thomas L. Irving, Reg. No. 28,619; Charles E. Lipsey, Reg. No. 28,165; Thomas W. Winland, Reg. No. 27,605; Basil J. Lewris, Reg. No. 28,818; Robert J. Gaybrick, Reg. No. 27,890; Martin I. Fuchs, Reg. No. 28,508; E. Robert Yoches, Reg. No. 30,120; Stephen J. Rosenman, Reg. No. 29,209; Barry W. Graham, Reg. No. 29,924; Thomas H. Jenkins, Reg. No. 30,857; and MATTHEW T. BAILEY, Reg. No. 33,829 .... Please address all correspondence to FINNEGAN, HENDERSON, FARABOW, GARRETT AND DUNNER, 1300 I Street, N.W., Washington, D.C. 20005, Telephone No. (202) 408-4000.

See Paper #8

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

100

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Listing of Inventors Continued on Page 2 hereof. ☒ Yes ☐ No

FHFGD Form

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER • WASHINGTON, D.C.

ATTORNEY [ ]ET NO: 03680.0083-00000

Listing of Inventors Continued from Page 1 of Declaration and Power of Attorney for invention entitled:

A NATIONWIDE COMMUNICATION SYSTEM

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RESIDENCE 2345 TWIN LAKE CIRCLE, JACKSON, MS 39211 MS		CITIZENSHIP U.S.A.
POST OFFICE ADDRESS 2345 TWIN LAKE CIRCLE, JACKSON, MS 39211		
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POST OFFICE ADDRESS 3730 W STREET, N.W., WASHINGTON, DC 20007		
FULL NAME OF EIGHTH JOINT INVENTOR, IF ANY	INVENTOR'S SIGNATURE	DATE
RESIDENCE		CITIZENSHIP
POST OFFICE ADDRESS		
FULL NAME OF NINTH JOINT INVENTOR, IF ANY	INVENTOR'S SIGNATURE	DATE
RESIDENCE		CITIZENSHIP
POST OFFICE ADDRESS		

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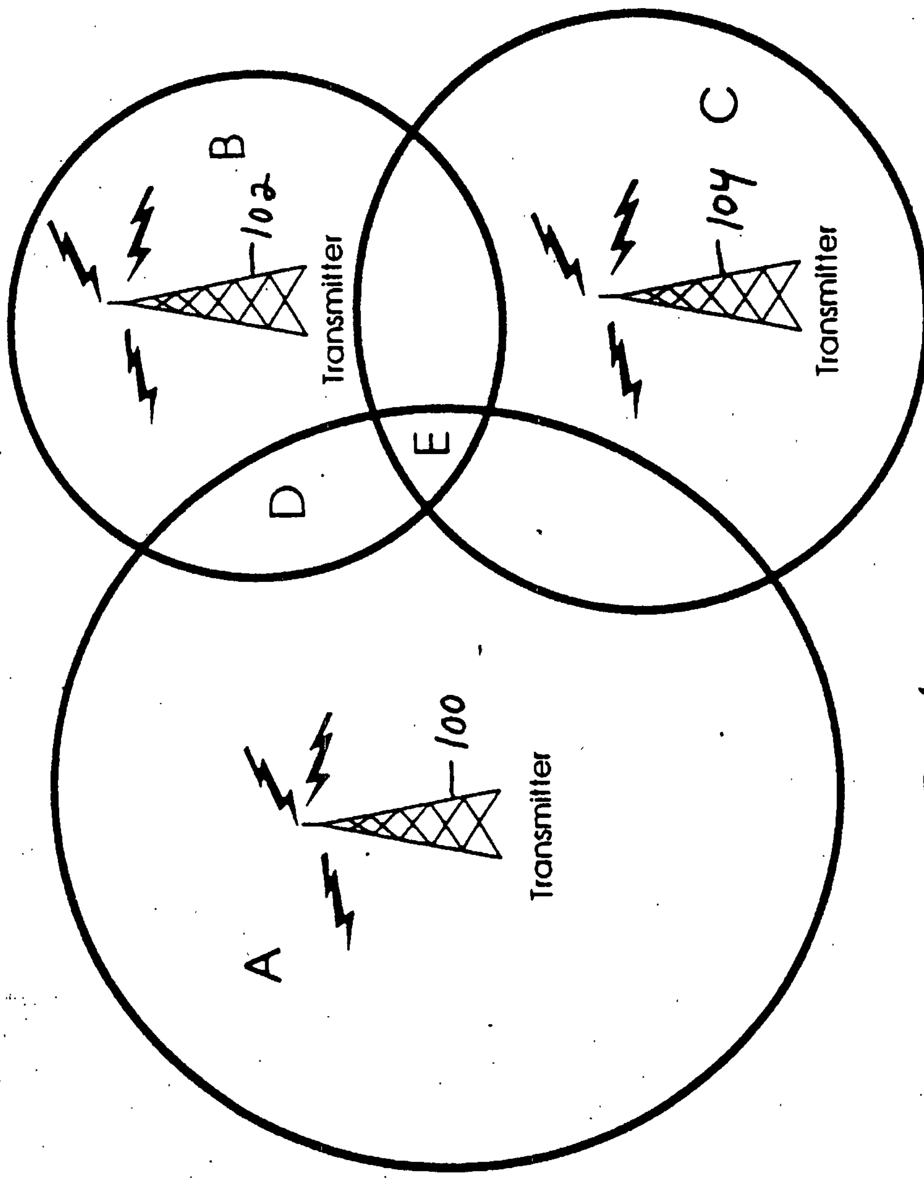

Fig. 1

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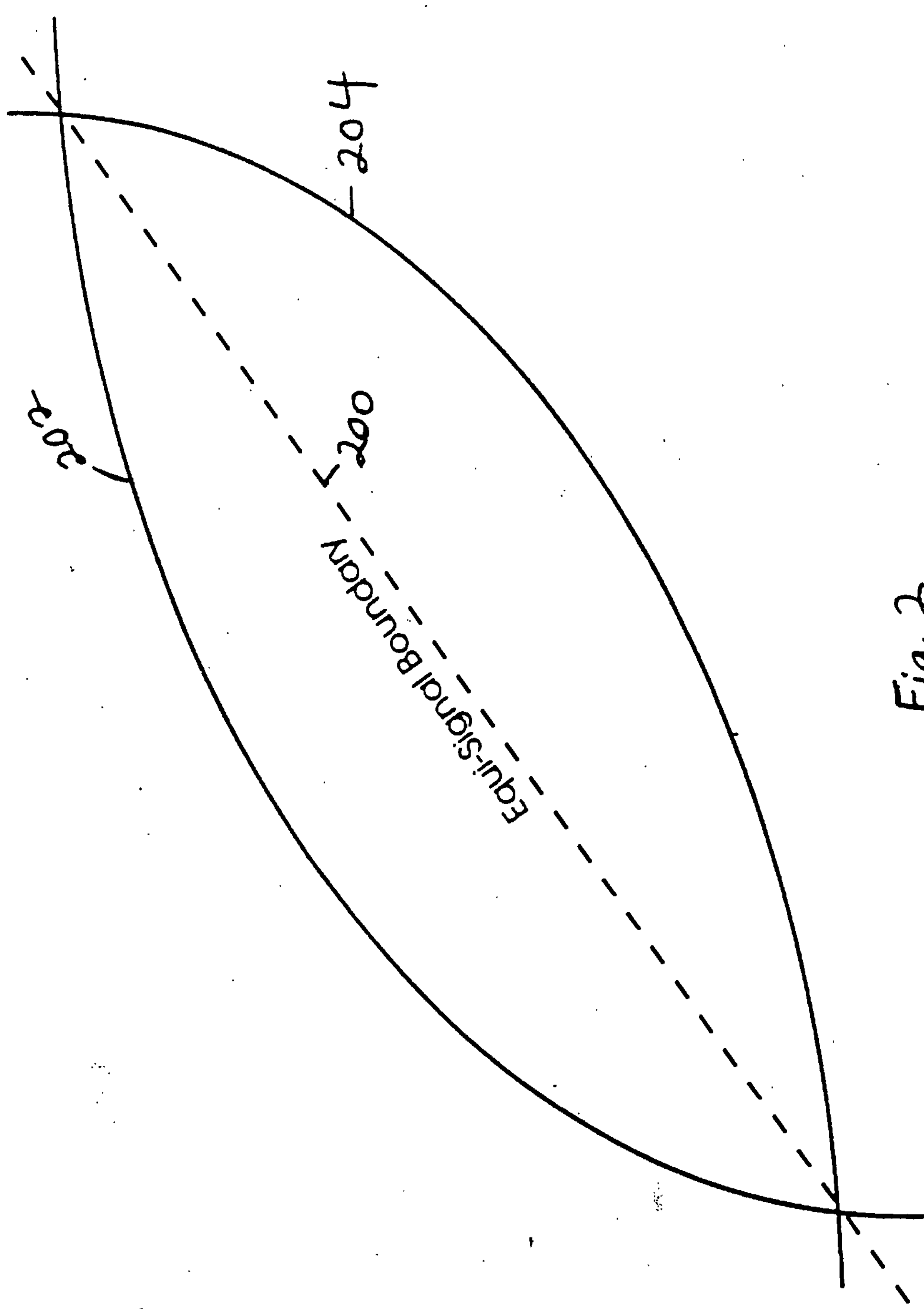

Fig. 2

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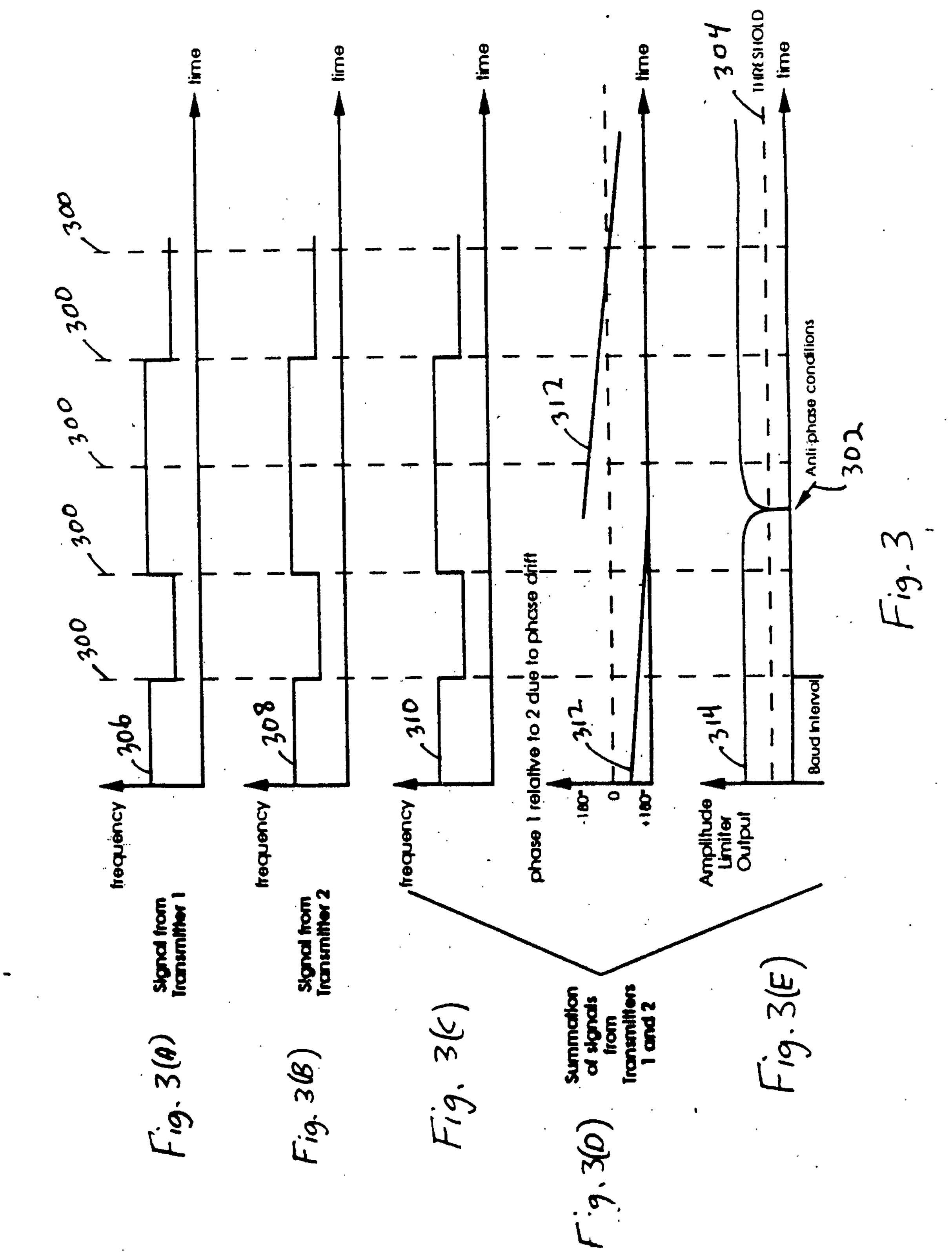

Fig. 3

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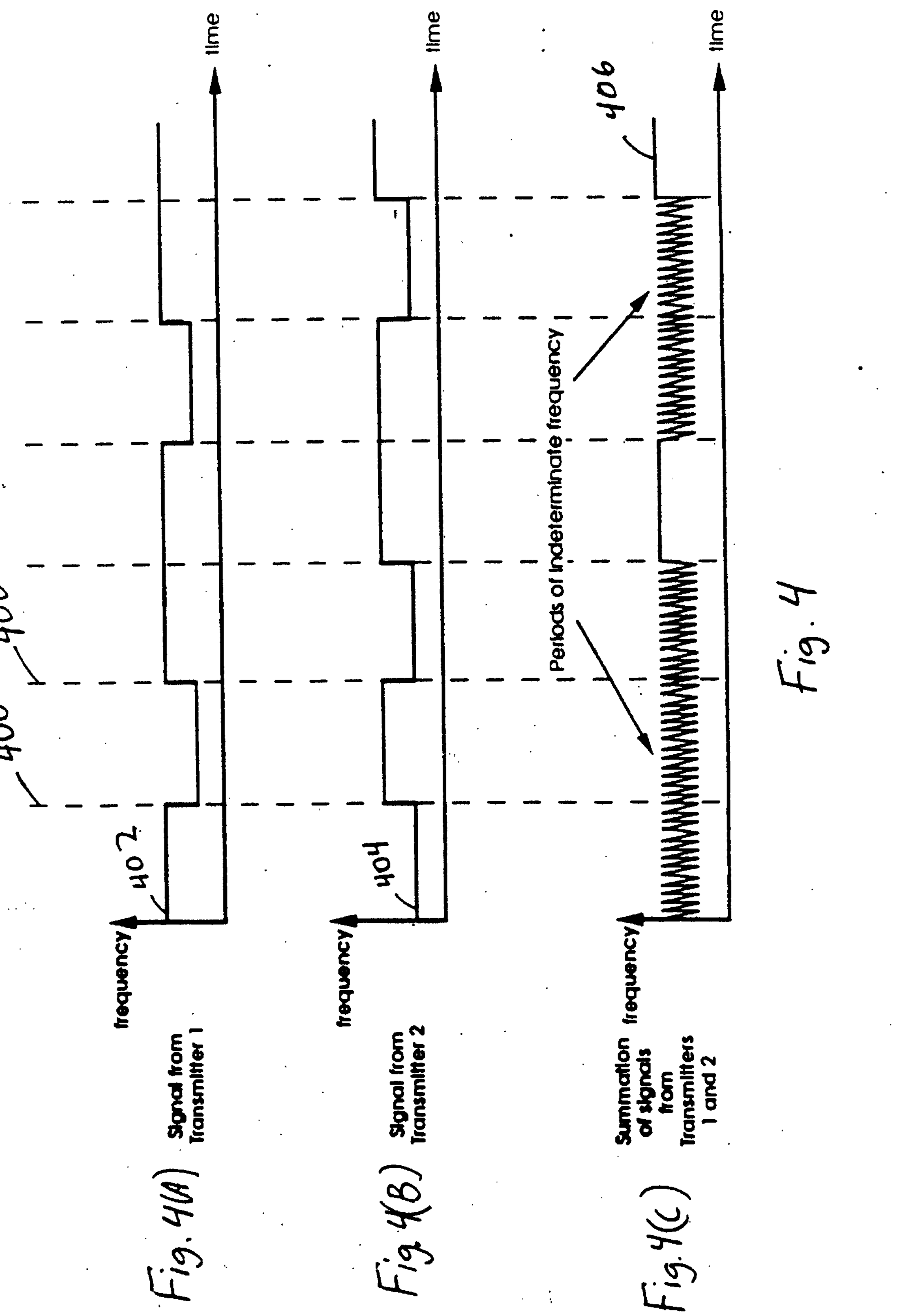

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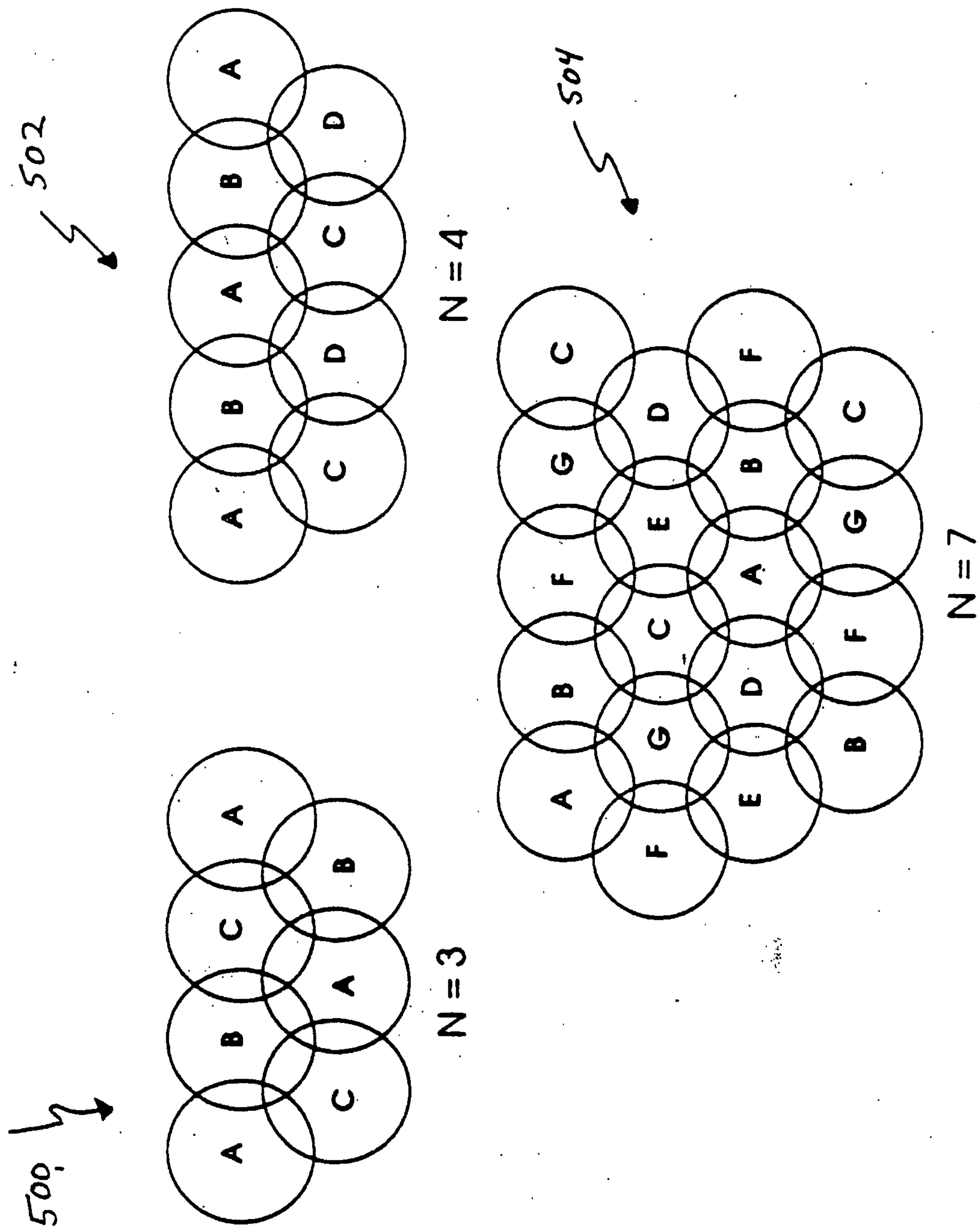

Fig. 5

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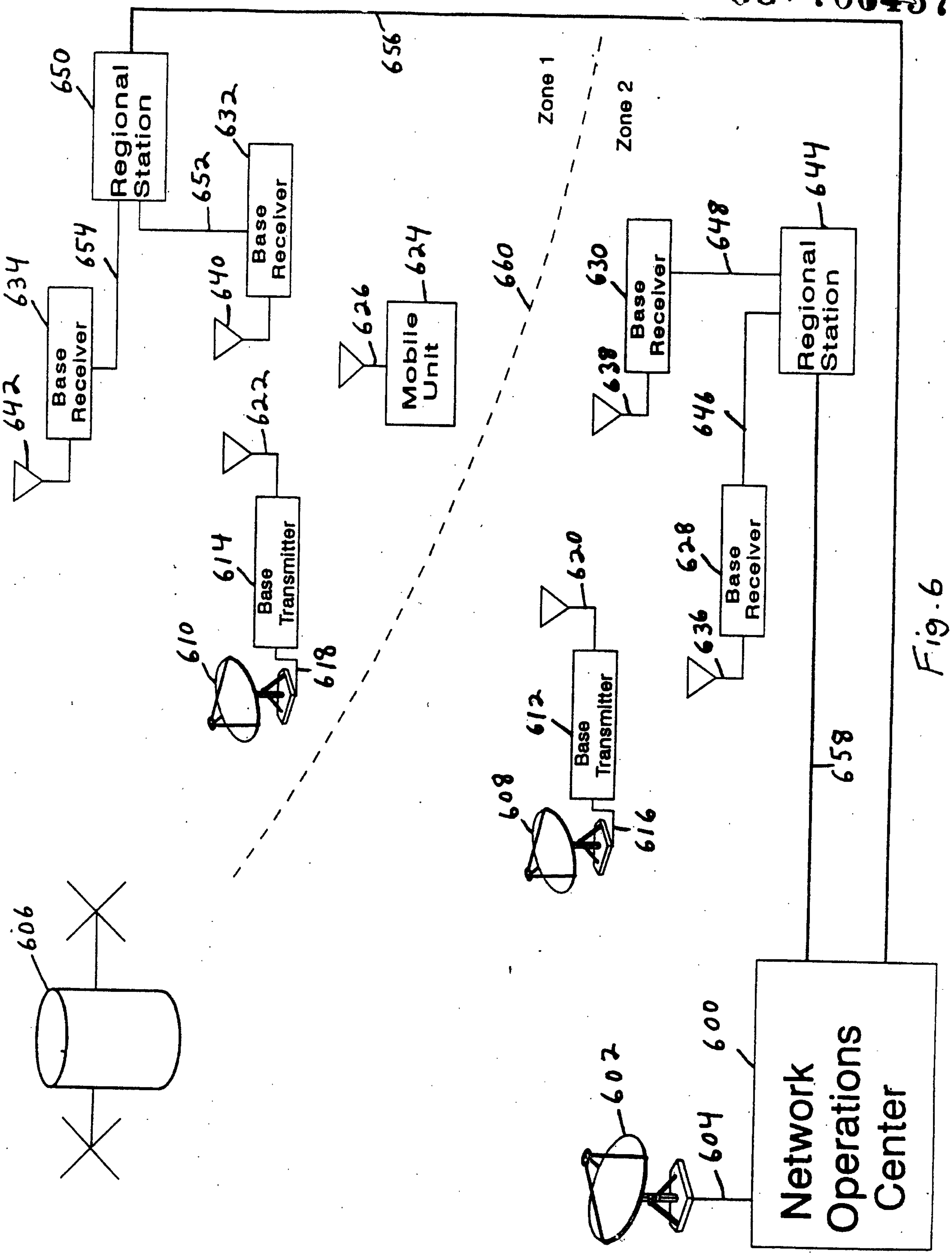

Fig. 6

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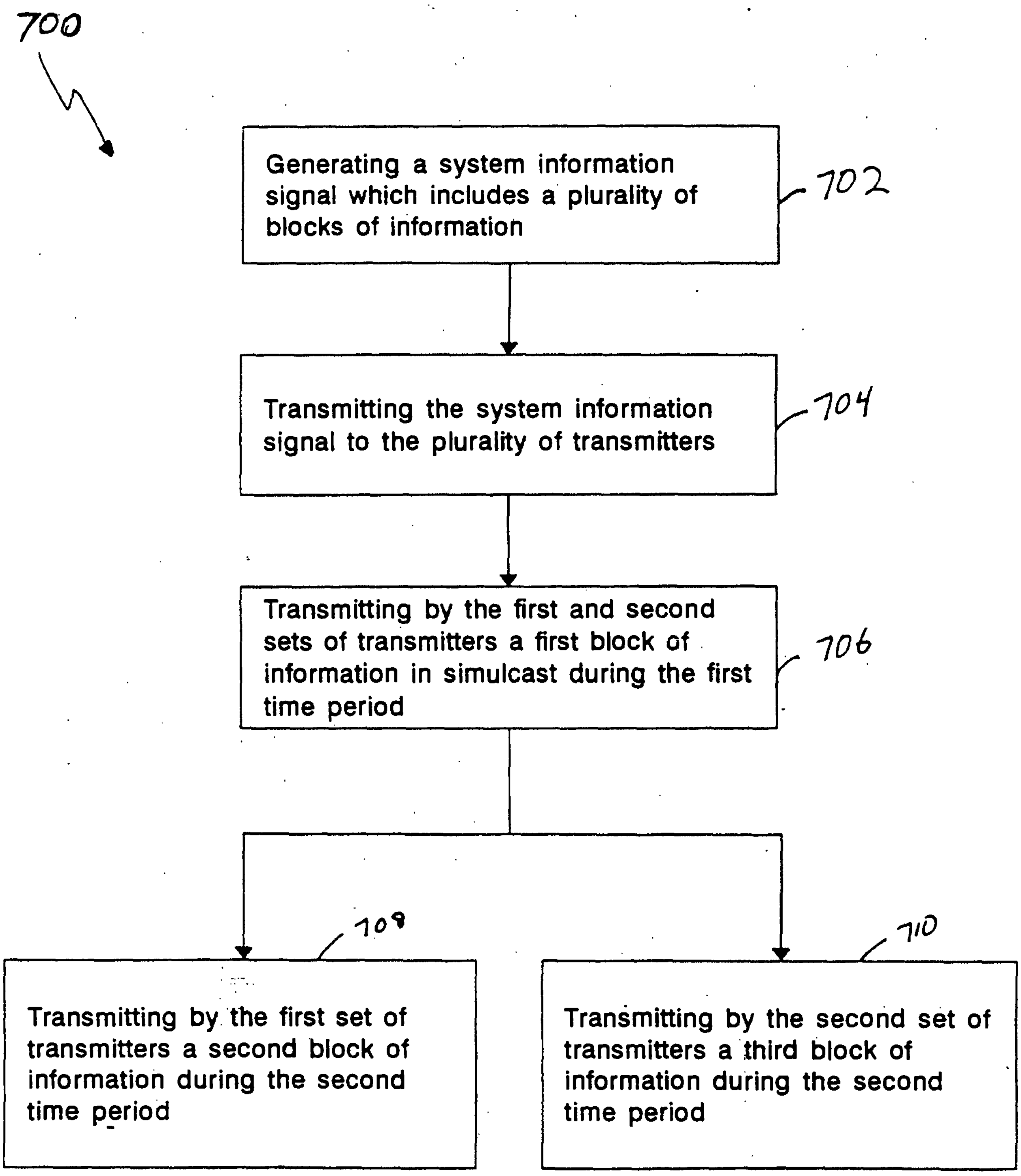

Fig. 7

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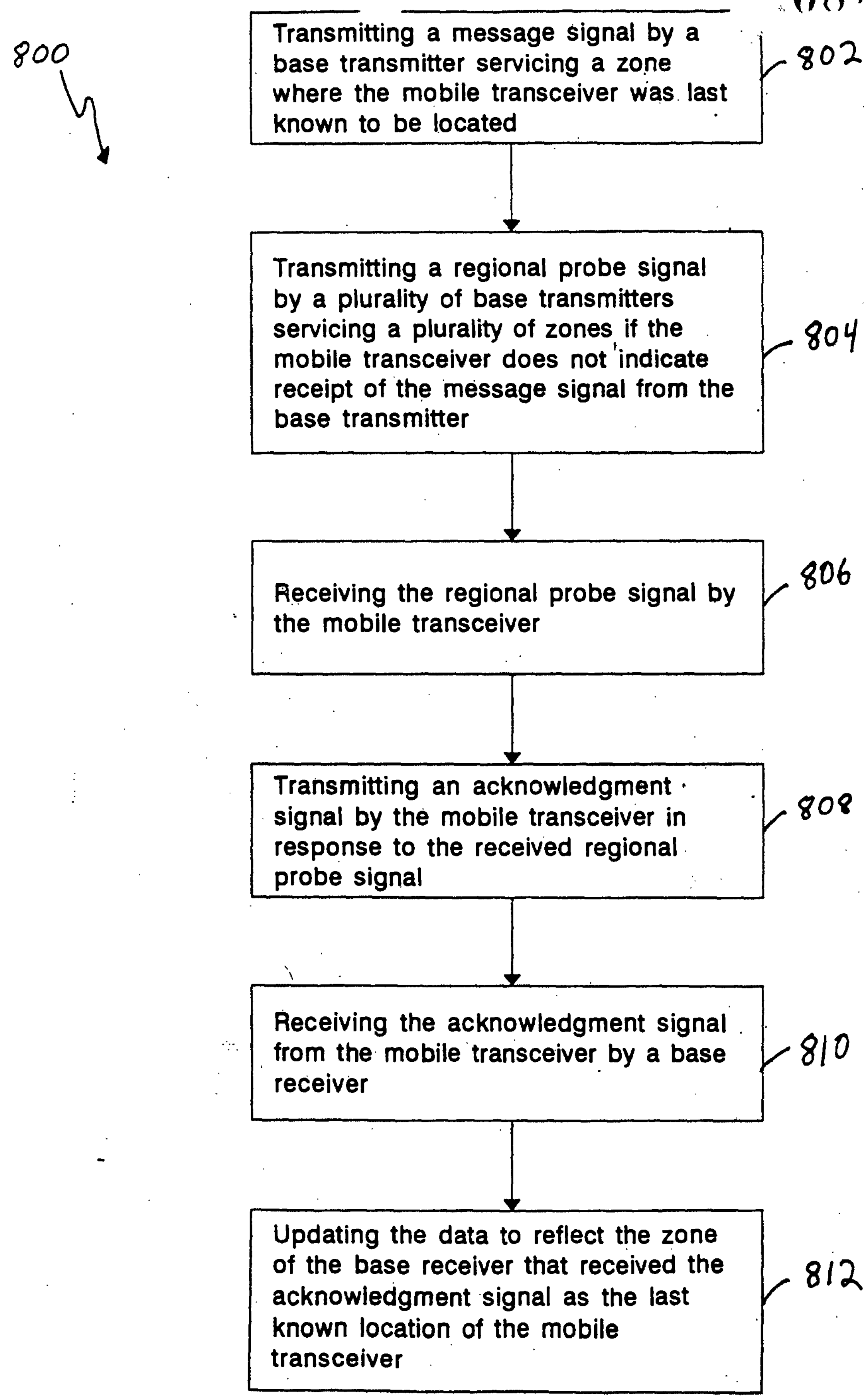

Fig. 8

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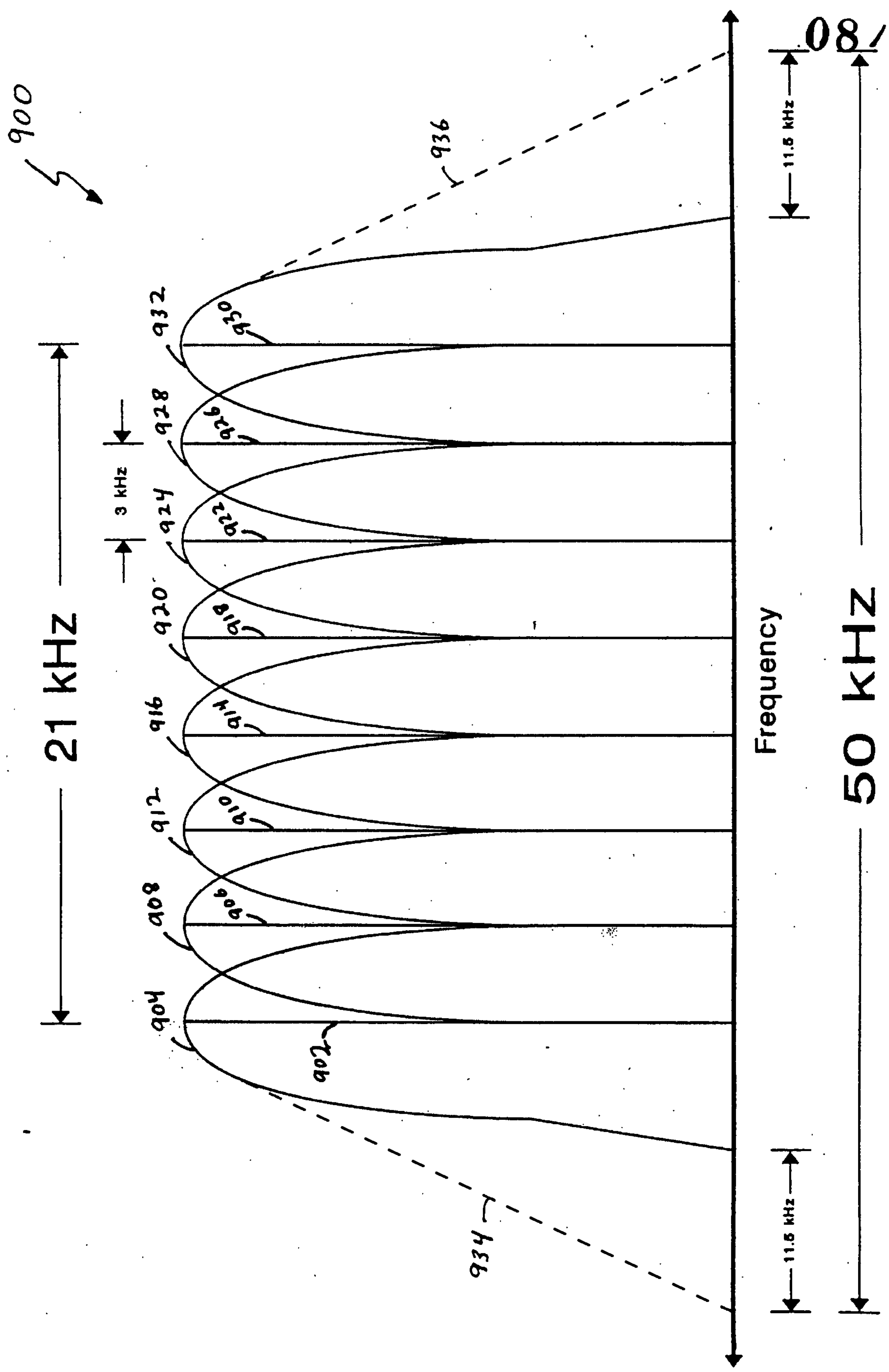

Fig. 9

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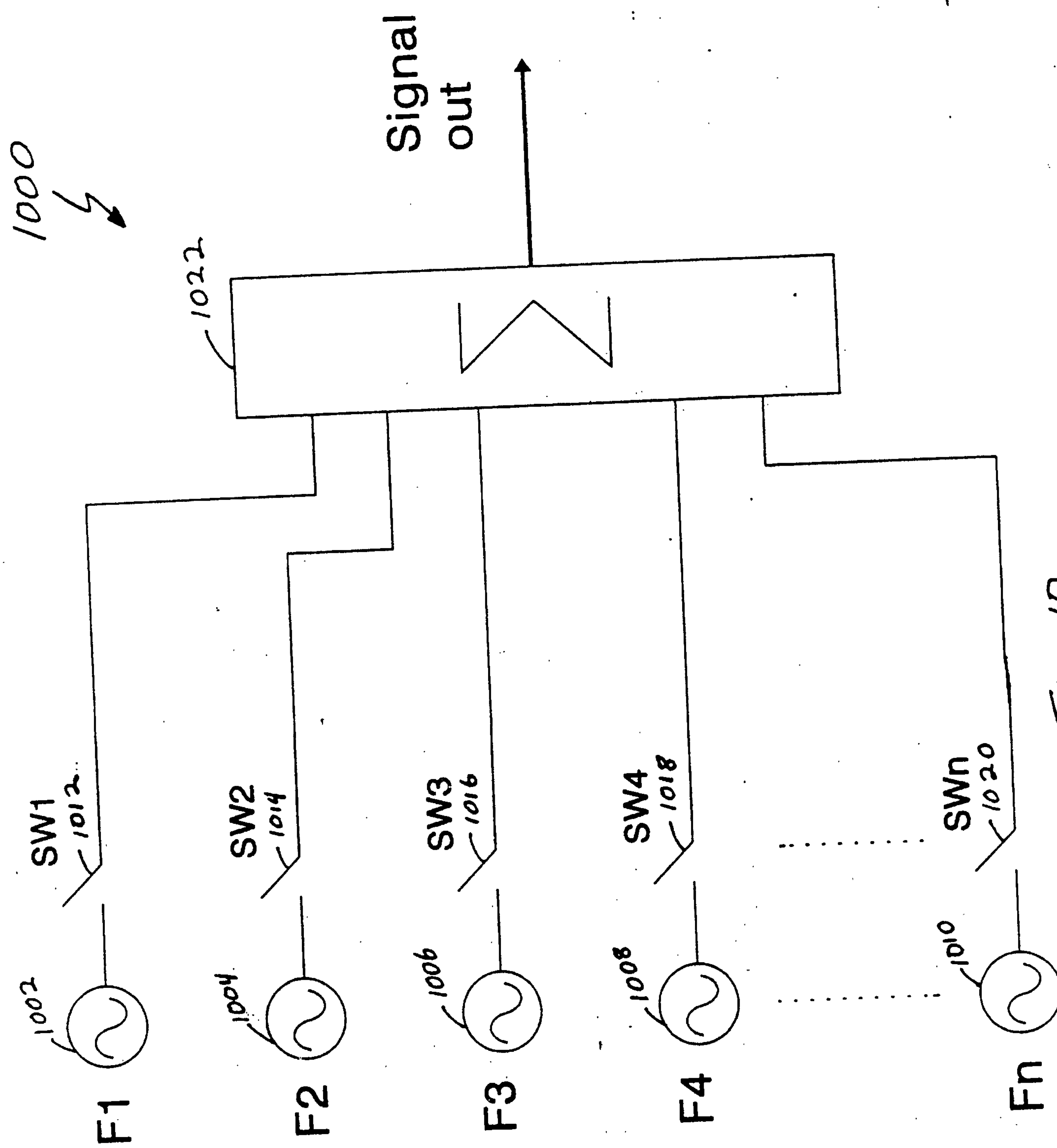

Fig. 10

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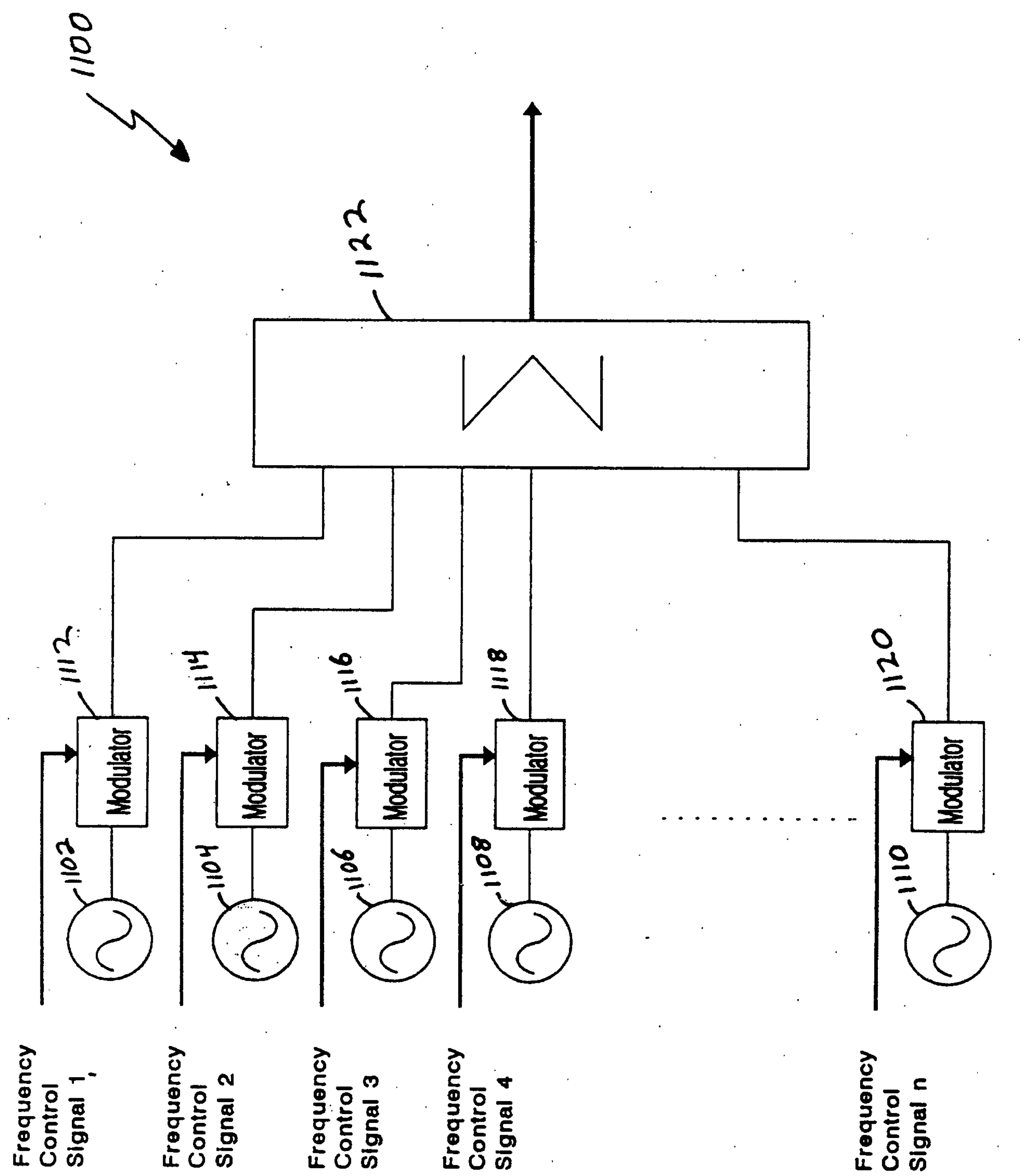

Fig. 11

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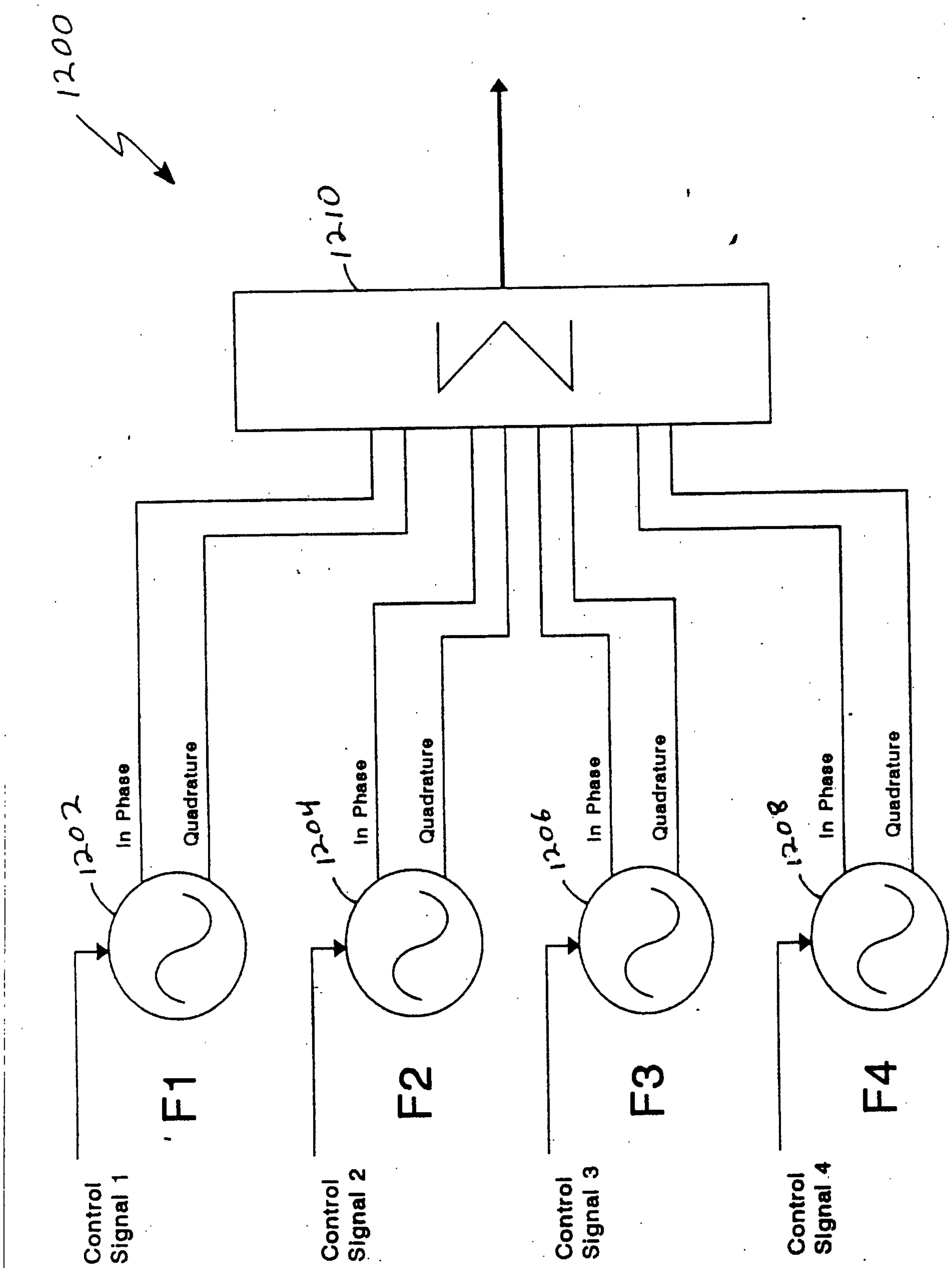

Four Carrier Quadrature Modulator

Fig. 12

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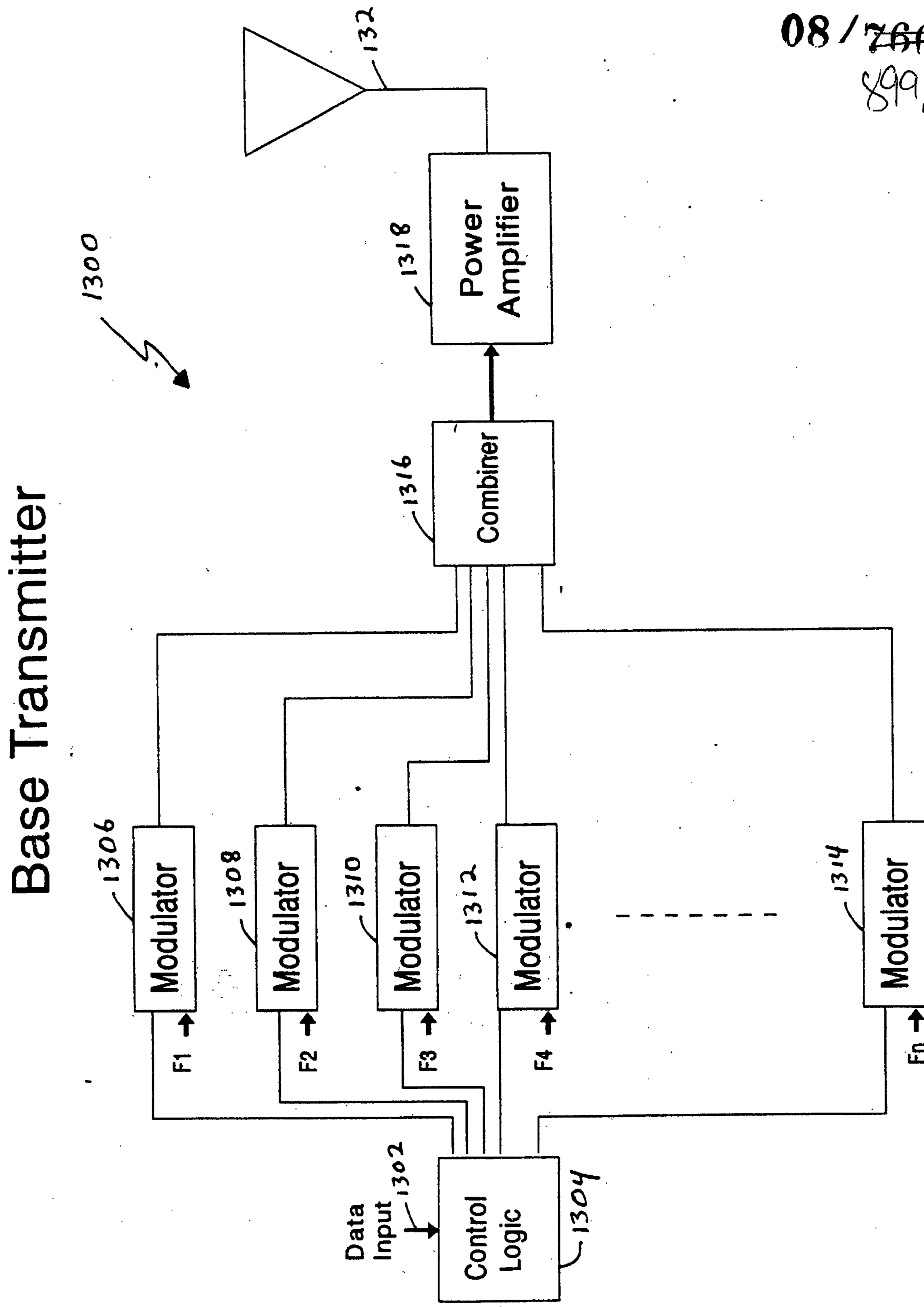

Fig. 13

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Base Transmitter

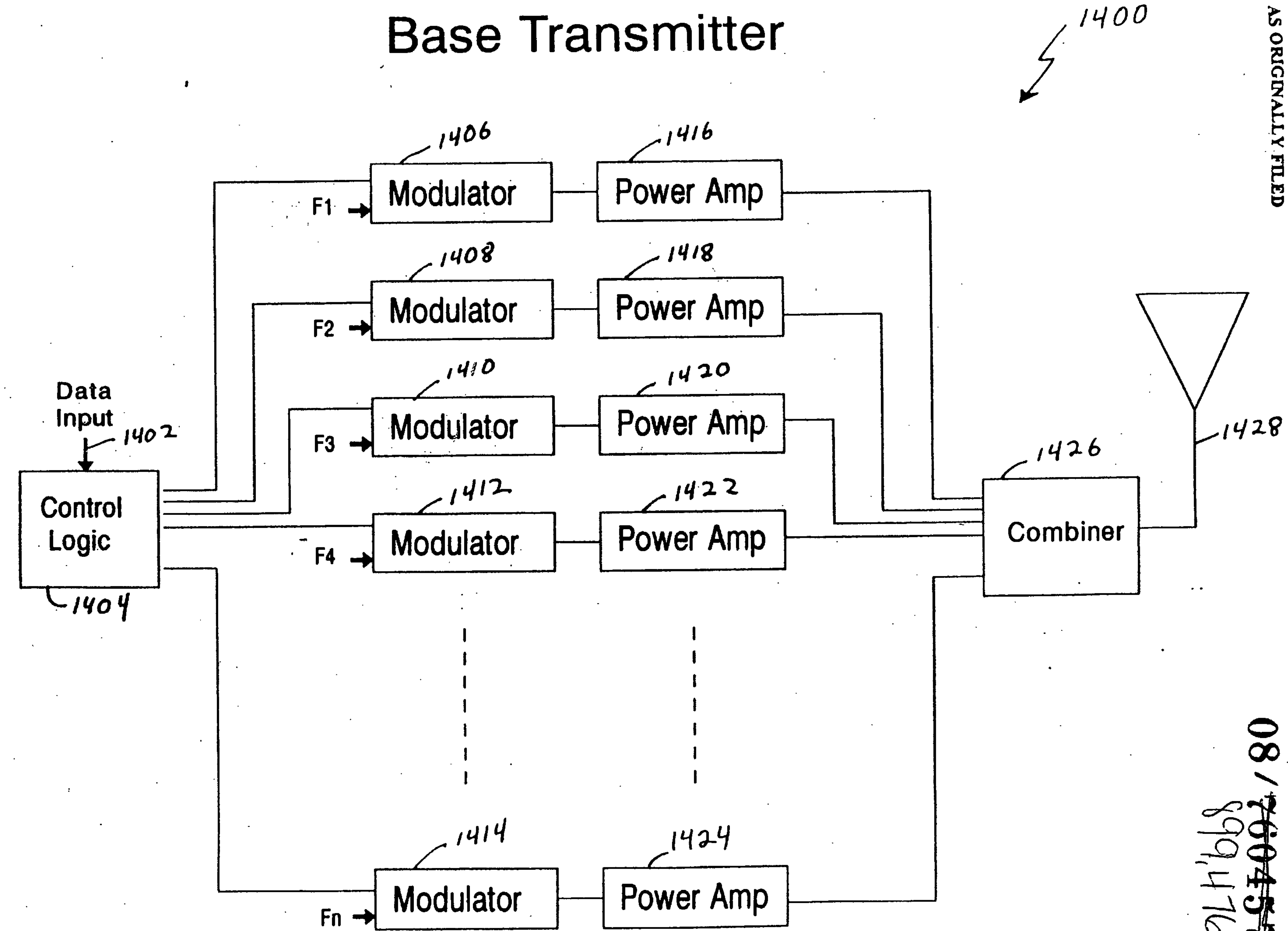

Fig. 14

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Mobile Transceiver

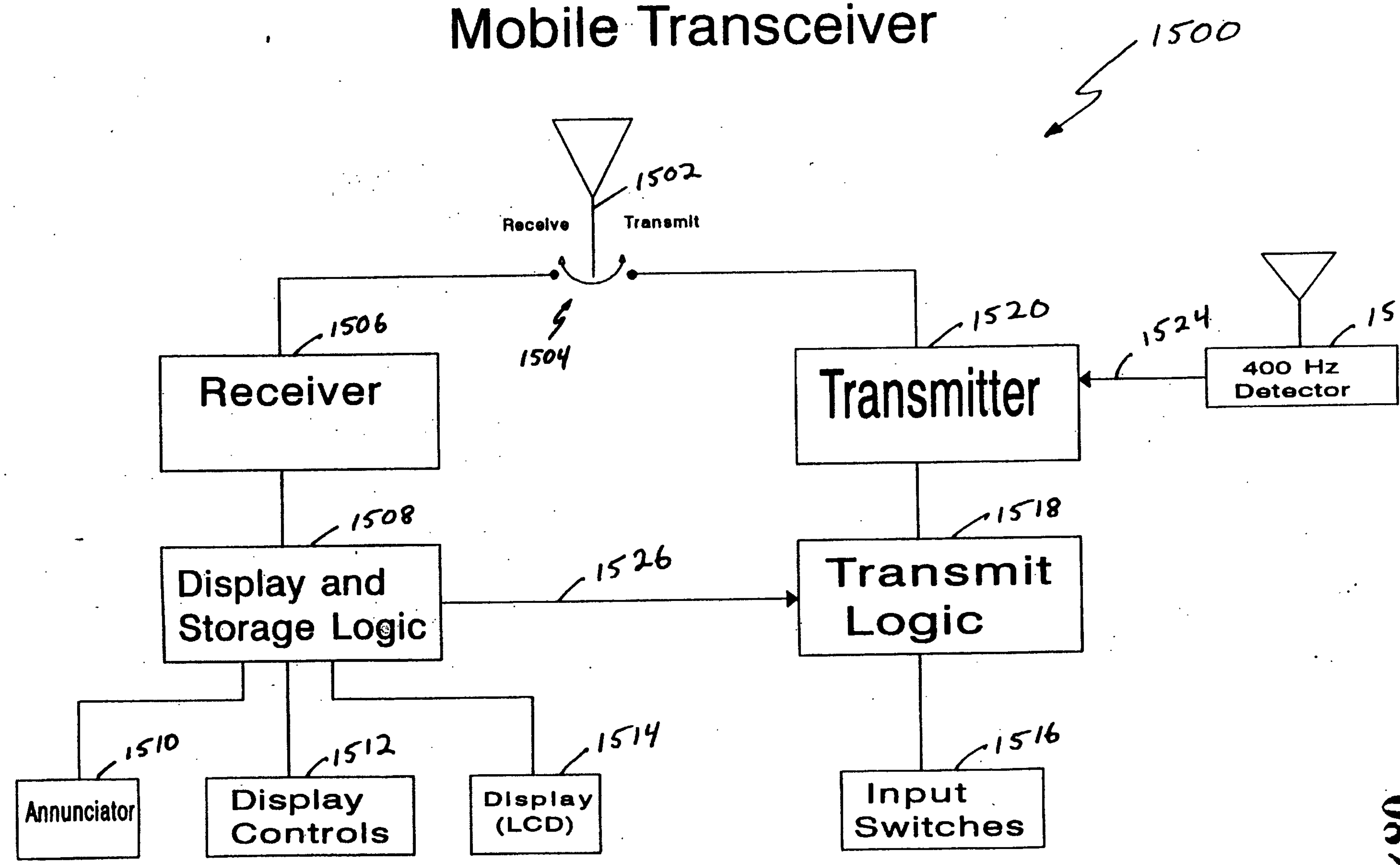

Fig. 15

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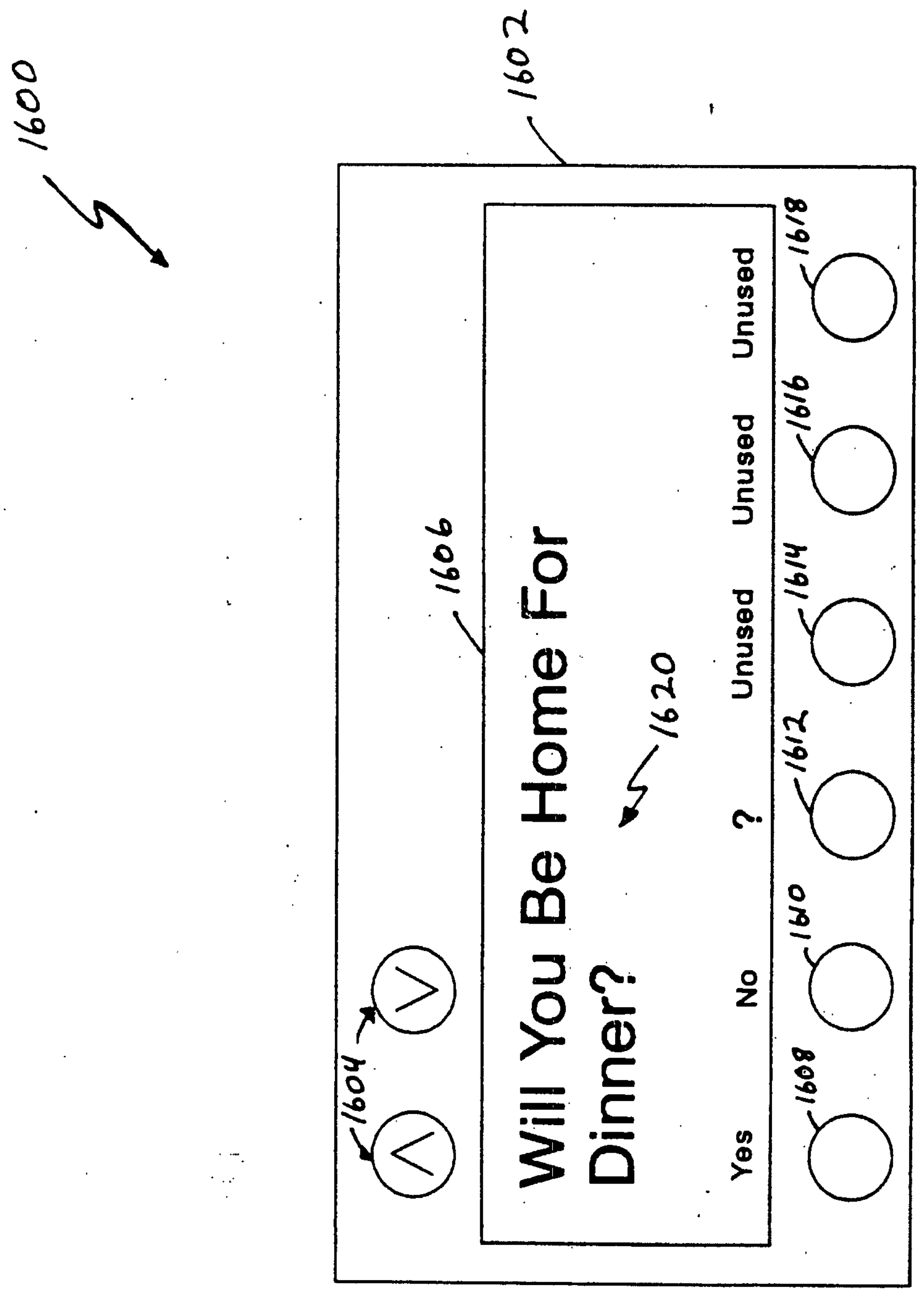

Mobile Transceiver

Fig. 16

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Mobile Receiver

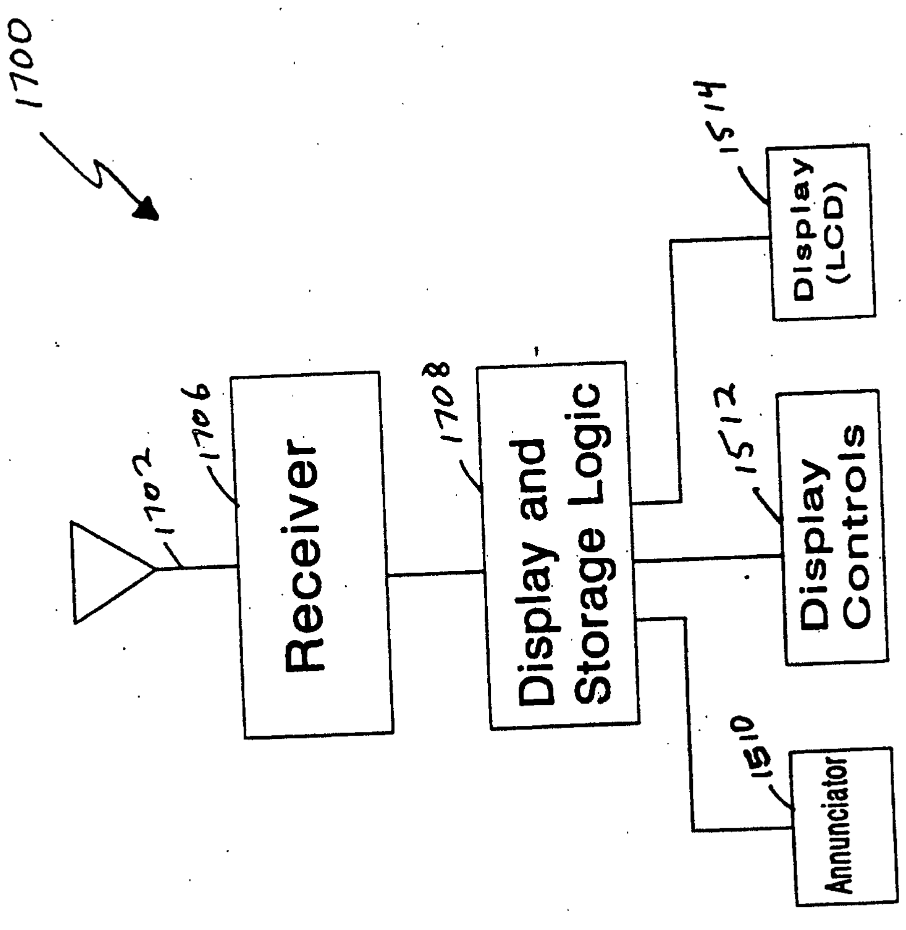

Fig. 17

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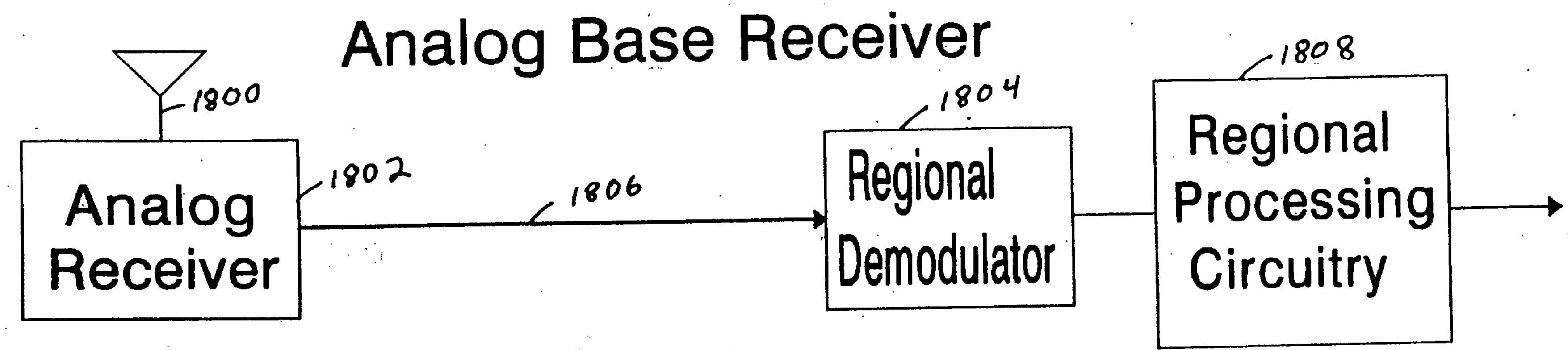

Fig. 18(A)

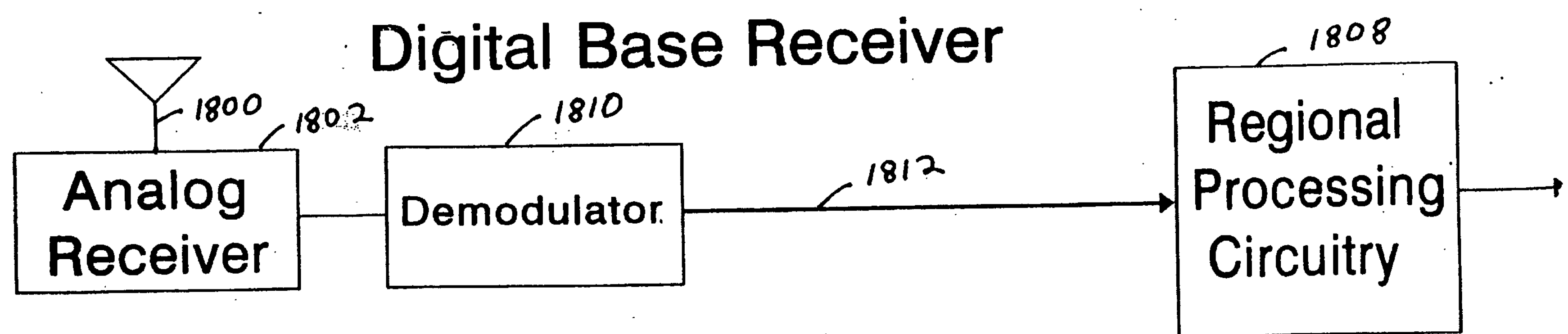

Fig. 18(B)

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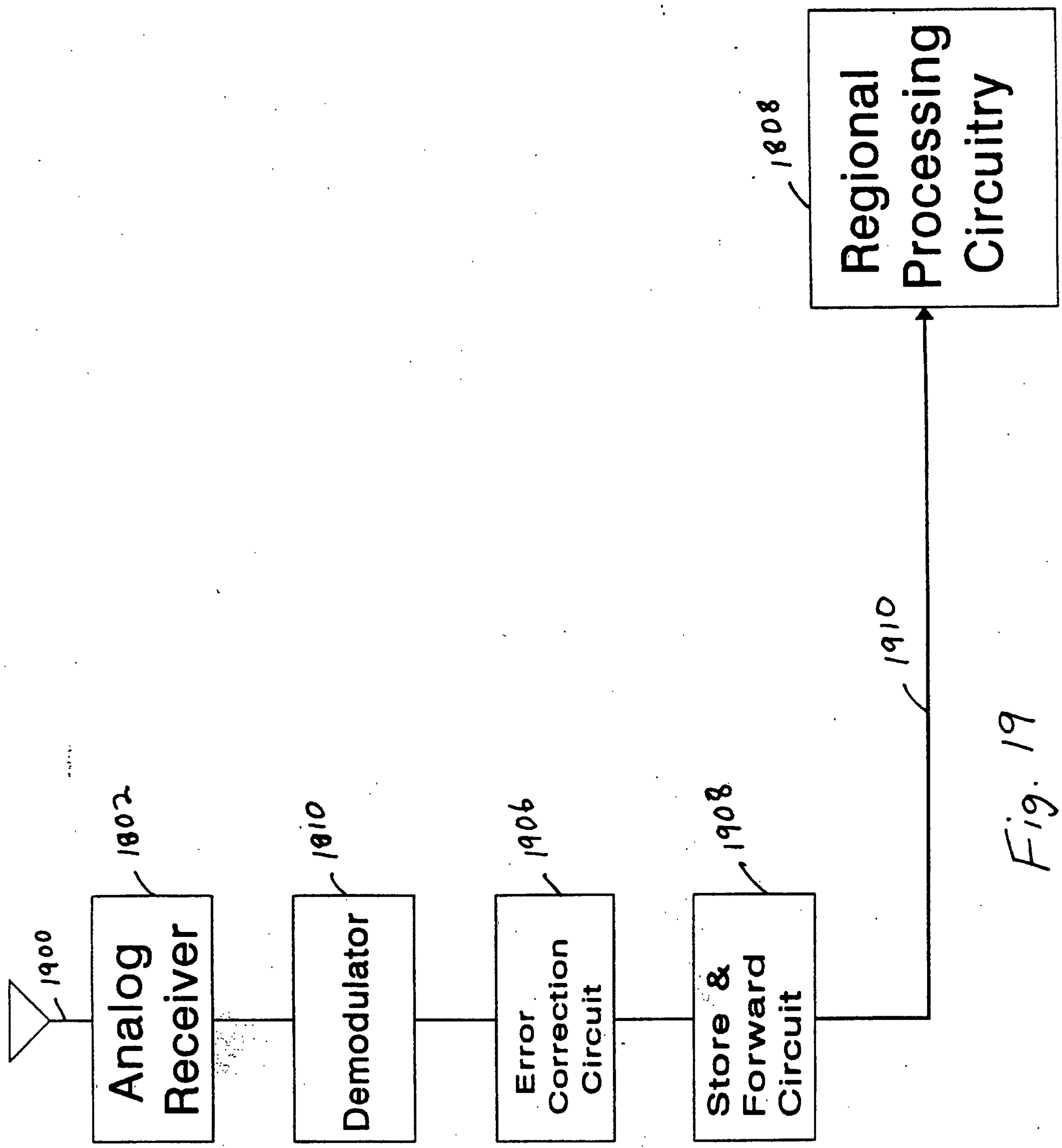

Fig. 19

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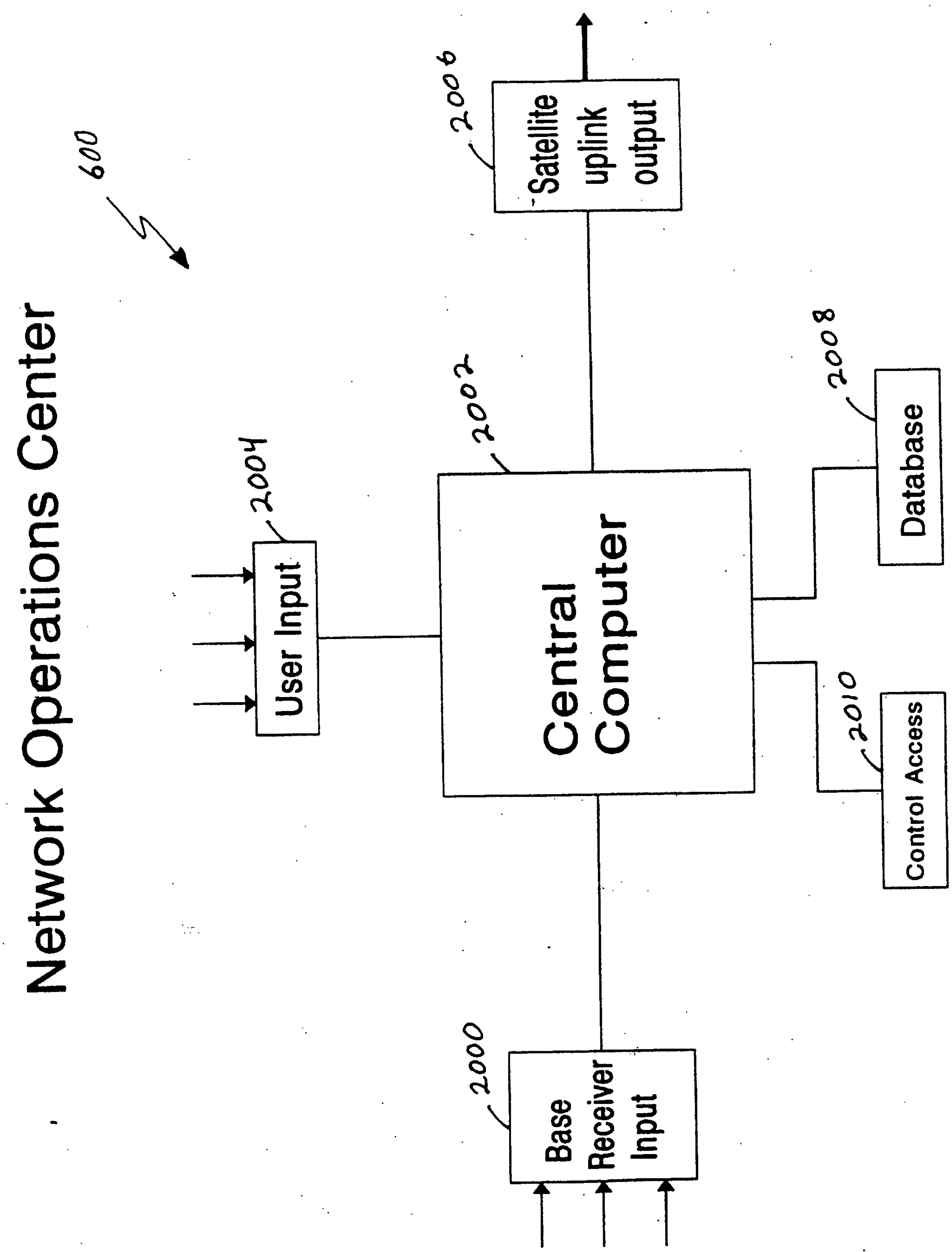

Fig. 20

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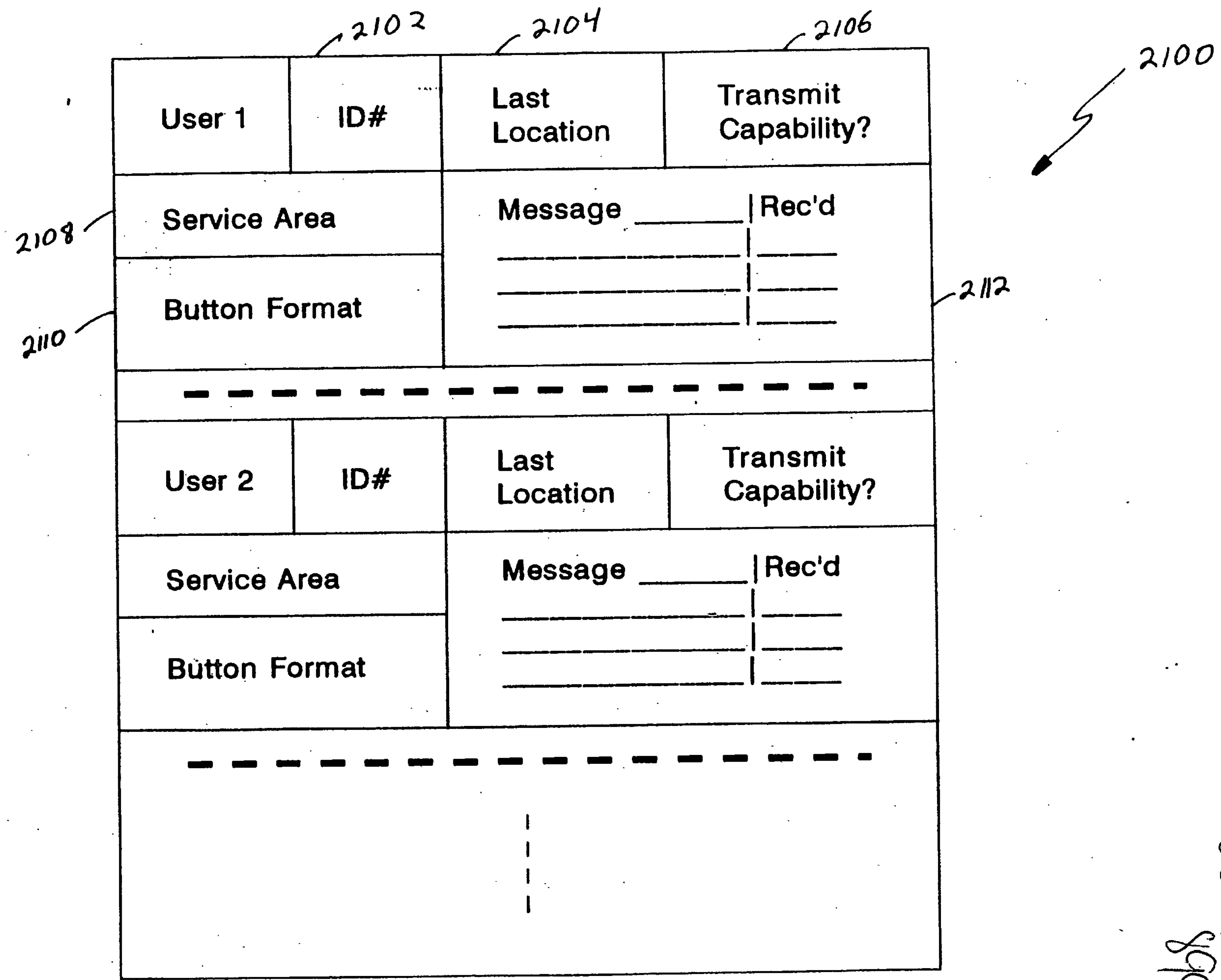

User Database

Fig. 21

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2200

2202	2204	2206	2208	2210
User 1	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 2	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 3	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 4	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
■ ■ ■				

Traffic Database

Fig. 22

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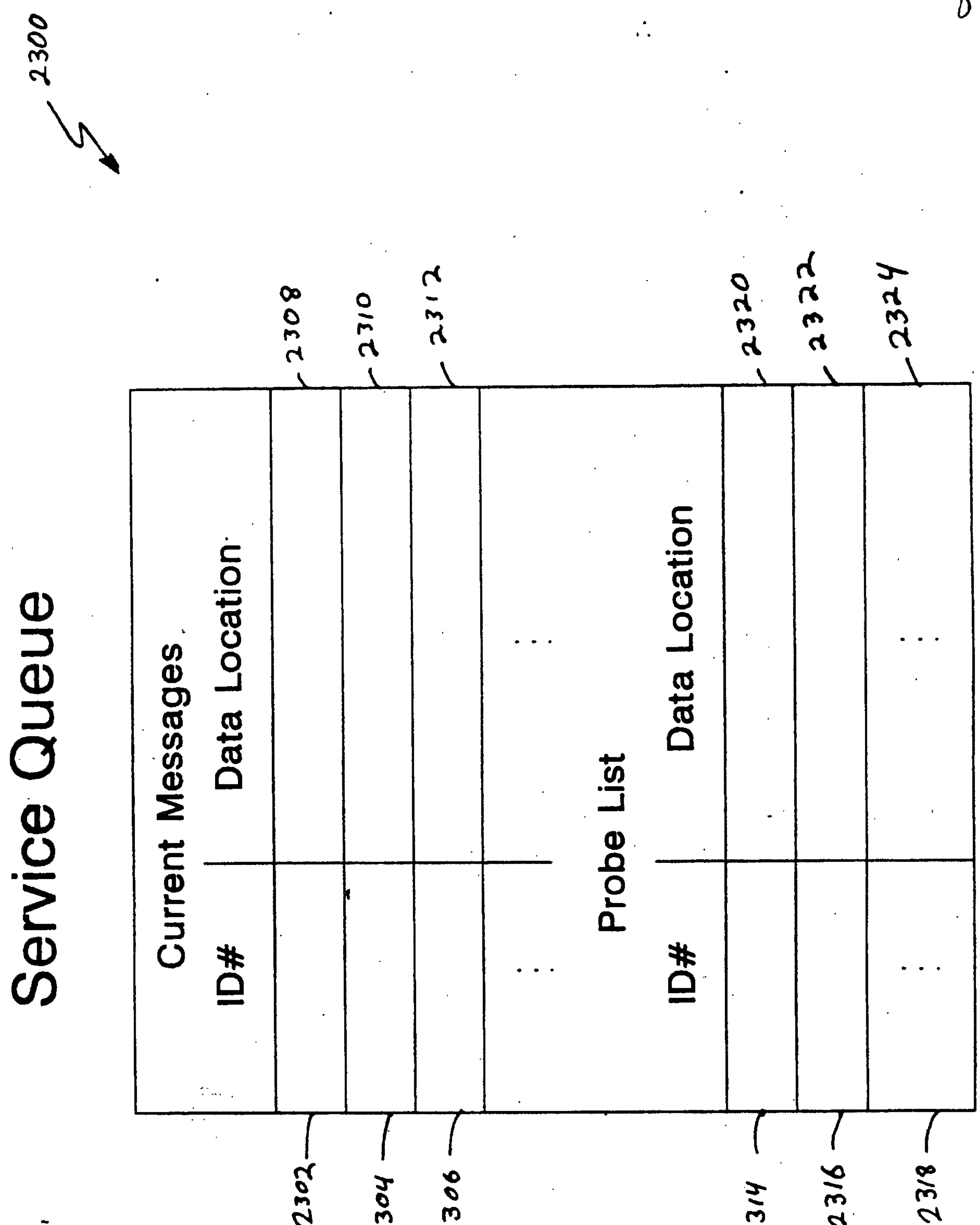

Fig. 23

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2400

2402	2404	2406	2408
Base Transmitter 1	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 2	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 3	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 4	Zonal Assignment	Base Receivers in Coverage Area	Other Data
■ ■ ■			

Base Transmitter Database

Fig. 24

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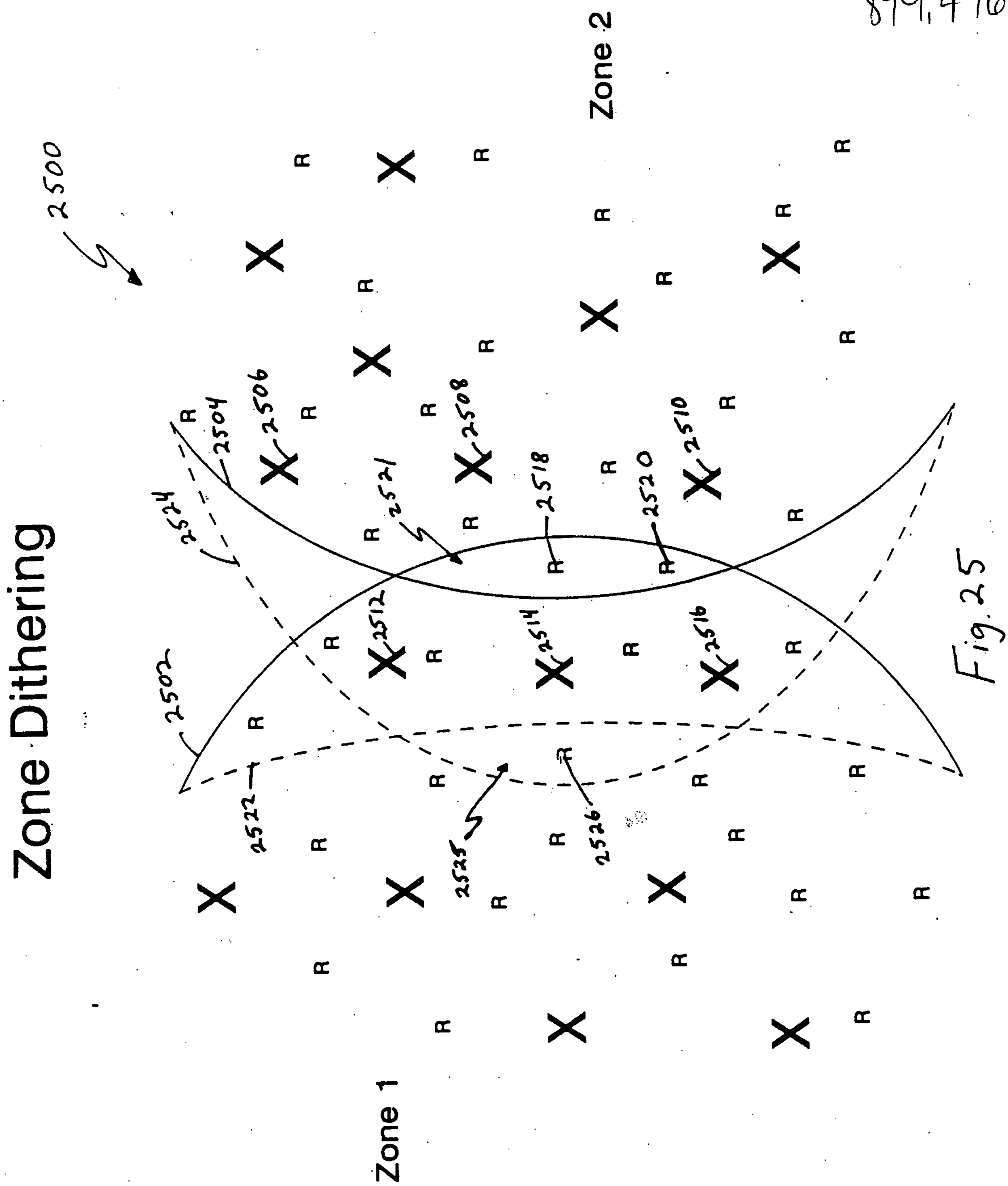

Fig. 25

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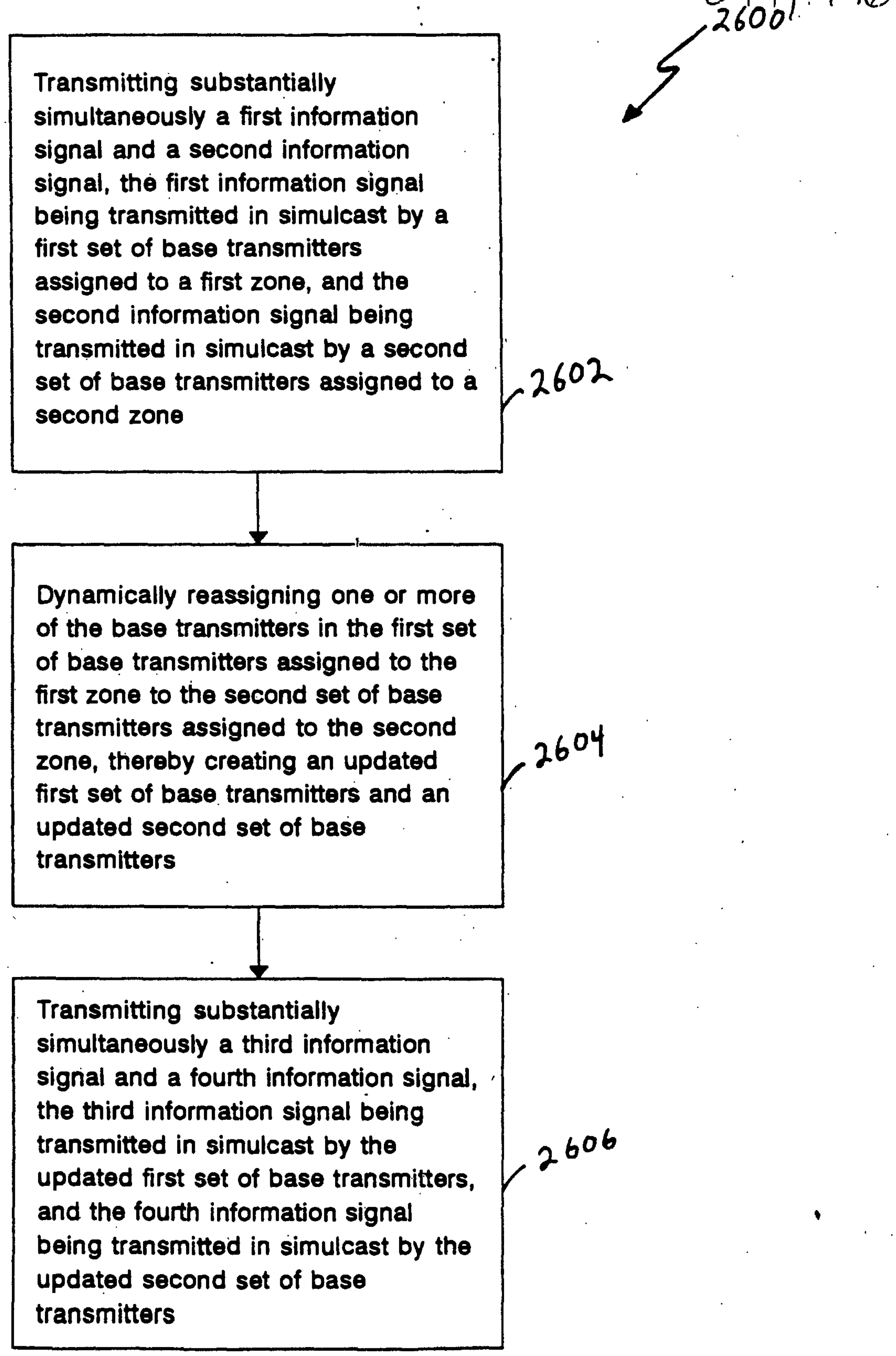

Fig. 26

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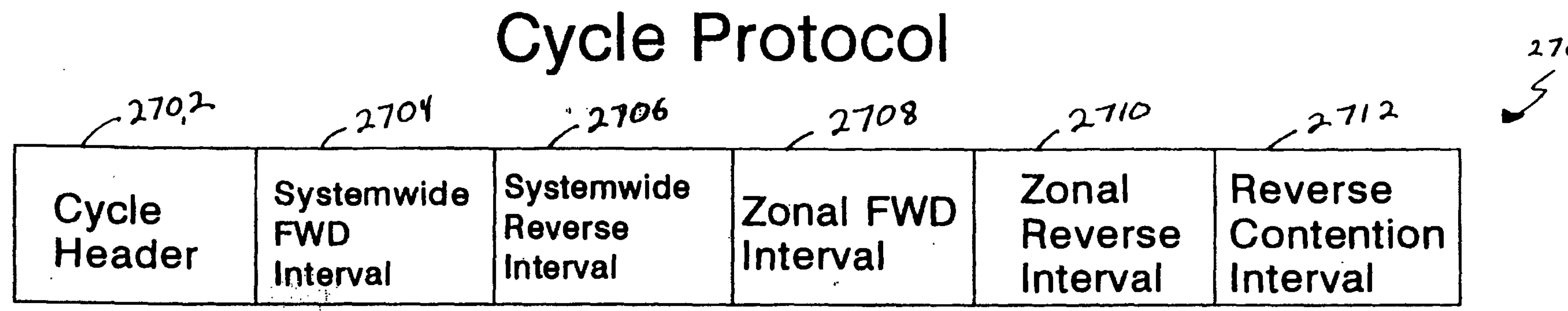

Fig. 27(A)

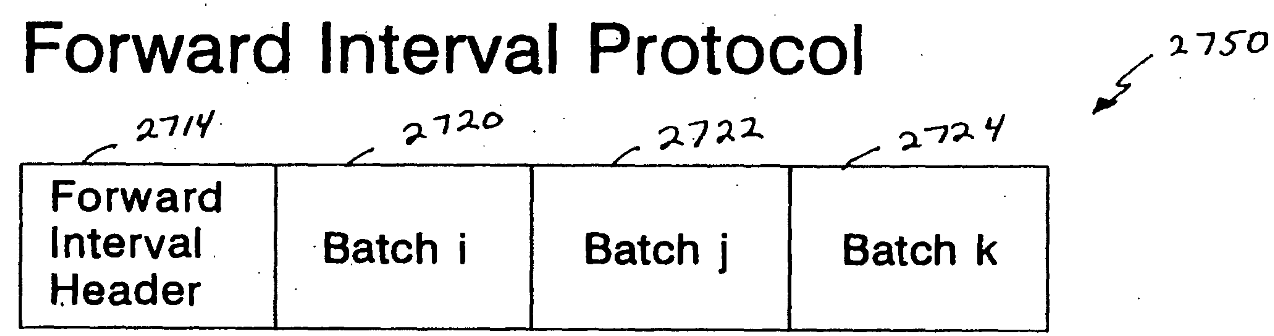

Fig. 27(B)

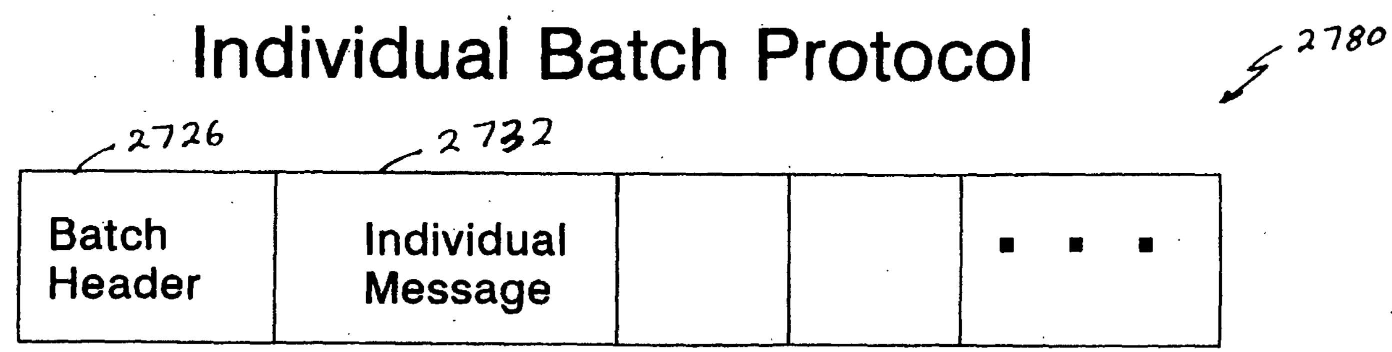

Fig. 27(C)

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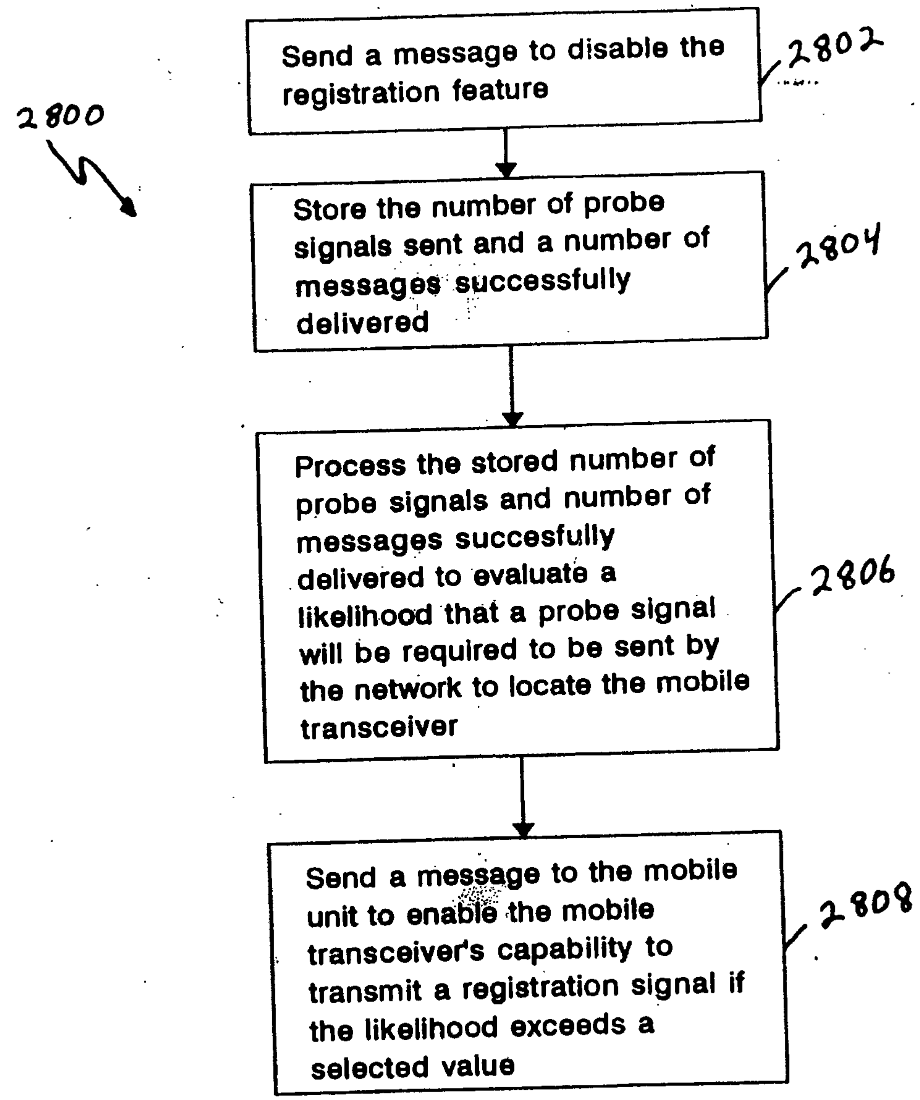

Fig. 28(A)

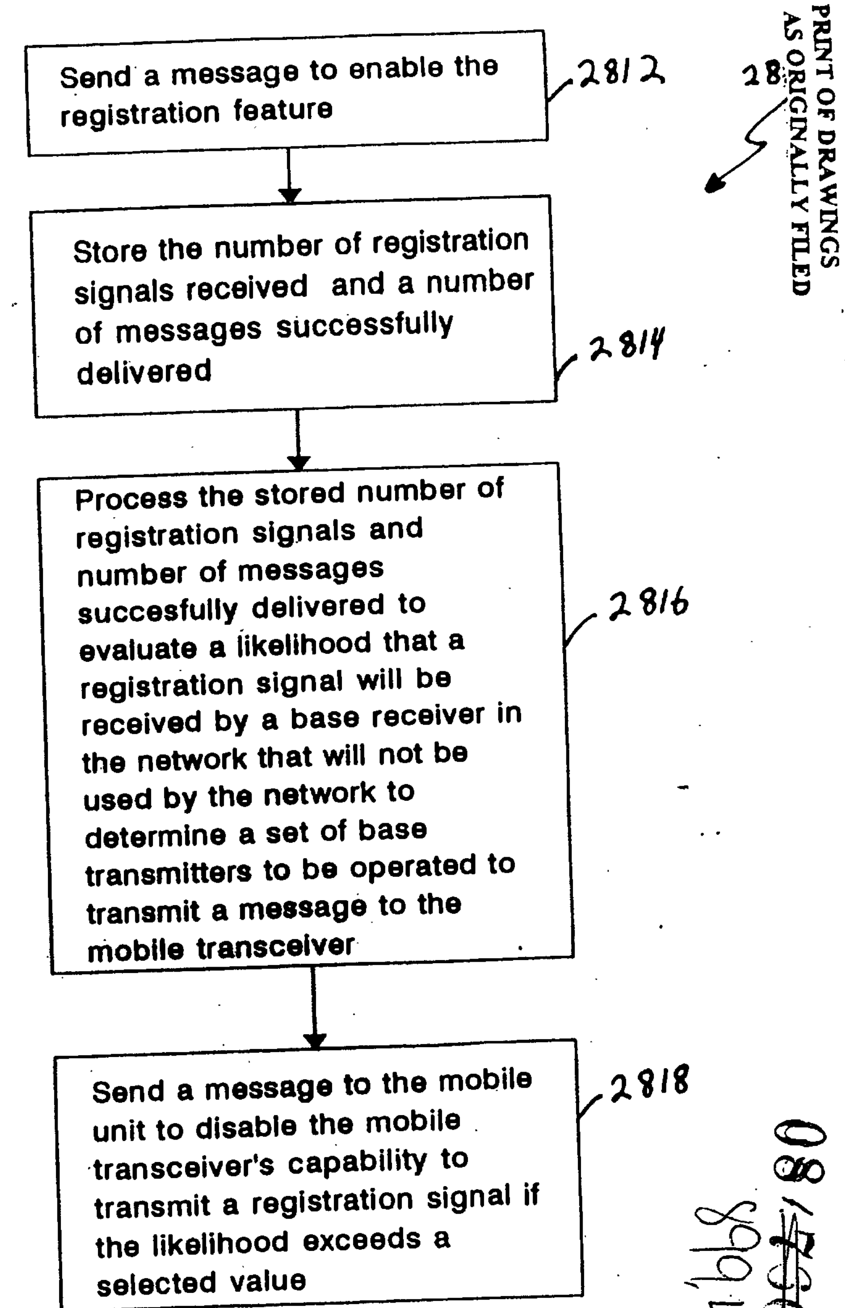

Fig. 28(B)

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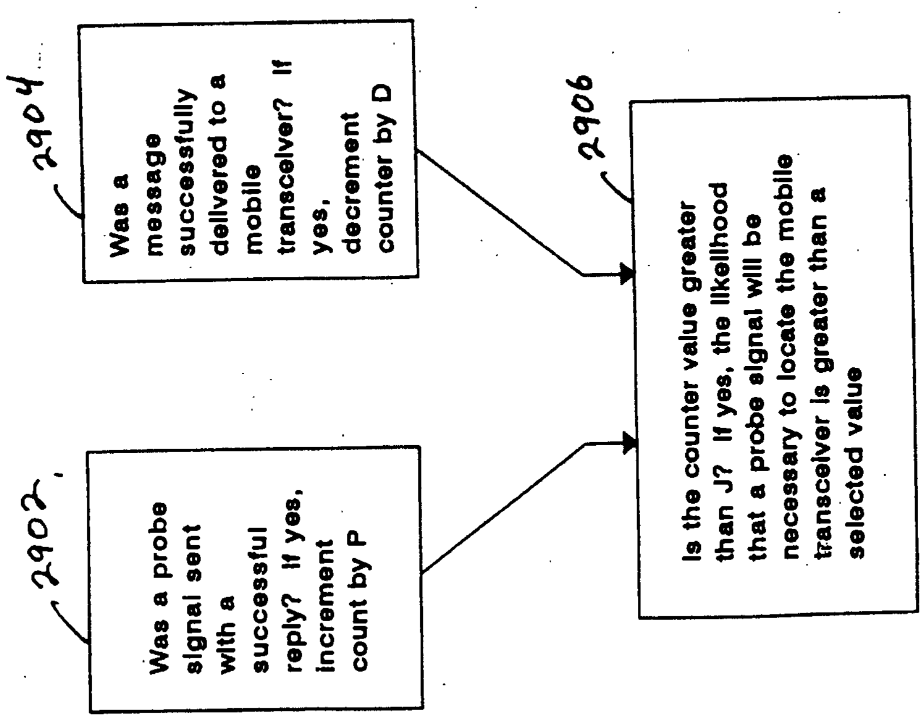

Fig. 29(A)

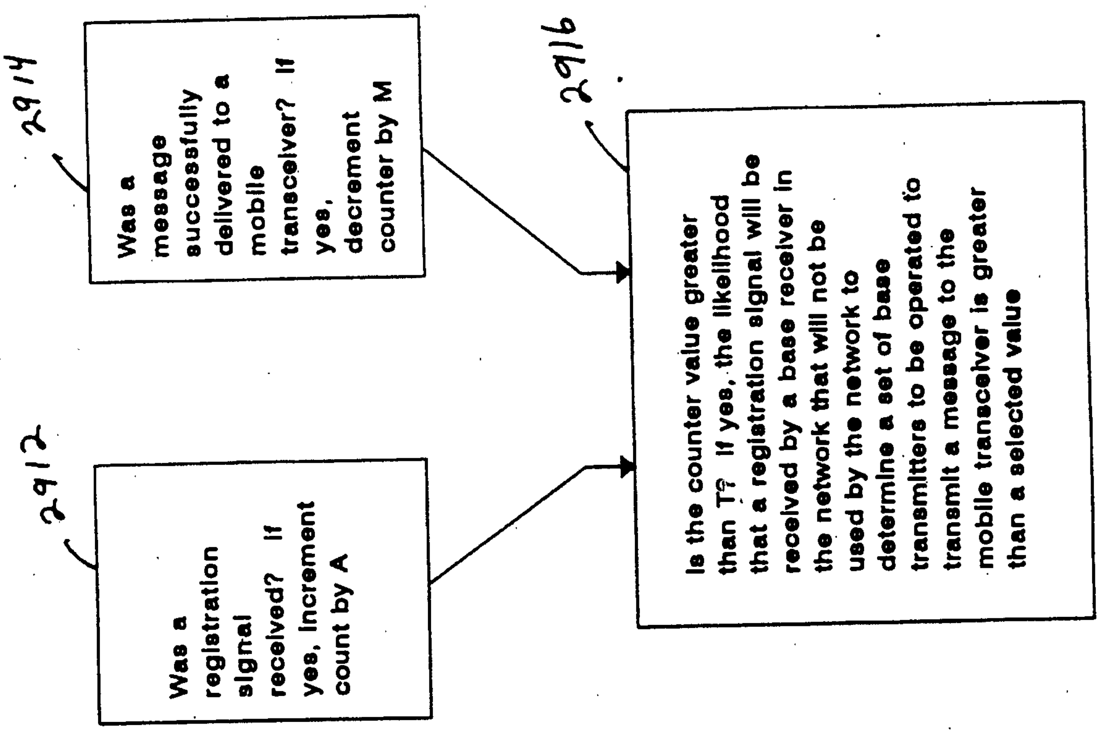

Fig 29(B)

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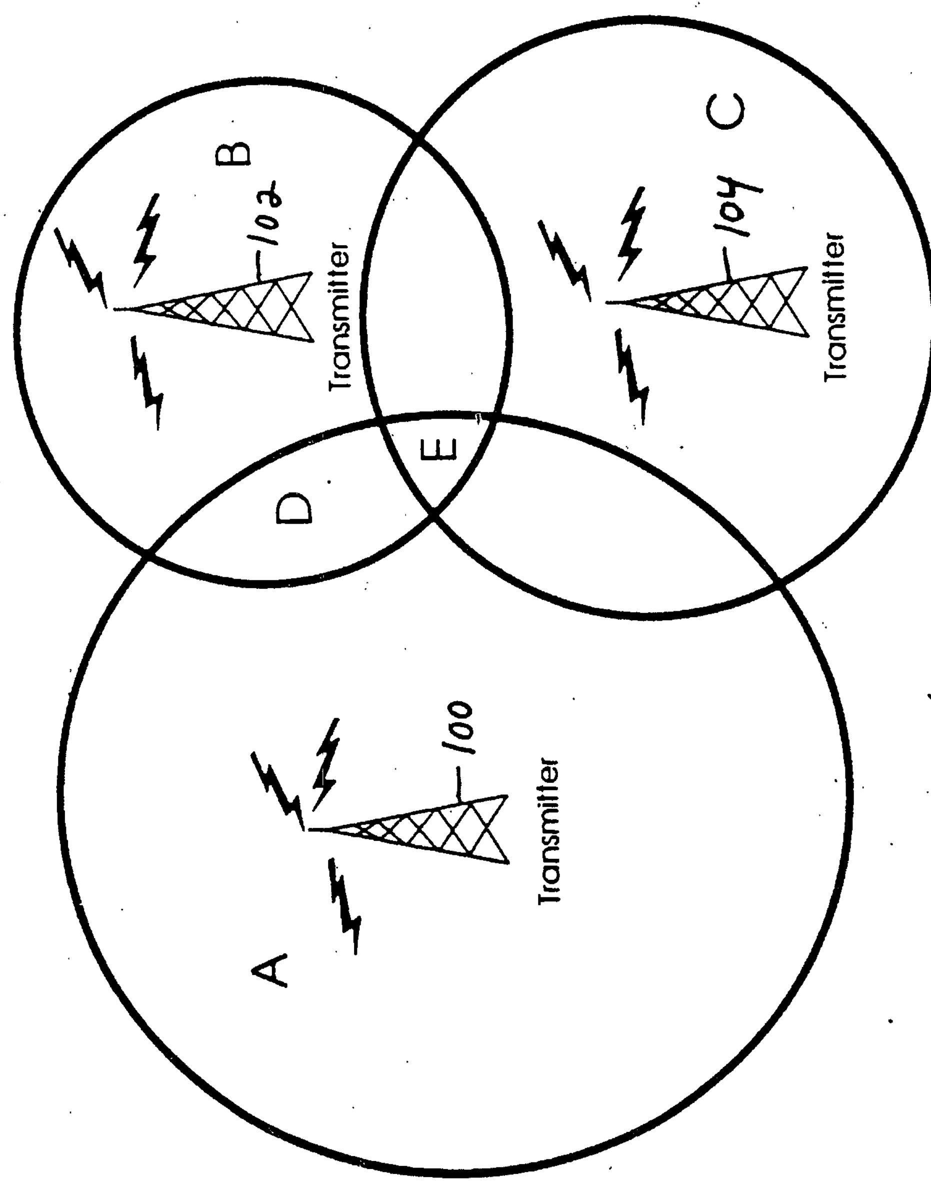

Fig. 1

40

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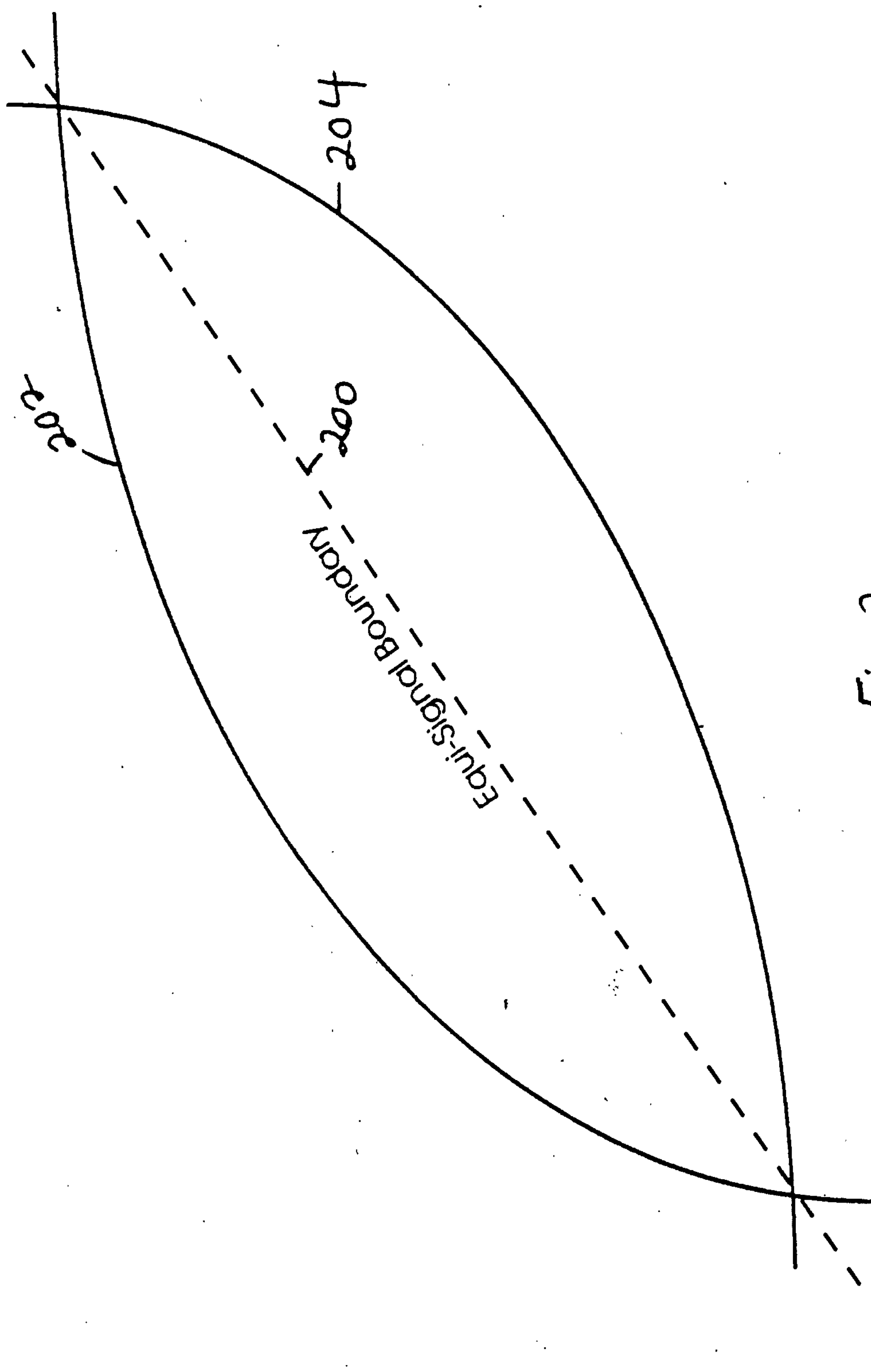

Fig. 2

Fig. 3(A)

Fig. 3(B)

Fig. 3(C)

Fig. 3(D)

Fig. 3(E)

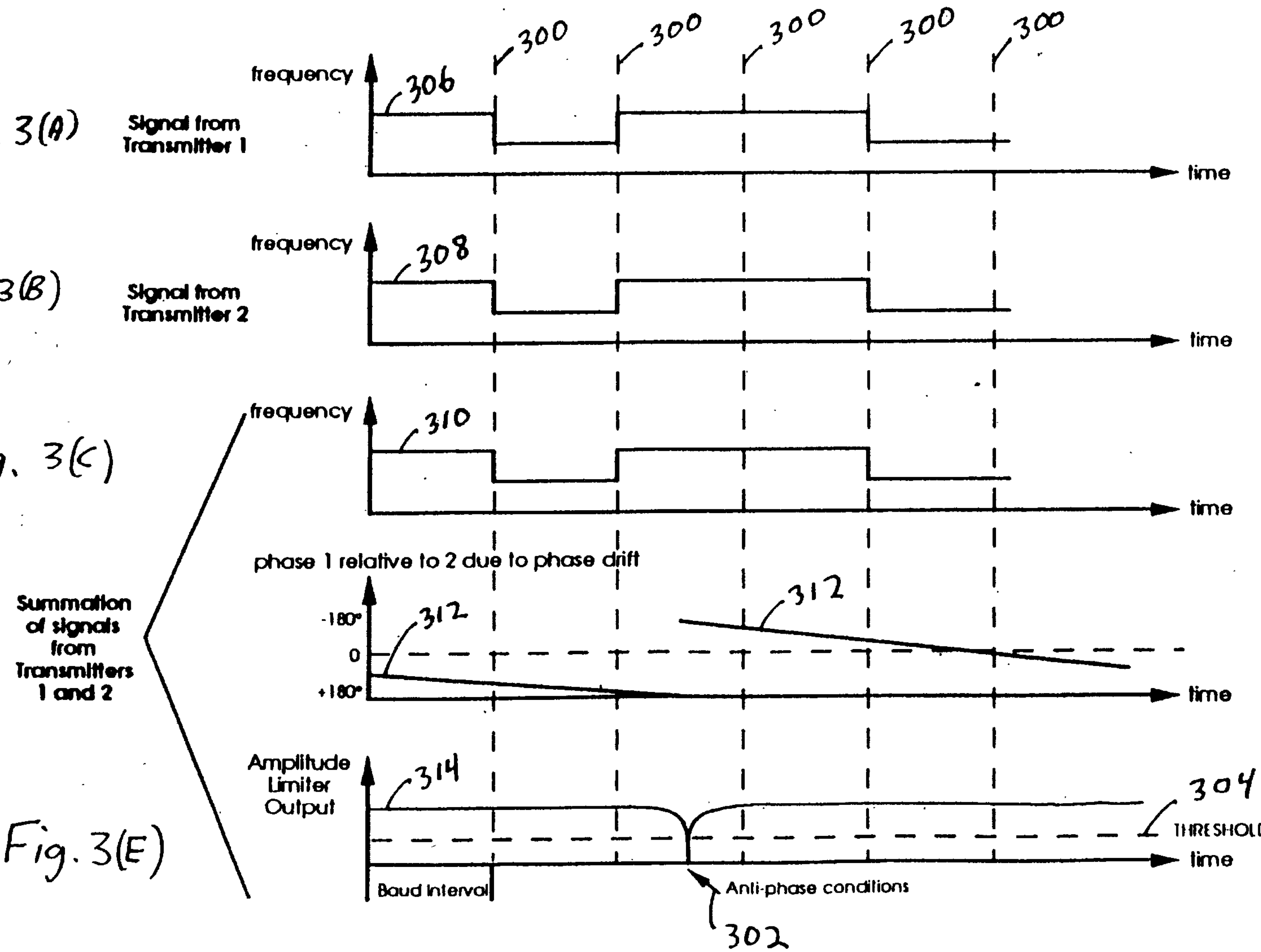

Fig. 3

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Fig. 4(A)

Fig. 4(B)

Fig. 4(C)

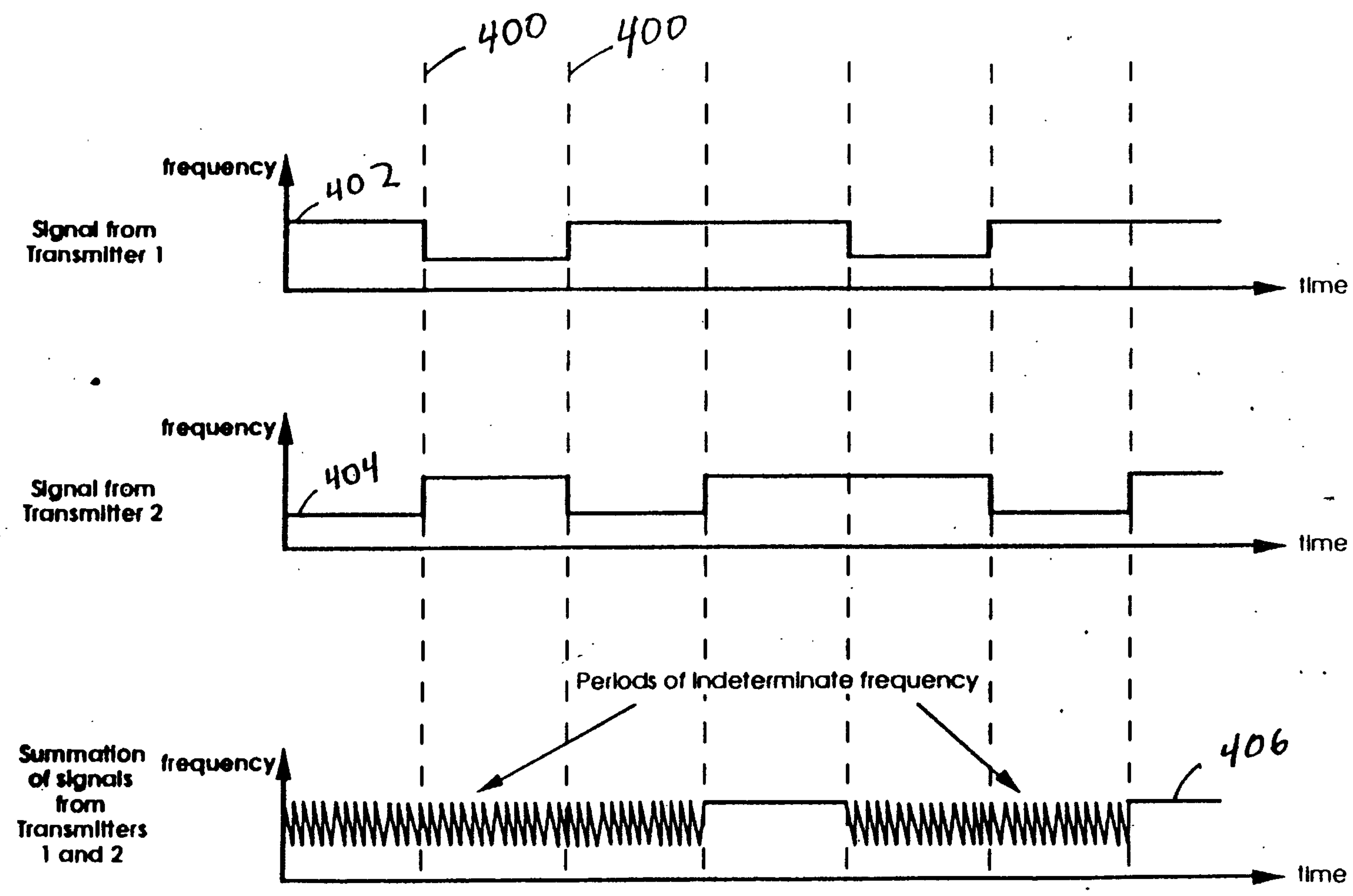

Fig. 4

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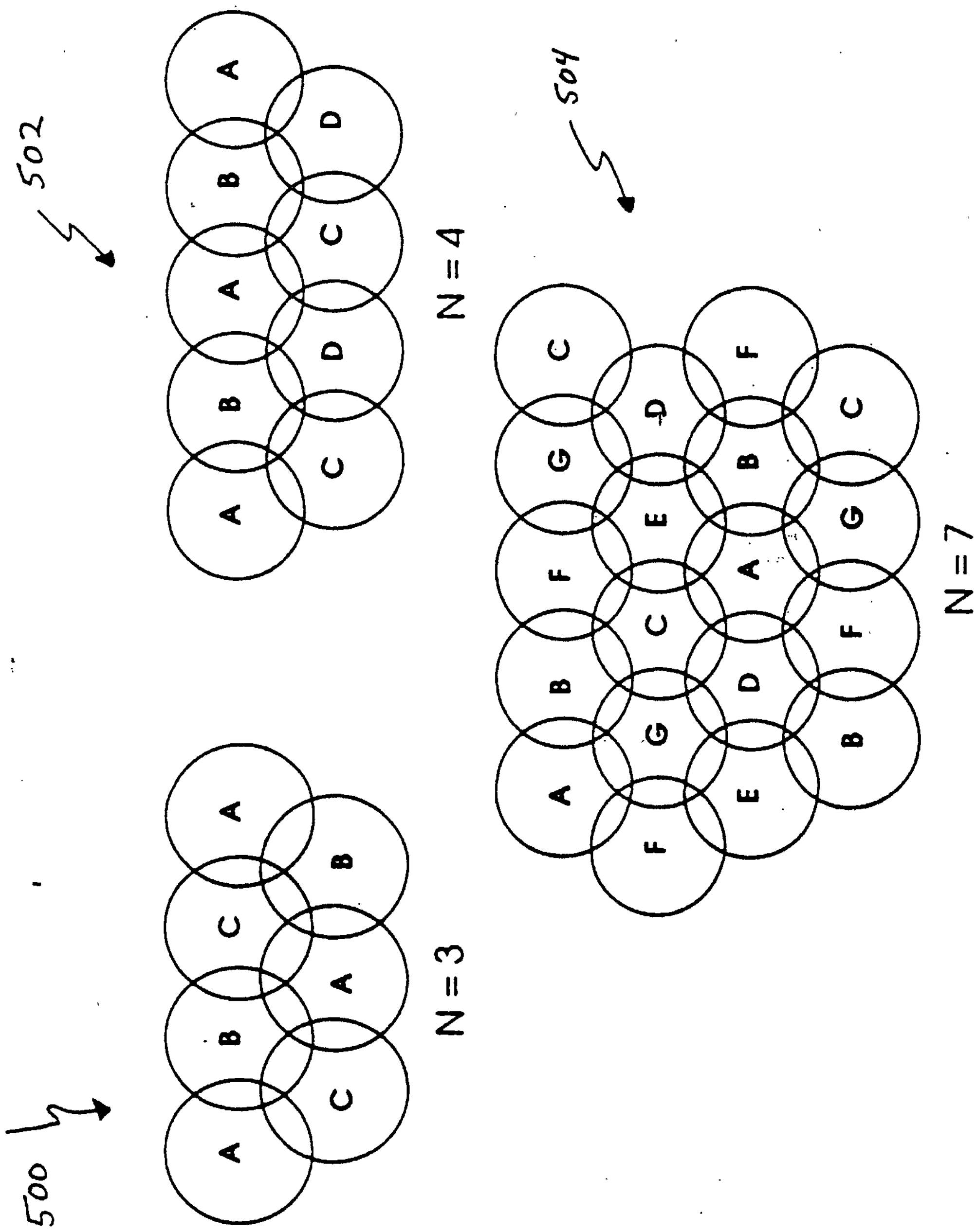

Fig. 5

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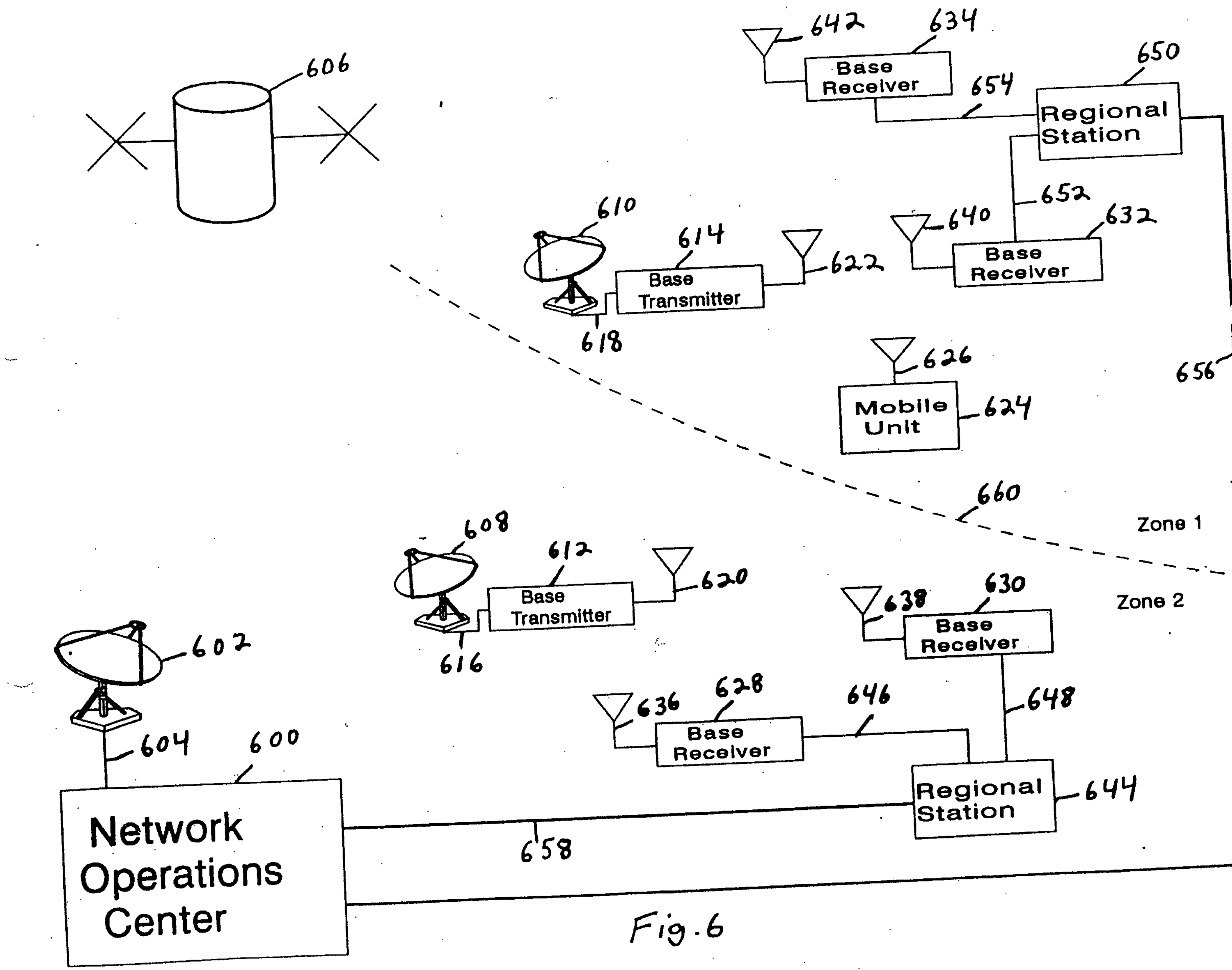

Fig. 6

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899,476

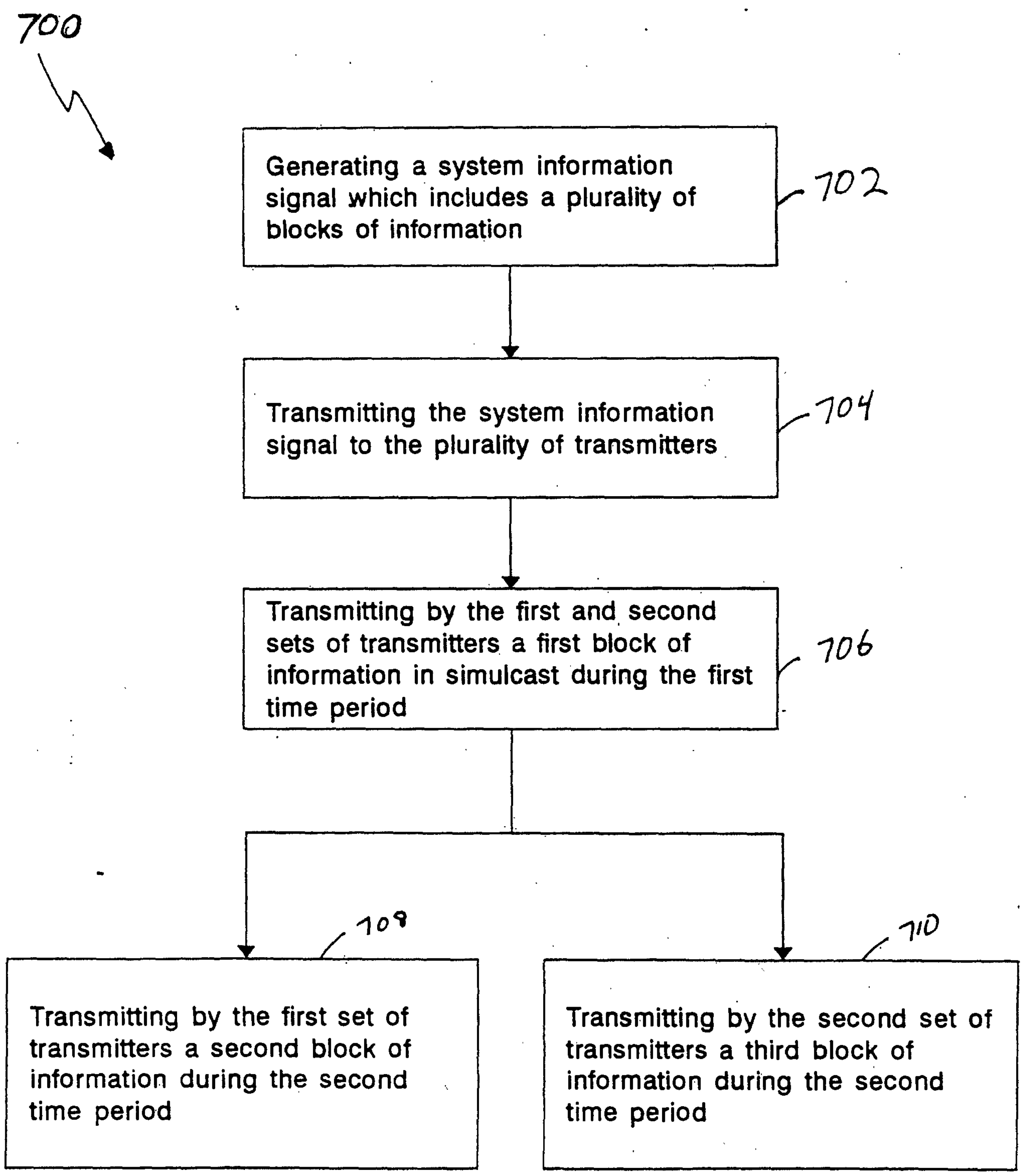

Fig. 7

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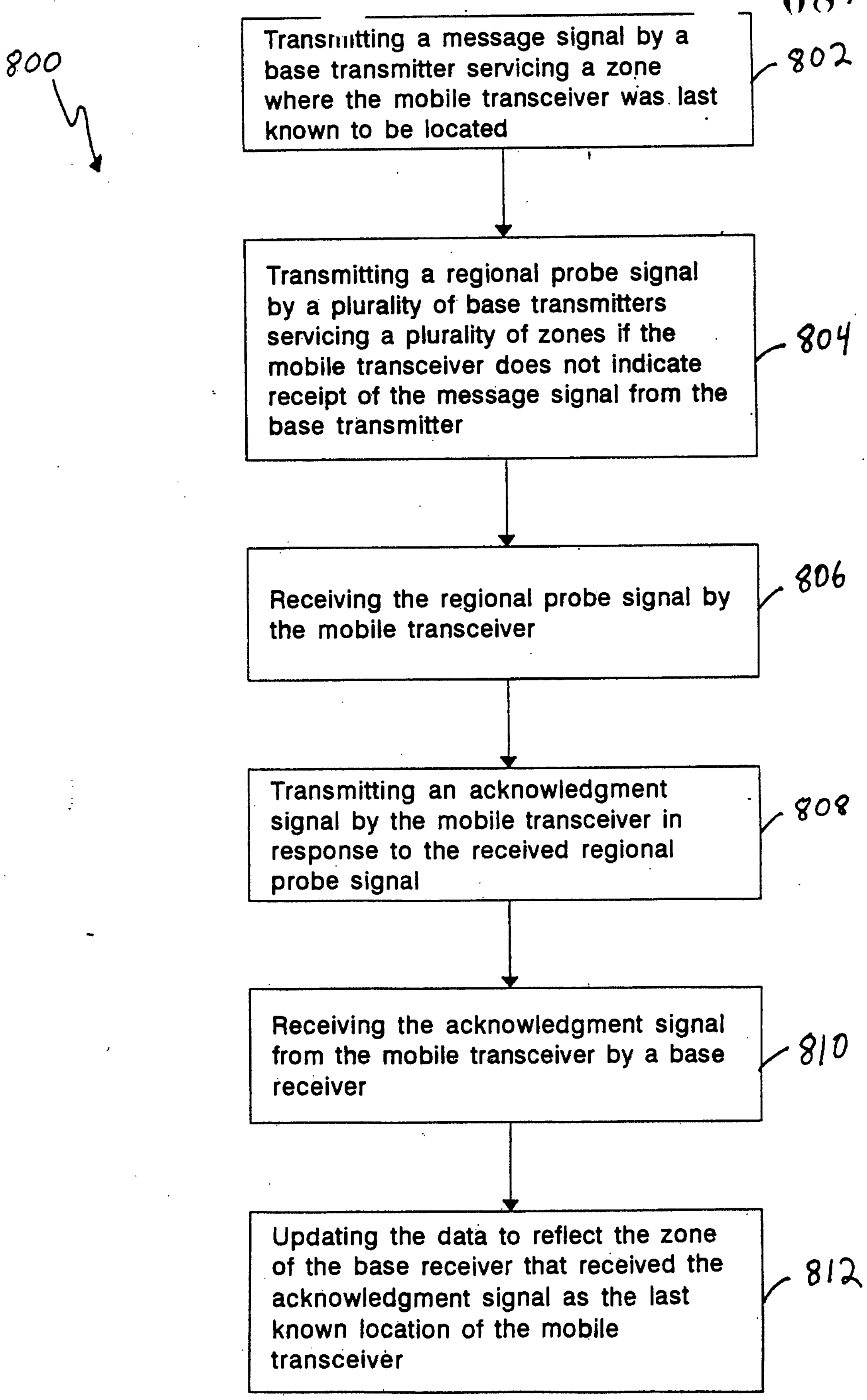

Fig. 8

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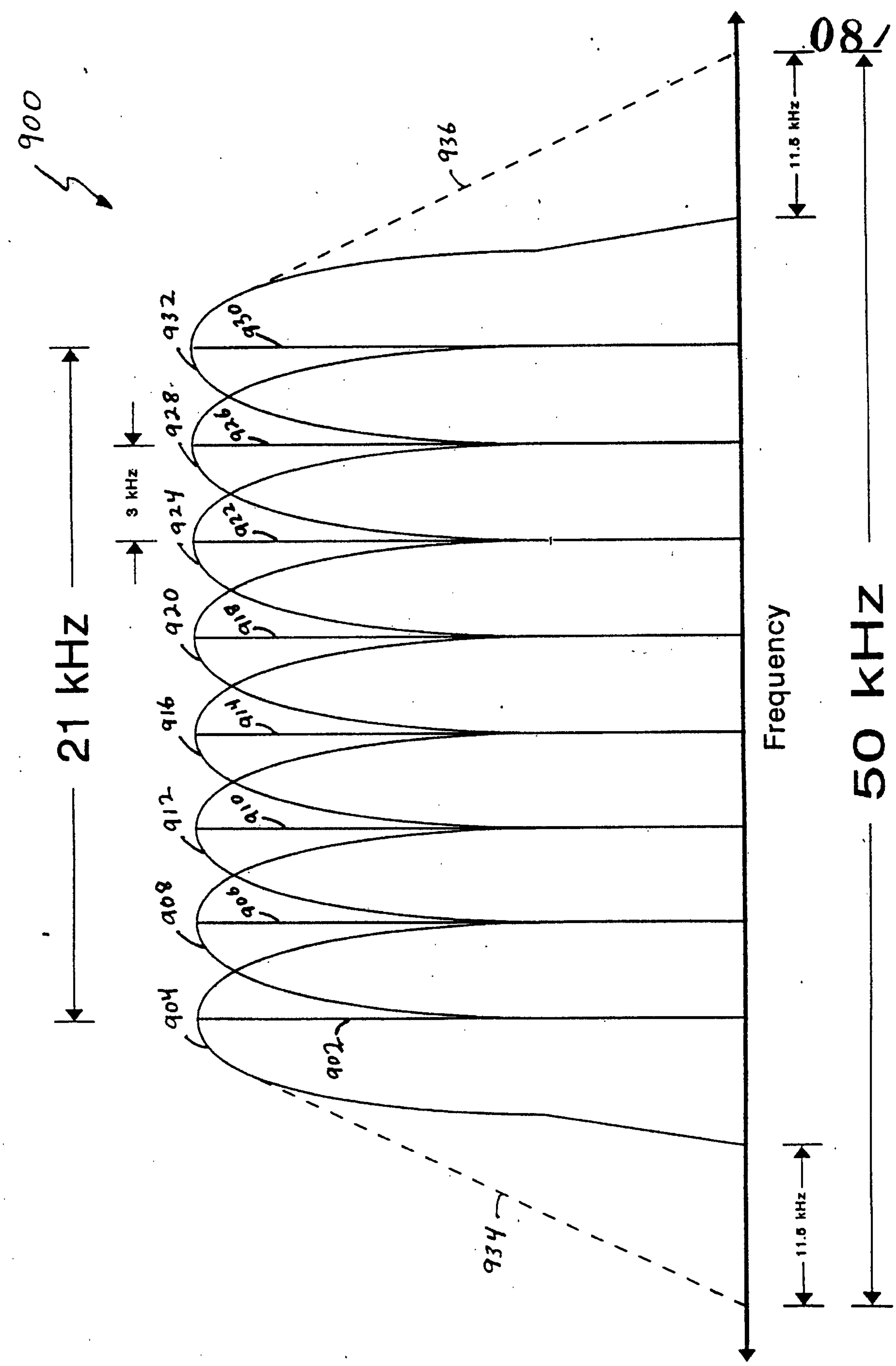

Fig. 9

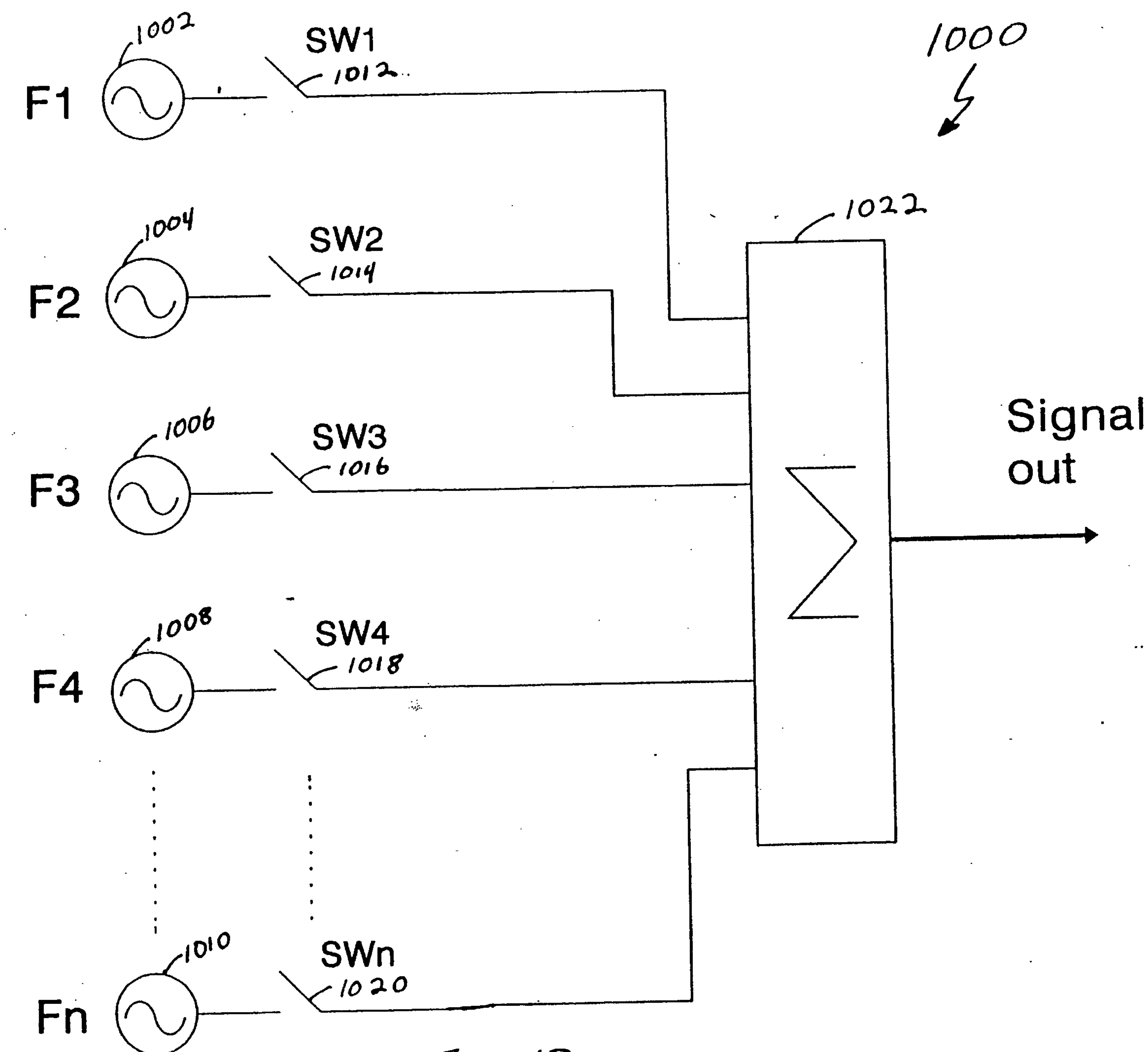

Fig. 10

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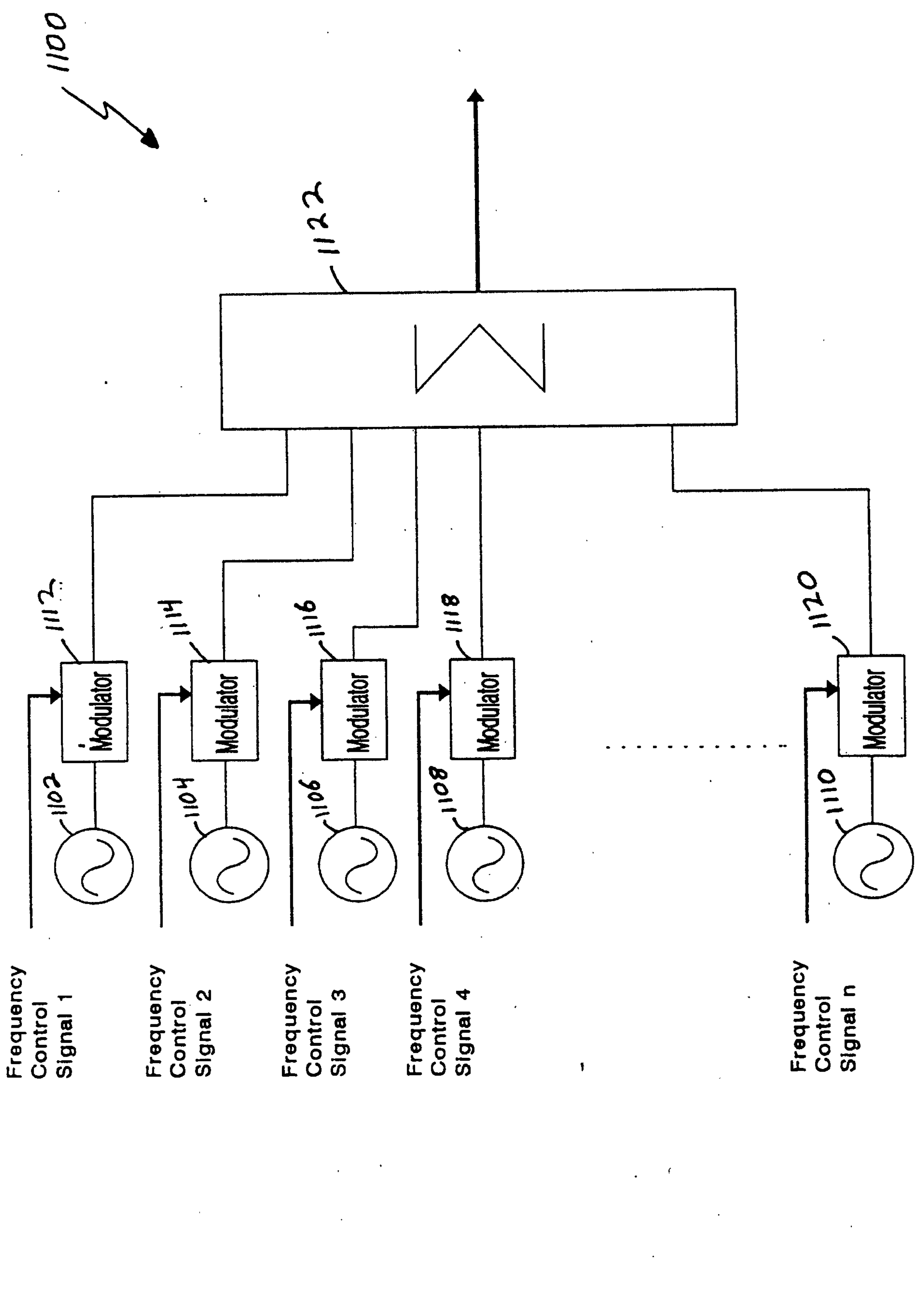
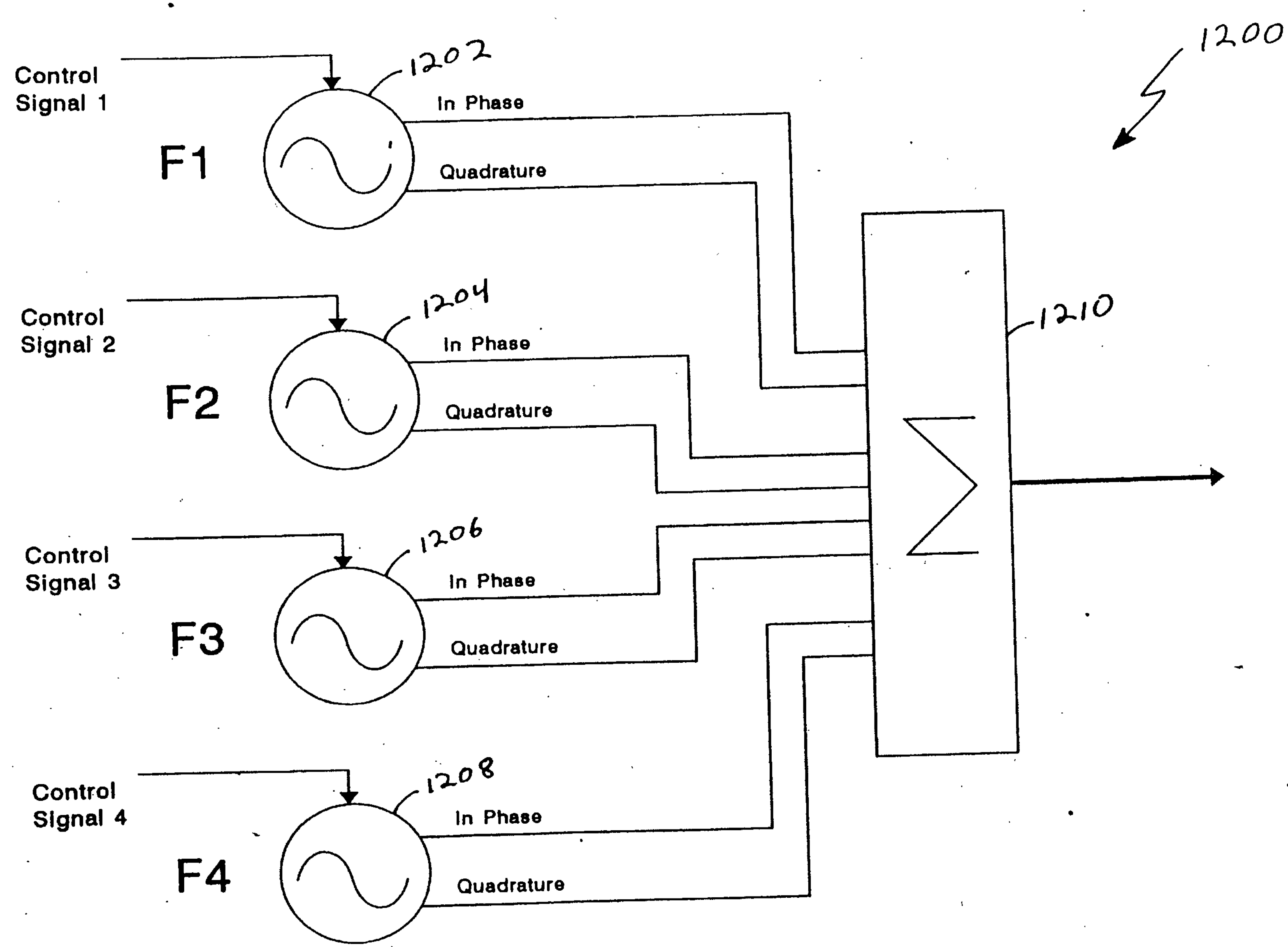


Fig. 11



Four Carrier Quadrature Modulator

Fig. 12

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Base Transmitter

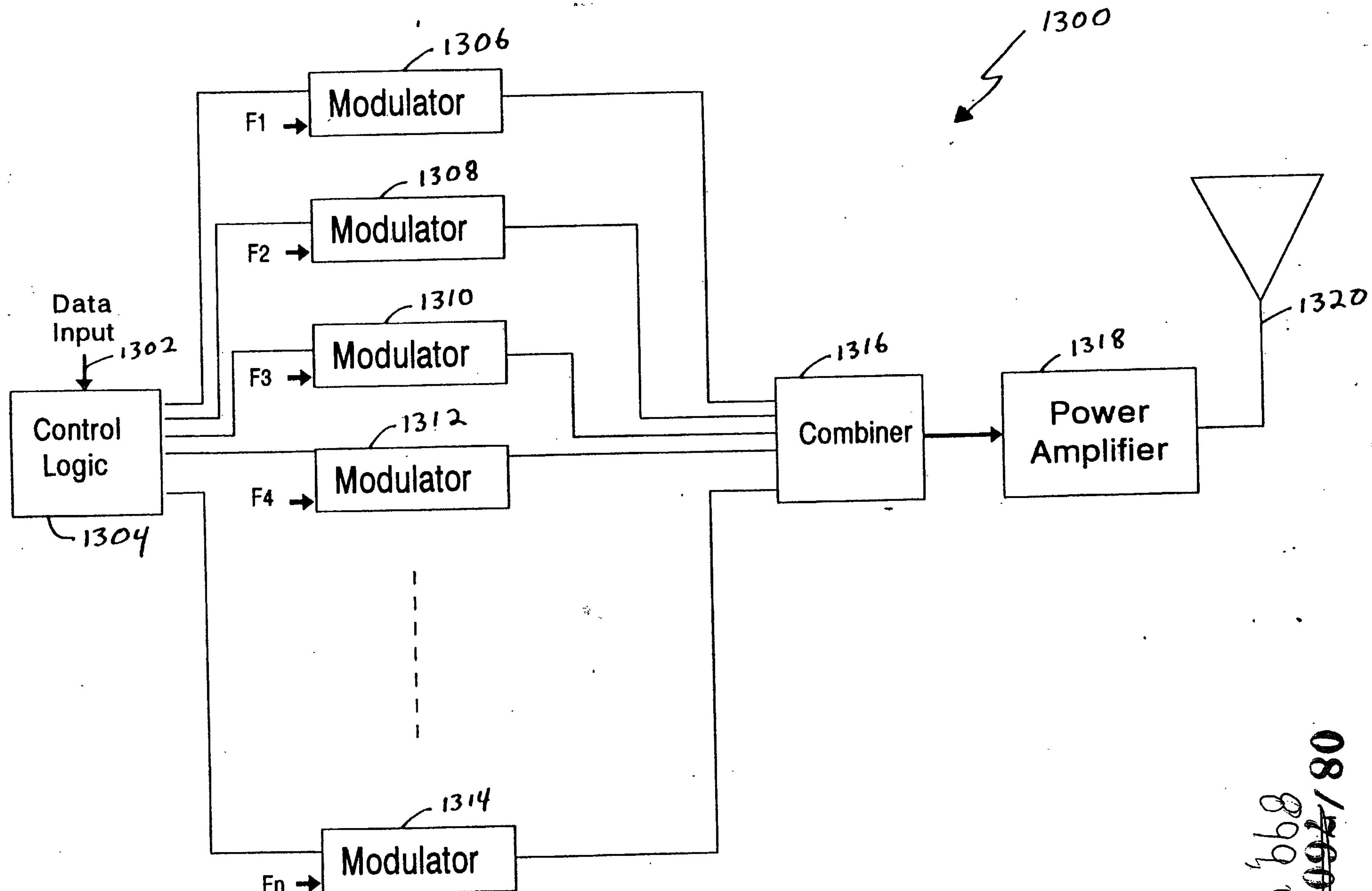

Fig. 13

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Base Transmitter

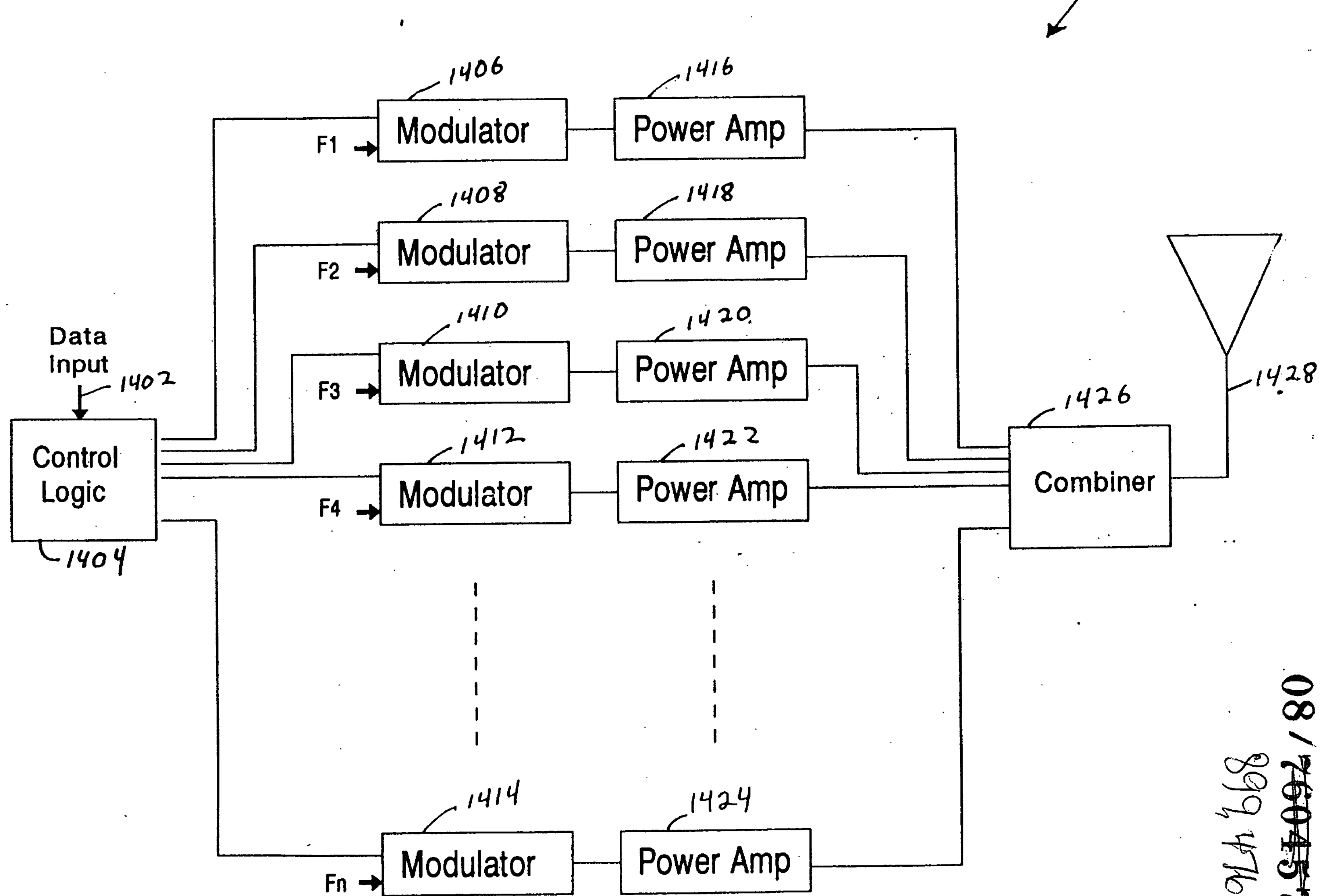

Fig. 14

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899,476

Mobile Transceiver

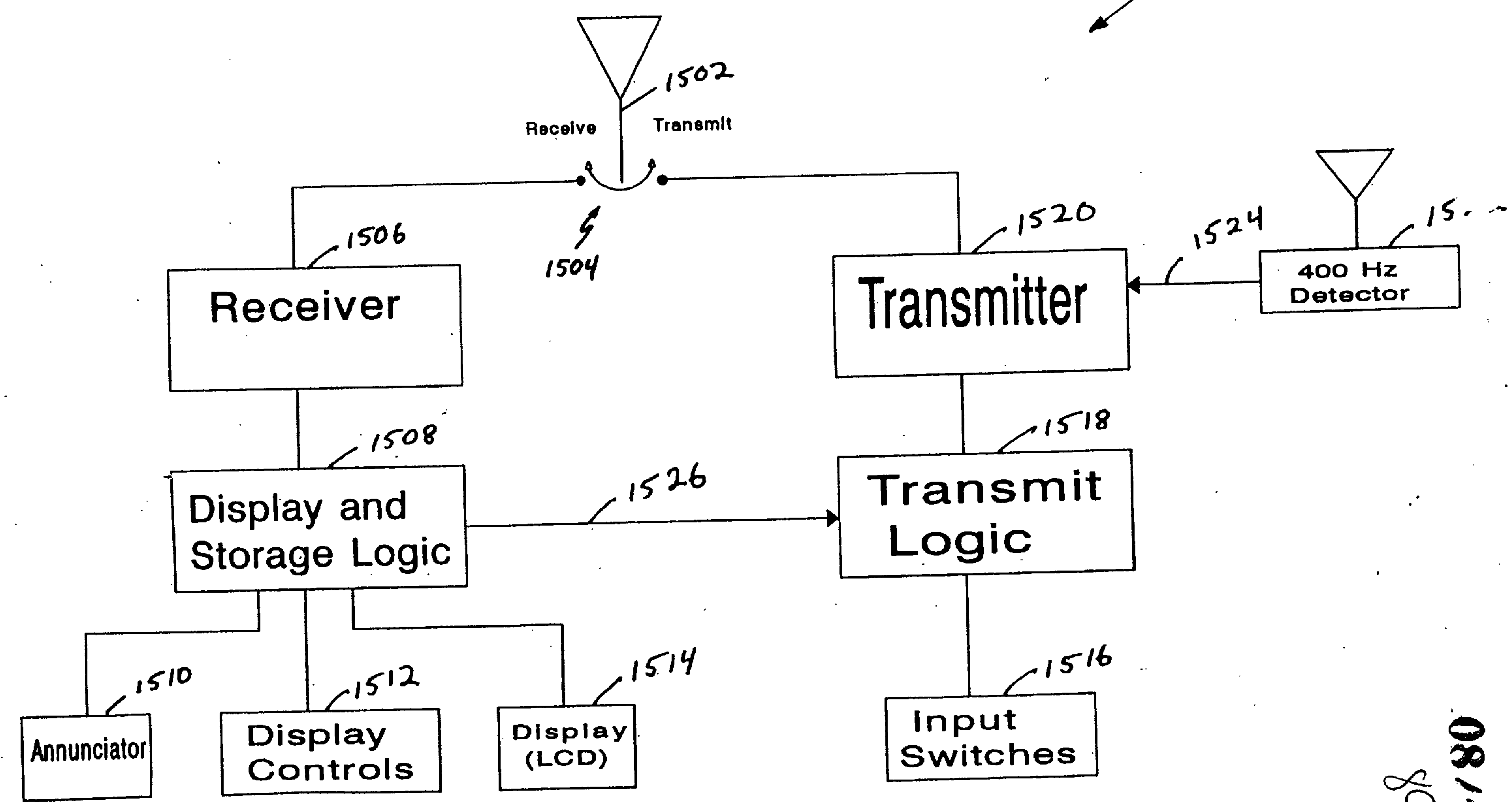


Fig. 15

08/~~260457~~
899,476

~~08/760457~~ 08/899,476

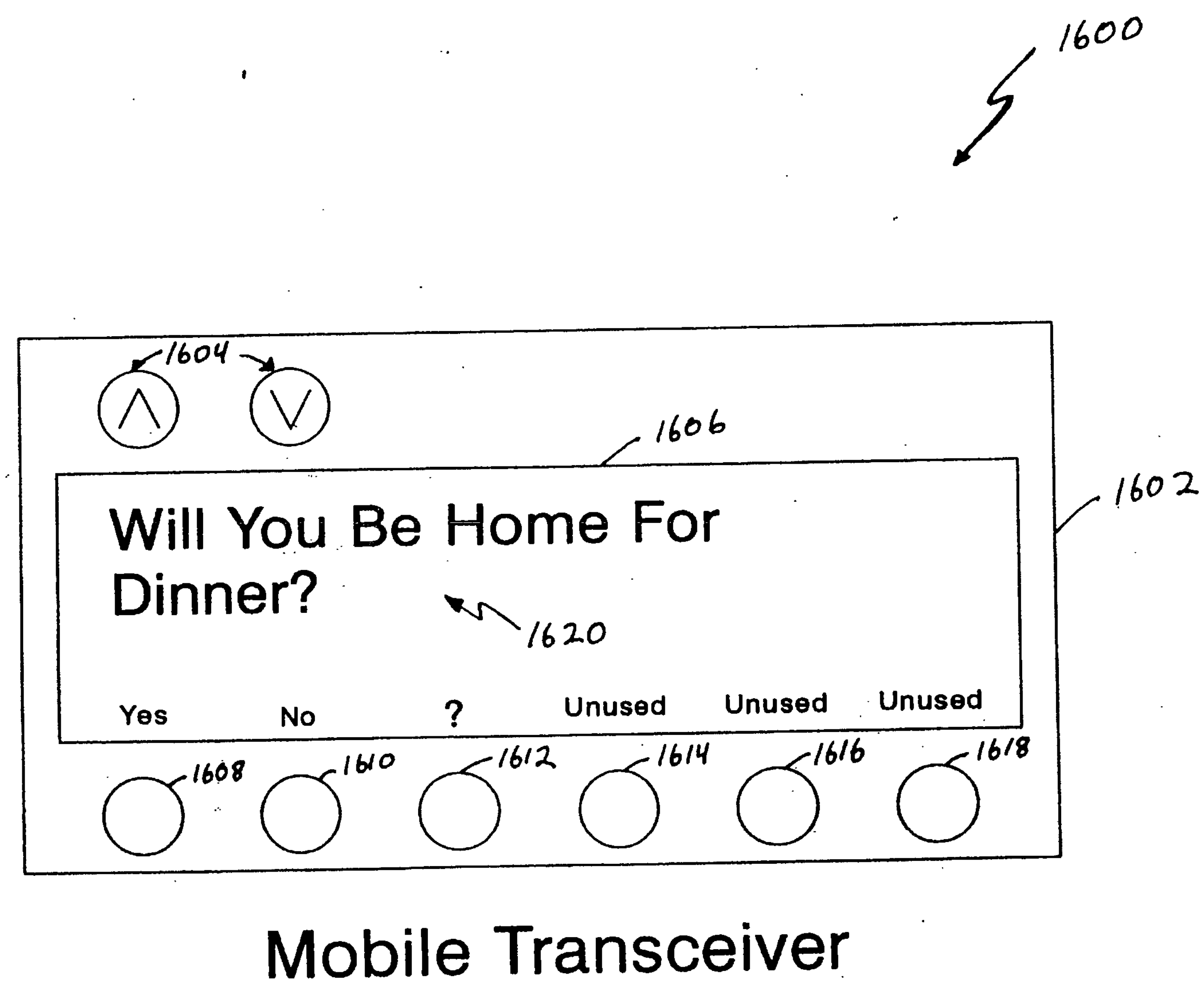


Fig. 16

Mobile Receiver

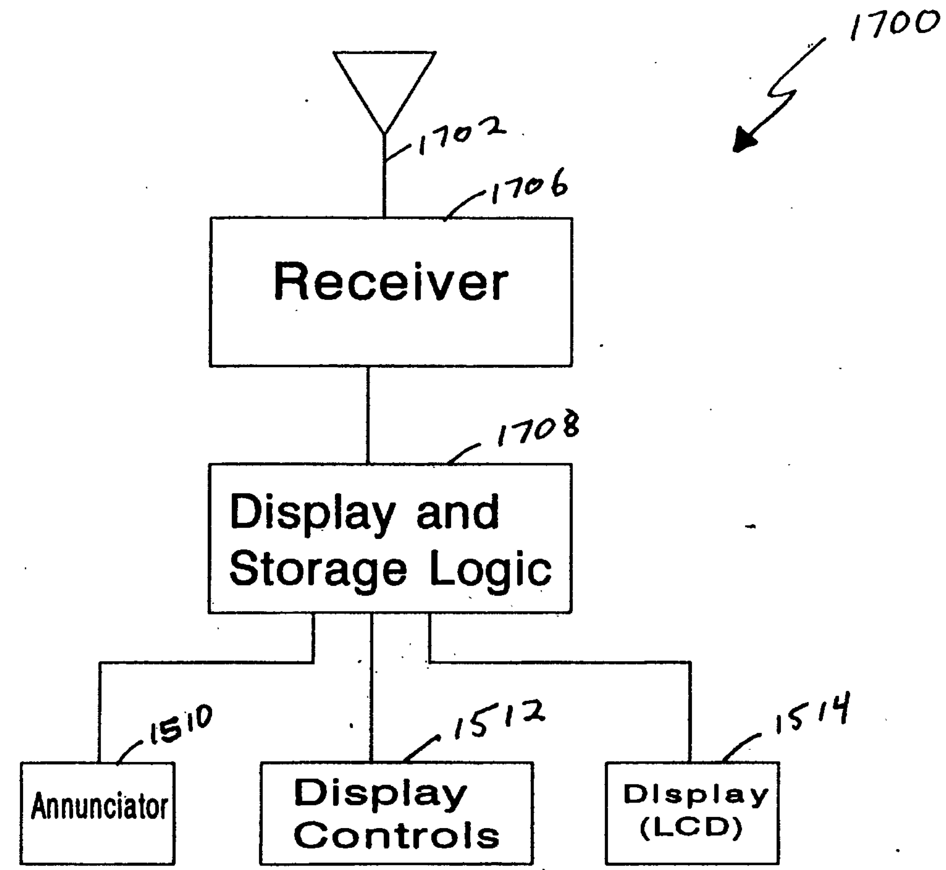


Fig. 17

08/~~760457~~
899,476

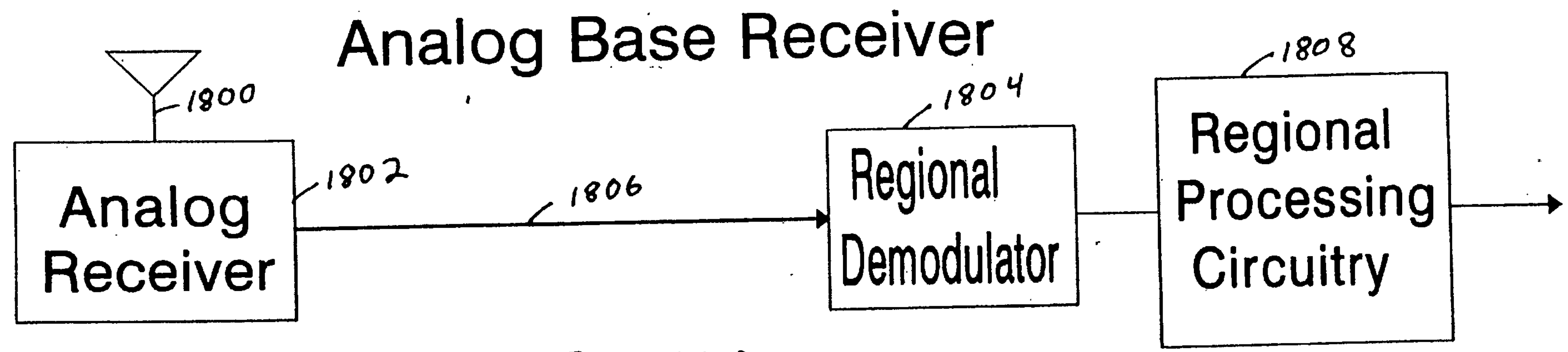


Fig. 18(A)

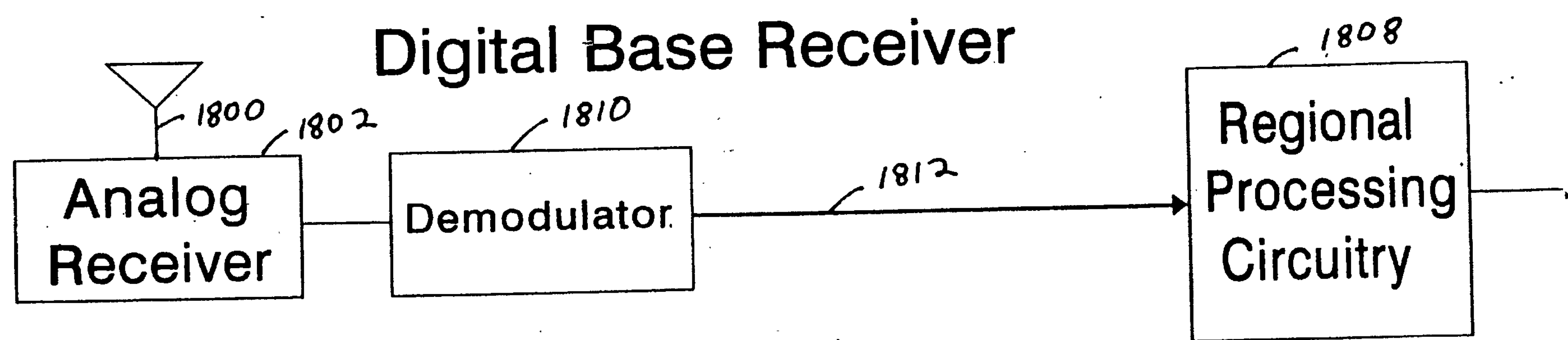


Fig. 18(B)

08/~~760457~~
899,476

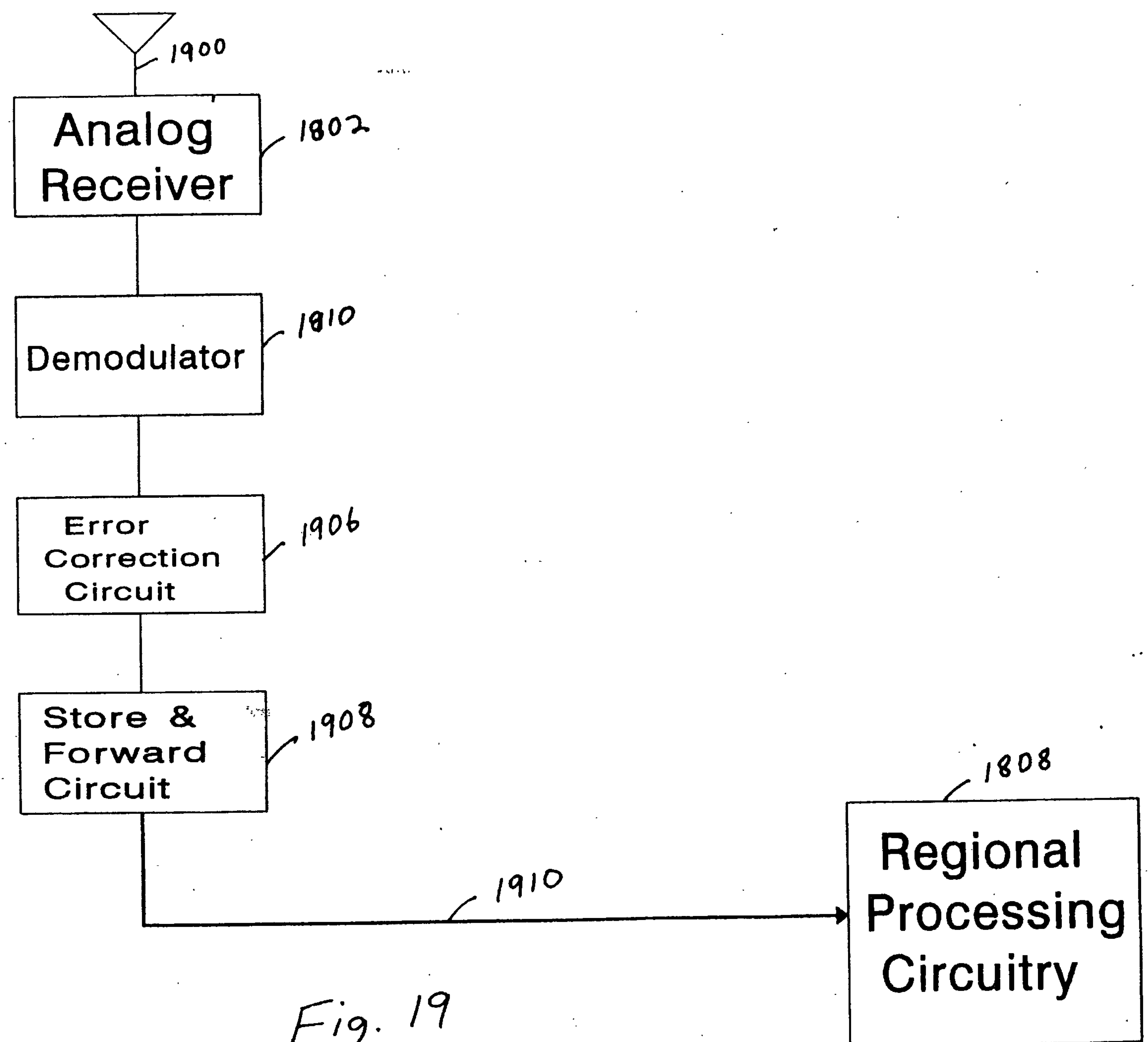


Fig. 19

08/~~760457~~ 899,476

Network Operations Center

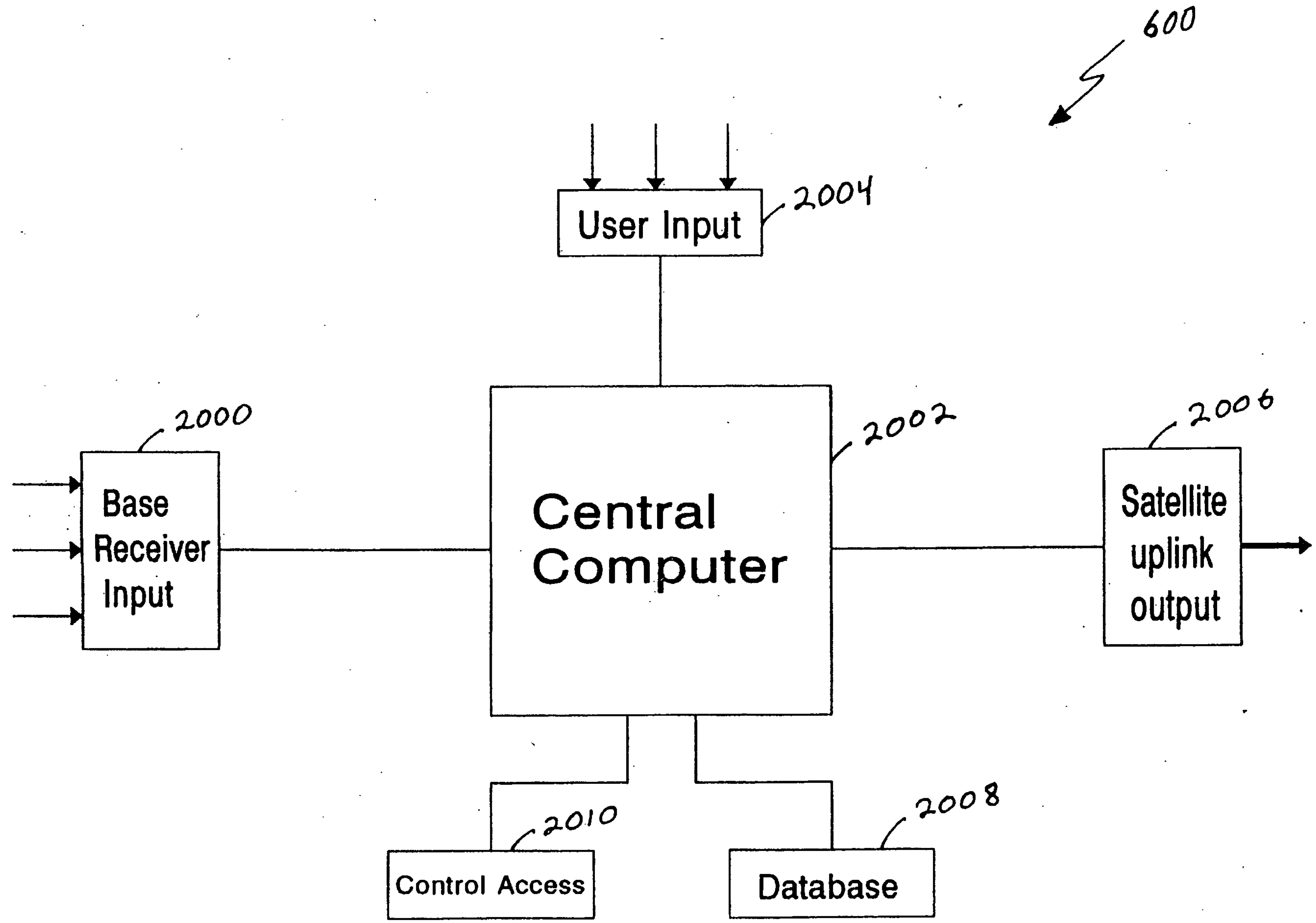
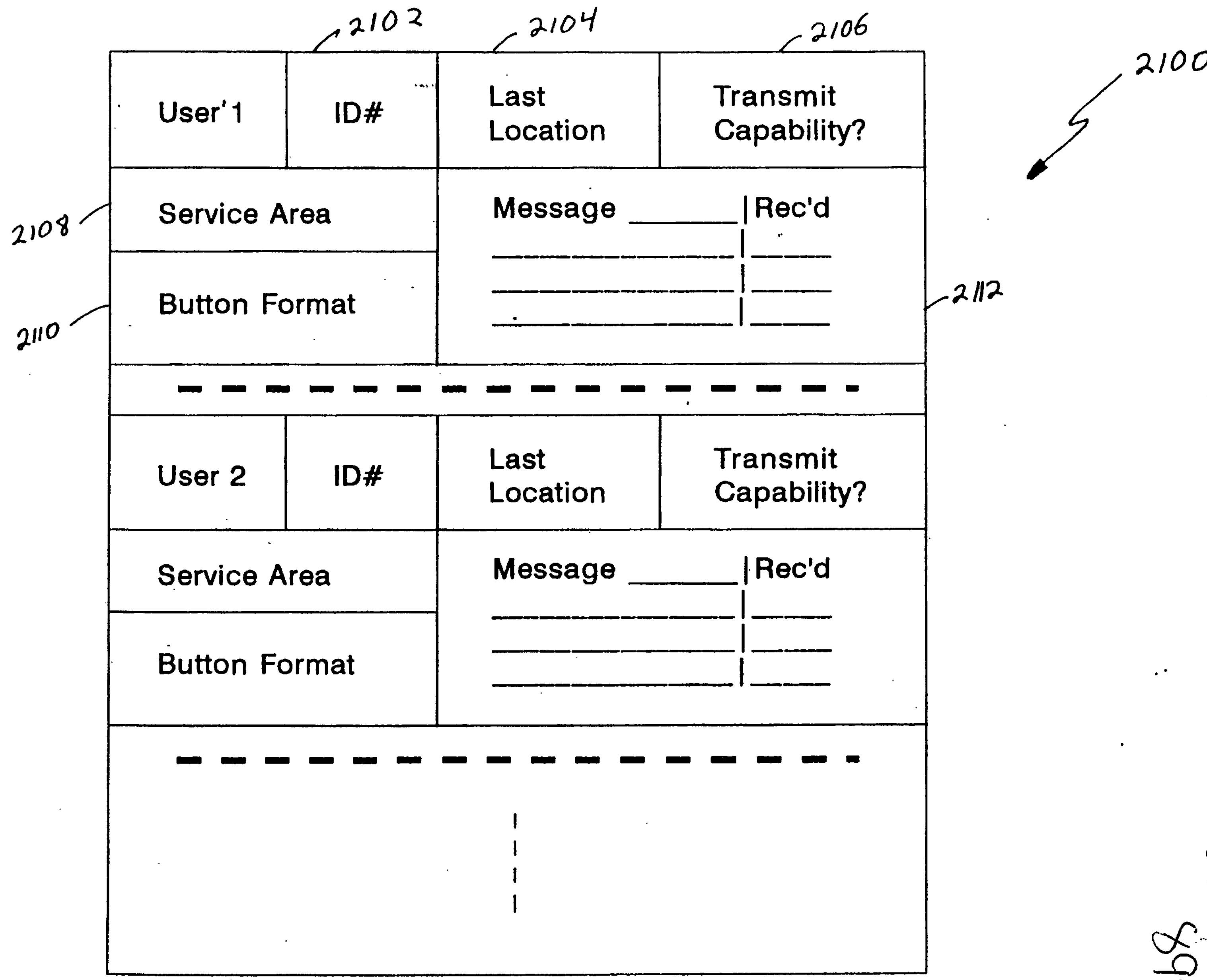


Fig. 20

08/~~760457~~
890,476
[redacted]



User Database
Fig. 21

08/~~760457~~
899,476

2200

2202	2204	2206	2208	2210
User 1	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 2	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 3	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 4	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
■ ■ ■				

Traffic Database

Fig. 22

08/~~760457~~ 899,476

08/~~760457~~
899,476

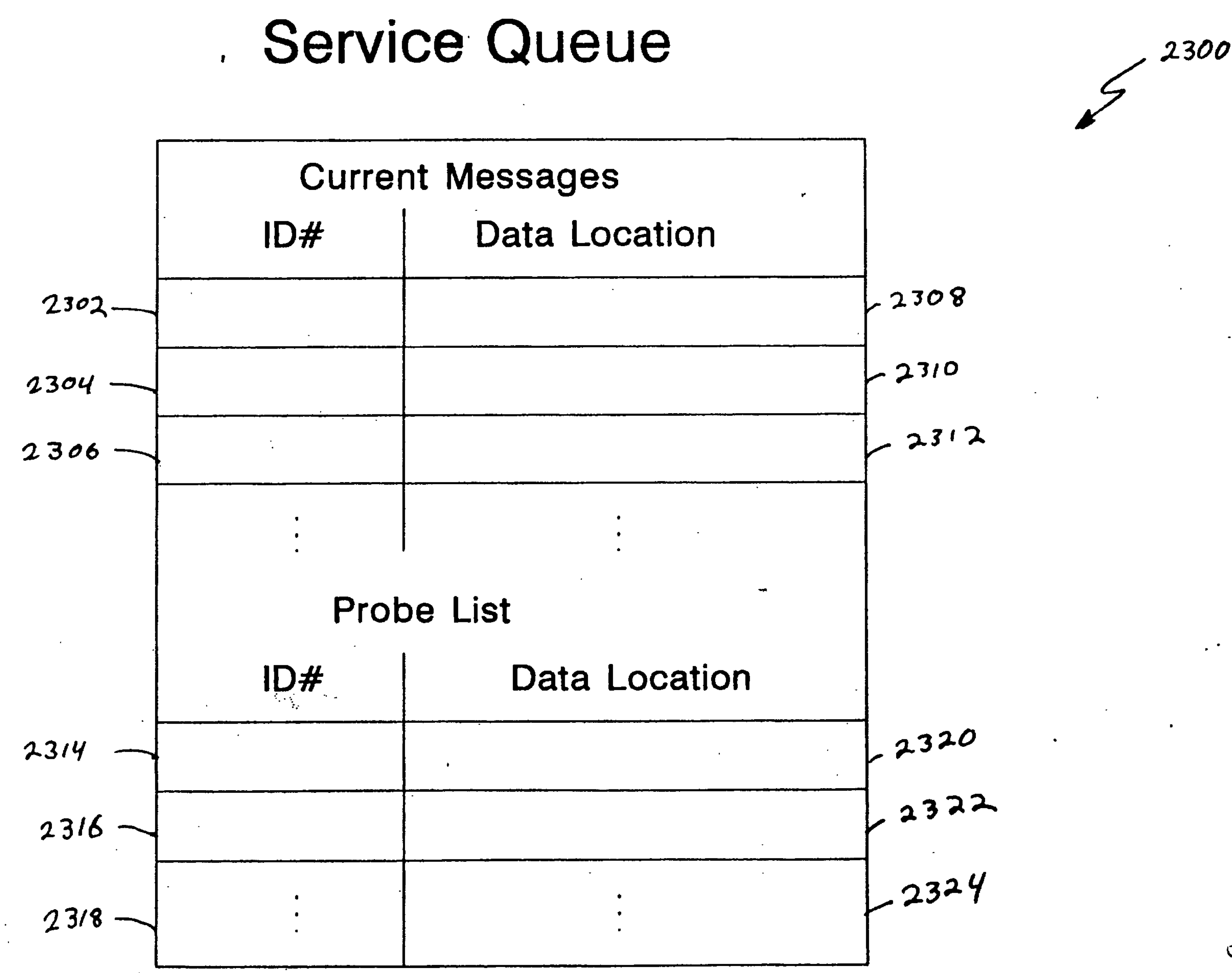


Fig. 23

2400

2402	2404	2406	2408
Base Transmitter 1	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 2	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 3	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 4	Zonal Assignment	Base Receivers in Coverage Area	Other Data
■ ■ ■			

Base Transmitter Database

Fig. 24

08/~~760457~~ 899,476

Zone Dithering

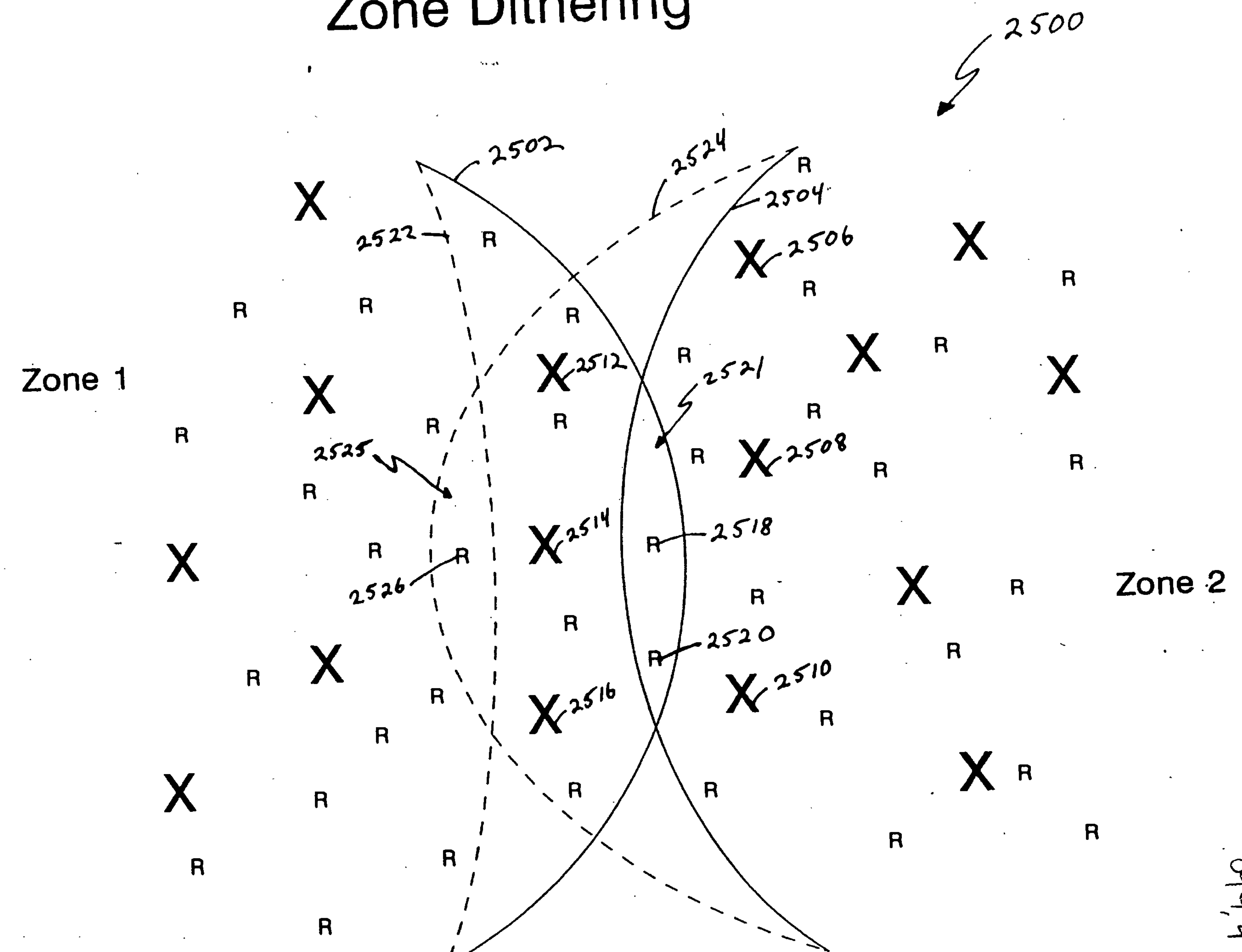


Fig. 25

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899,476

08/~~76045~~ 899,476

2600

Transmitting substantially simultaneously a first information signal and a second information signal, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone

2602

Dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone, thereby creating an updated first set of base transmitters and an updated second set of base transmitters

2604

Transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters

2606

Fig. 26

Cycle Protocol

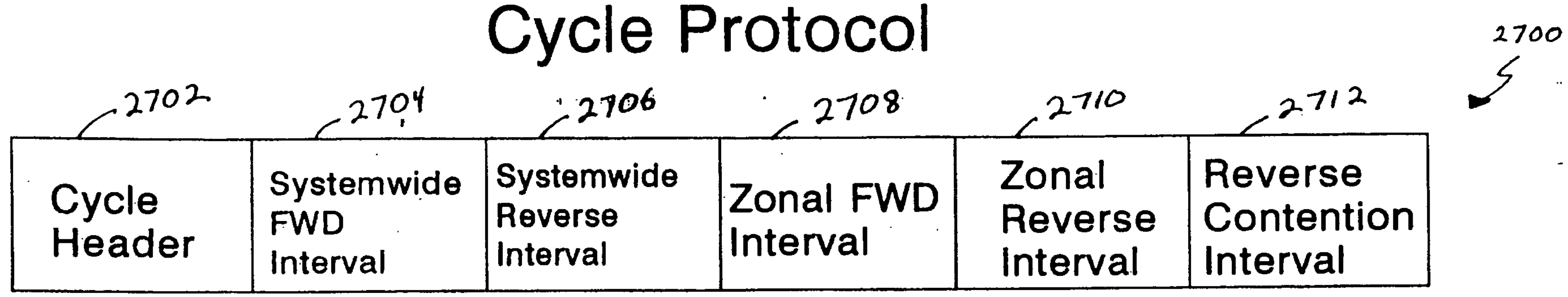


Fig. 27(A)

Forward Interval Protocol

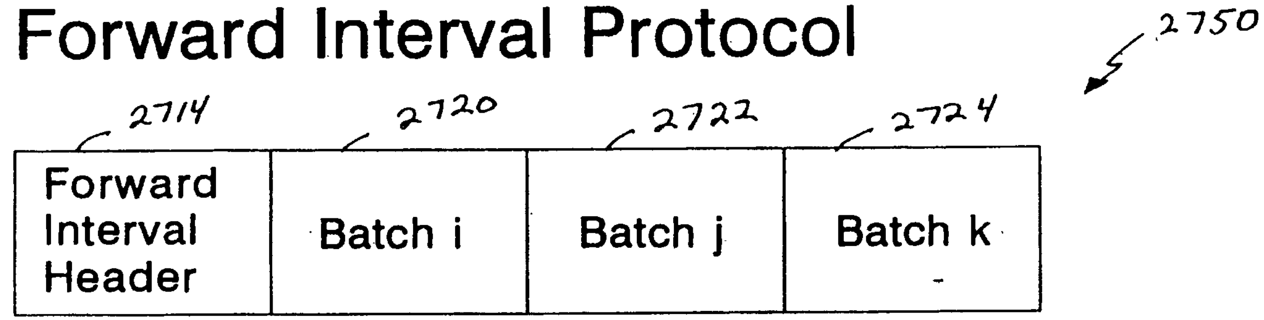


Fig. 27(B)

Individual Batch Protocol

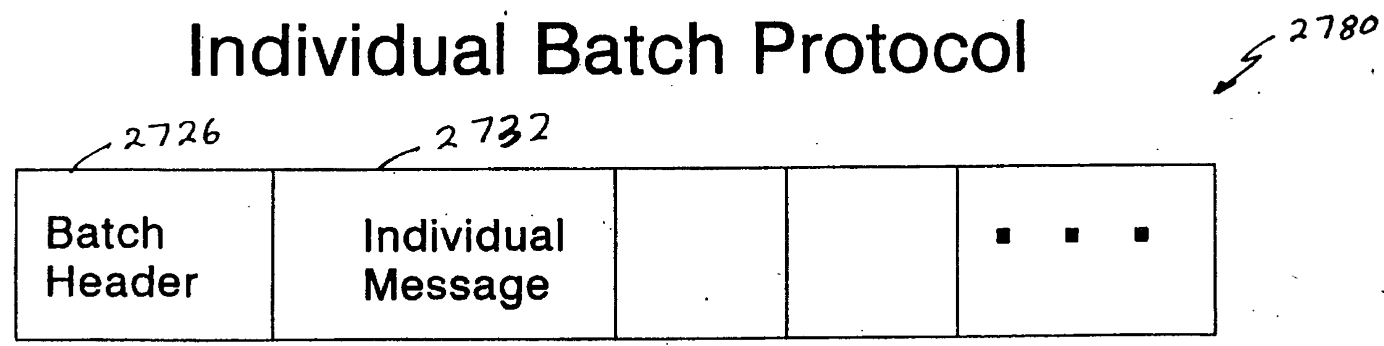


Fig. 27(C)

08/~~760457~~ 899,476

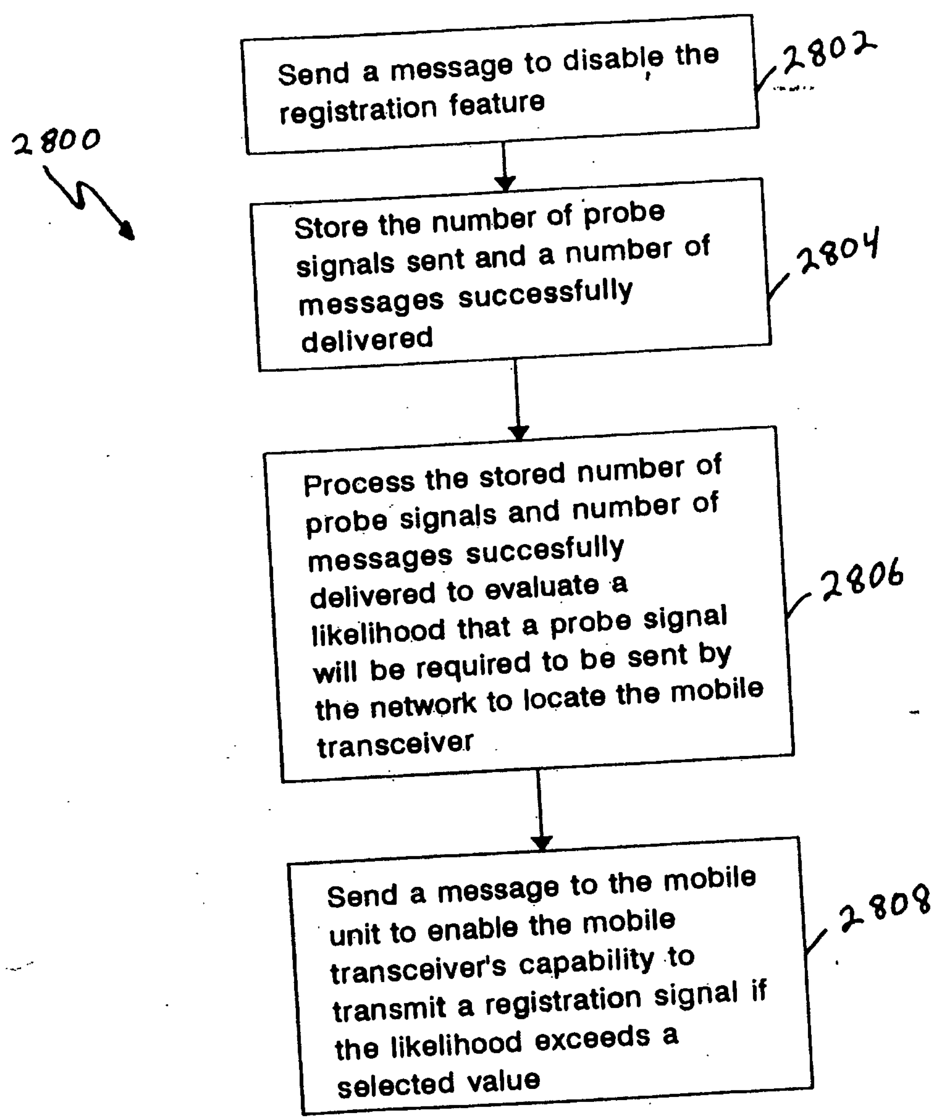


Fig. 28(A)

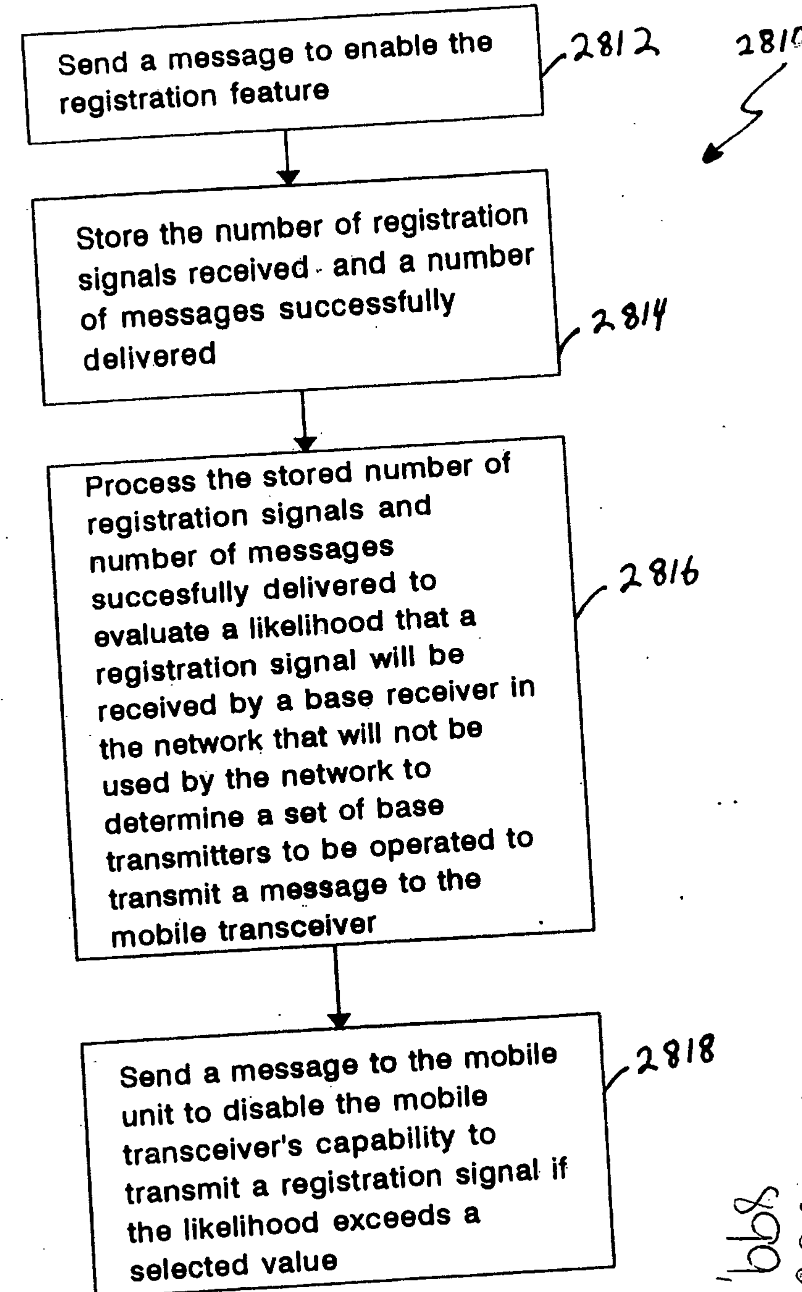


Fig. 28(B)

08/~~760457~~ 899,476

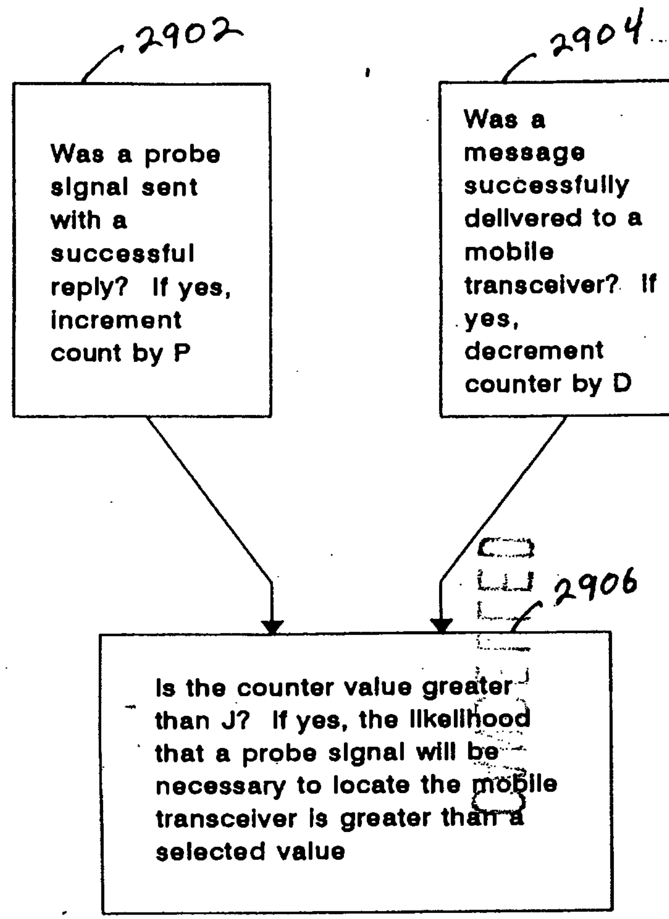


Fig. 29(A)

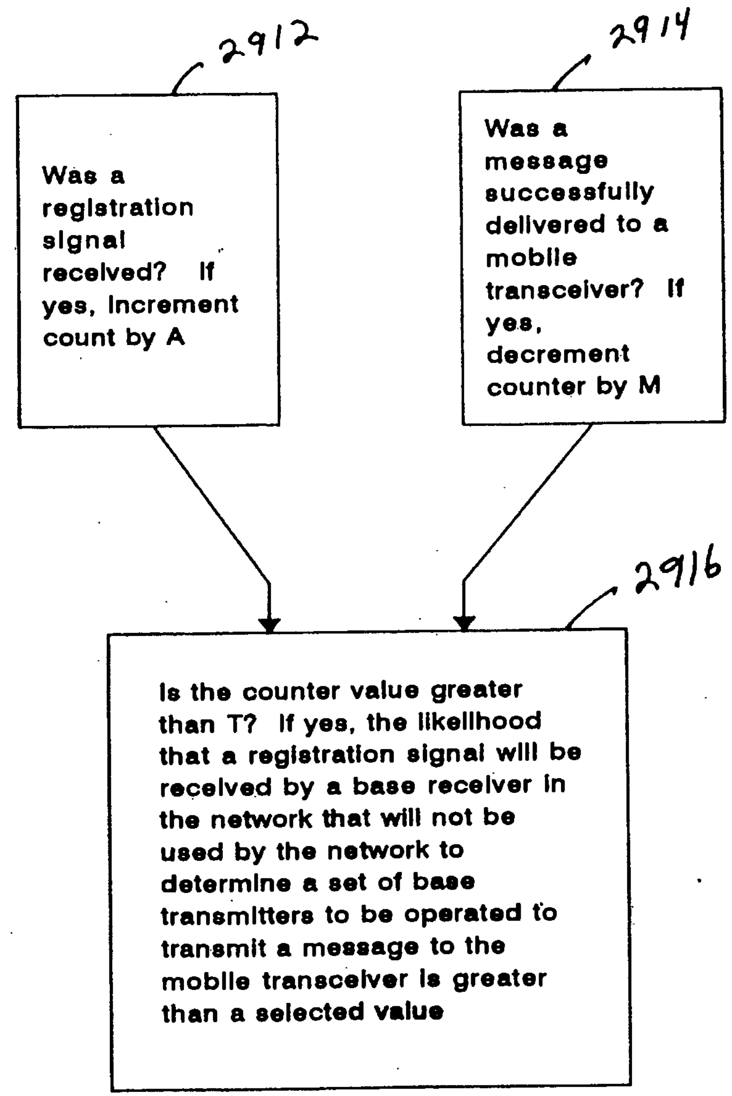
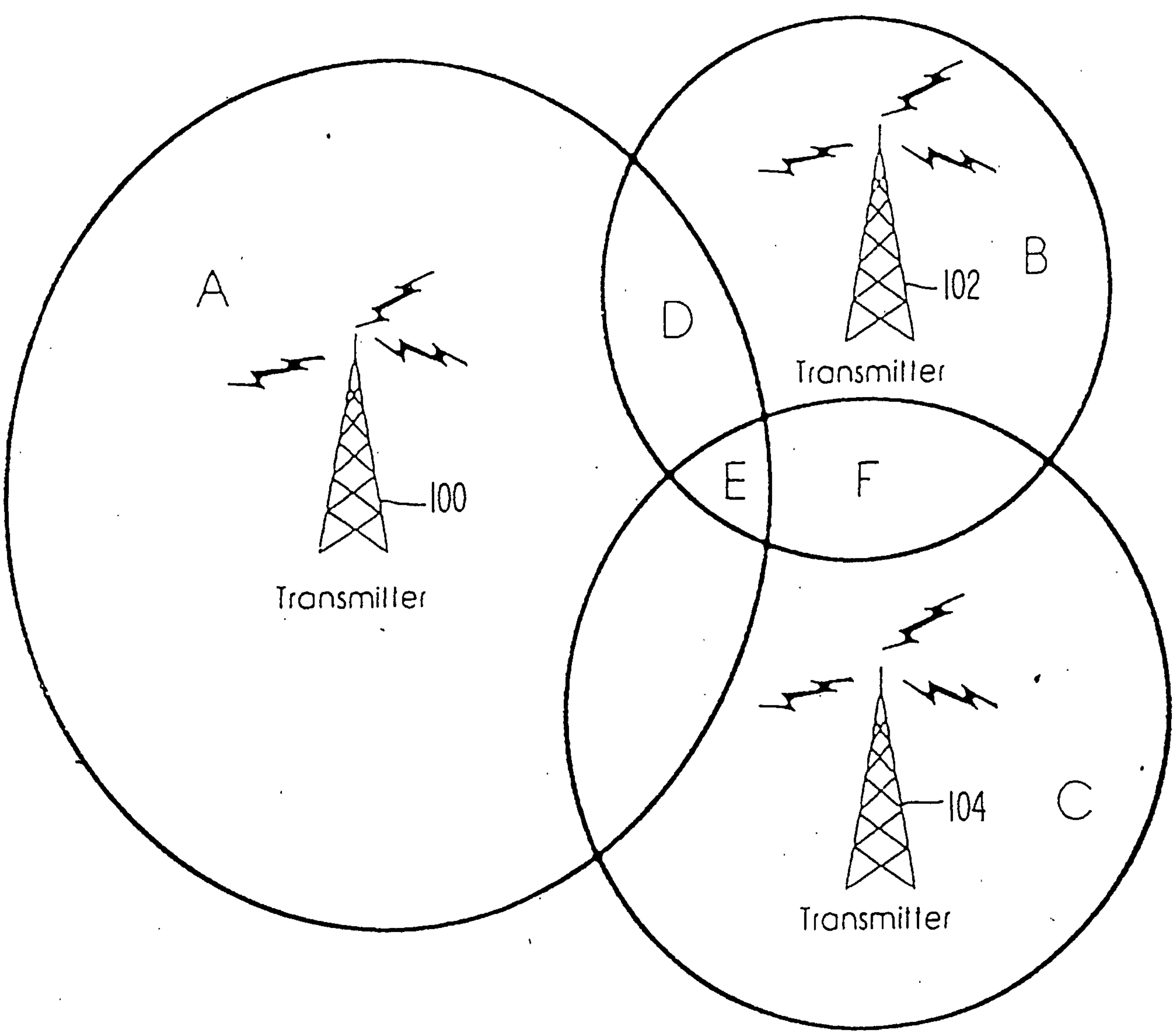


Fig 29(B)

08/~~760457~~
899,476

FIG. 1
PRIOR ART



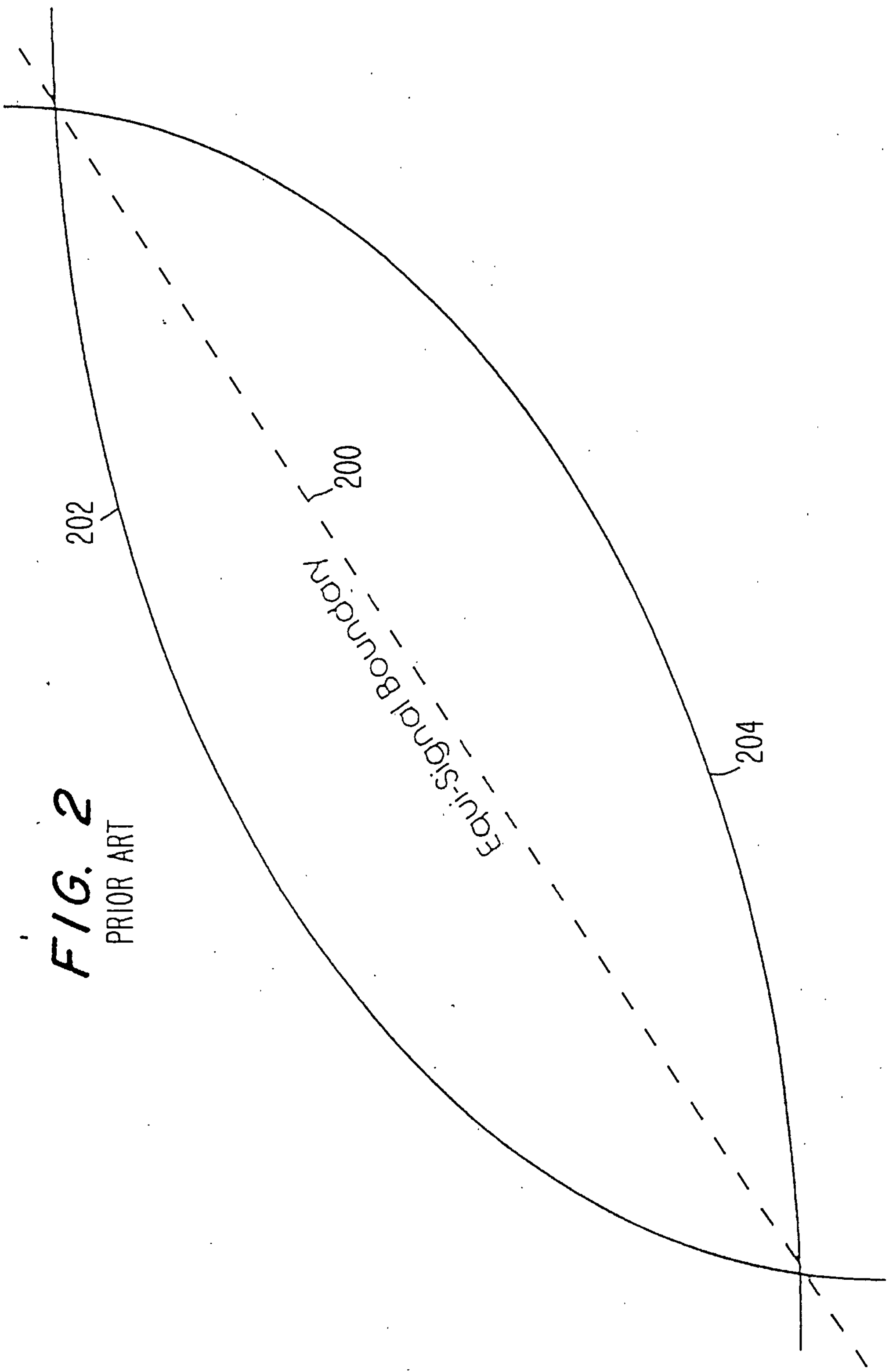


FIG. 2
PRIOR ART

FIG. 3(A)
PRIOR ART

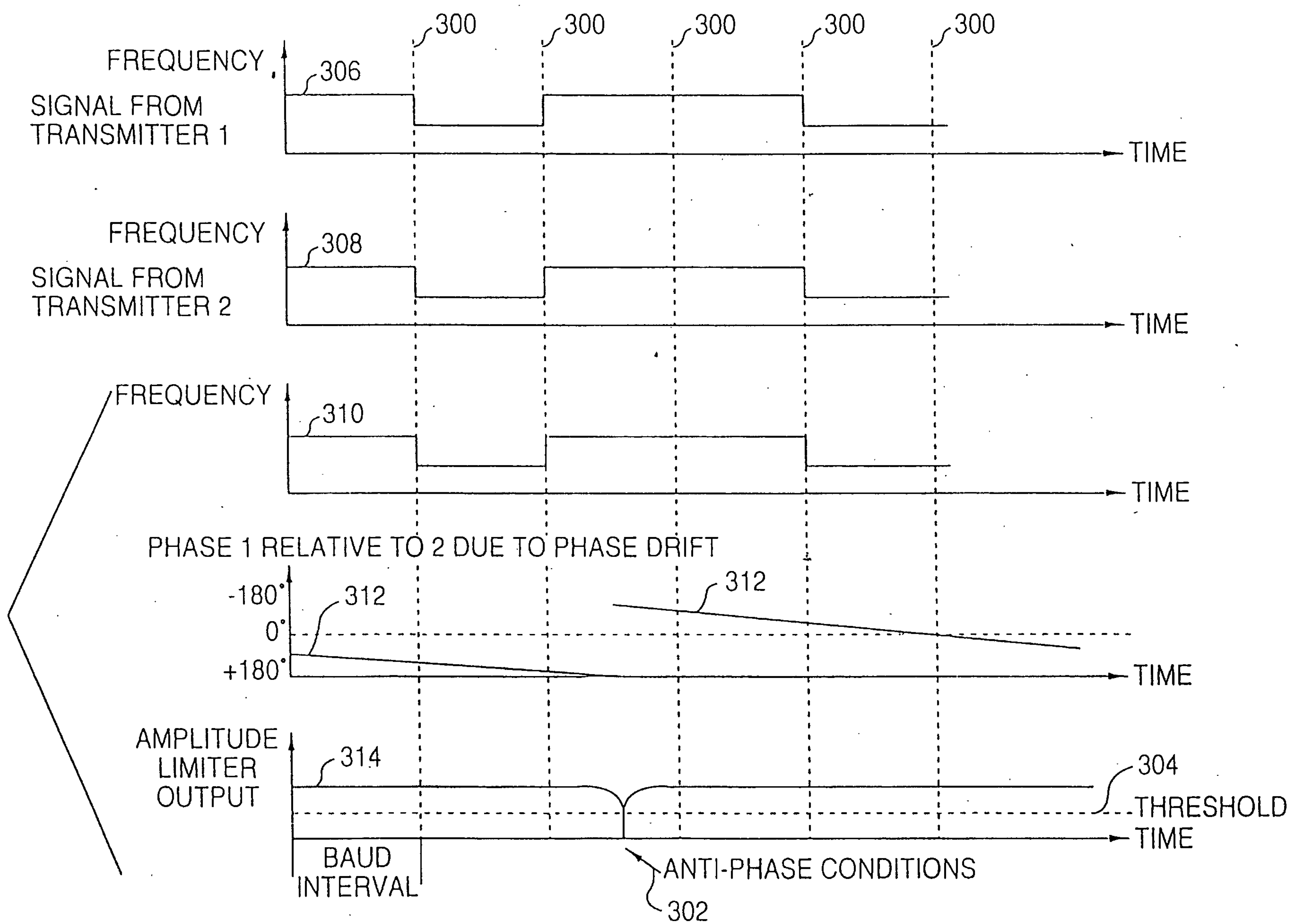
FIG. 3(B)
PRIOR ART

FIG. 3(C)
PRIOR ART

FIG. 3(D)
PRIOR ART

SUMMATION OF SIGNALS FROM TRANSMITTERS 1 AND 2

FIG. 3(E)
PRIOR ART



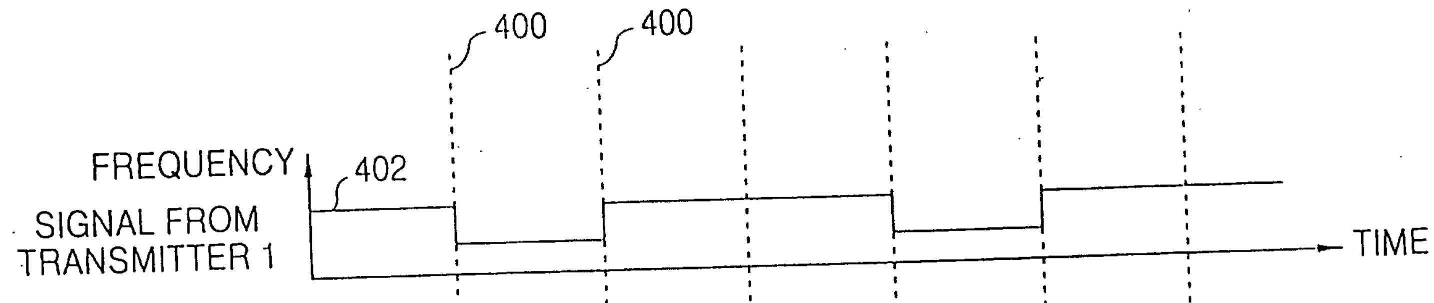


FIG. 4(A)
PRIOR ART

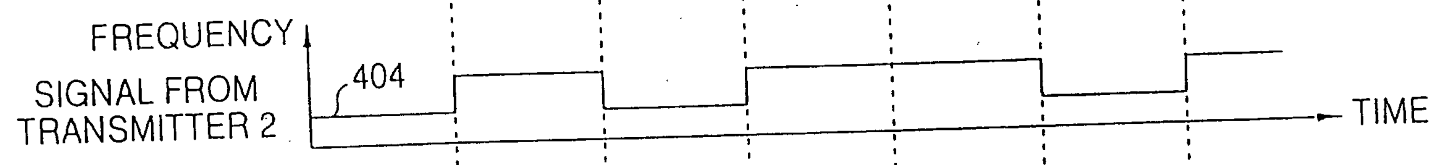


FIG. 4(B)
PRIOR ART

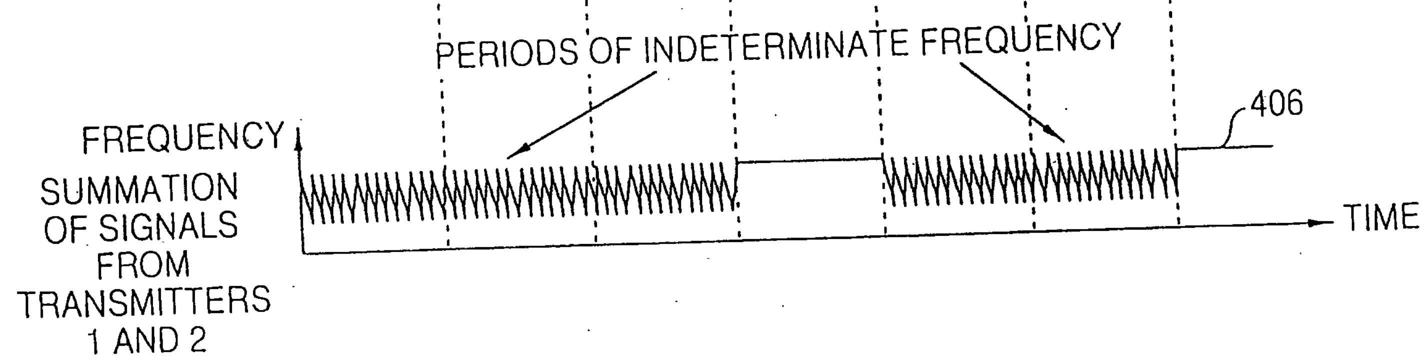


FIG. 4(C)
PRIOR ART

FIG. 5 PRIOR ART

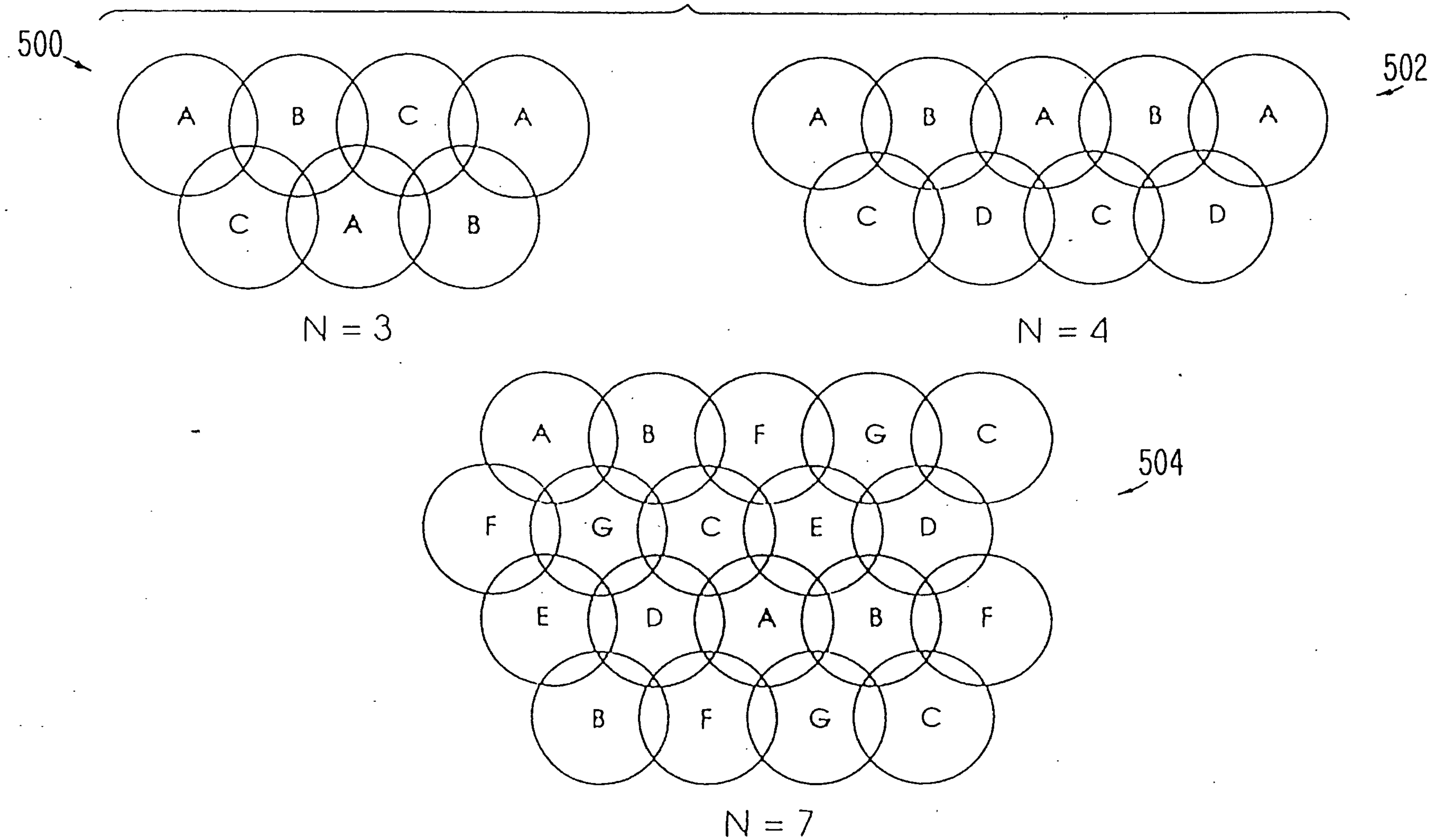


FIG. 6

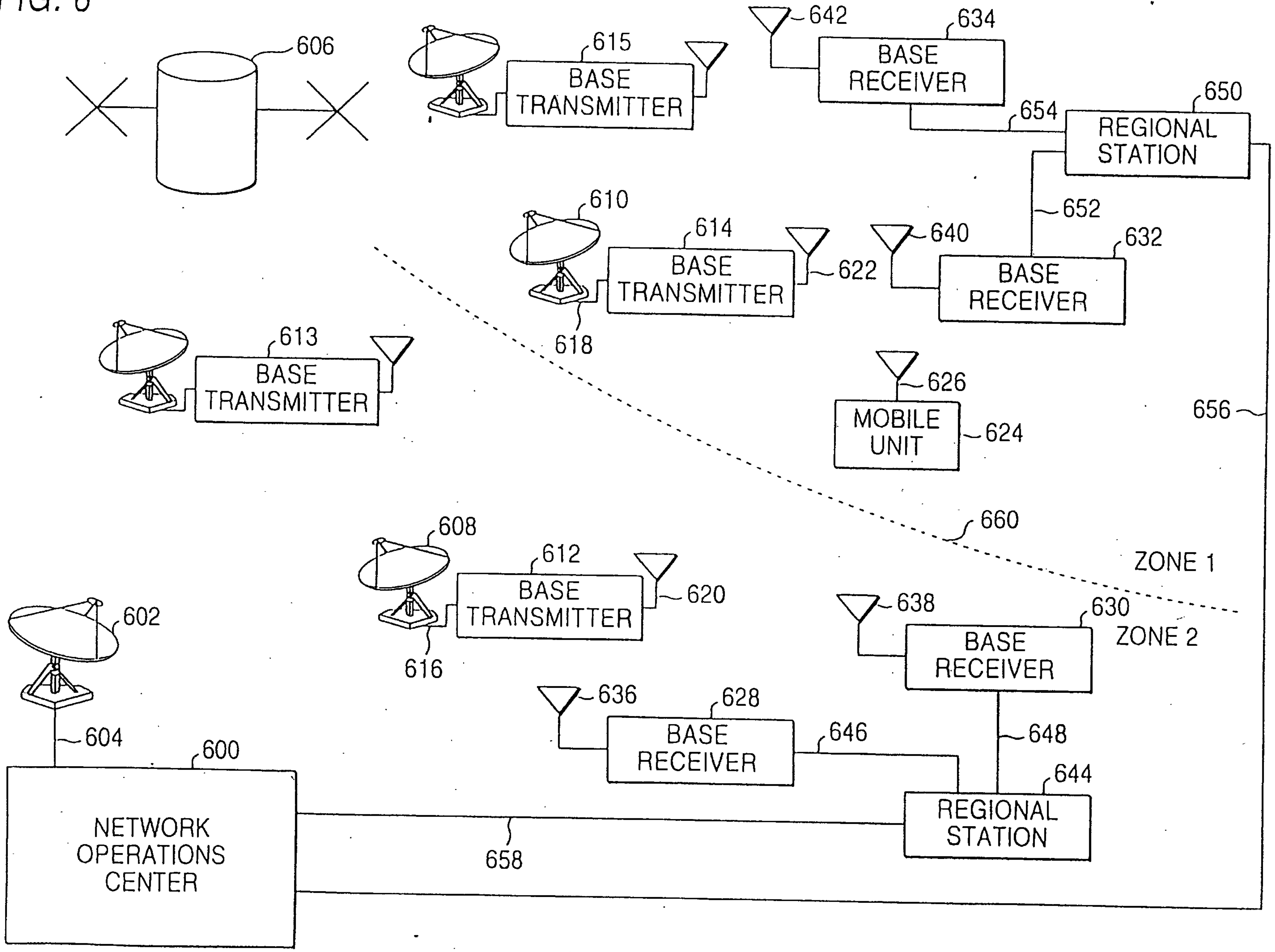

606
615
BASE TRANSMITTER
642
634
BASE RECEIVER
654
650
REGIONAL STATION
610
614
BASE TRANSMITTER
622
640
652
632
BASE RECEIVER
618
613
BASE TRANSMITTER
626
MOBILE UNIT
624
656
660
ZONE 1
ZONE 2
608
612
BASE TRANSMITTER
620
638
630
BASE RECEIVER
602
616
636
628
BASE RECEIVER
646
648
644
REGIONAL STATION
604
600
NETWORK OPERATIONS CENTER
658

FIG. 7

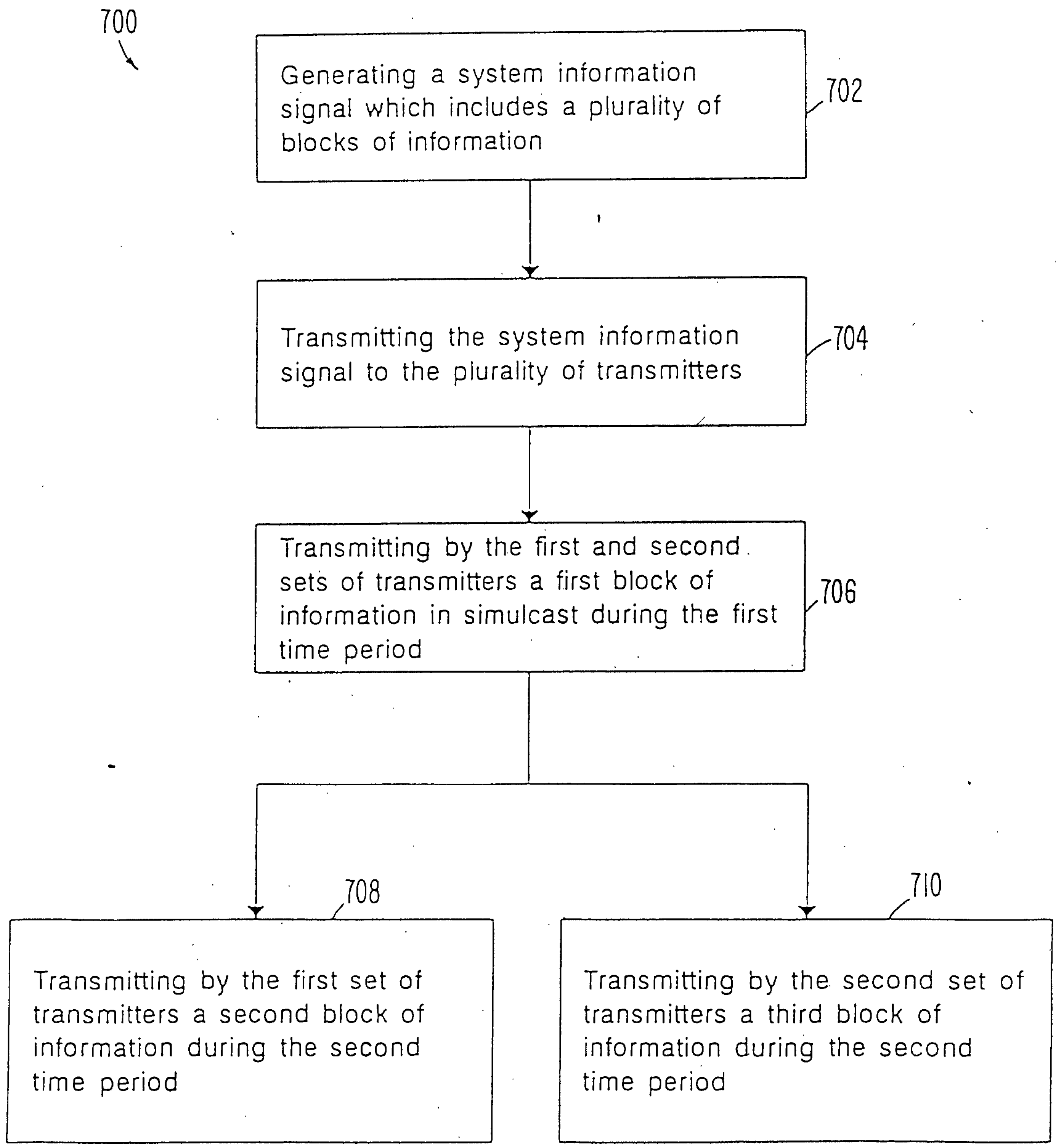
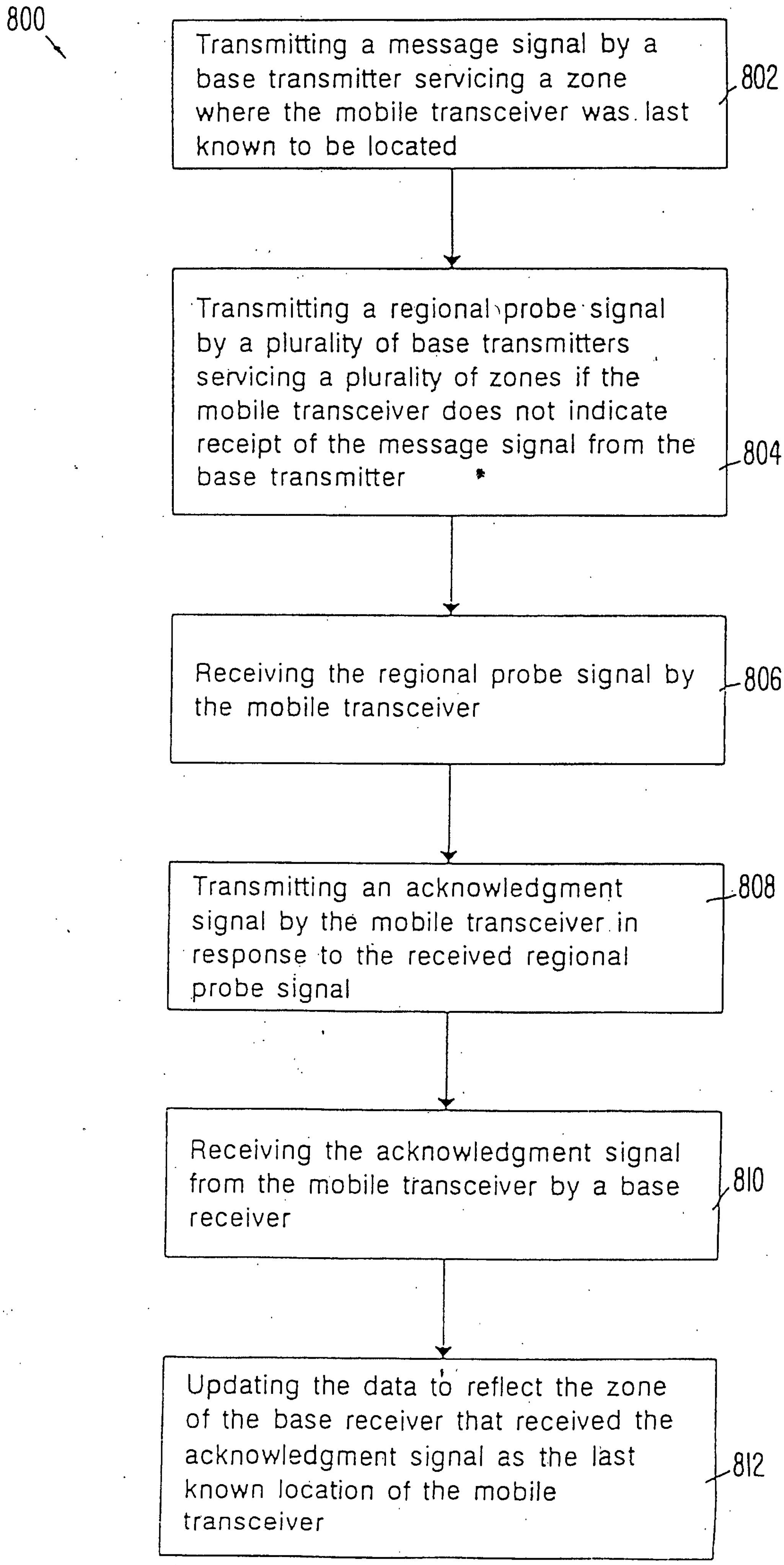

700
Generating a system information signal which includes a plurality of blocks of information
702
Transmitting the system information signal to the plurality of transmitters
704
Transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period
706
708
Transmitting by the first set of transmitters a second block of information during the second time period
710
Transmitting by the second set of transmitters a third block of information during the second time period

FIG. 8


800
Transmitting a message signal by a base transmitter servicing a zone where the mobile transceiver was last known to be located
802
Transmitting a regional probe signal by a plurality of base transmitters servicing a plurality of zones if the mobile transceiver does not indicate receipt of the message signal from the base transmitter
804
Receiving the regional probe signal by the mobile transceiver
806
Transmitting an acknowledgment signal by the mobile transceiver in response to the received regional probe signal
808
Receiving the acknowledgment signal from the mobile transceiver by a base receiver
810
Updating the data to reflect the zone of the base receiver that received the acknowledgment signal as the last known location of the mobile transceiver
812

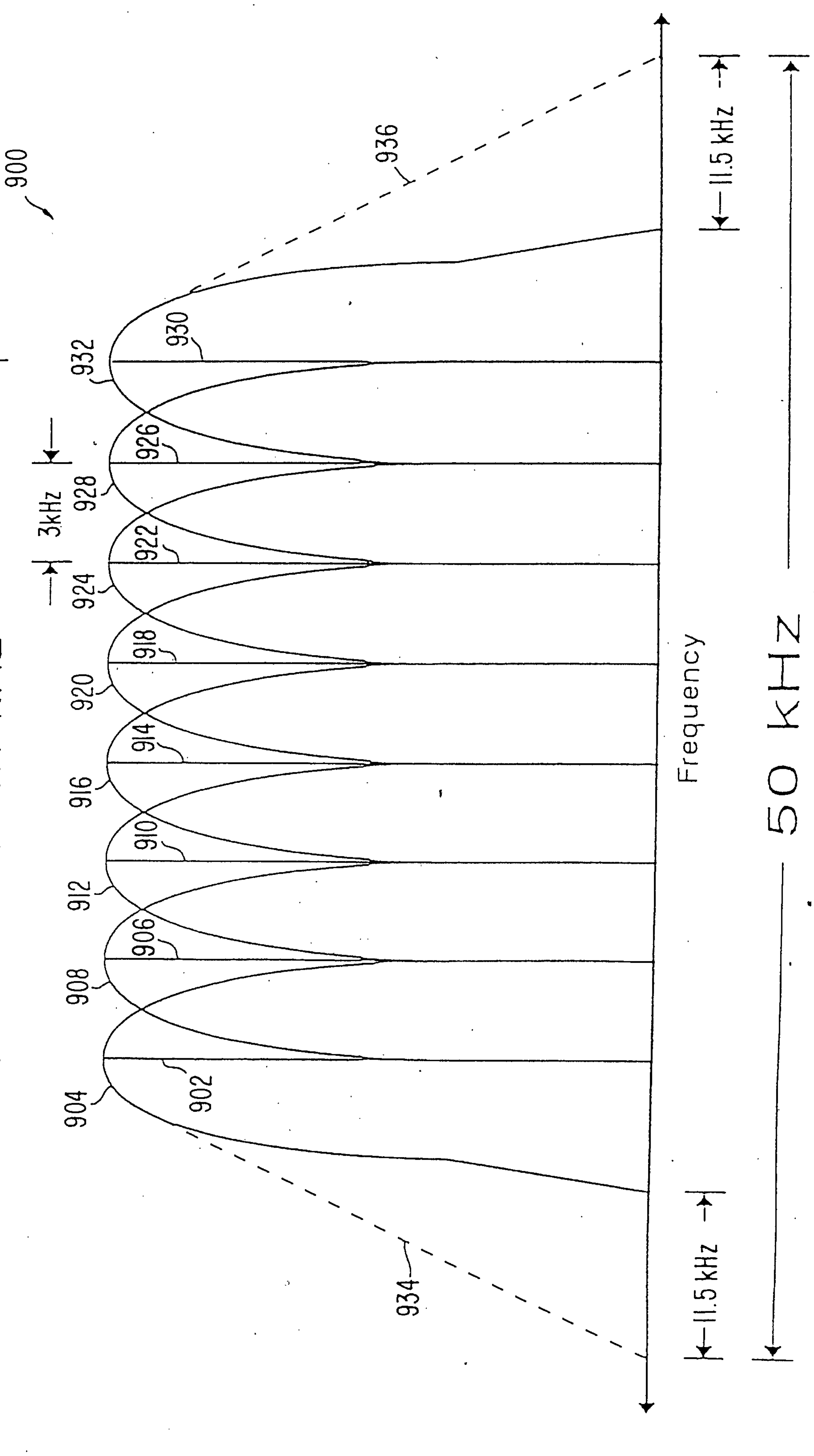

900
21 kHz
3kHz
902
904
906
908
910
912
914
916
918
920
922
924
926
928
930
932
934
936
Frequency
11.5 kHz
11.5 kHz
50 KHz

FIG. 9

FIG. 10

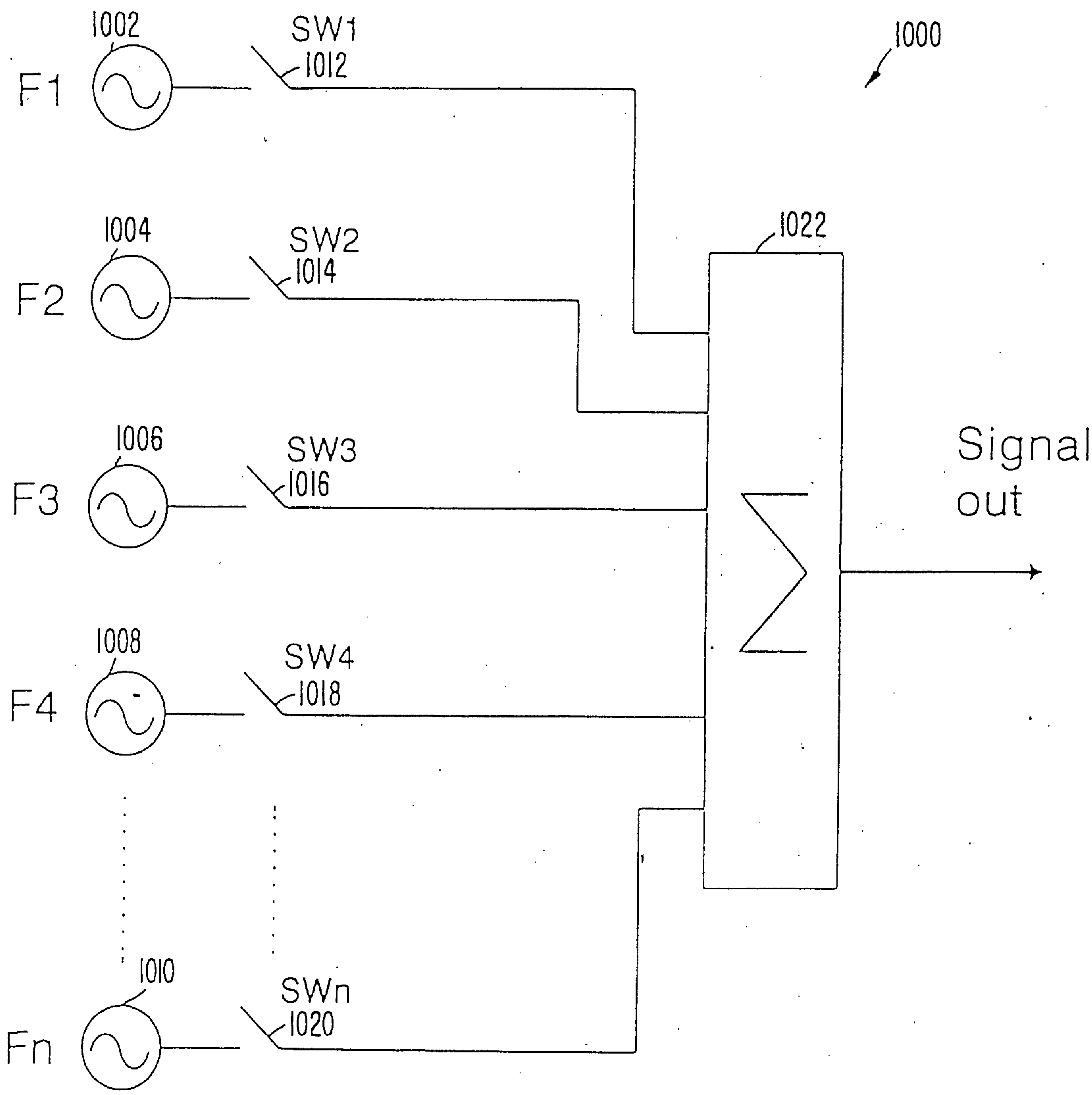

1002
F1
SW1
1012
1000
1004
F2
SW2
1014
1022
1006
F3
SW3
1016
Signal out
1008
F4
SW4
1018
1010
Fn
SWn
1020

FIG. 11

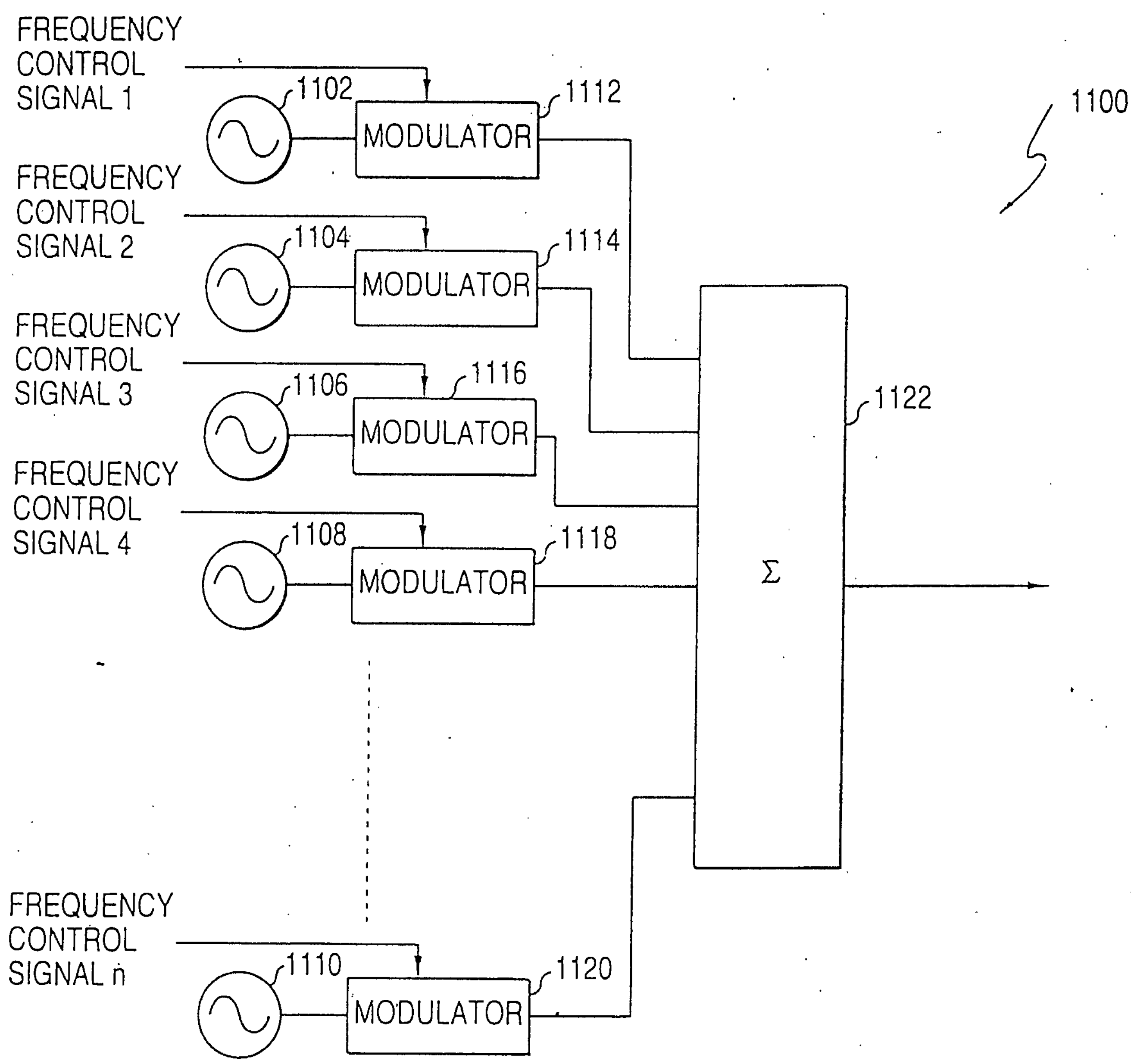
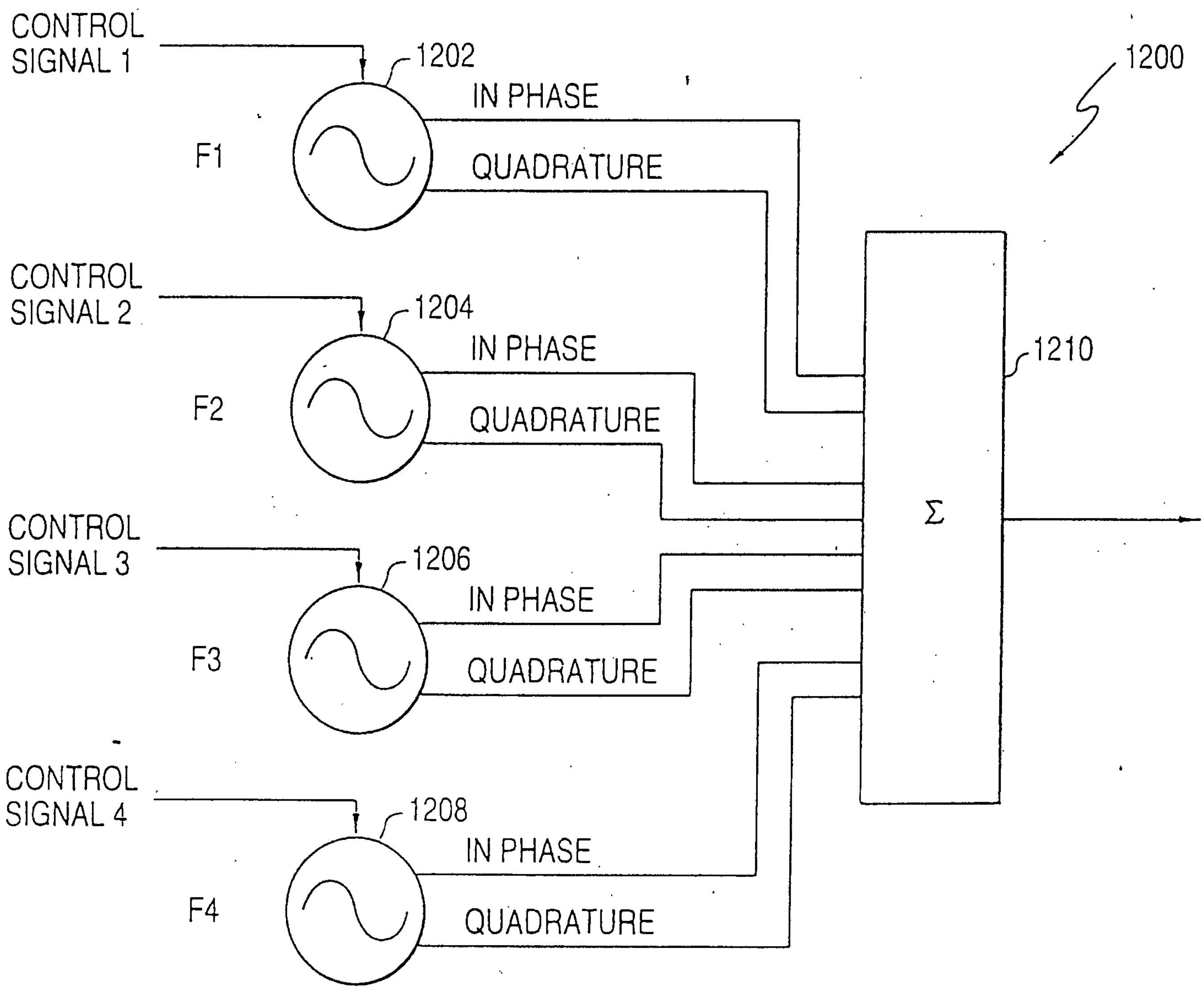

FREQUENCY CONTROL SIGNAL 1
1102
MODULATOR
1112
1100
FREQUENCY CONTROL SIGNAL 2
1104
MODULATOR
1114
FREQUENCY CONTROL SIGNAL 3
1106
1116
MODULATOR
1122
FREQUENCY CONTROL SIGNAL 4
1108
1118
MODULATOR
Σ
FREQUENCY CONTROL SIGNAL n
1110
1120
MODULATOR

FIG. 12



FOUR CARRIER QUADRATURE MODULATOR

FIG. 13

Base Transmitter

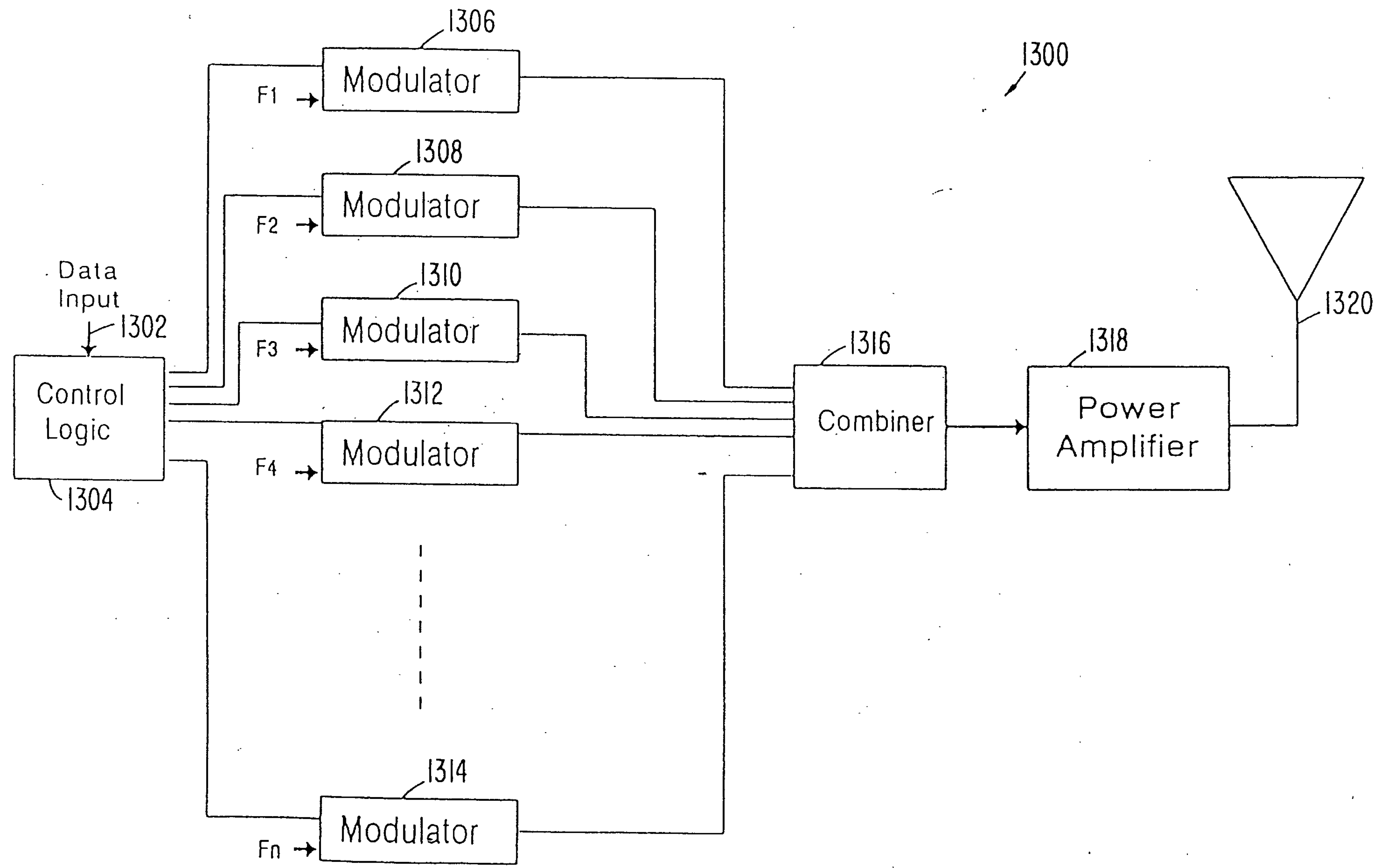


FIG. 14

Base Transmitter

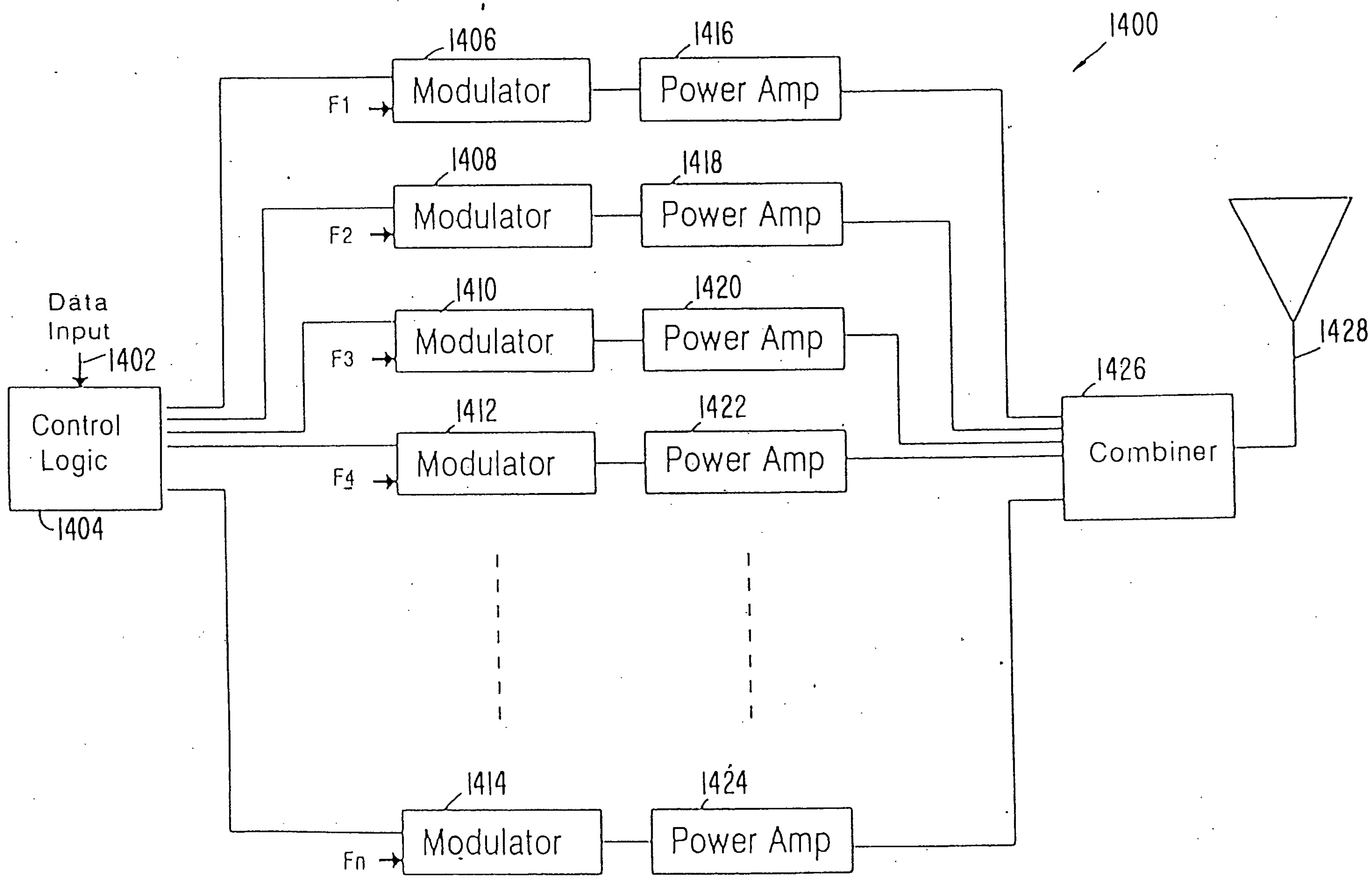


FIG. 15

Mobile Transceiver

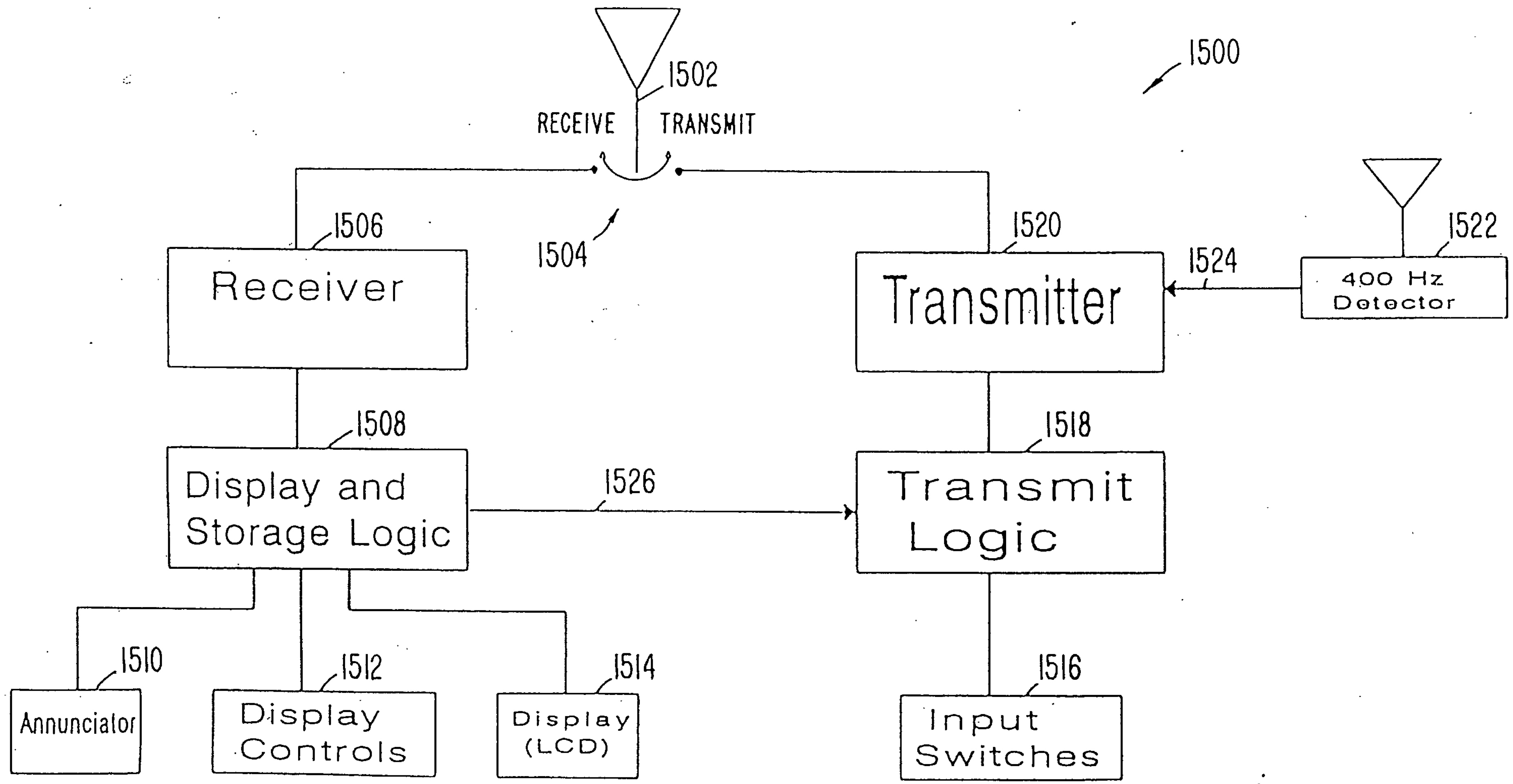


FIG. 16

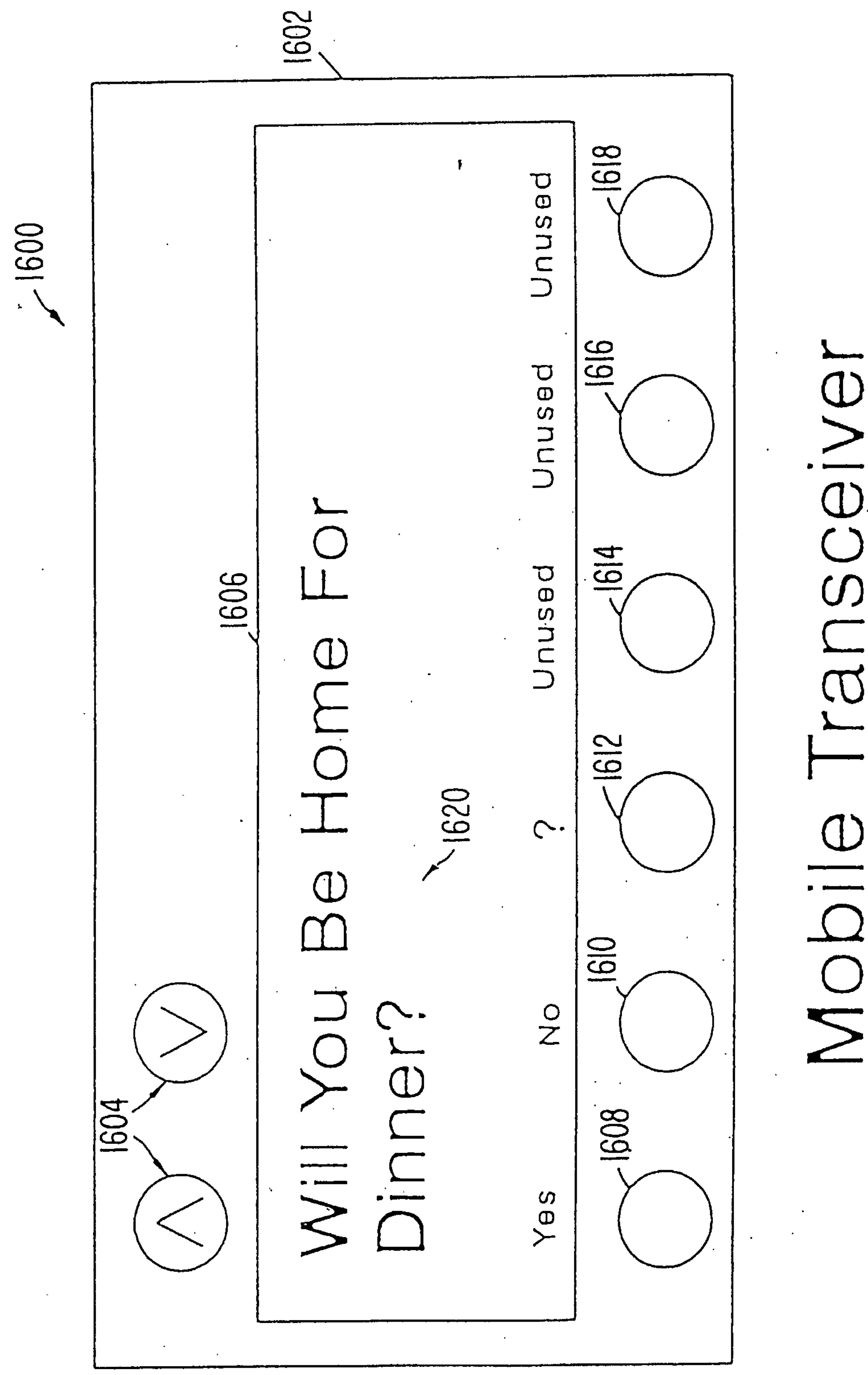

1600
1602
1604
1606
Will You Be Home For
Dinner?
1620
Yes
No
?
Unused
Unused
Unused
1608
1610
1612
1614
1616
1618
Mobile Transceiver

FIG. 17

Mobile Receiver

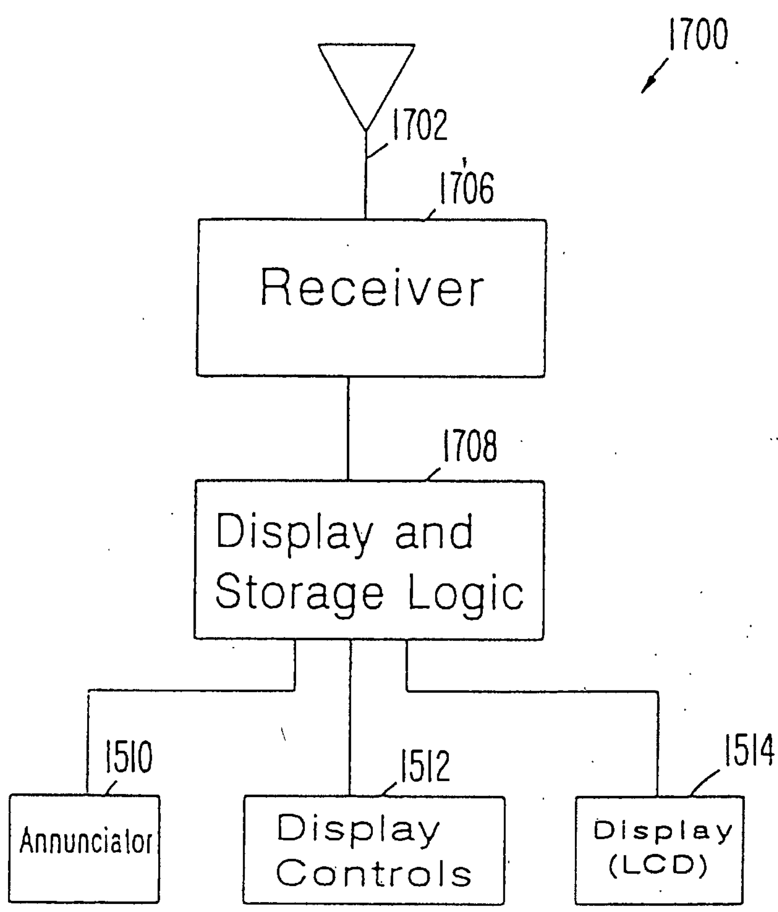


FIG. 18(A)

Analog Base Receiver

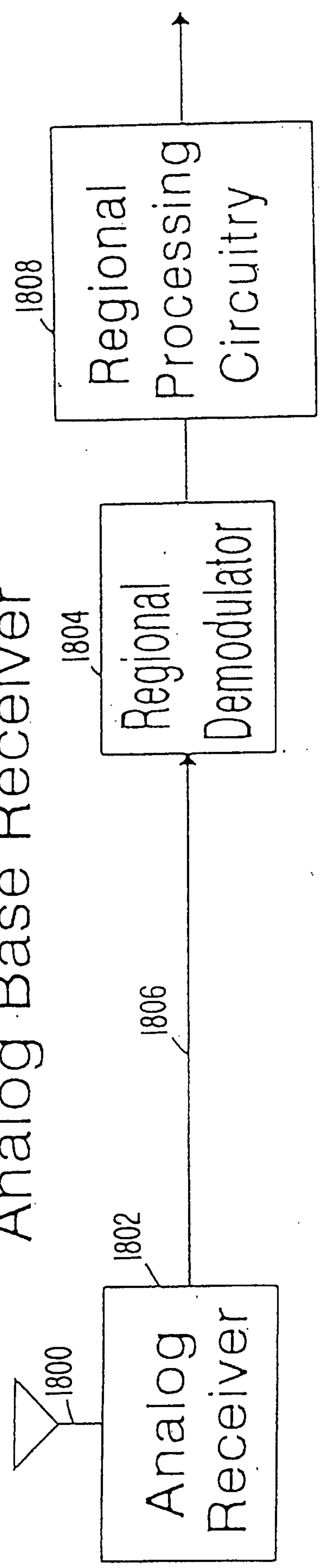


FIG. 18(B)

Digital Base Receiver

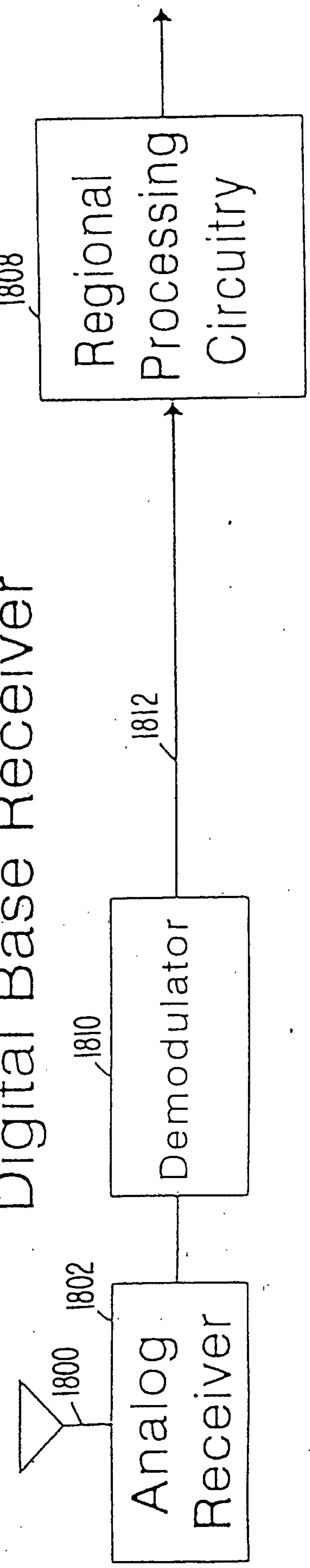
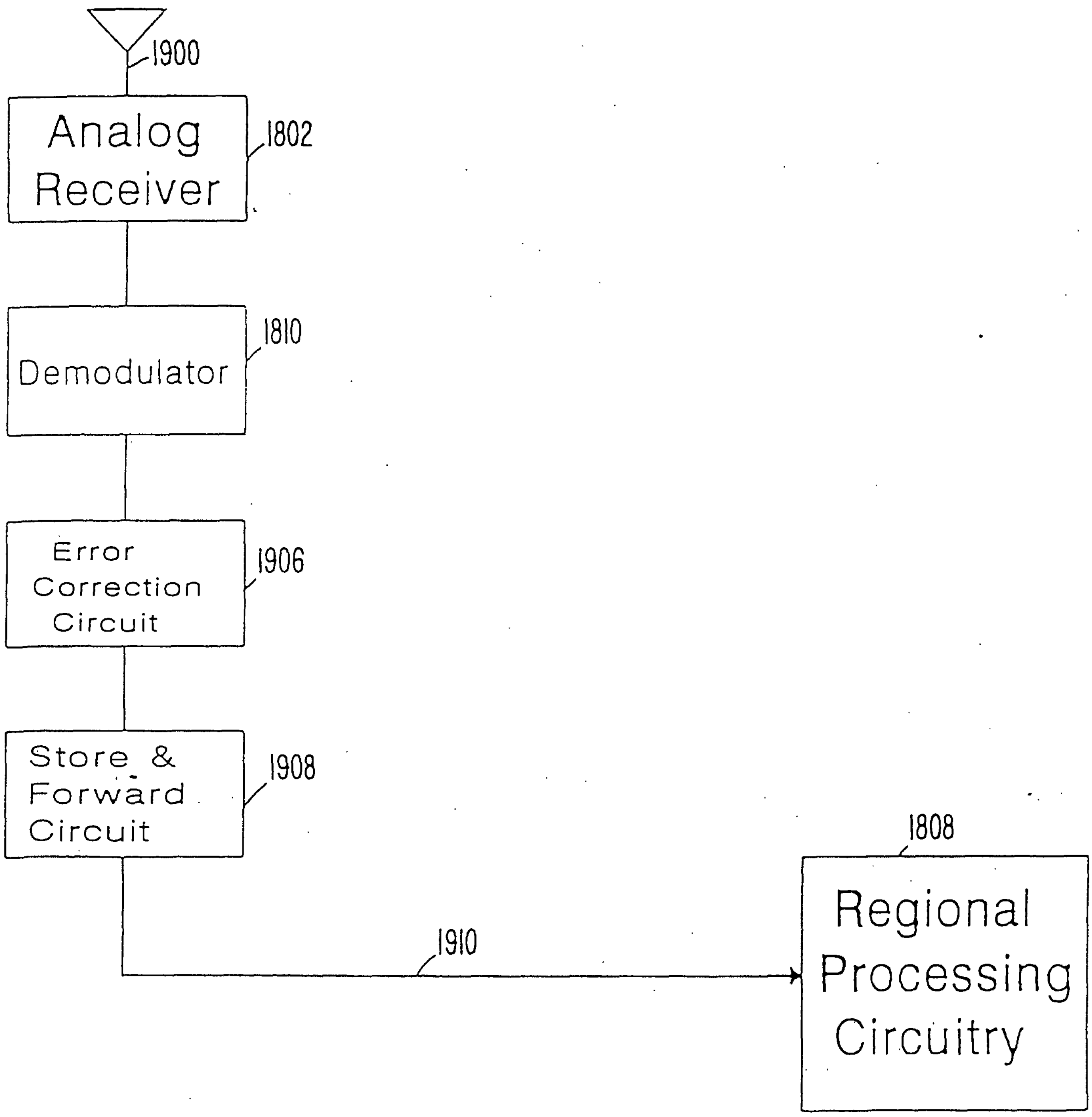


FIG. 19



1900
Analog Receiver
1802
Demodulator
1810
Error Correction Circuit
1906
Store & Forward Circuit
1908
1808
Regional Processing Circuitry
1910

FIG. 20

Network Operations Center

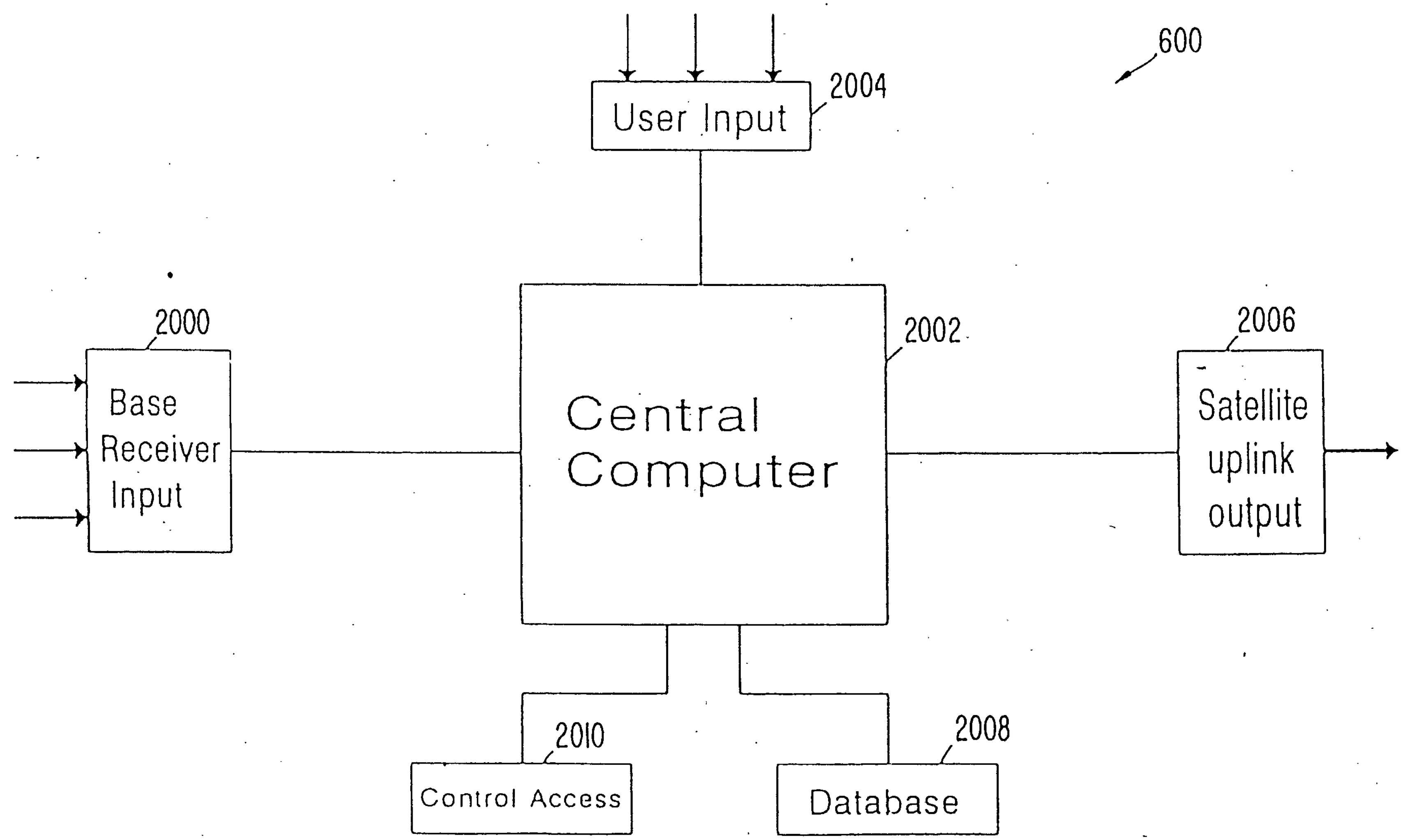
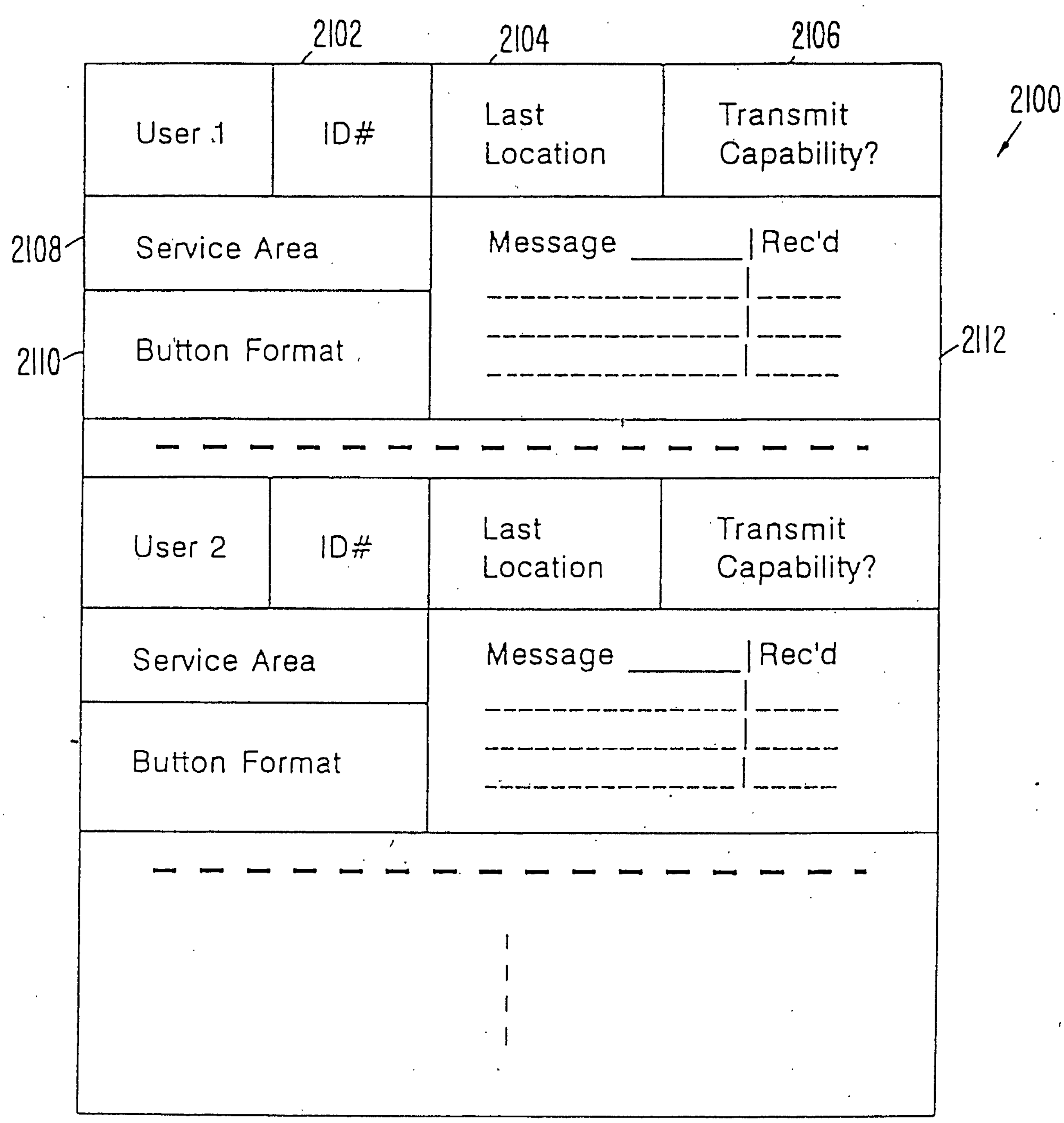


FIG. 21



User Database

FIG. 22

2200

2202	2204	2206	2208	2210
User 1	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 2	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 3	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 4	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
■ ■ ■				

Traffic Database

FIG. 23

Service Queue

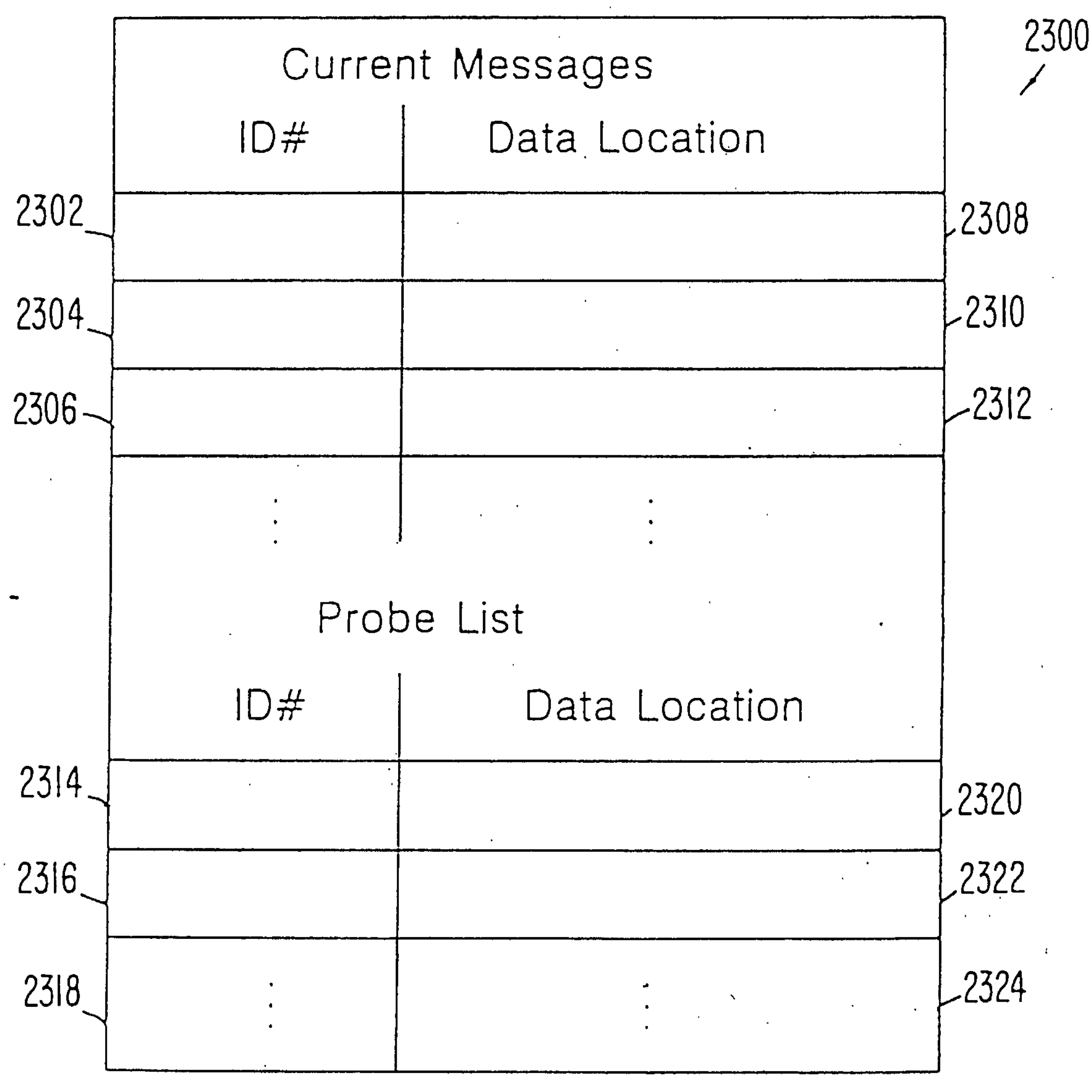


FIG. 24

2400

2402	2404	2406	2408
Base Transmitter 1	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 2	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 3	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 4	Zonal Assignment	Base Receivers in Coverage Area	Other Data
▪ ▪ ▪			

Base Transmitter Database

FIG. 25

Zone Dithering

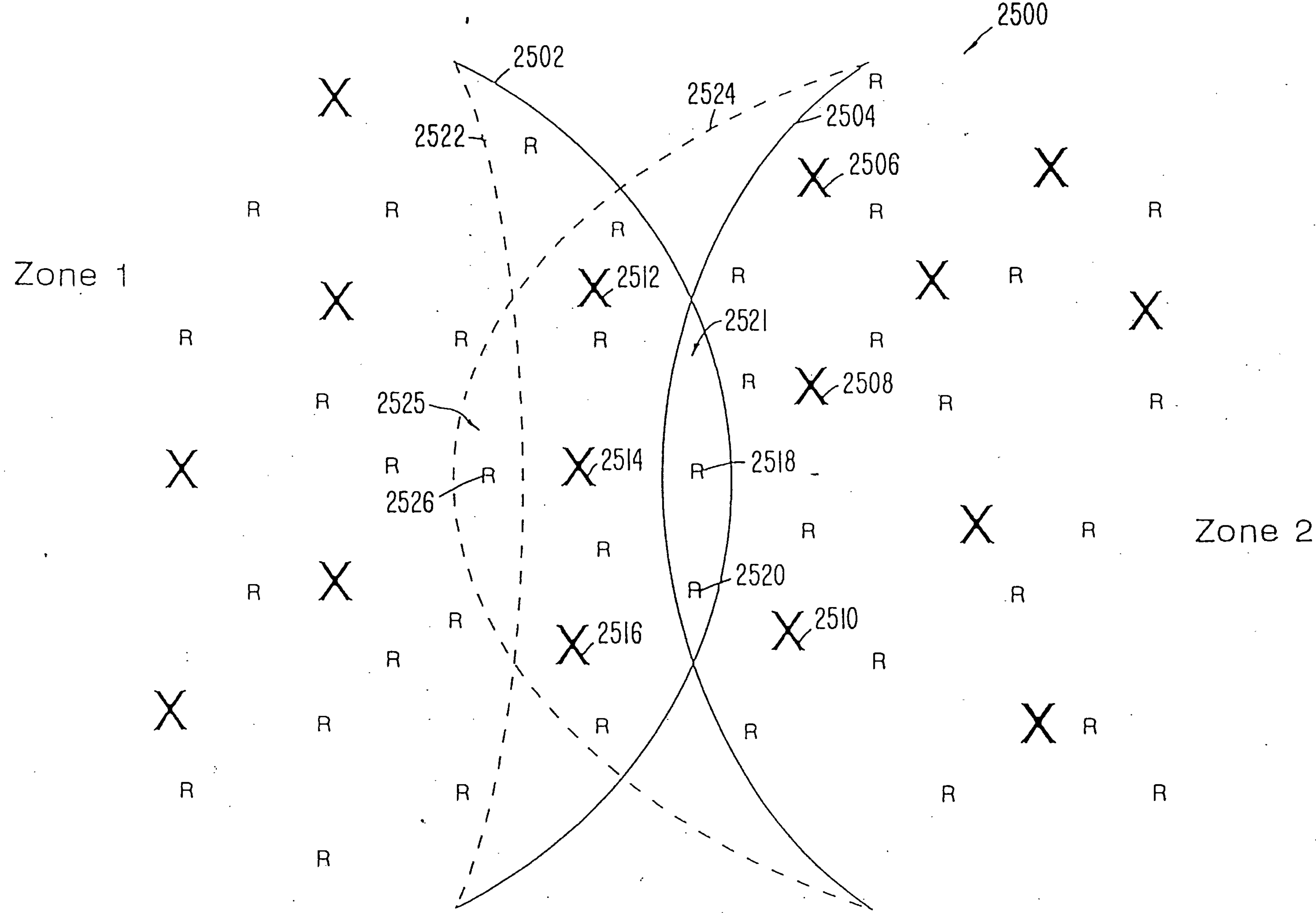


FIG. 26

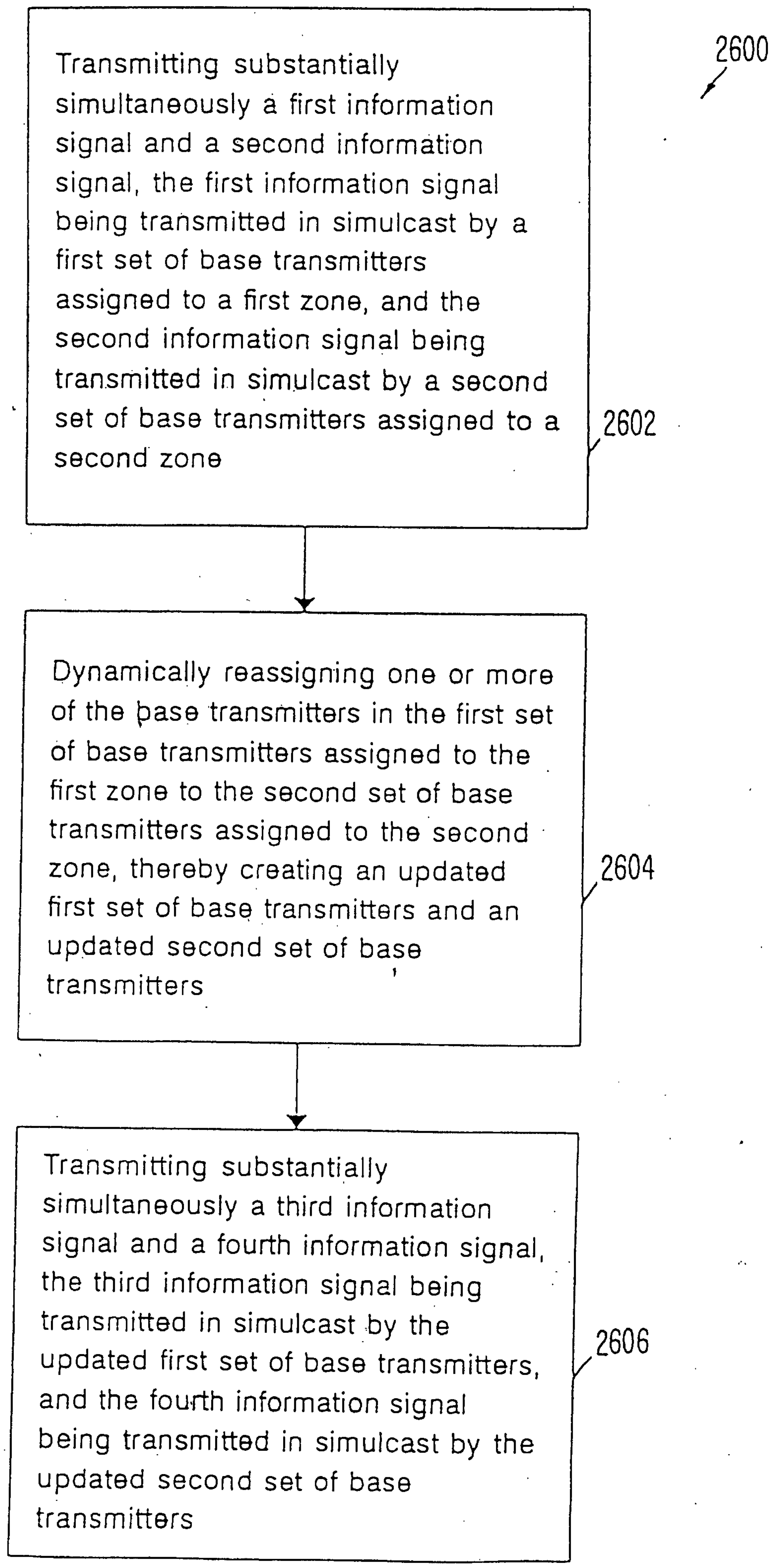

2600
Transmitting substantially simultaneously a first information signal and a second information signal, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone
2602
Dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone, thereby creating an updated first set of base transmitters and an updated second set of base transmitters
2604
Transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters
2606

FIG. 27(A)

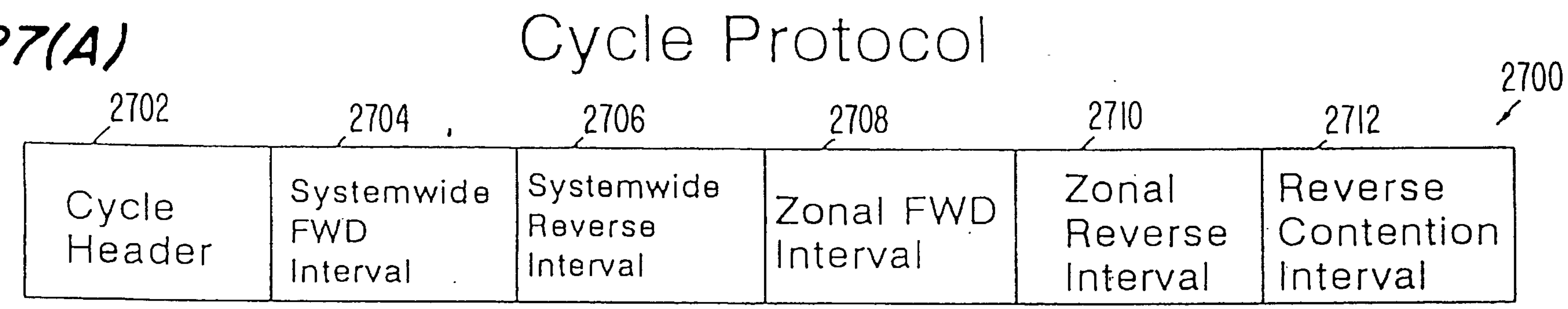


FIG. 27(B)

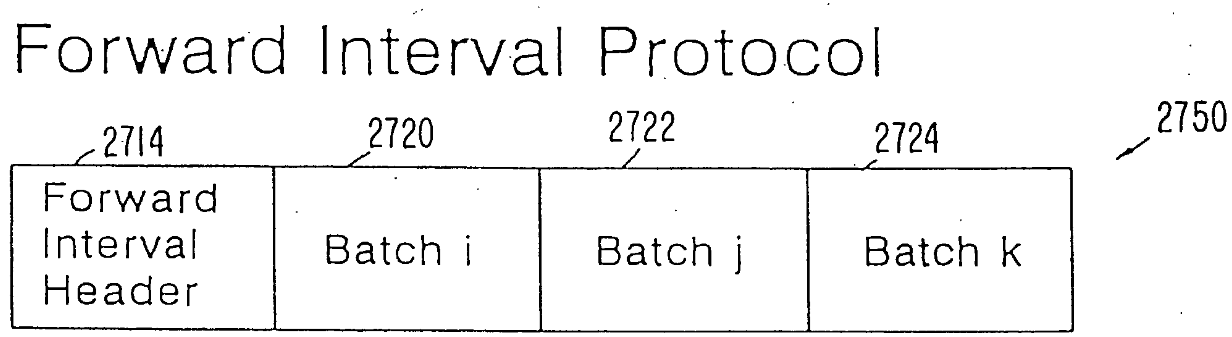


FIG. 27(C)

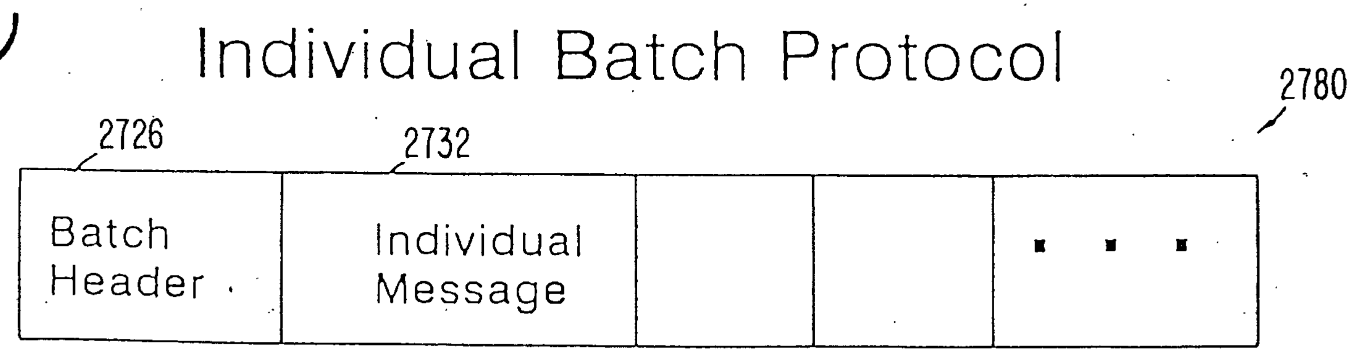


FIG. 28(A)

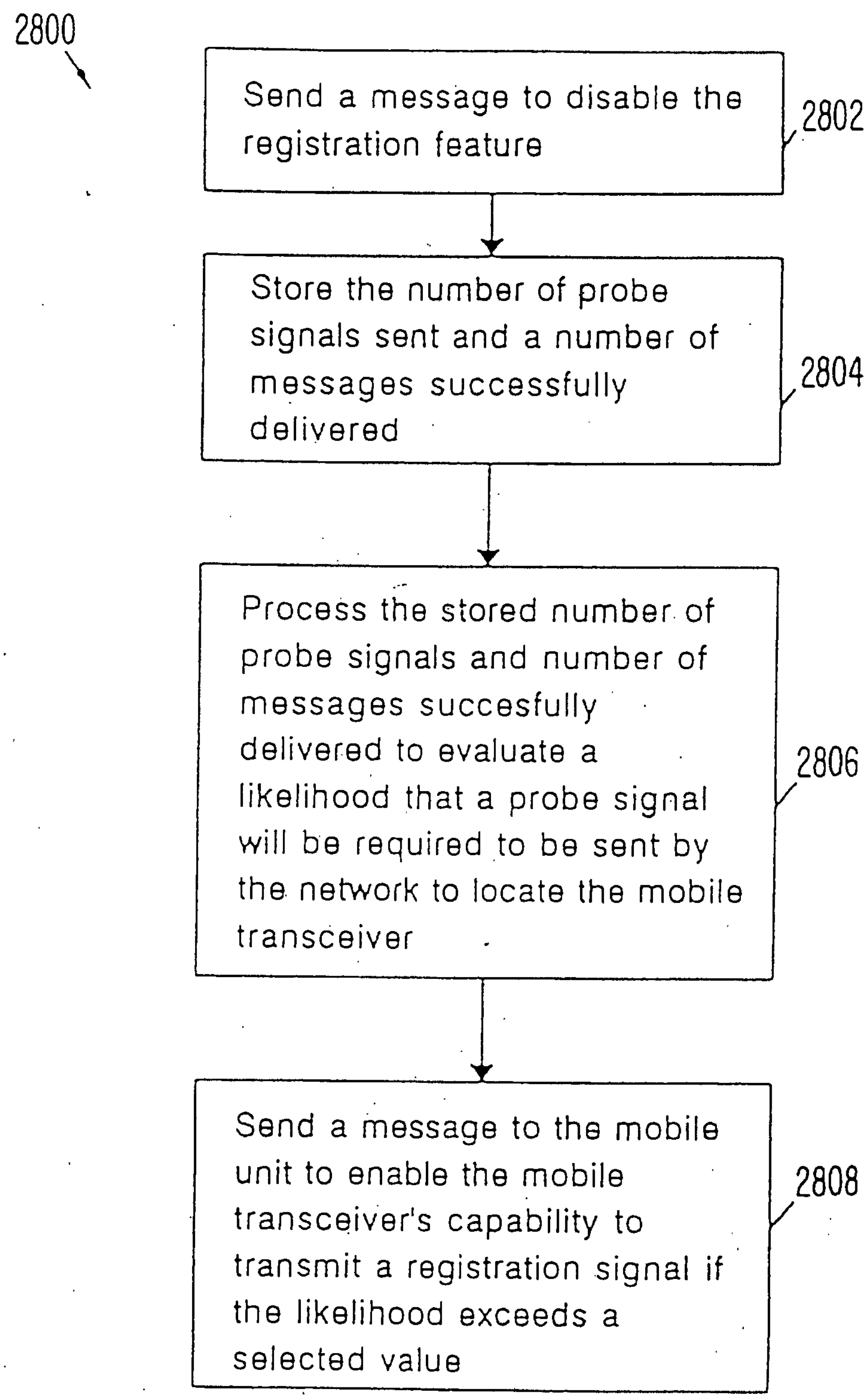

2800
Send a message to disable the registration feature
2802
Store the number of probe signals sent and a number of messages successfully delivered
2804
Process the stored number of probe signals and number of messages succesfully delivered to evaluate a likelihood that a probe signal will be required to be sent by the network to locate the mobile transceiver
2806
Send a message to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2808

FIG. 28(B)

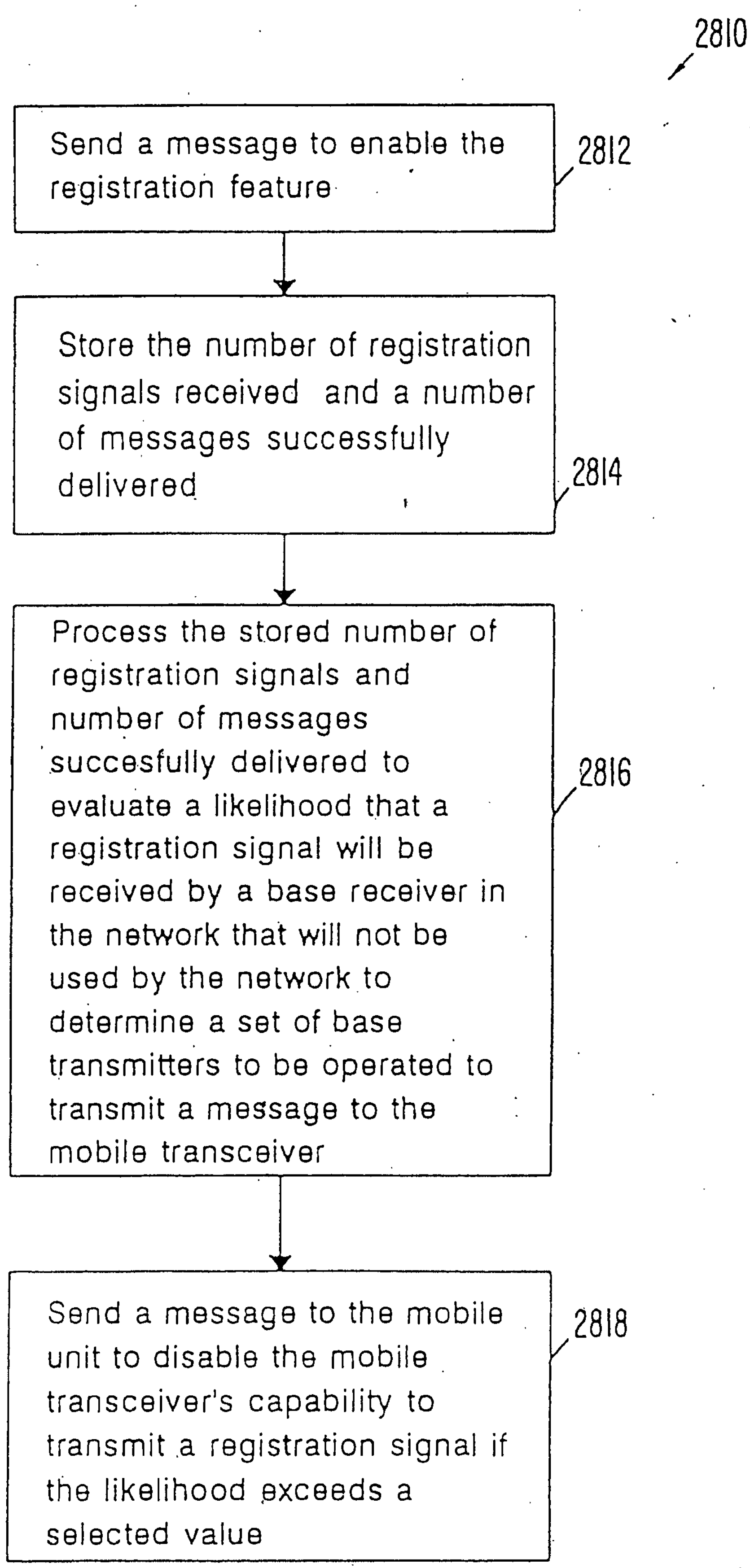

2810
Send a message to enable the registration feature
2812
Store the number of registration signals received and a number of messages successfully delivered
2814
Process the stored number of registration signals and number of messages succesfully delivered to evaluate a likelihood that a registration signal will be received by a base receiver in the network that will not be used by the network to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver
2816
Send a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2818

FIG. 29(A)

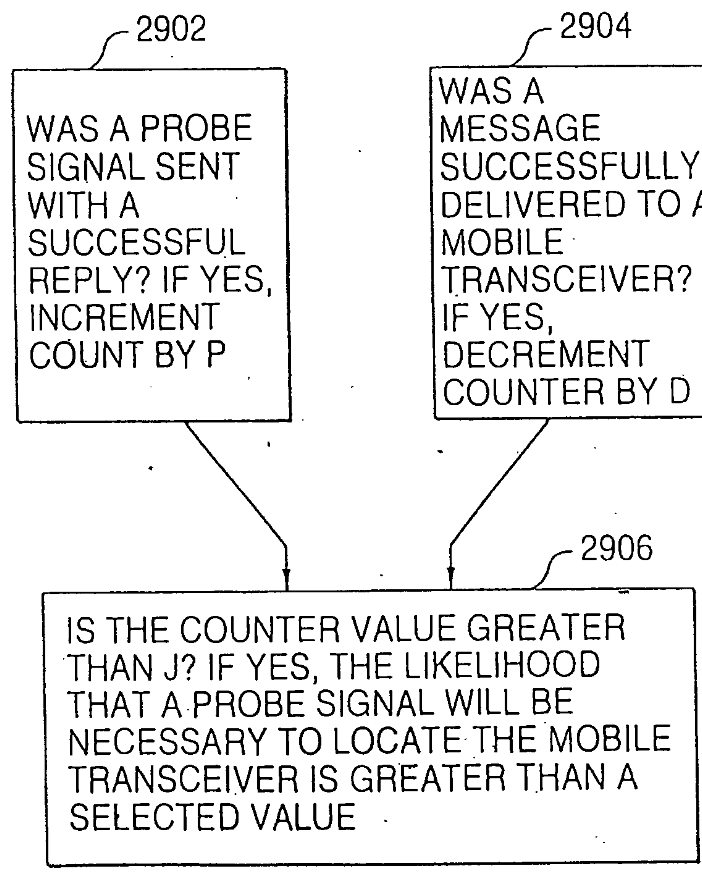
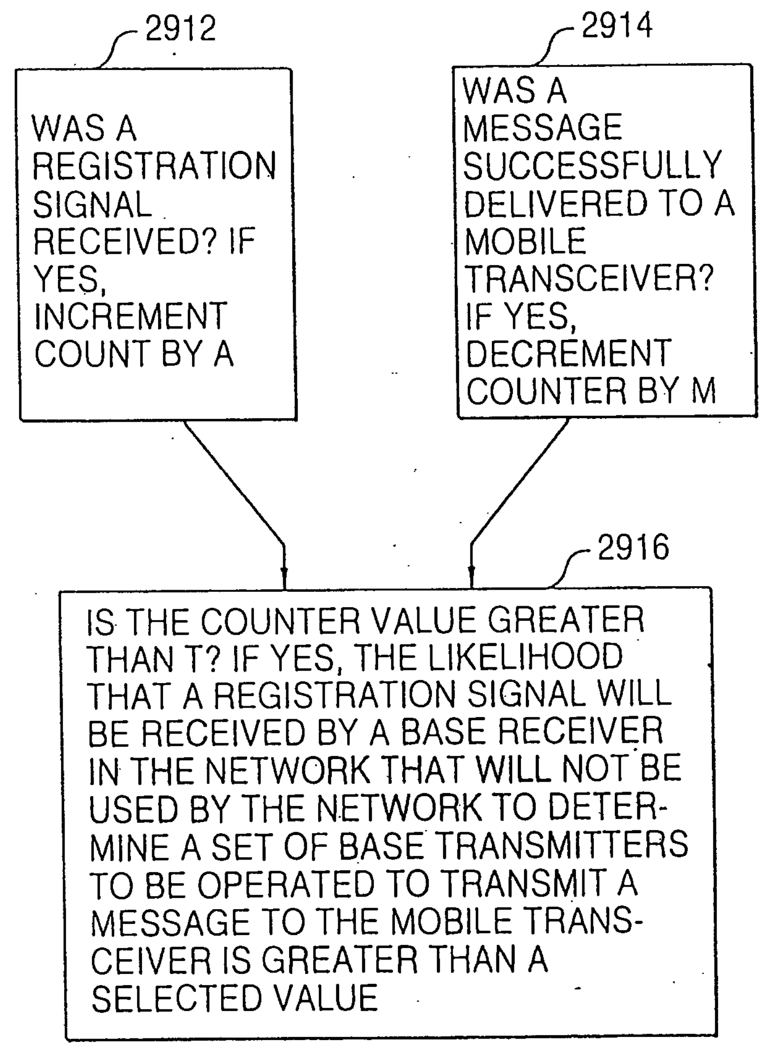


FIG. 29(B)



#3/B
TLR
3/7/97

PATENT
Attorney Docket No. 03680.0083-04

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
Dennis CAMERON et al.	)	
Continuation Application of Serial No.: 07/973,918	)	Group Art Unit: Unassigned
Filed: December 6, 1996	)	Examiner: Unassigned
For: A Nationwide Communication System	)	

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

Prior to the examination of the above application, please amend this application as follows:

INVENTORSHIP:

[Please delete "RADE PETROVIC" as a named coinventor in this application.]

IN THE TITLE:

Kindly change the title to -- METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION--.

IN THE DRAWINGS:

Subject to the approval of the Examiner and as indicated in the concurrently-filed Request For Approval Of Drawing Change, please amend the drawings as follows:

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202-408-4000

Fig. 1, add reference character "F" in the overlap area between transmitters 102 and 104;

Figs. 1-5, add the label "Prior Art"; and

Fig. 6, add base transmitters 613 and 615.

IN THE SPECIFICATION:

Please amend the specification as follows:

In the title page, change "Baggat" to --Bhagat-- and change "Massood" to --Masood--.

Page 19, line 3, replace "Although not shown in Fig. 6, each" with --Each--; and

line 4, after "stations" insert --, shown as, for example, base transmitters 613 and 615 in Fig. 6,--

B1

IN THE CLAIMS:

Please cancel claims 1 and 3-7 without prejudice or disclaimer of the subject matter thereof, and amend claim 2 and add new claims 8-24 as follows:

Sub B1

1. ~~2.~~ (Amended) A multi-carrier simulcast transmission system for transmitting in a desired frequency band a message contained in an information signal, the system comprising:

B2 cont.

a first transmitter [means for transmitting an information signal by generating] configured to transmit a first plurality of carrier signals within the desired frequency band [and by modulating the first plurality of carrier signals to convey the information signal], each of the first plurality of carrier signals representing a portion of the information signal not represented by others of the plurality of carrier signals; and

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B2 concld.

a second transmitter [means], spatially separated from the first transmitter, [for transmitting the information signal] configured to transmit a second plurality of carrier signals in simulcast with the first plurality of carrier signals, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals [transmitter by generating a second plurality of carrier signals at substantially the same frequencies as the first plurality of carrier signals and by modulating the second plurality of carrier signals to convey this information signal].

B3 cont.

2. ~~8.~~ The multi-carrier simulcast transmission system of claim 1 ~~2~~, wherein the first transmitter comprises a plurality of transmitters located in a first area, and the second transmitter comprises a plurality of transmitters located in a second area.

3. ~~9.~~ The multi-carrier simulcast transmission system of claim 1 ~~2~~, wherein the first and second pluralities of carrier signals are evenly spaced within the desired frequency band.

4. ~~10.~~ The multi-carrier simulcast transmission system of claim 3 ~~9~~, wherein the first and second pluralities of carrier signals are spaced approximately every 3 KHz, and wherein the desired frequency band is approximately 50 KHz wide.

5. ~~11.~~ The multi-carrier simulcast transmission system of claim 1 ~~2~~, wherein each of the first and second pluralities of carrier signals comprise eight carrier signals.

6. ~~12.~~ The multi-carrier simulcast transmission system of claim 1 ~~2~~, wherein the first and second pluralities of carrier signals include an identical number of carrier signals, and wherein each carrier signal in the first plurality corresponds to and is

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slightly frequency shifted 10-20 Hz from the respective carrier signal in the second plurality.

7. ~~13~~. The multi-carrier simulcast transmission system of claim ~~2~~ 1, wherein the first transmitter comprises means for modulating the first plurality of carrier signals using a modulation scheme, and the second transmitter comprises means for modulating the second plurality of carrier signals using the modulation scheme.

8. ~~14~~. The multi-carrier simulcast transmission system of claim ~~13~~ 7, wherein the modulation scheme is selected from the group including: modulated on/off keying, binary frequency shift keying, M'ary frequency shift keying, and quadrature amplitude modulation.

9. ~~15~~. The multi-carrier simulcast transmission system of claim ~~2~~ 1, further comprising:

a network operations center configured to generate the information signal, the network operations center including a receiver for receiving data input to the network operations center, a database for storing data, a central computer connected to the receiver and the database for processing the input data and the database data to generate the information signal, and a satellite uplink connected to the central computer for broadcasting the information signal; and

a satellite for receiving the information signal from the network operations center and for retransmitting the information signal to the first and second transmitters,

wherein each of the first and second transmitters comprises satellite downlink means and base transmitter means.

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Sub D10 10. ~~16~~. In a multi-carrier simulcast transmission system, a method for transmitting in a desired frequency band a message contained in an information signal, the method comprising the steps of:

generating a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal not represented by others of the first pluarlity of carrier signals;

generating a second plurality of carrier signals within the desired frequency band, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals;

B3 cont

transmitting the first plurality of carrier signals from a first transmitter;

transmitting the second plurality of carrier signals from a second transmitter in simulcast with transmission of the first plurality of carrier signals from the first transmitter.

11. ~~17~~. The method of claim ~~16~~ 10, wherein the first and second pluralities of carrier signals are evenly spaced within the desired frequency band.

12. ~~18~~. The method of claim ~~16~~ 10, wherein the first and second pluralities of carrier signals are spaced approximately every 3 KHz, and wherein the desired frequency band is approximately 50 KHz wide.

13. ~~19~~. The method of claim ~~16~~ 10, wherein the first and second pluralities of carrier signals each comprise eight carrier signals.

14. ~~20~~. The method of claim ~~16~~ 10, wherein the first and second pluralities of carrier signals include an identical number of carrier signals, and wherein each carrier signal in

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the first plurality corresponds to and is slightly frequency shifted 10-20 Hz from the respective carrier signal in the second plurality.

15 ~~21~~. The method of claim 10 ~~16~~, wherein at least one of the first and second pluralities of carrier signals is modulated according to a modulation scheme selected from the group including: modulated on/off keying, binary frequency shift keying, M'ary frequency shift keying, and quadrature amplitude modulation.

B3 concl.

16 ~~22~~. The method of claim 10 ~~16~~, wherein the step of generating the first plurality of carrier signals comprises the substep of modulating the first plurality of carrier signals using a modulation scheme.

17 ~~23~~. The method of claim 10 ~~16~~, wherein the step of generating a second plurality of carrier signals comprises the substep of modulating the second plurality of carrier signals using a modulation scheme.

18 ~~24~~. The method of claim 10 ~~16~~, wherein the step of generating a second plurality of carrier signals comprises the substep of generating the second plurality of carrier signals at frequencies slightly offset from the first plurality of carrier signals.--

REMARKS

Prior to examination, applicants have amended this application. Specifically, applicants amended the title, drawings, and specification to address issues raised in previous Office Actions of the parent application. In addition, applicants canceled claims 1 and 3-7, which were considered in related applications, and amended claim 2 and added new claims 8-24.

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Applicants submit that the invention, as claimed in pending claims 2 and 8-24, is not disclosed or suggested by the prior art of record in the parent application or any other related applications. Accordingly, applicants request favorable consideration of this application and allowance of the pending claims.

If an extension of time required to timely file this Amendment under 37 C.F.R. § 1.136 is not accounted for above, such extension is hereby requested and the fee for the extension should be charged to our Deposit Account No. 06-0916. If there are any other fees due in connection with the filing of this Amendment not accounted for above, such fees should also be charged to our Deposit Account.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Allen M. Lo

Allen M. Lo
Reg. No. 37,059

Dated: December 6, 1996

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& DUNNER, L.L.P.
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08/760457

#4

PATENT

Attorney Docket No. 03680.0083-04 3/7/97

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

MAIL ROOM DEC. 6 1996 PAT. & TRADEMARK OFF.

In re Application of:	)	
	)	
Dennis CAMERON et al.	)	
	)	
Continuation application of	)	
Serial No.: 07/973,918	)	Group Art Unit: Unassigned
	)	
Filed: December 6, 1996	)	Examiner: Unassigned
	)	
For: A Nationwide Communication System	)	

Assistant Commissioner of Patents
Washington, D.C. 20231
Sir:

REQUEST FOR APPROVAL OF DRAWING CHANGE

The Examiner is requested to approve the proposed drawing changes, which are indicated in red in the attached drawings, as follows:

Fig. 1, add reference character "F" in the overlap area between transmitters 102 and 104;

Figs. 1-5, add the label "Prior Art"; and

Fig. 6, add base transmitters 613 and 615.

If there is any fee due in connection with the filing of this proposed drawing change, please charge such fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER

Dated: December 6, 1996

By: Allen M. Lo
Allen M. Lo
Reg. No. 37,059

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& DUNNER, L.L.P.
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08/760457

Approved
3/10/97
TR

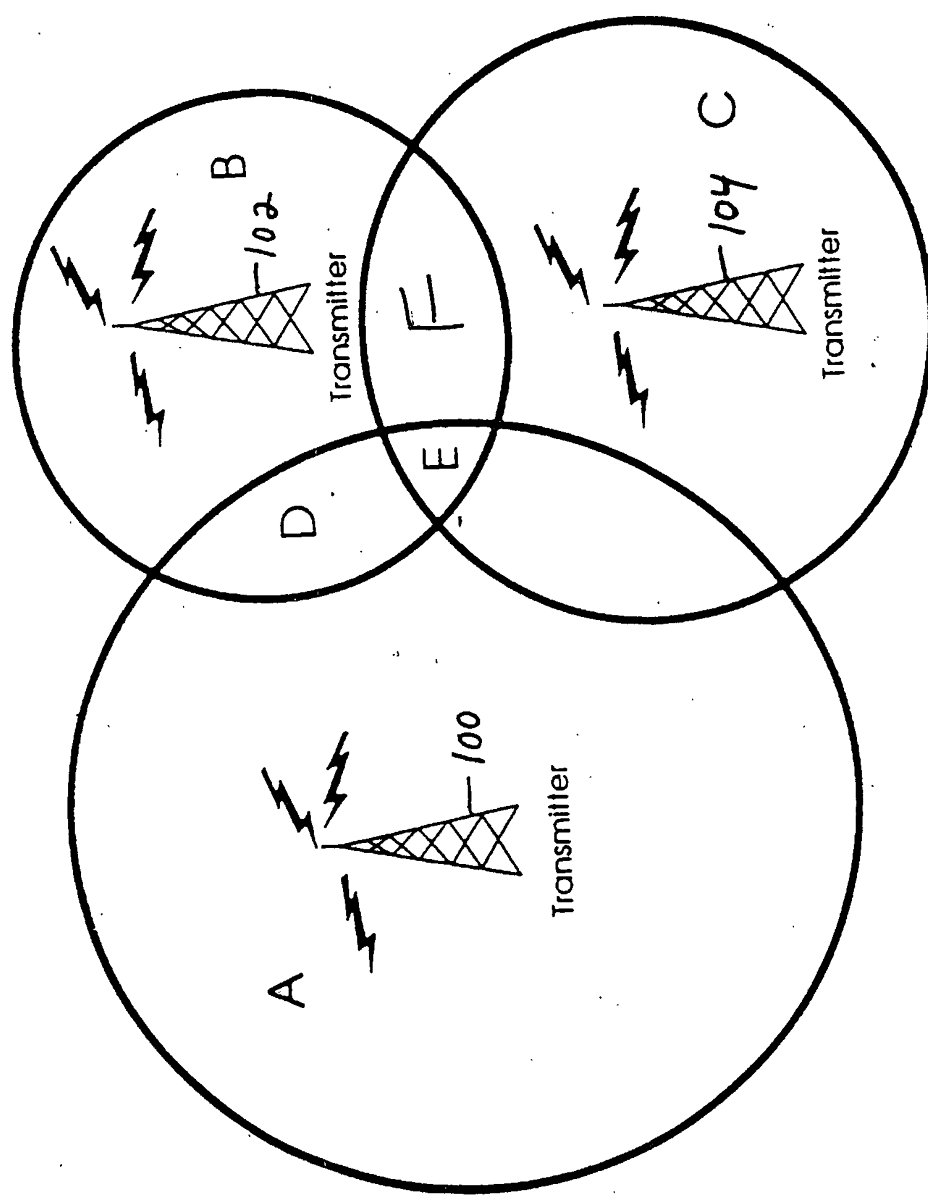

Fig. 1
Prior Art

08/760457

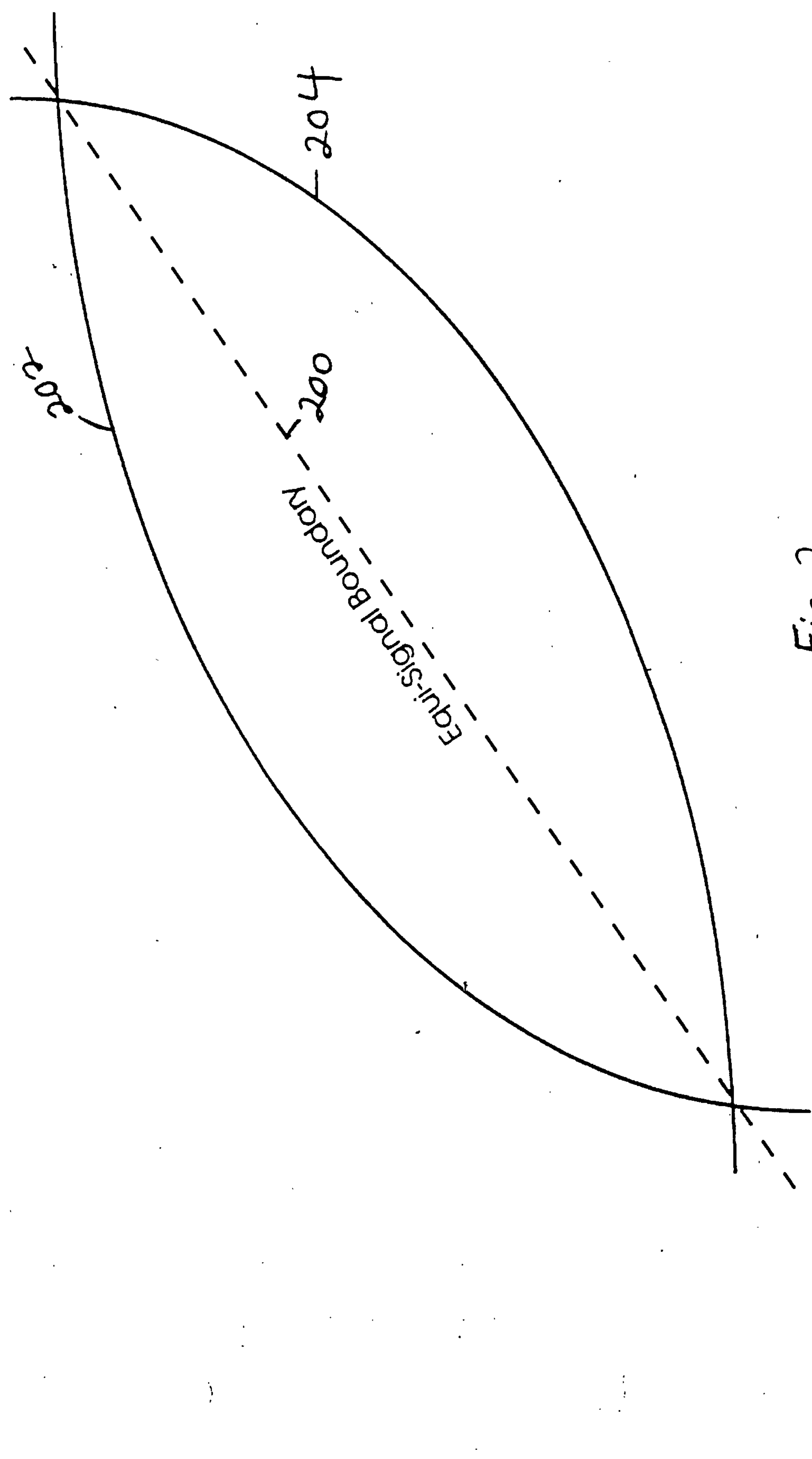

Fig. 2
Prior Art

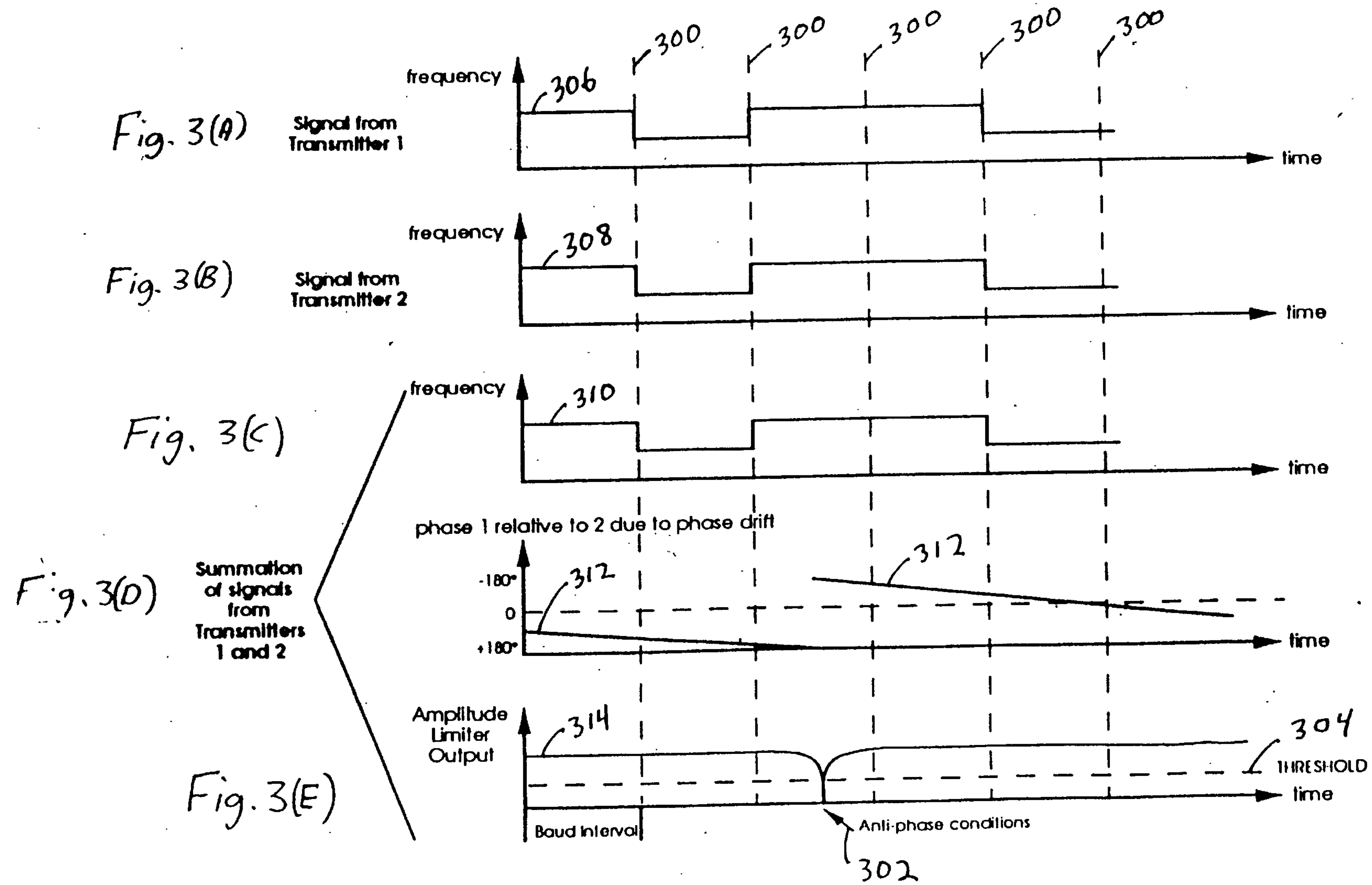

Fig. 3
Prior Art

08/760457

08/760457

Fig. 4(A) Signal from Transmitter 1

Fig. 4(B) Signal from Transmitter 2

Fig. 4(C) Summation of signals from Transmitters 1 and 2

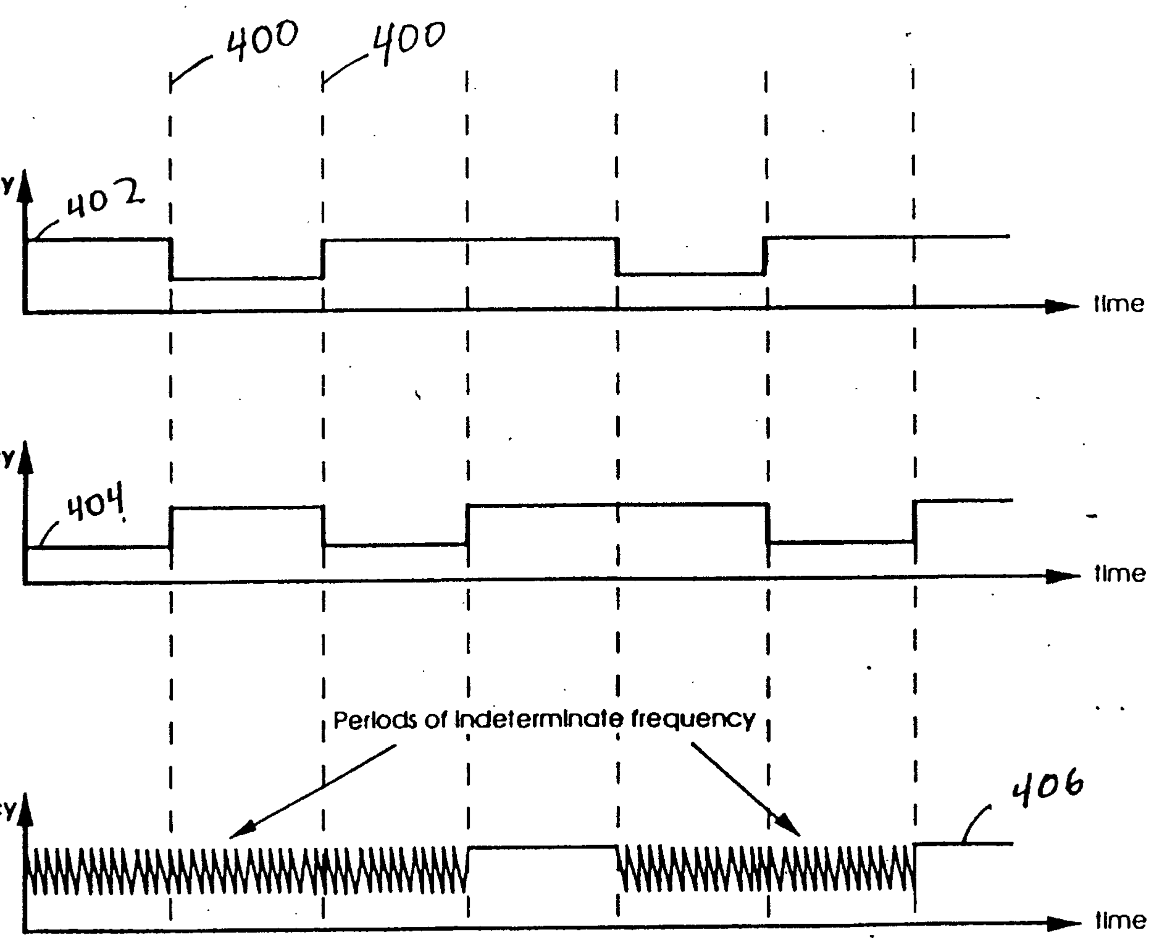

Fig. 4
Prior Art

08/760457

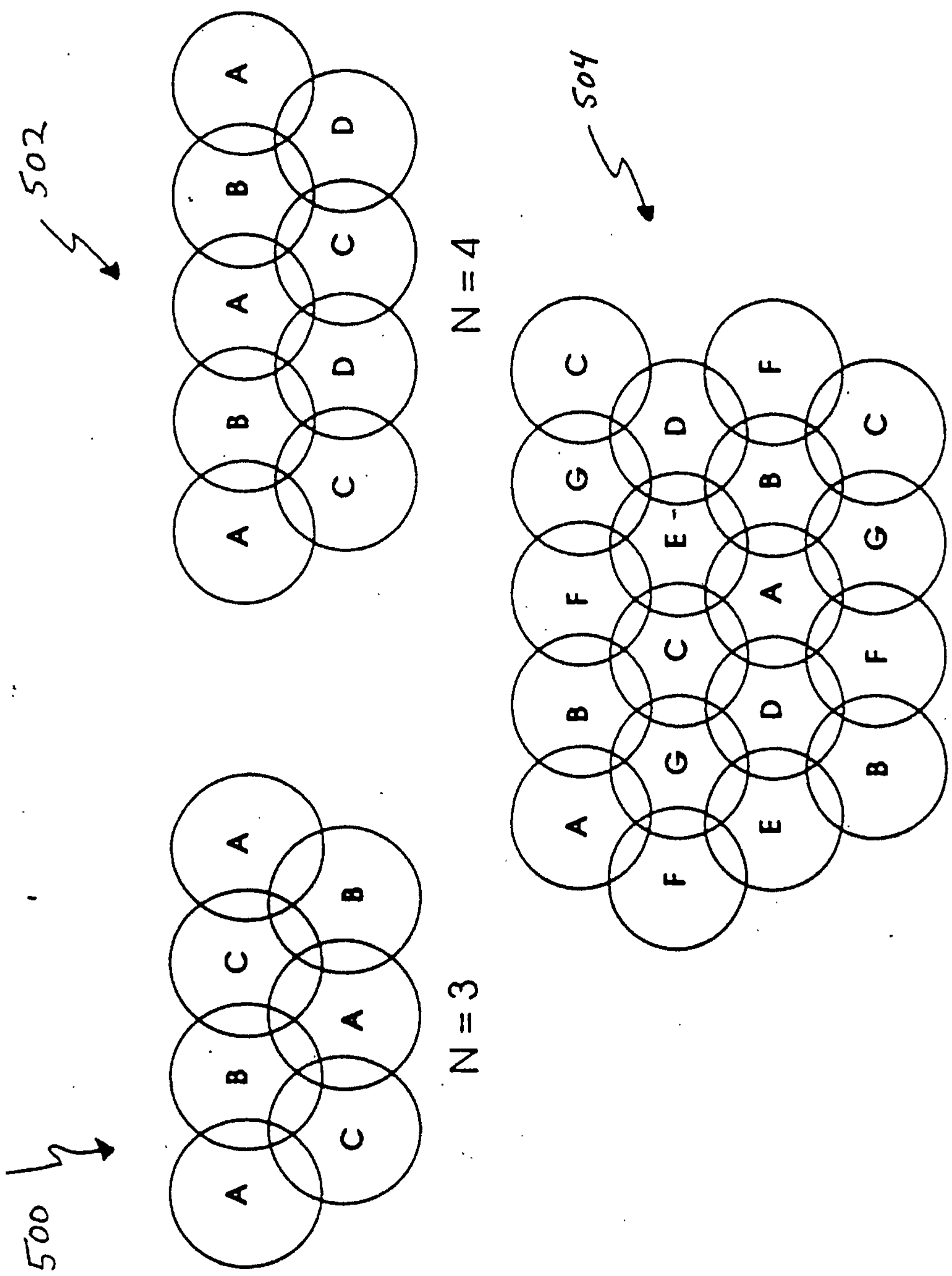

Fig. 5
Prior Art

08/760457

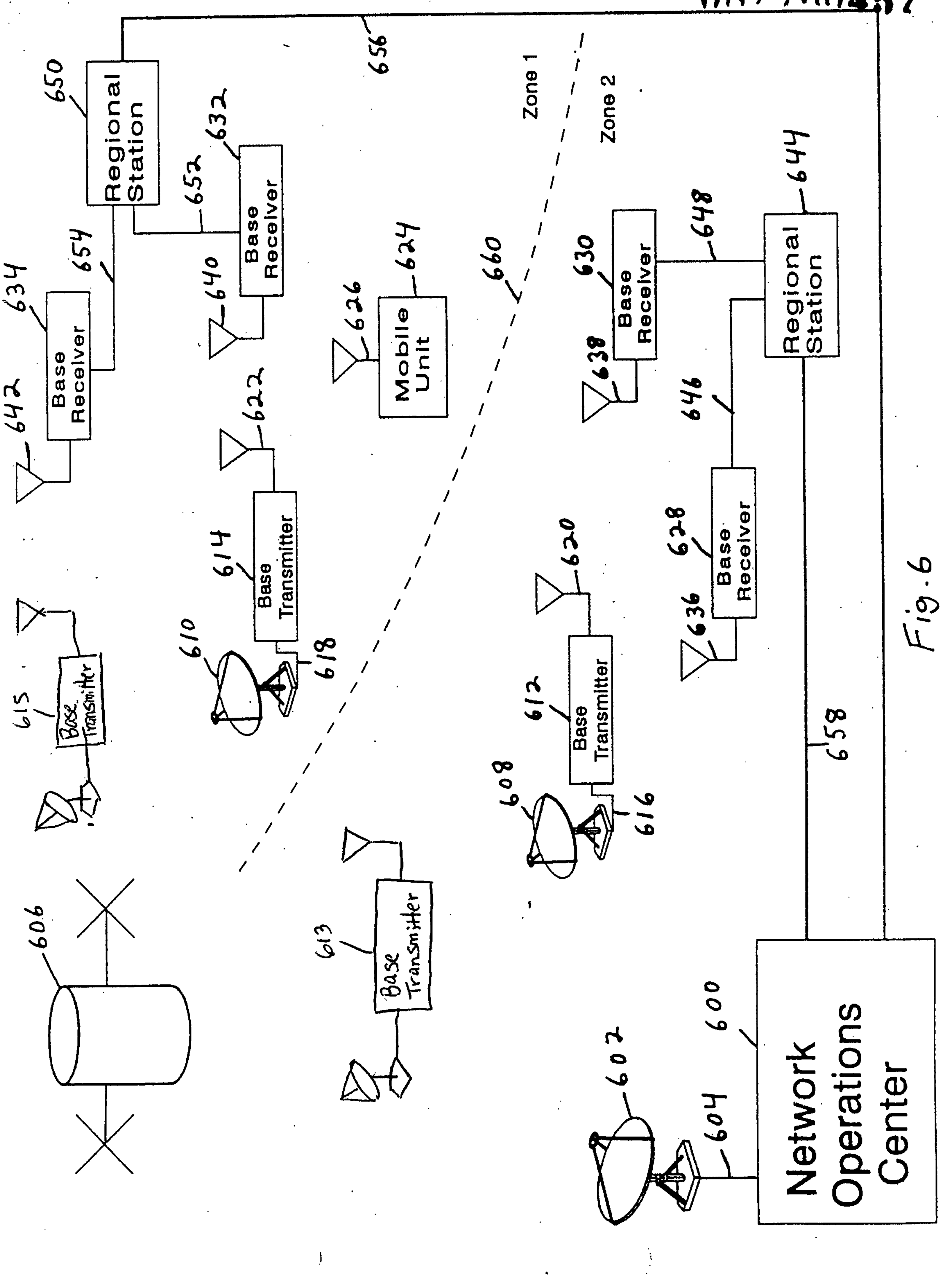

Fig. 6

130 '22

08/76045

PATENT
Attorney Docket No. 03680.0083-04

MAIL ROOM DEC 6 1996 PAT. & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	
Dennis W. Cameron et al.	)	
	)	
Continuation application of Serial No.: 07/973,918	)	Group Art Unit: Unassigned
	)	
Filed: December 6, 1996	)	Examiner: Unassigned
	)	
For: A NATIONWIDE COMMUNICATIONS SYSTEM	)	

Assistant Commissioner for Patents
Washington, D.C. 20231

PETITION UNDER 37 C.F.R. § 1.48(b)

Pursuant to 37 C.F.R. § 1.48(b), applicants petition the Commissioner to correct the inventorship of this application by deleting Mr. Rade Petrovic as an inventor. Applicants acknowledge that the subject matter to which Mr. Petrovic is an inventor is no longer claimed in this application, which is a continuation application of Serial No. 07/973,918.

A check in the amount of $130.00 is attached as payment of the fee set forth in 37 C.F.R. §1.17(h). If there are any other fees due in connection with the filing of this petition, please charge the fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Allen M. Lo

Allen M. Lo
Reg. No. 37,059

300 SB 01/06/97 07973918
1 122 130.00 CK

Date: December 6, 1996

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WASHINGTON, DC 20005
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Transaction History Date 1997-04-25
Date information retrieved from USPTO Patent Application Information Retrieval (PAIR) system records at www.uspto.gov

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UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
[illegible]	[illegible]	CAMERON D	[illegible]

26M1/0425

FINNEGAN HENDERSON FARABOW
GARRETT AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

EXAMINER
LE, T

ART UNIT	PAPER NUMBER
26	5

04/25/97

DATE MAILED:

NOTICE OF ALLOWABILITY

PART I.

1. ☑ This communication is responsive to application filed 12/6/96.
2. ☑ All the 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 And Issue Fee Due or other appropriate communication will be sent in due course.
3. ☑ The allowed claims are 2 and 8-24, renumbered 1-18.
4. ☐ The drawings filed on ______ are acceptable.
5. ☐ Acknowledgment is made of the claim for priority under 35 U.S.C. 119. The certified copy has [_] been received. [_] not been received. [_] been filed in parent application Serial No. ______, filed on ______.
6. ☐ Note the attached Examiner's Amendment.
7. ☐ Note the attached Examiner Interview Summary Record, PTOL-413.
8. ☑ Note the attached Examiner's Statement of Reasons for Allowance.
9. ☑ Note the attached NOTICE OF REFERENCES CITED, PTO-892.
10. ☐ Note the attached INFORMATION DISCLOSURE CITATION, PTO-1449.

PART II.

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" indicated on this form. Failure to timely comply will result in the ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

1. ☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.
2. ☑ APPLICANT MUST MAKE THE DRAWING CHANGES INDICATED BELOW IN THE MANNER SET FORTH ON THE REVERSE SIDE OF THIS PAPER.
   a. ☑ Drawing informalities are indicated on the NOTICE RE PATENT DRAWINGS, PTO-948, attached hereto or to Paper No. 5. CORRECTION IS REQUIRED.
   b. ☑ The proposed drawing correction filed on 12/6/96 has been approved by the examiner. CORRECTION IS REQUIRED.
   c. ☐ Approved drawing corrections are described by the examiner in the attached EXAMINER'S AMENDMENT. CORRECTION IS REQUIRED.
   d. ☑ Formal drawings are now REQUIRED.

Any response to this letter should include in the upper right hand corner, the following information from the NOTICE OF ALLOWANCE AND ISSUE FEE DUE: ISSUE BATCH NUMBER, DATE OF THE NOTICE OF ALLOWANCE, AND SERIAL NUMBER.

Attachments:

- _ Examiner's Amendment
- _ Examiner Interview Summary Record, PTOL-413
- ✓ Reasons for Allowance
- ✓ Notice of References Cited, PTO-892
- _ Information Disclosure Citation, PTO-1449
- _ Notice of Informal Application, PTO-152
- ✓ Notice re Patent Drawings, PTO-948
- _ Listing of Bonded Draftsmen
- _ Other

T. LE
(703) 305-4819

PTOL-37 (REV. 4-89) *

1. The petition under 37 CFR 1.48(b) regarding the deletion of "Mr. Rade Petrovic" as an inventor has been entered and the inventorship of this application has been corrected.

2. The following is an Examiner's Statement of Reasons for Allowance:

As to claims 2 and 16, the prior art of record fails to show a multi-carrier simulcast transmission system comprising the first and second transmitters for simultaneously transmitting the same information signals. The system comprises a plurality of carrier signals in each of the transmitters wherein each of the carrier signals represent a portion of the information signal not represented by others of the plurality carrier signals.

Any comments considered necessary by applicant must be submitted no later than the payment of the Issue Fee and, to avoid processing delays, should preferably **accompany** the Issue Fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tomisato et al. and Wei both teach a diversity transmitter system with plural modulator for transmitting information via plural carrier frequencies.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Le whose telephone number is (703) 305-4819.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-4700.

TL

Thanh C. Le
Mar 10, 1997

Reinhard Eisenzopf

Reinhard J. Eisenzopf 3-13-97
Supervisory Patent Examiner
Group 2600

TO SEPARATE, HOLD TOP AND BOTTOM EDGES, SNAP-APART AND DISCARD CARBON

FORM PTO-892 (REV. 2-92)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

SERIAL NO. 08/760,457 | GROUP ART UNIT 2611 | ATTACHMENT TO PAPER NUMBER 5

NOTICE OF REFERENCES CITED

APPLICANT(S): CAMERON et al.

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE
*	A	4490830	12/84	Kai et al.	455	59	
*	B	4223405	9/80	Hattori et al.	455	59	
*	C	4392242	7/83	Kai	455	34.1	
*	D	4968966	11/90	Jasinski	455	51.2	
*	E	4570265	2/86	Thro	455	59	
*	F	5504783	4/96	Tomisato et al	455	101	
*	G	5243629	9/93	Wei	375	299	
	H						
	I						
	J						
	K						

FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUB-CLASS	PERTINENT SHTS. DWG	PP. SPEC.
*	L	WO91/18458	11/28/91	US	Wilkinson	455	101		
*	M	WO92/11707	07/09/92	US	Fennel et al.	455	33.1		
	N								
	O								
	P								
	Q								

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

R	
S	
T	
U	

EXAMINER	DATE	
THANH LE	3/10/97	

* A copy of this reference is not being furnished with this office action. (See Manual of Patent Examining Procedure, section 707.05 (a).)

Form PTO 948 (Rev. 10-94) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office Application No. 760457

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

PTO Draftpersons review all originally filed drawings regardless of whether they are designated as formal or informal. Additionally, patent Examiners will review the drawings for compliance with the regulations. Direct telephone inquiries concerning this review to the Drawing Review Branch, 703-305-8404.

The drawings filed (insert date) 12/6/96, are
A._____ not objected to by the Draftsperson under 37 CFR 1.84 or 1.152.
B. X objected to by the Draftsperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawings must be submitted according to the instructions on the back of this Notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings: Black ink. Color.
   - ___ Not black solid lines. Fig(s)______
   - ___ Color drawings are not acceptable until petition is granted. Fig(s)______
2. PHOTOGRAPHS. 37 CFR 1.84(b)
   - ___ Photographs are not acceptable until petition is granted. Fig(s)______
   - ___ Photographs not properly mounted (must use brystol board or photographic double-weight paper). Fig(s)______
   - ___ Poor quality (half-tone). Fig(s)______
3. GRAPHIC FORMS. 37 CFR 1.84 (d)
   - ___ Chemical or mathematical formula not labeled as separate figure. Fig(s)______
   - ___ Group of waveforms not presented as a single figure, using common vertical axis with time extending along horizontal axis. Fig(s)______
   - ___ Individuals waveform not identified with a separate letter designation adjacent to the vertical axis. Fig(s)______
4. TYPE OF PAPER. 37 CFR 1.84(c)
   - ___ Paper not flexible, strong, white, smooth, nonshiny, and durable. Sheet(s)______
   - ___ Erasures, alterations, overwritings, interlineations, cracks, creases, and folds copy machine marks not accepted. Fig(s)______
   - ___ Mylar, velum paper is not acceptable (too thin). Fig(s)______
5. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable sizes:
   21.6 cm. by 35.6 cm. (8 1/2 by 14 inches)
   21.6 cm. by 33.1 cm. (8 1/2 by 13 inches)
   21.6 cm. by 27.9 cm. (8 1/2 by 11 inches)
   21.0 cm. by 29.7 cm. (DIN size A4)
   - ___ All drawing sheets not the same size. Sheet(s)______
   - ___ Drawing sheet not an acceptable size. Sheet(s)______
6. MARGINS. 37 CFR 1.84(g): Acceptable margins:

Paper size

	21.6 cm. X 35.6 cm. (8 1/2 X 14 inches)	21.6 cm X 33.1 cm. (8 1/2 X 13 inches)	21.6 cm. X 27.9 cm. (8 1/2 X 11 inches)	21.0 cm. X 29.7 cm. (DIN Size A4)
T	5.1 cm. (2")	2.5 cm. (1")	2.5 cm. (1")	2.5cm.
L	.64 cm. (1/4")	.64 cm. (1/4")	2.5 cm. (1/4")	2.5 cm.
R	.64 cm. (1/4")	.64 cm. (1/4")	1.5 cm. (1/4")	1.5 cm.
B	.64 cm. (1/4")	.64 cm. (1/4")	1.0 cm. (1/4")	1.0 cm.

Margins do not conform to chart above.
Sheet(s)______
X Top (T) X Left (L) X Right (R) X Bottom (B)

7. VIEWS. 37 CFR 1.84(h)
   REMINDER: Specification may require revision to correspond to drawing changes.
   - ___ All views not grouped together. Fig(s)______
   - ___ Views connected by projection lines or lead lines. Fig(s)______

   Partial views. 37 CFR 1.84(h) 2
   - ___ View and enlarged view not labled separatly or properly. Fig(s)______

   Sectional views. 37 CFR 1.84 (h) 3
   - ___ Hatching not indicated for sectional portions of an object. Fig(s)______
   - ___ Cross section not drawn same as view with parts in cross section with regularly spaced parallel oblique strokes. Fig(s)______
8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
   - ___ Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s)______
9. SCALE. 37 CFR 1.84(k)
   - ___ Scale not large enough to show mechanism with crowding when drawing is reduced in size to two-thirds in reproduction. Fig(s)______
   - ___ Indication such as "actual size" or scale 1/2" not permitted. Fig(s)______
10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
    - X Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (except for color drawings). Fig(s) 1-29B
11. SHADING. 37 CFR 1.84(m)
    - ___ Solid black shading areas not permitted. Fig(s)______
    - ___ Shade lines, pale, rough and blurred. Fig(s)______
12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR. 1.84(p)
    - ___ Numbers and reference characters not plain and legible. 37 CFR 1.84(p)(l) Fig(s)______
    - ___ Numbers and reference characters not oriented in same direction as the view. 37 CFR 1.84(p)(l) Fig(s)______
    - ___ English alphabet not used. 37 CFR 1.84(p)(2) Fig(s)______
    - ___ Numbers, letters, and reference characters do not measure at least .32 cm. (1/8 inch) in height. 37 CFR(p)(3) Fig(s)______
13. LEAD LINES. 37 CFR 1.84(q)
    - ___ Lead lines cross each other. Fig(s)______
    - ___ Lead lines missing. Fig(s)______
14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)
    - ___ Sheets not numbered consecutively, and in Arabic numerals, beginning with number 1. Sheet(s)______
15. NUMBER OF VIEWS. 37 CFR 1.84(u)
    - ___ Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s)______
    - ___ View numbers not preceded by the abbreviation Fig. Fig(s)______
16. CORRECTIONS. 37 CFR 1.84(w)
    - ___ Corrections not made from prior PTO-948. Fig(s)______
17. DESIGN DRAWING. 37 CFR 1.152
    - ___ Surface shading shown not appropriate. Fig(s)______
    - ___ Solid black shading not used for color contrast. Fig(s)______

COMMENTS:

ATTACHMENT TO PAPER NO. 5 REVIEWER A. Dean DATE 2/19/97

PTO Copy

#5

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

Address: Box ISSUE FEE
ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

26M1/0425

FINNEGAN HENDERSON FARABOW
GARRETT AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/760,457	12/06/96	018	LE, T	2611	04/25/97

First Named Applicant: CAMERON, DENNIS W.

TITLE OF INVENTION: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION (AS AMENDED)

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 03680.0083-0	455-052.000	M25	UTILITY	NO	$1290.00	07/25/97

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE 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.

HOW TO RESPOND 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 changed, pay twice the amount of the FEE DUE shown and notify the Patent and Trademark Office of the change in status, or
B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

A. Pay FEE DUE shown above, or
B. File verified statementof Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B of this notice should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "6b" of Part B should be completed.

III. All communications regarding this application must give application number and batch number. Please direct all communication prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: ***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. 05-96)(0651-0033) 3. PATENT AND TRADEMARK OFFICE COPY *U.S. GPO: 1997-422-197/60032

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/760,457	12/06/96	CAMERON	D 03880-0083-0

4102/0325

FINNEGAN HENDERSON FARABOW
GARRETT AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

EXAMINER	
LE, T	
ART UNIT	PAPER NUMBER
2611	6

DATE MAILED: 03/25/98

NOTICE OF ABANDONMENT

This application is abandoned in view of:

1. ☐ Applicant's failure to respond to the Office letter, mailed ______________.
2. ☐ Applicant's letter of express abandonment which is in compliance with 37 C.F.R. 1.138.
3. ☐ Applicant's failure to timely file the response received ______________ within the period set in the Office letter.
4. ☐ Applicant's failure to pay the required issue fee within the statutory period of 3 months from the mailing date of ______________ of the Notice of Allowance.

   ☐ The issue fee was received on ______________.

   ☐ The issue fee has not been received in Allowed Files Branch as of ______________.

   In accordance with 35 U.S.C. 151, and under the provisions of 37 C.F.R. 1.316(b), applicant(s) may petition the Commissioner to accept the delayed payment of the issue fee if the delay in payment was unavoidable. The petition must be accompanied by the issue fee, unless it has been previously submitted, in the amount specified by 37 C.F.R. 1.17(l), and a verified showing as to the causes of the delay.

   If applicant(s) never received the Notice of Allowance, a petition for a new Notice of Allowance and withdrawal of the holding of abandonment may be appropriate in view of Delgar Inc. v. Schuyler, 172 U.S.P.Q. 513.

5. ☒ Applicant's failure to timely correct the drawings and/or submit new or substitute formal drawings by 7/25/97 as required in the last Office action.

   ☐ The corrected and/or substitute drawings were received on ______________.

6. ☐ The reason(s) below.

703) 305-8428
Drawing Processing Branch

PTO-1432 (Rev. 4/93)

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 1996

Application or Docket Number

08/760 457

CLAIMS AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE				385.00	OR		770.00
TOTAL CLAIMS	1 minus 20 =	*	x$11=		OR	x$22=	
INDEPENDENT CLAIMS	1 minus 3 =	*	x40=		OR	x80=	
MULTIPLE DEPENDENT CLAIM PRESENT			+130=		OR	+260=	
			TOTAL		OR	TOTAL	770

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 10/96) *U.S. Government Printing Office: 1996 - 413-288/49191 Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

1; 3-7

Form PTO 1130
(REV 2/94)

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

PACE DATA ENTRY CODING SHEET

1ST EXAMINER	Carol (?)	DATE	2-10-97
2ND EXAMINER		DATE	

APPLICATION NUMBER	TYPE APPL	FILING DATE (MONTH DAY YEAR)	SPECIAL HANDLING	GROUP ART UNIT	CLASS	SHEETS OF DRAWING
08/760457	1	12 Ø6 96	2	26 11	455	29

TOTAL CLAIMS	INDEPENDENT CLAIMS	SMALL ENTITY?	FILING FEE	FOREIGN LICENSE	ATTORNEY DOCKET NUMBER
1	7	Ø	77Ø	Y	Ø368Ø.ØØ83-Ø

CONTINUITY DATA

CONT CODE	STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE (MONTH DAY YEAR)
Ø2	2	Ø7973918	PCT/ - /		11 12 92
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE (MONTH DAY YEAR)

☆ U.S. GPO: 1995-401-429

60245 U.S. PTO
08/899476
07/24/97

PATENT APPLICATION SERIAL NO. ____________

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

08/22/1997 MPEOPLES 00000101 08899476
01 FC:101 770.00 OP

PTO-1556
(5/87)

08/~~760457~~
899,476

ABSTRACT OF THE DISCLOSURE

A two-way communication system for communication between a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximize information throughput. The preferred mobile unit includes a noise detector circuit to prevent unwanted transmissions. The system network further provides an adaptive registration feature for mobile units which controls the registration operations by the mobile units to maximize information throughput.

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#7/C
TLR
4/9/98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

ASSISTANT COMMISSIONER FOR PATENTS
BOX FWC
Washington, D.C. 20231

Attorney's Docket Number: 3680.0083-05

Prior Application: 08/760,457

Art Unit: 2611

Examiner: T. Le

SIR: This is a request for filing a

[X] Continuation [ ] Continuation-in-part [ ] Divisional application under 37 C.F.R. § 1.62 of pending prior application Serial No. 08/760,457, filed December 6, 1996, which is a Rule 1.60 continuation of prior application Serial No. 07/973,918, filed November 12, 1992, now patent No. 5,590,403, for METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

(Title of Invention)

by the following named inventor(s).

Full Name of Inventor	: Family Name	First Given Name		Second Given Name
	: CAMERON	Dennis		Wayne
Residence & Citizenship	: City	State or Foreign Country		Country of Citizenship
	: Jackson,	Mississippi		U.S.A.
Post Office Address	: Post Office Address		City	State & Zip Code/Country
	: 29 Polo Drive, Jackson, Mississippi 39211			
Full Name of Inventor	: Family Name	First Given Name		Second Given Name
	: ROEHR JR.	Walter		Charles
Residence & Citizenship	: City	State or Foreign Country		Country of Citizenship
	: Reston,	Virginia		U.S.A.
Post Office Address	: Post Office Address		City	State & Zip Code/Country
	: 11317 South Shore Road, Reston, Virginia 22090			

Full Name of Inventor	: Family Name	First Given Name	Second Given Name
	: BHAGAT	Jai	P.
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	: Jackson,	Mississippi	U.S.A.
Post Office Address	: Post Office Address	City	State & Zip Code/Country
	: 155 Rolling Meadows Drive, Jackson, Mississippi 39211		
Full Name of Inventor	: Family Name	First Given Name	Second Given Name
	: GARAHI	Masood	
Residence & Citizenship	: City	State or Foreign Country	Country of Citizenship
	: Madison,	Mississippi	U.S.A.
Post Office Address	: Post Office Address	City	State & Zip Code/Country
	: 454 Morning Forest Lane, Madison, Mississippi 39110		
Full Name of Inventor	: Family Name	First Given Name	Second Given Name
	: HAYS	William	D.
Residence & Citizenship	: City	State or Foreign Country	Country of Citizenship
	: Jackson,	Mississippi	U.S.A.
Post Office Address	: Post Office Address	City	State & Zip Code/Country
	: 2345 Twin Lake Circle, Jackson, Mississippi 39211		
Full Name of Inventor	: Family Name	First Given Name	Second Given Name
	: ACKERMAN	David	W.
Residence & Citizenship	: City	State or Foreign Country	Country of Citizenship
	: Washington, D.C.		U.S.A.
Post Office Address	: Post Office Address	City	State & Zip Code/Country
	: 3730 W Street, N.W., Washington, D.C. 20007		

The above-identified prior application in which no payment of the issue fee, abandonment of, or termination of proceedings has occurred, is hereby expressly abandoned as of the filing date of this new application. Please use all the contents of the prior application file wrapper, including the drawings, as the basic papers for the new application.

1. [ ] Enter the amendment previously filed on ________ under 37 C.F.R. § 1.116 but unentered, in the prior application.

2. [ ] A Preliminary Amendment is enclosed.

3. [X] The filing fee is calculated on the basis of the claims existing in the prior application as amended at 1 and 2 above.

For	Number Filed	Number Extra	Rate	Basic Fee $770.00
Total Claims	18 -20=	-0-	x$ 22.00=	$ -0-
Independent Claims	2 -3=	-0-	x$ 80.00=	-0-
Multiple Dependent Claim(s) (if applicable)			+$260.00=	
			Total =	$770.00
			Reduction by ½ for filing by small entity :	-
			TOTAL FILING FEE =	$770.00

4. [XX] A check in the amount of $ 770.00 to cover the filing fee is enclosed.

5. [XX] The Commissioner is hereby authorized to charge any fees including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, or credit any overpayment to Deposit Account No. 06-0916.

6. [ ] A new declaration is included since this application is a continuation-in-part which discloses and claims additional matter.

7. [XX] Amend the specification by inserting before the first line, the sentence:

--This application is a [ ] continuation-in-part, [X] continuation, [ ] division, of application Serial No. 08/760,457, filed December 6, 1996, now abandoned, which is a Rule 60 continuation of prior application Serial No. 07/973,918, filed November 12, 1992, now patent No. 5,590,403.--

8. [ ] A verified statement claiming small entity status

[ ] is enclosed or [ ] is on file in the prior application.

9. [ ] Priority of application Serial No. ____ filed on ________ (country) is claimed under 35 U.S.C. § 119. A certified copy

[ ] is enclosed or [ ] is on file in the prior application.

10. [X] The prior application is assigned of record to: Destineer Corporation

11. [X] The power of attorney in the prior application is to at least one of the following: FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P., Reg. No. 22,540, Douglas B. Henderson, Reg. No. 20,291; Ford F. Farabow, Jr., Reg. No. 20,630; Arthur S. Garrett, Reg. No. 20,338; Donald R. Dunner, Reg. No. 19,073; Brian G. Brunsvold, Reg. No. 22,593; Tipton D. Jennings, IV, Reg. No. 20,645; Jerry D. Voight, Reg. No. 23,020; Laurence R. Hefter, Reg. No. 20,827; Kenneth E. Payne, Reg. No. 23,098; Herbert H. Mintz, Reg. No. 26,691; C. Larry O'Rourke, Reg. No. 26,014; Albert J. Santorelli, Reg. No. 22,610; Michael C. Elmer, Reg. No. 25,857; Richard H. Smith, Reg. No. 20,609; Stephen L. Peterson, Reg. No. 26,325; John M. Romary, Reg. No. 26,331; Bruce C. Zotter, Reg. No. 27,680; Dennis P. O'Reilley, Reg. No. 27,932; Allen M. Sokal, Reg. No. 26,695; Robert D. Bajefsky, Reg. No. 25,387; Richard L. Stroup, Reg. No. 28,478; David W. Hill, Reg. No. 28,220; Thomas L. Irving, Reg. No. 28,619; Charles E. Lipsey, Reg. No. 28,165; Thomas W. Winland, Reg. No. 27,605; Basil J. Lewris, Reg. No. 28,818; Martin I. Fuchs, Reg. No. 28,508; E. Robert Yoches, Reg. No. 30,120; Barry W. Graham, Reg. No. 29,924; Susan Haberman Griffen, Reg. No. 30,907; Richard B. Racine, Reg. No. 30,415; Thomas H. Jenkins, Reg. No. 30,857; Robert E. Converse, Jr., Reg. No. 27,432; Clair X. Mullen, Jr., Reg. No. 20,348; Christopher P. Foley, Reg. No. 31,354; John C. Paul, Reg. No. 30,413; David M. Kelly, Reg. No. 30,953; Kenneth J. Meyers, Reg. No. 25,146; Carol P. Einaudi, Reg. No. 32,220; Walter Y. Boyd, Jr., Reg. No. 31,738; Steven M. Anzalone, Reg. No. 32,095; Jean B. Fordis, Reg. No. 32,984; Barbara C. McCurdy, Reg. No. 32,120; James K. Hammond, Reg. No. 31,964; Richard V. Burgujian, Reg. No. 31,744; J. Michael Jakes, Reg. No. 32,824; Dirk D. Thomas, Reg. No. 32,600; Thomas W. Banks, Reg. No. 32,719; Christopher P. Isaac, Reg. No. 32,616; Bryan C. Diner, Reg. No. 32,409; M. Paul Barker, Reg. No. 32,013; Andrew Chanho Sonu, Reg. No. 33,457; David S. Forman, Reg. No. 33,694; Vincent P. Kovalick, Reg. No. 32,867; and Allen M. Lo, Reg. No. 37,059.

12. [XX] Please address all correspondence to FINNEGAN, HENDERSON, FARABOW, GARRETT and DUNNER, L.L.P., 1300 I Street, N.W., Washington, D.C. 20005-3315.

13. [ ] Recognize as associate attorney

(name, address & Reg. No.)

14. [ ] Also enclosed is

<u>PETITION FOR EXTENSION</u>. If any extension of time is necessary for the filing of this application, including any extension in the parent application, serial no. <u>08/760,457</u>, filed <u>December 6, 1996</u>, for the purpose of maintaining copendency between the parent application and this application, and such extension has not otherwise been requested, such an extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

It is understood that secrecy under 35 U.S.C. § 122 is hereby waived to the extent that if information or access is available to any one of the applications in the file wrapper of a 37 C.F.R. § 1.62 application, be it either this application or a prior application in the same file wrapper, the U.S. Patent and Trademark Office may provide similar information or access to all the other applications in the same file wrapper.

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Allen M. Lo
Allen M. Lo
Reg. No. 37,059

Date: July 24, 1997

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#13/D

PATENT
Attorney Docket No. 3680.0083-05

9/15/98 (NE) entered 9/21/98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

MAIL ROOM SEP 12 1997 PAT. & TRADEMARK OFF.

In re Application of:	)	
	)	
Dennis CAMERON et al.	)	
	)	
Serial No.: 08/899,476	)	Group Art Unit: ~~Unassigned~~ 2611
	)	
Filed: July 24, 1997	)	Examiner: Unassigned
	)	

For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

please enter 9/21/98

Prior to the examination of the above application, please amend this application as follows:

IN THE CLAIMS:

Please amend claims 2 and 16 and add new claim 25 as follows:

D1 cont.

1. ~~2~~. (Twice Amended) A multi-carrier simulcast transmission system for transmitting in a desired frequency band [a] <u>at least one</u> message contained in an information signal, the system comprising:

a first transmitter configured to transmit a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal <u>substantially</u> not represented by others of the <u>first</u> plurality of carrier signals; and

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202-408-4000

a second transmitter, spatially separated from the first transmitter, configured to transmit a second plurality of carrier signals in simulcast with the first plurality of carrier signals, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals.

D1 concld

10. ~~16.~~ (Amended) In a multi-carrier simulcast transmission system, a method for transmitting in a desired frequency band [a] at least one message contained in an information signal, the method comprising the steps of:

generating a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal substantially not represented by others of the first pluarlity of carrier signals;

generating a second plurality of carrier signals within the desired frequency band, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals;

D2 concld

transmitting the first plurality of carrier signals from a first transmitter;

transmitting the second plurality of carrier signals from a second transmitter in simulcast with transmission of the first plurality of carrier signals from the first transmitter.

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--~~25~~ 9. A multi-carrier simulcast transmission system for transmitting in a desired frequency band at least one message contained in an information signal, the system comprising:

means for transmitting a first plurality of carrier signals within the desired frequency band, each of the first plurality of carrier signals representing a portion of the information signal substantially not represented by others of the first plurality of carrier signals; and

means for transmitting a second plurality of carrier signals in simulcast with the first plurality of carrier signals, each of the second plurality of carrier signals corresponding to and representing substantially the same information as a respective carrier signal of the first plurality of carrier signals.--

D3 concl'd

REMARKS

Prior to examination, applicants have amended independent claims 2 and 16 and added new claim 25. New claim 25 defines a multi-carrier simulcast system using means-plus-function recitations, rather than structural recitations as contained in independent claim 2.

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If an extension of time required to timely file this Preliminary Amendment under 37 C.F.R. § 1.136 is not accounted for above, such extension is hereby requested and the fee for the extension should be charged to our Deposit Account No. 06-0916. If there are any other fees due in connection with the filing of this Preliminary Amendment not accounted for above, such fees should also be charged to our Deposit Account.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

By: Allen M. Lo

Allen M. Lo
Reg. No. 37,059

Dated: September 12, 1997

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WASHINGTON, D. C. 20005
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Transaction History Date 1997-09-12
Date information retrieved from USPTO Patent Application Information Retrieval (PAIR) system records at www.uspto.gov

#11
TLR
9/15/98

PATENT
Attorney Docket No. 3680.0083-05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
Dennis Cameron et al.	)	
Serial No.: 08/899,476	)	Group Art Unit: Unassigned
Filed: July 24, 1997	)	Examiner: Unassigned

For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(b), applicants bring to the attention of the Examiner the documents listed on the attached PTO 1449. This Information Disclosure Statement is being filed within three months of the filing date of the above-referenced application.

Copies of the listed documents are attached.

Applicants respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the

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202-408-4000

documents as prior art against any claim in the application and applicants determine that the cited documents do not constitute "prior art" under United States law, applicants reserve the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Allen M. Lo
Allen M. Lo
Reg. No. 37,059

Date: September 12, 1997

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT
& DUNNER, L. L. P.
1300 I STREET, N. W.
WASHINGTON, D. C. 20005
202-408-4000

OMB No. 0651-0011

INFORMATION DISCLOSURE CITATION	Atty. Docket No.	Serial No.
	3680.0083-05	08/899,476
	Applicant	
	Dennis Cameron et al.	
	Filing Date	Group
	July 24, 1997	~~2611~~ 2745

U.S. PATENT DOCUMENTS

*Examiner Initial	Document Number	Date	Name	Class	Sub Class	Filing Date If Appropriate
TL	3,488,445	01/06/70	Chang	—	—	
	3,914,554	10/21/75	Seidel	—	—	
	4,244,047	01/06/81	Perkins	—	—	
	4,506,384	03/19/85	Lucas	—	—	
	4,701,758	10/20/87	Dunkerton et al.	—	—	
	4,850,032	07/18/89	Freeburg	—	—	
	5,128,934	07/07/92	Jasinski	—	—	
	5,163,181	11/10/92	Koontz	—	—	
	5,343,499	08/30/94	Jasper et al.	—	—	
TL	5,392,452	02/21/95	Davis	—	—	

FOREIGN PATENT DOCUMENTS

	Document Number	Date	Country	Class	Sub Class	Translation Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	~~Search Report for International Application No. PCT/US93/10713~~

Examiner THANH LE	Date Considered 9/17/98

***EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.**

Form PTO 1449 **Patent and Trademark Office - U.S. DEPARTMENT OF COMMERCE**

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 93/10713

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 H04H3/00 H04Q7/04

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 5 H04H 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	WO,A,90 04314 (MOTOROLA INC.) 19 April 1990 see page 1, line 1 - page 4, line 32; claims 1,2,4,6,7,10,13; figure 2 ---	1-4,6,7
A	US,A,4 850 032 (THOMAS. A FREEBURG) 18 July 1989 see column 1, line 1 - line 52; claims 1,3,5,7; figure 1 ---	1-4,6,7
A	US,A,4 701 758 (DUNKERTON ET AL.) 20 October 1987 see column 1, line 1 - column 2, line 44; claims 1,2,10; figure 1 ---	1-4,6,7
A	US,A,4 506 384 (LUCAS) 19 March 1985 see column 1, line 1 - column 3, line 4; claim 1; figure 1 --- -/--	1-4,6,7

[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

2

Date of the actual completion of the international search	Date of mailing of the international search report
1 March 1994	06.06.94

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	DE HAAN A.J.

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

INTERNATIONAL SEARCH REPORT

Inte   onal Application No
PCT/US 93/10713

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 128 934 (JASINSKI) 7 July 1992 see column 1, line 1 - column 2, line 43; claims 1,9,16; figure 3 -----	1-4,6,7

2

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ US 93/ 10713

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. claims 1-4,6-32
2. claim 5
3. claims 33-41

For further information see form PCT/ISA/206 dated 22/03/94.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searches without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-4,6-32

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 93/10713

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9004314	19-04-90	US-A-	4918437	17-04-90
		EP-A-	0438463	31-07-91
		JP-T-	4501195	27-02-92
		US-A-	4968966	06-11-90
US-A-4850032	18-07-89	NONE		
US-A-4701758	20-10-87	NONE		
US-A-4506384	19-03-85	NONE		
US-A-5128934	07-07-92	NONE		

Form PCT/ISA/210 (patent family annex) (July 1992)

2611

#12

PATENT

Attorney Docket No. 3680.0083-05

TLR 9/15/98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OIPE DEC 19 1997 PAT. & TRADEMARK OFF.

In re Application of:	)	
Dennis W. CAMERON et al.	)	
Serial No.: 08/899,476	)	Group Art Unit: Unassigned
Filed: July 24, 1997	)	Examiner: Unassigned
	)	
For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION	)	

Assistant Commissioner for Patents
Washington, D.C. 20231

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)

Sir:

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(b), Applicants bring to the attention of the Examiner the document listed on the attached PTO 1449. This Information Disclosure Statement is being filed, insofar as the undersigned is aware, before the mailing date of a first Office Action on the merits for the above-referenced application.

The document listed in this Information Disclosure Statement was cited in a communication from the European Patent Office in a counterpart foreign application, and this Information Disclosure Statement is being filed within three months of the mailing date of that communication.

A copy of the listed document is attached.

Applicants respectfully request that the Examiner consider the listed document and

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indicate that it was considered by making the appropriate notation on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that the listed document is material or constitutes "prior art." If the Examiner applies the document as prior art against any claim in the application and Applicants determine that the cited document does not constitute "prior art" under United States law, Applicants reserve the right to present to the Office the relevant facts and law regarding the appropriate status of such document.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed document, should the listed document be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Robert A. Cahill
Robert A. Cahill
Reg. No. 20,557

Dated: December 19, 1997

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202-408-4000

OMB No. 0651-0011

INFORMATION DISCLOSURE CITATION
(Use several sheets if necessary)

Atty. Docket No.	03680.0083-05	Serial No.	08/899,476
Applicant	Dennis W. CAMERON et al		
Filing Date	July 24, 1997	Group	~~Unassigned~~ 2745

OIPE DEC 19 1997 PAT. & TRADEMARK OFF.

U.S. PATENT DOCUMENTS

Examiner Initial*		Document Number	Date	Name	Class	Sub Class	Filing Date If Appropriate

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Sub Class	Translation Yes or No
TL		WO 90/04314	19.04.90	EPO	—	—	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

Examiner THANH LE	Date Considered 9/17/98

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form PTO 1449 — Patent and Trademark Office - U.S. Department of Commerce

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/899,476	07/24/97	CAMERON	D 3680.0083-05

LM61/0416
FINNEGAN HENDERSON FARABOW GARRETT
AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

EXAMINER	
LE, T	
ART UNIT	**PAPER NUMBER**
2745	8

DATE MAILED: 04/16/98

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

NOTICE OF ALLOWABILITY

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 and Issue Fee Due or other appropriate communication will be mailed in due course.

☑ This communication is responsive to Pre-amendment filed 7/24/97.

☑ The allowed claim(s) is/are 2 and 8-24, renumbered 1-18.

☐ The drawings filed on ______ are acceptable.

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE **THREE MONTHS** FROM THE "DATE MAILED" of this Office action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

☑ Applicant MUST submit NEW FORMAL DRAWINGS

☐ because the originally filed drawings were declared by applicant to be informal.

☑ including changes required by the Notice of Draftperson's Patent Drawing Review, PTO-948, attached hereto or to Paper No. 5.

☑ including changes required by the proposed drawing correction filed on 12/6/96, which has been approved by the examiner.

☐ including changes required by the attached Examiner's Amendment/Comment.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftperson.

☐ Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any response to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

☐ Interview Summary, PTO-413

☐ Examiner's Amendment/Comment

☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

☑ Examiner's Statement of Reasons for Allowance

T. LE (703) 305-4819

PTOL-37 (Rev. 10/95)

☆ U.S. GOVERNMENT PRINTING OFFICE: 1997—429-299

1. The following is an Examiner's Statement of Reasons for Allowance:

As to claims 2 and 16, the prior art of record fails to show a multi-carrier simulcast transmission system comprising the first and second transmitters for simultaneously transmitting the same information signals. The system comprises a plurality of carrier signals in each of the transmitters wherein each of the carrier signals represents a portion of the information signal not represented by others of the plurality carrier signals.

Any comments considered necessary by applicant must be submitted no later than the payment of the Issue Fee and, to avoid processing delays, should preferably **accompany** the Issue Fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Le whose telephone number is (703) 305-4819.

Thanh C. Le
Apr 10, 1998

4-10-98
THANH CONG LE
PRIMARY EXAMINER
GROUP 2700

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

LM61/0416

FINNEGAN HENDERSON FARABOW GARRETT
AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/899,478	07/24/97	018	LE, T	2745	04/16/98

First Named Applicant: CAMERON, DENNIS WAYNE

TITLE OF INVENTION: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 3680.0083-05	455-059.000	D05	UTILITY	NO	$1320.00	07/16/98

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. <u>PROSECUTION ON THE MERITS IS CLOSED.</u>

THE ISSUE FEE MUST BE PAID WITHIN <u>THREE MONTHS</u> FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. <u>THIS STATUTORY PERIOD CANNOT BE EXTENDED.</u>

HOW TO RESPOND 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 changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or

B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

A. Pay FEE DUE shown above, or

B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give application number and batch number. Please direct all communications prior to issuance to Box 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.

PATENT AND TRADEMARK OFFICE COPY

PTOL-85 (REV. 10-96) Approved for use through 06/30/99. (0651-0033)

*U.S. GPO: 1998-437-639/80023

PART B—ISSUE FEE TRANSMITTAL

142-1320-CO

Complete an... ...ail this form, together w... appli... ...e fees, to: **Box ISSUE FEE**
Assistant Commissioner for Patents
Washington, D.C. 20231

MAILING INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE. Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, 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: Legibly mark-up with any corrections or use Block 1)

LM61/0416
FINNEGAN HENDERSON FARABOW GARRETT
AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

OIPE
JUN 1 6 1998
PATENT & TRADEMARK OFFICE

Note: The certificate of mailing below can only be used for domestic mailings of the Issue Fee 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.

Certificate of Mailing

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/899,476	07/24/97	018	LE, T	2745	04/16/98

First Named Applicant: CAMERON, DENNIS WAYNE

TITLE OF INVENTION: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 3680.0083-05	455-059.000	D05	UTILITY	NO	$1320.00	07/16/98

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

☐ 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) attached.

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 Finnegan, Henderson, Farabow, Garrett & Dunner
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. Inclusion of assignee data is only appropiate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a subsititue for filing an assignment.
(A) NAME OF ASSIGNEE
DESTINEER CORPORATION
(B) RESIDENCE: (CITY & STATE OR COUNTRY)
Jackson, Mississippi
Please check the appropriate assignee category indicated below (will not be printed on the patent)
☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):
☒ Issue Fee
☐ Advance Order - # of Copies ____

4b. The following fees or deficiency in these fees should be charged to:
DEPOSIT ACCOUNT NUMBER ____
(ENCLOSE AN EXTRA COPY OF THIS FORM)
☐ Issue Fee
☐ Advance Order - # of Copies ____

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above.

(Authorized Signature) (Date)
John M. Romary, Reg. No. 26,331 6/16/98

NOTE: The Issue Fee 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 Patent and Trademark Office.

06/22/1998 SHARRELL 00000092 08899476
01 FC:142 1320.00 OP

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending on the needs of the individual case. Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND FEES AND THIS FORM TO: Box Issue Fee, Assistant Commissioner for Patents, Washington D.C. 20231

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.

TRANSMIT THIS FORM WITH FEE

PTOL-85B (REV.10-96) Approved for use through 06/30/99. OMB 0651-0033 Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

27N2 D TR

#9

Attorney Docket No. 3680.0083-05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
Dennis W. CAMERON et al.	)	Group Art Unit: 2745
Serial No.: 08/899,476	)	Examiner: T. Le
Filed: July 24, 1997	)	**Allowed: April 16, 1998**
For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION	)	**Batch No. D05**

RECEIVED JUN 16 1998 07

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

SUBMISSION OF FORMAL DRAWINGS

Subject to the approval of the Examiner, please replace the informal drawings with the thirty (30) sheets of formal drawings filed herewith. If the formal drawings for any reason are not in full compliance with the pertinent statutes and regulations, please so advise the undersigned. If any fees are necessary for the submission of these formal drawings, please charge our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

By: John M. Romary
Reg. No. 26,331

Dated: June 16, 1998

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1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

5915210

FIG. 1
PRIOR ART

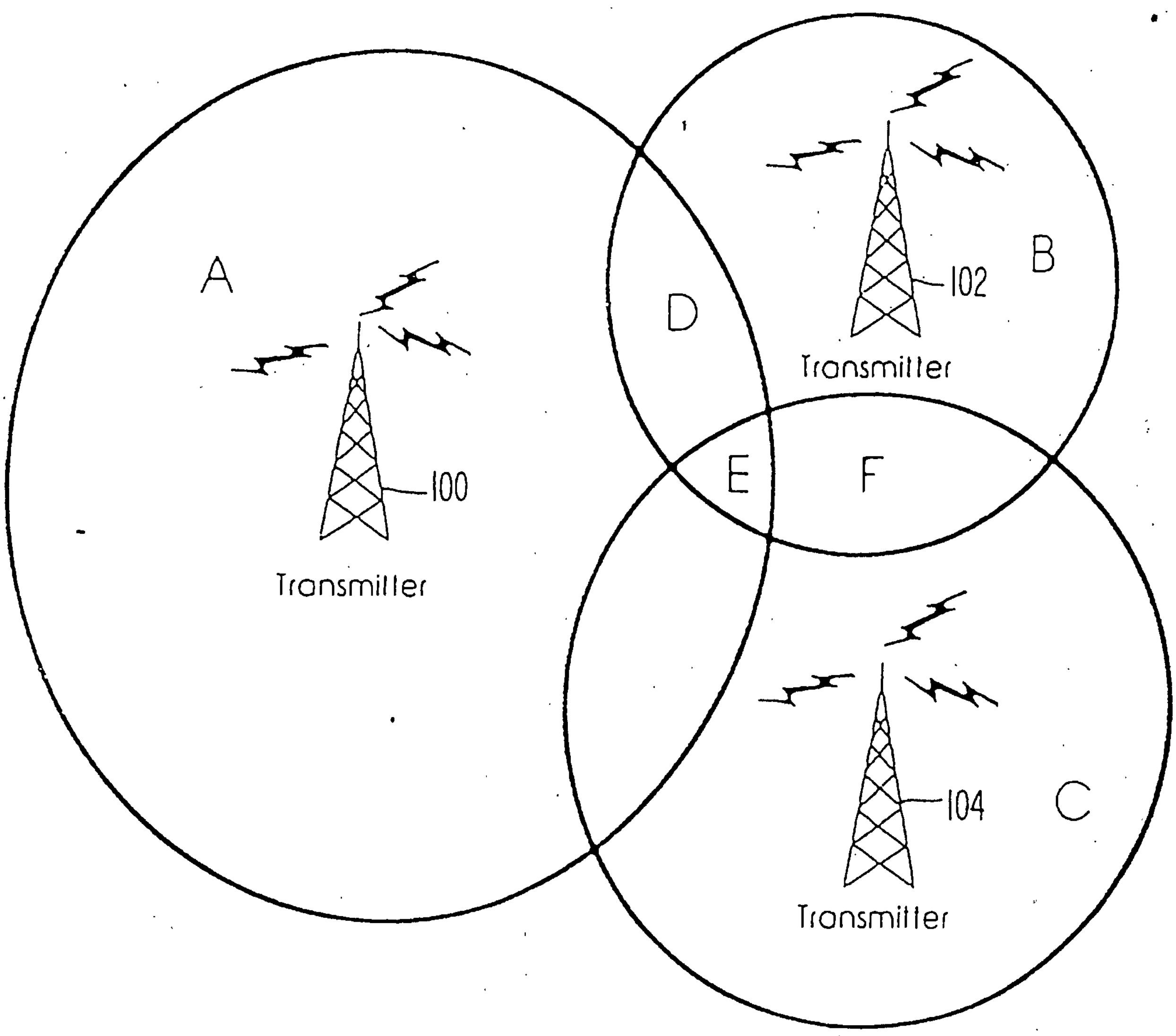
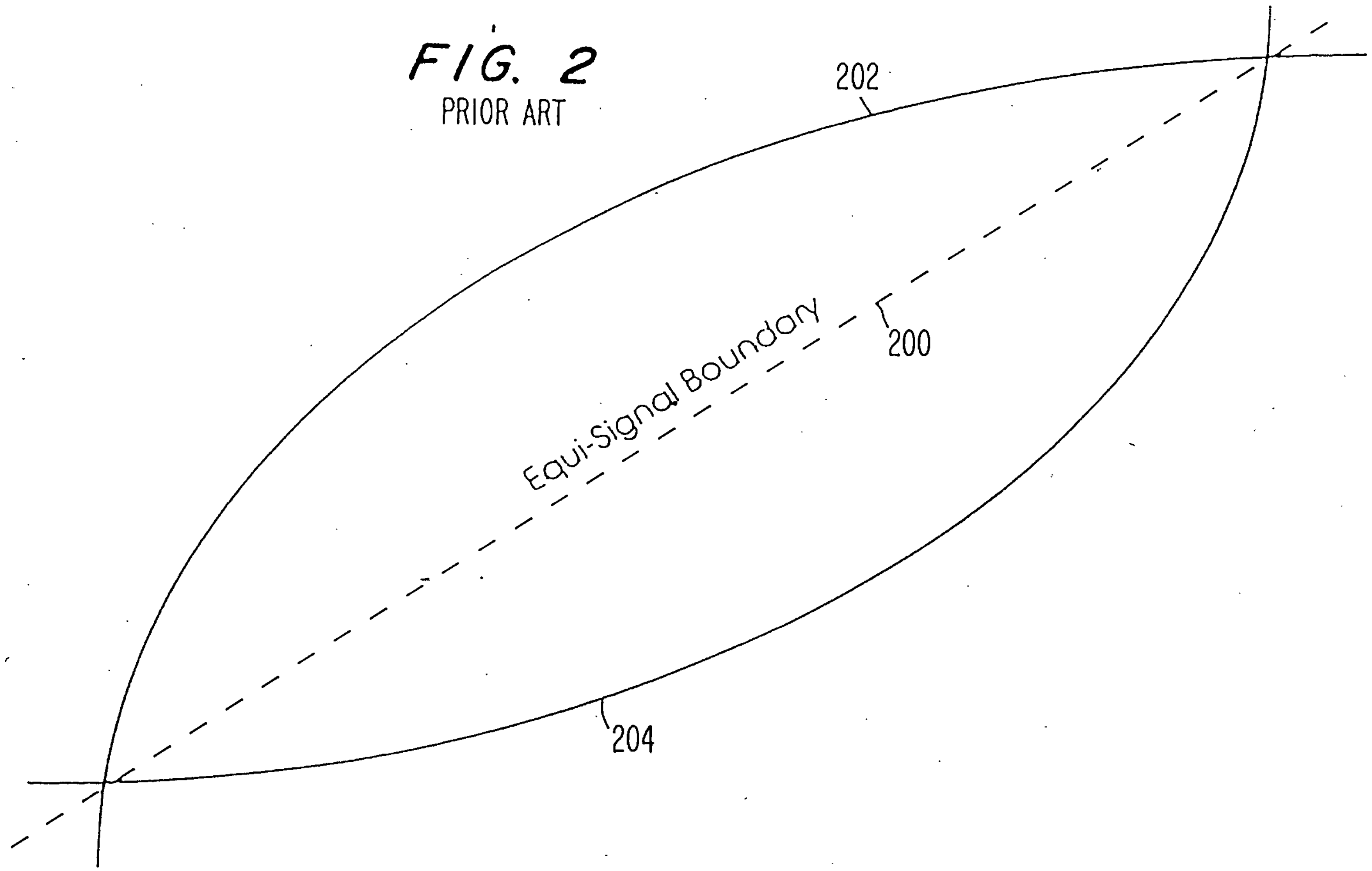


FIG. 2
PRIOR ART



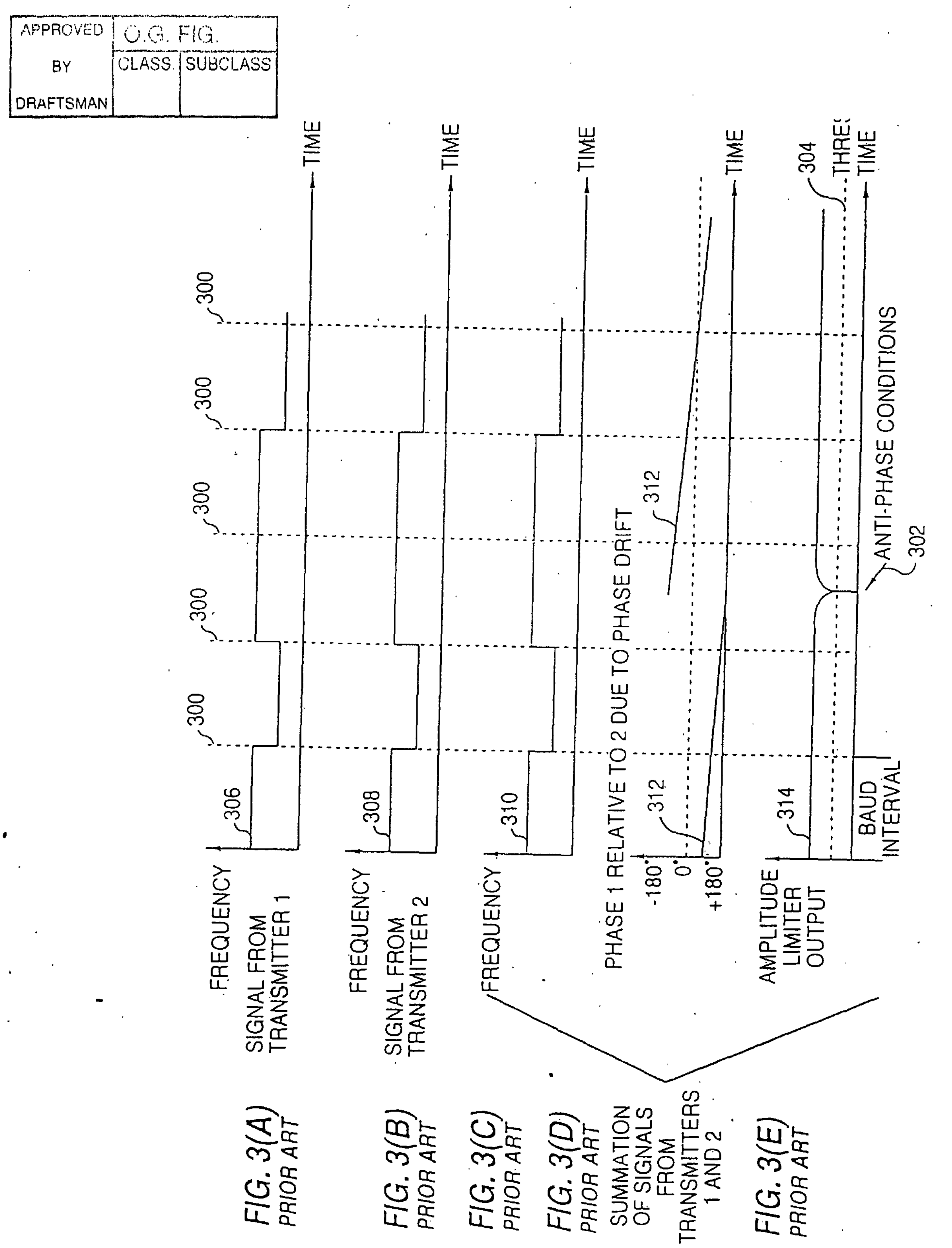


FIG. 3(A) PRIOR ART

FIG. 3(B) PRIOR ART

FIG. 3(C) PRIOR ART

FIG. 3(D) PRIOR ART SUMMATION OF SIGNALS FROM TRANSMITTERS 1 AND 2

FIG. 3(E) PRIOR ART

APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

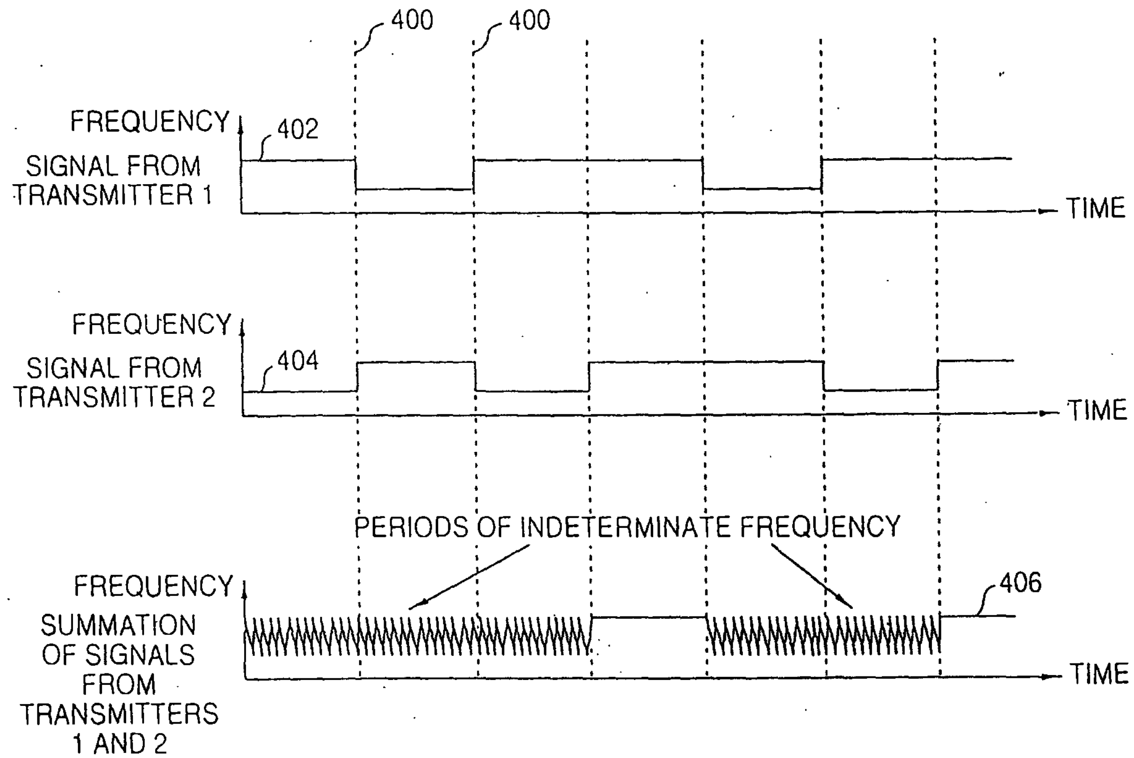


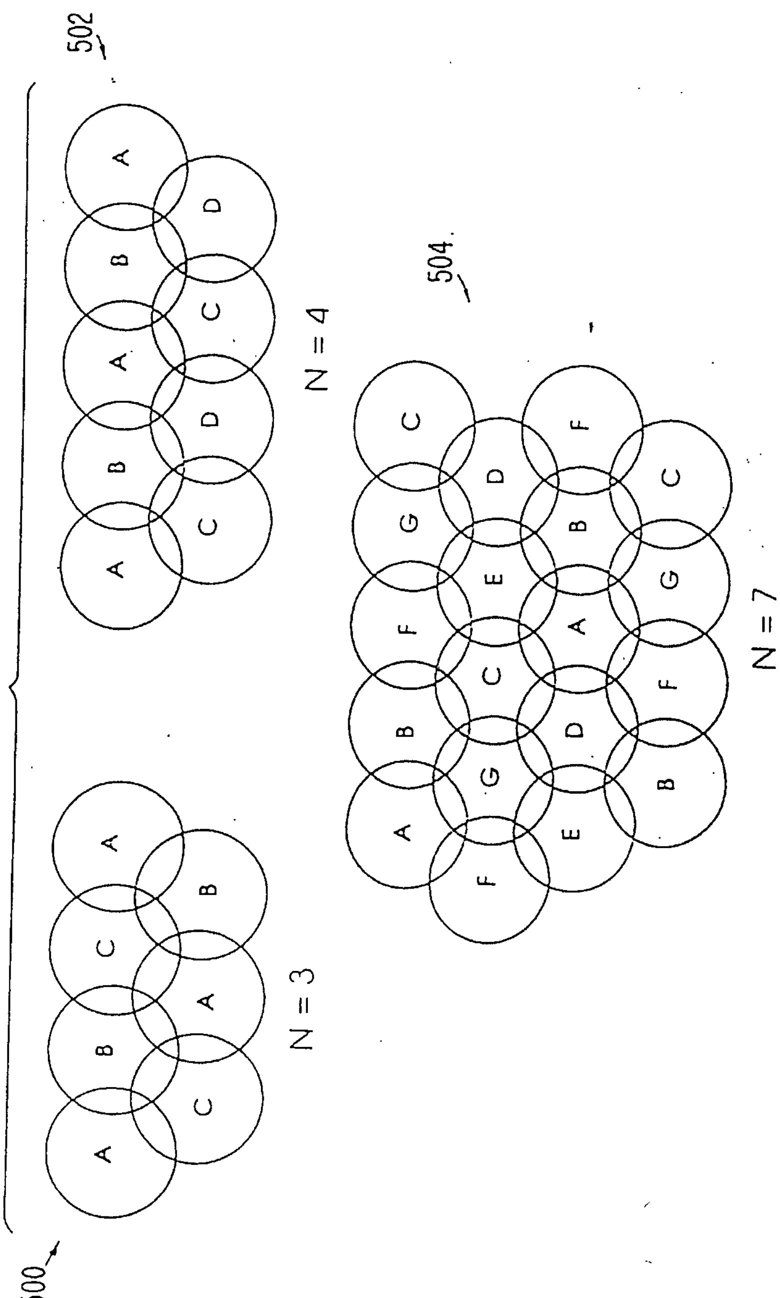
FIG. 4(A)
PRIOR ART

FIG. 4(B)
PRIOR ART

FIG. 4(C)
PRIOR ART

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 5 PRIOR ART



APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 6

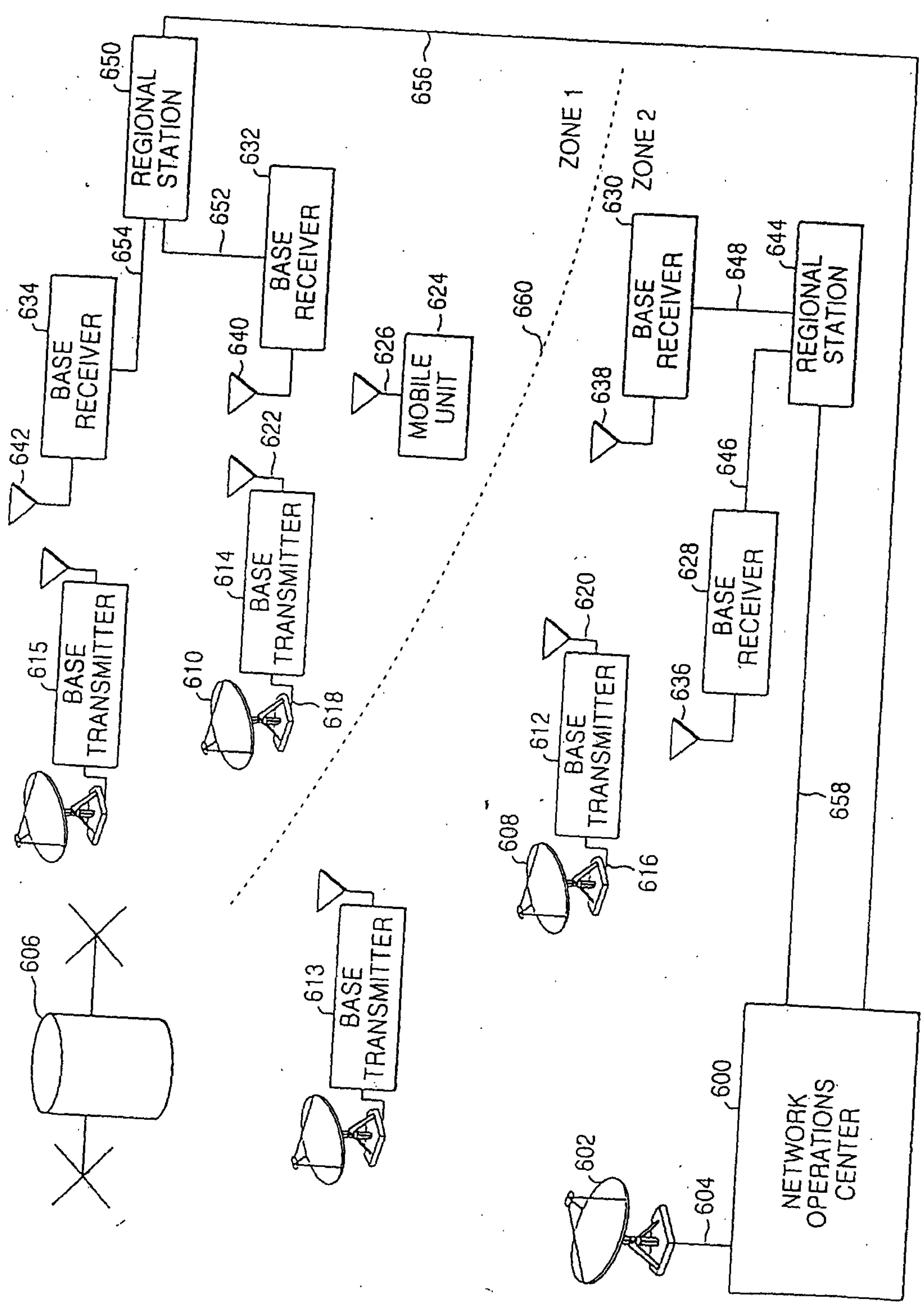
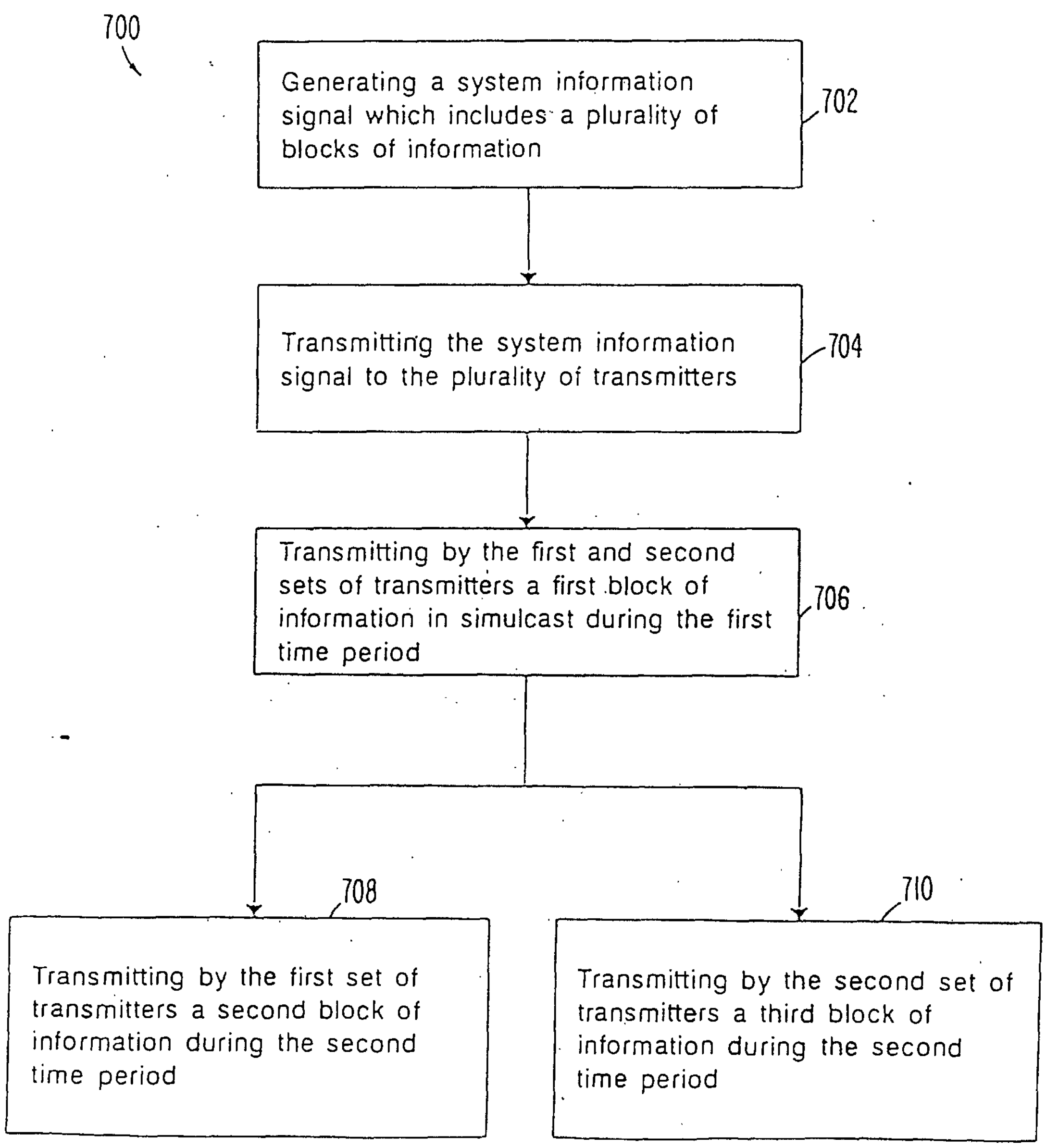
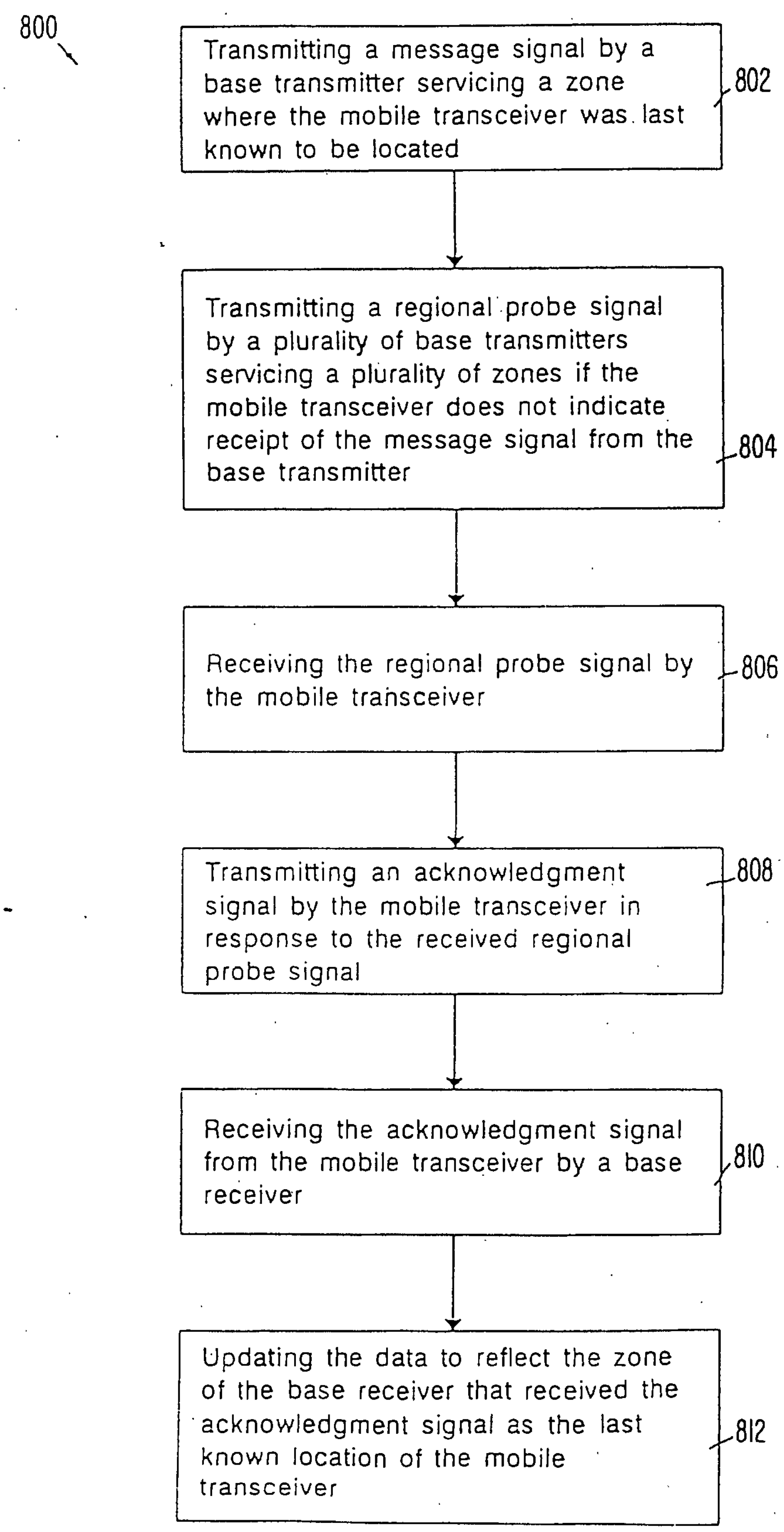


FIG. 7


700
Generating a system information signal which includes a plurality of blocks of information
702
Transmitting the system information signal to the plurality of transmitters
704
Transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period
706
708
Transmitting by the first set of transmitters a second block of information during the second time period
710
Transmitting by the second set of transmitters a third block of information during the second time period

APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 8



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

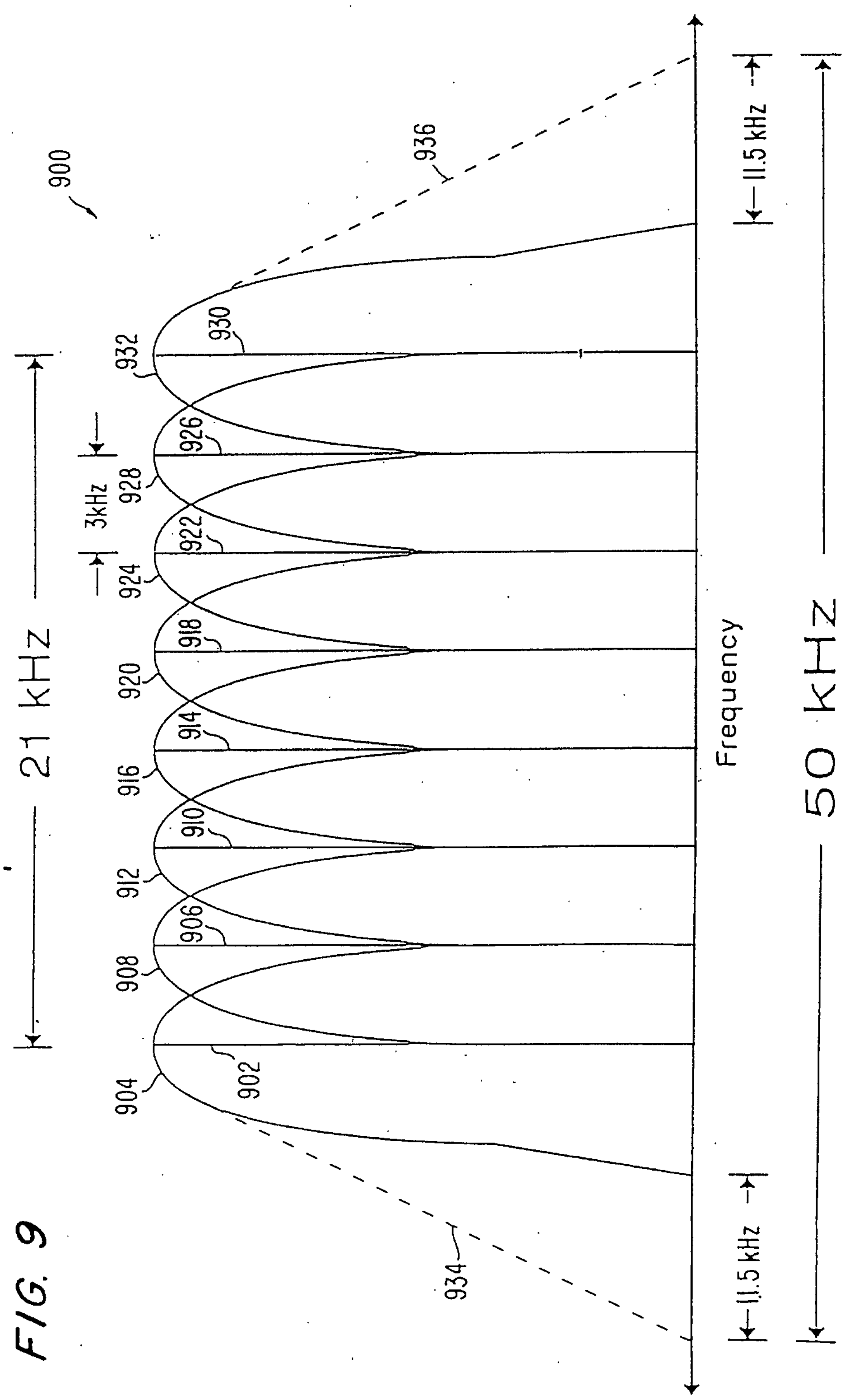
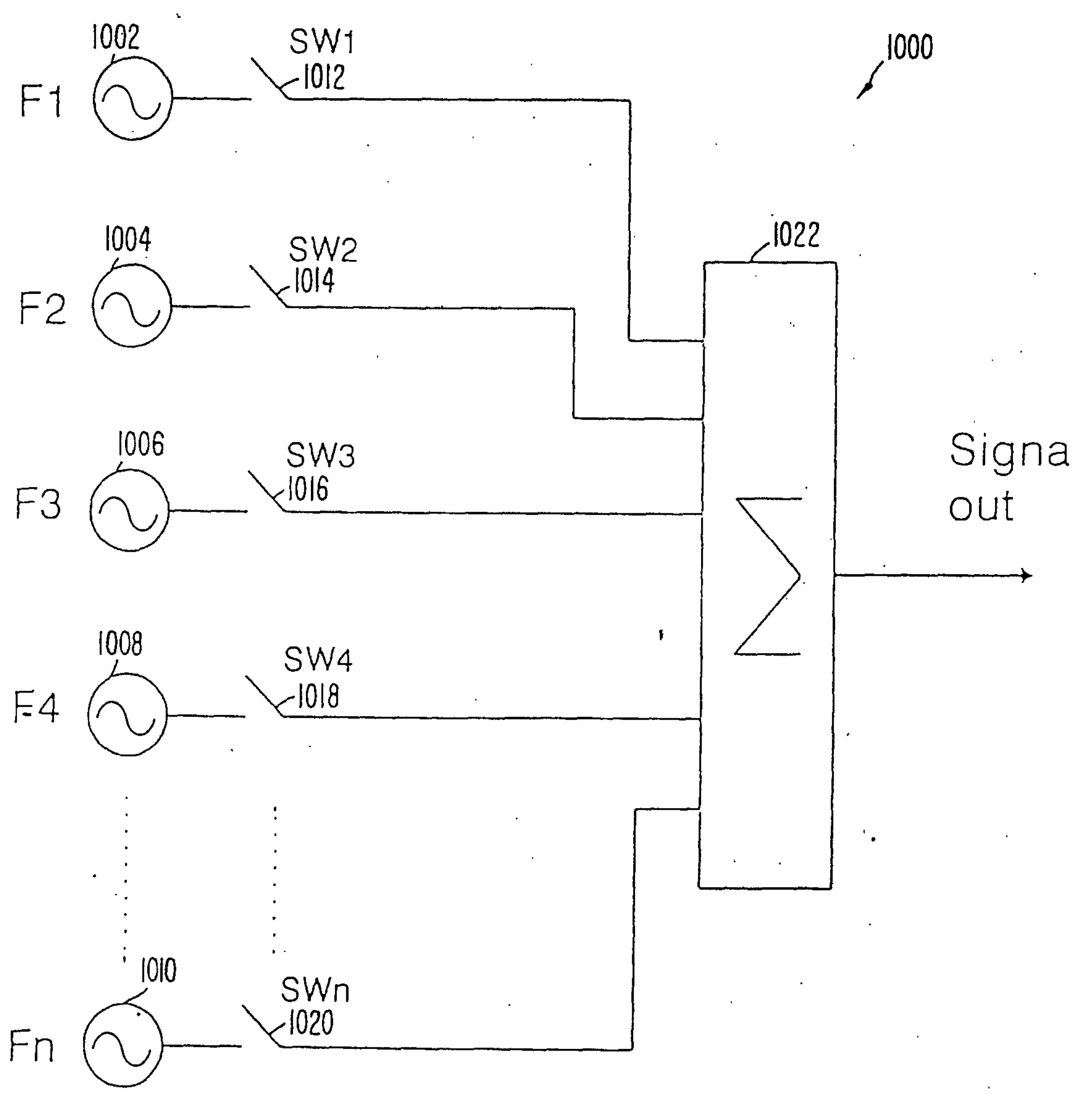


FIG. 9

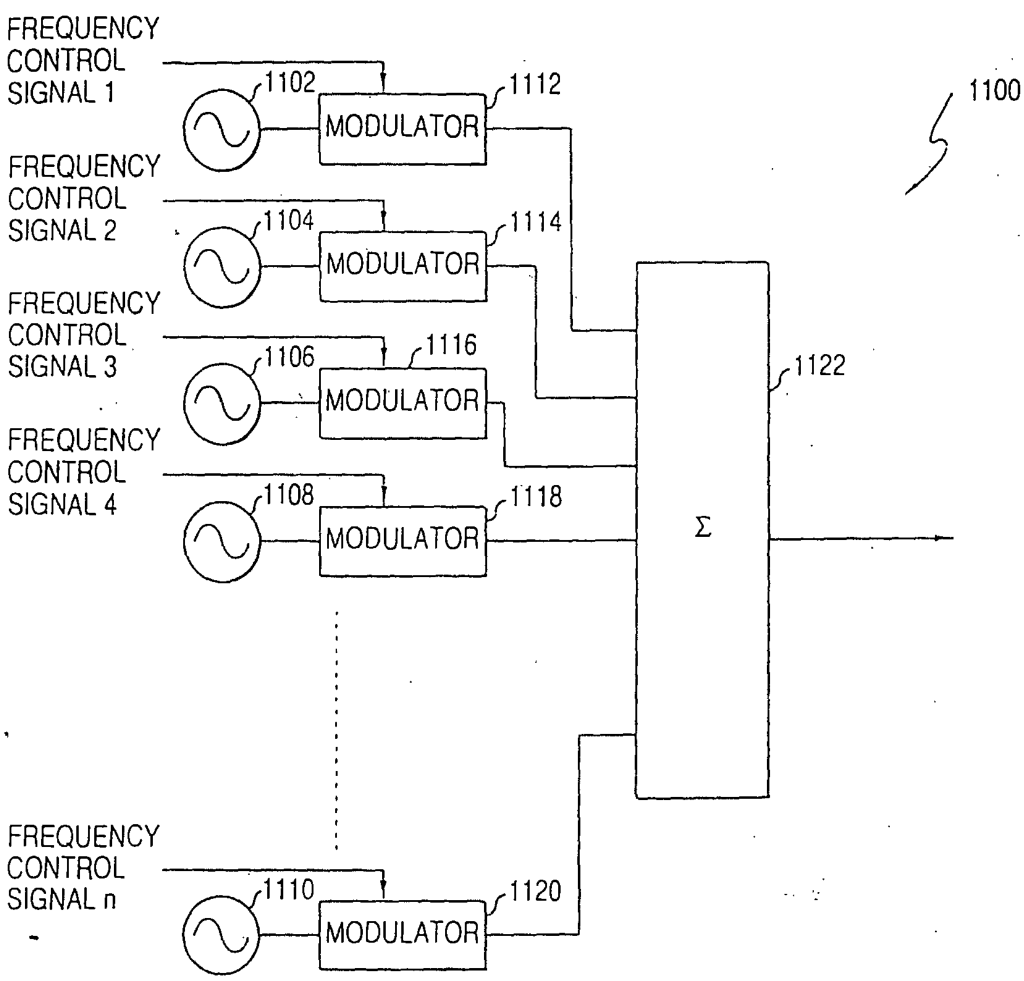
APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

FIG. 10



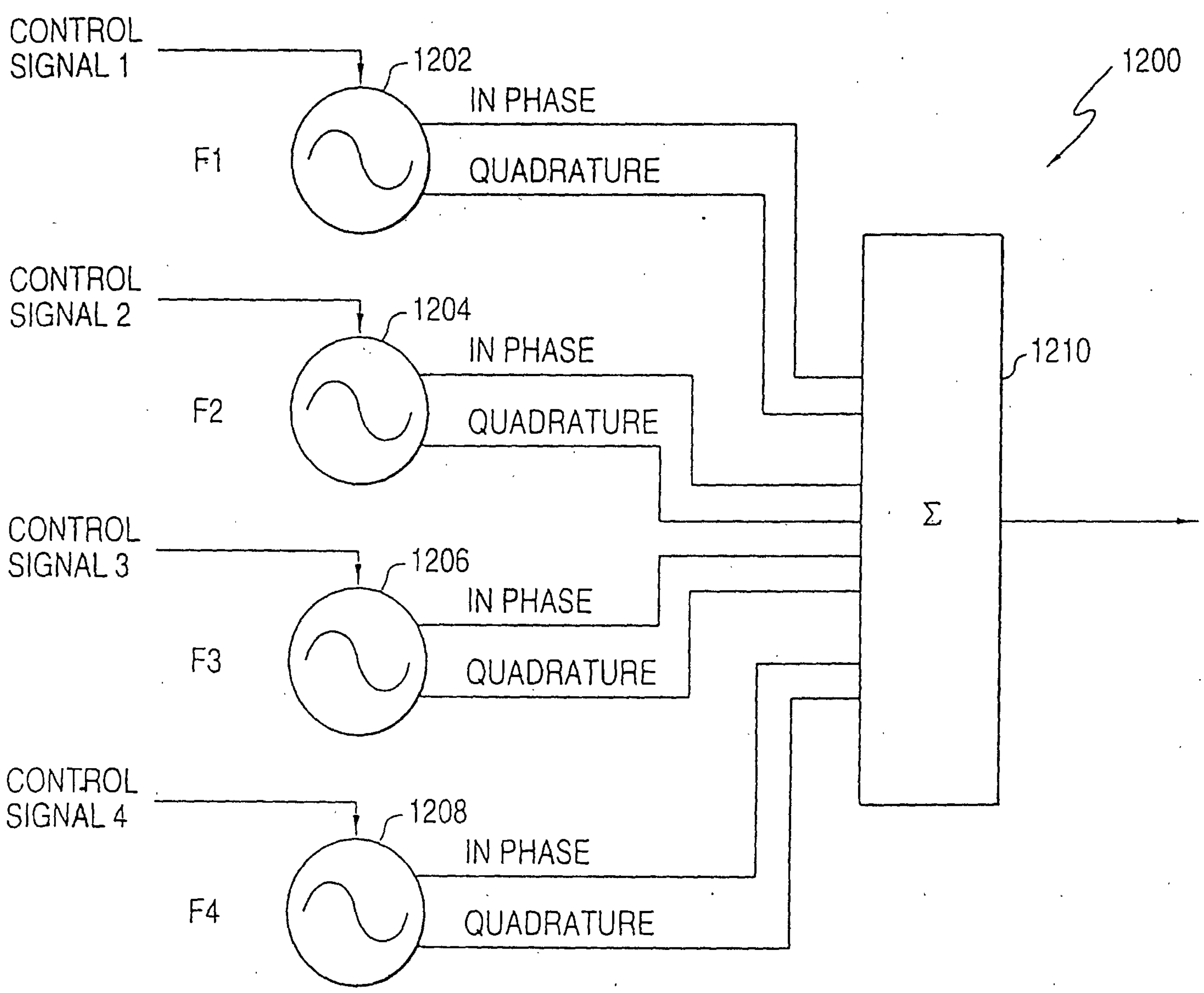
APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 11



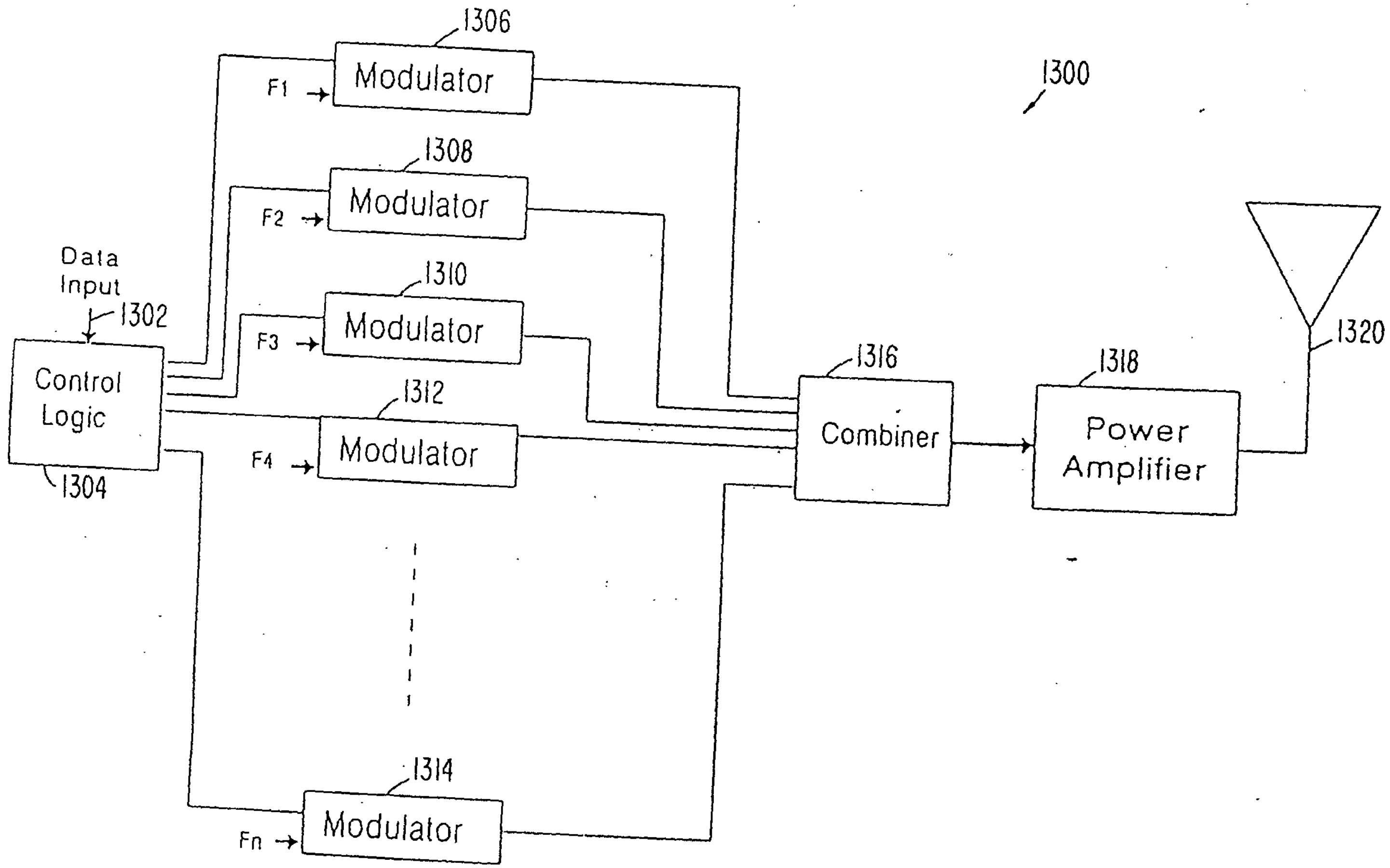
APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 12



FOUR CARRIER QUADRATURE MODULATOR

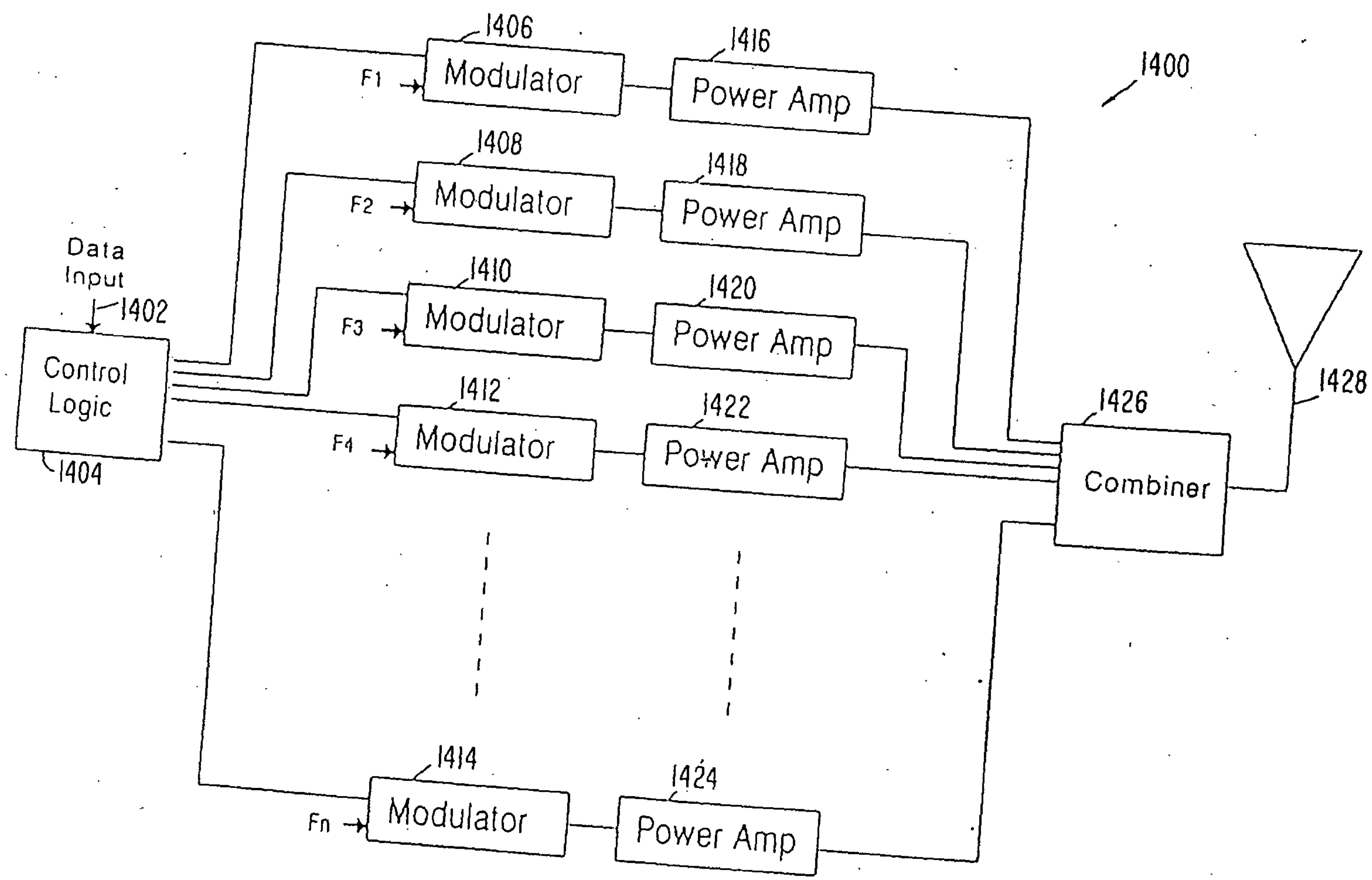
FIG. 13 Base Transmitter



APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

FIG. 14

Base Transmitter



APPROVED	O.G. FIG.	
BY	CLASS	SUBCLASS
DRAFTSMAN		

APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

FIG. 15

Mobile Transceiver

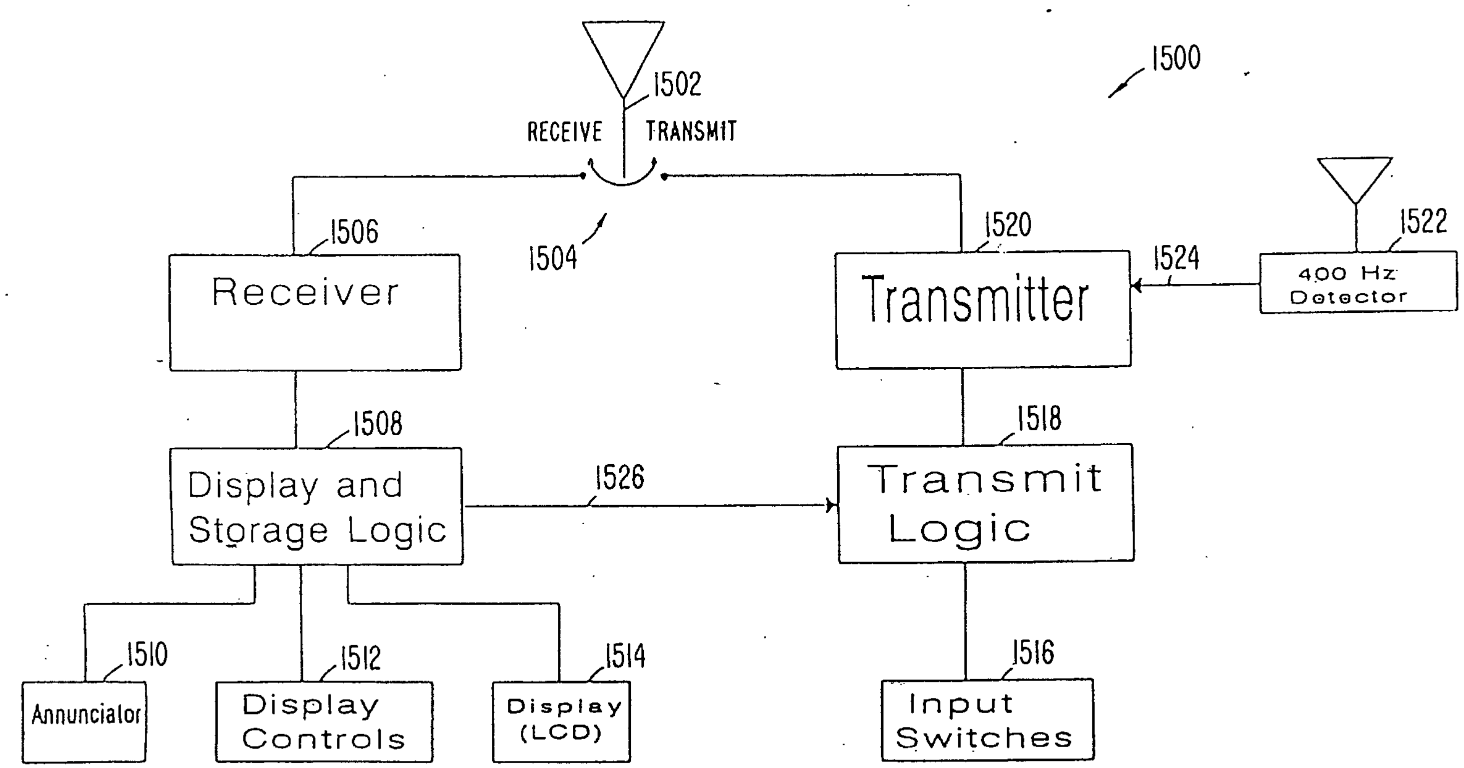
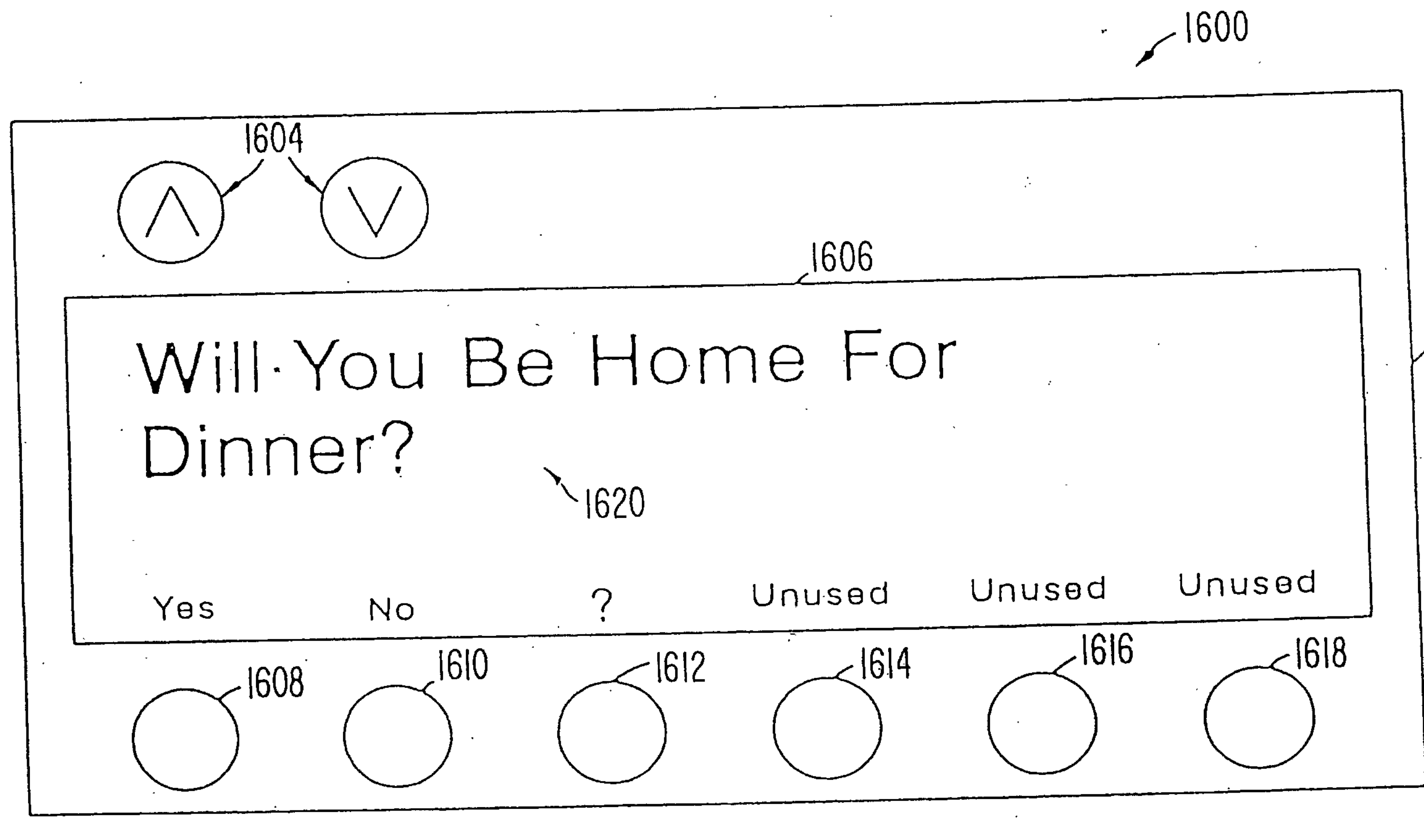


FIG. 16

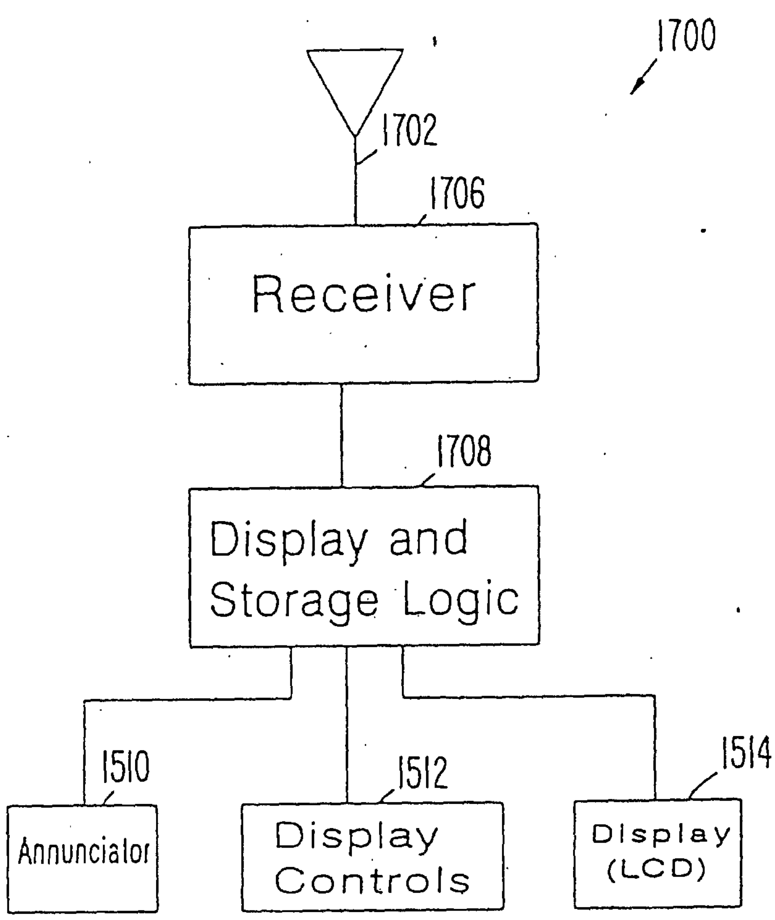


Mobile Transceiver

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 17

Mobile Receiver



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 18(A)

Analog Base Receiver

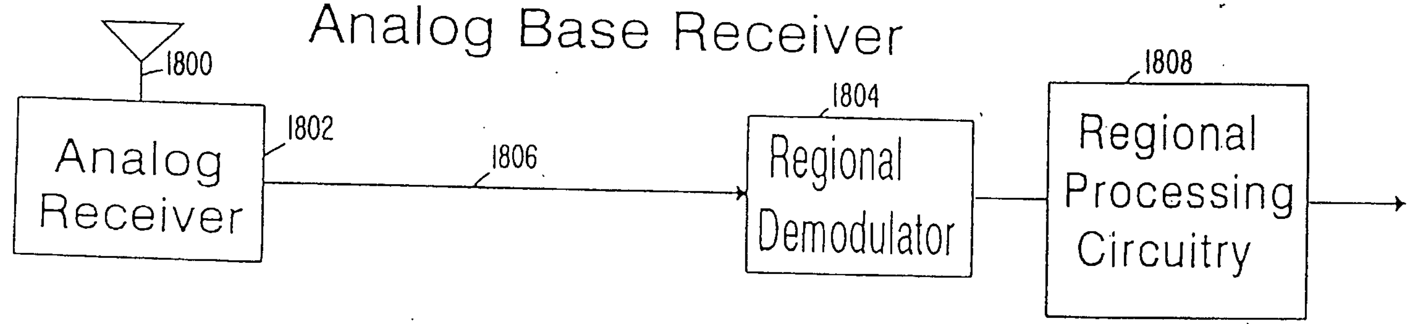
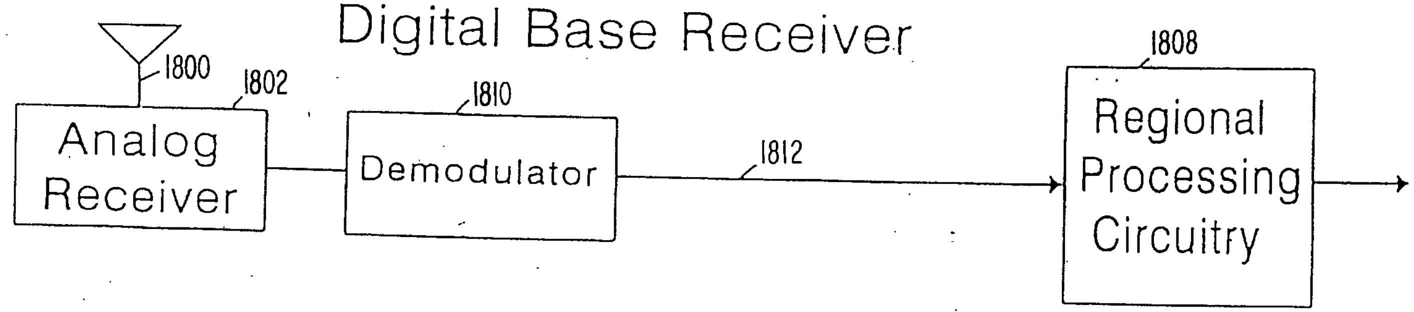


FIG. 18(B)

Digital Base Receiver



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 19

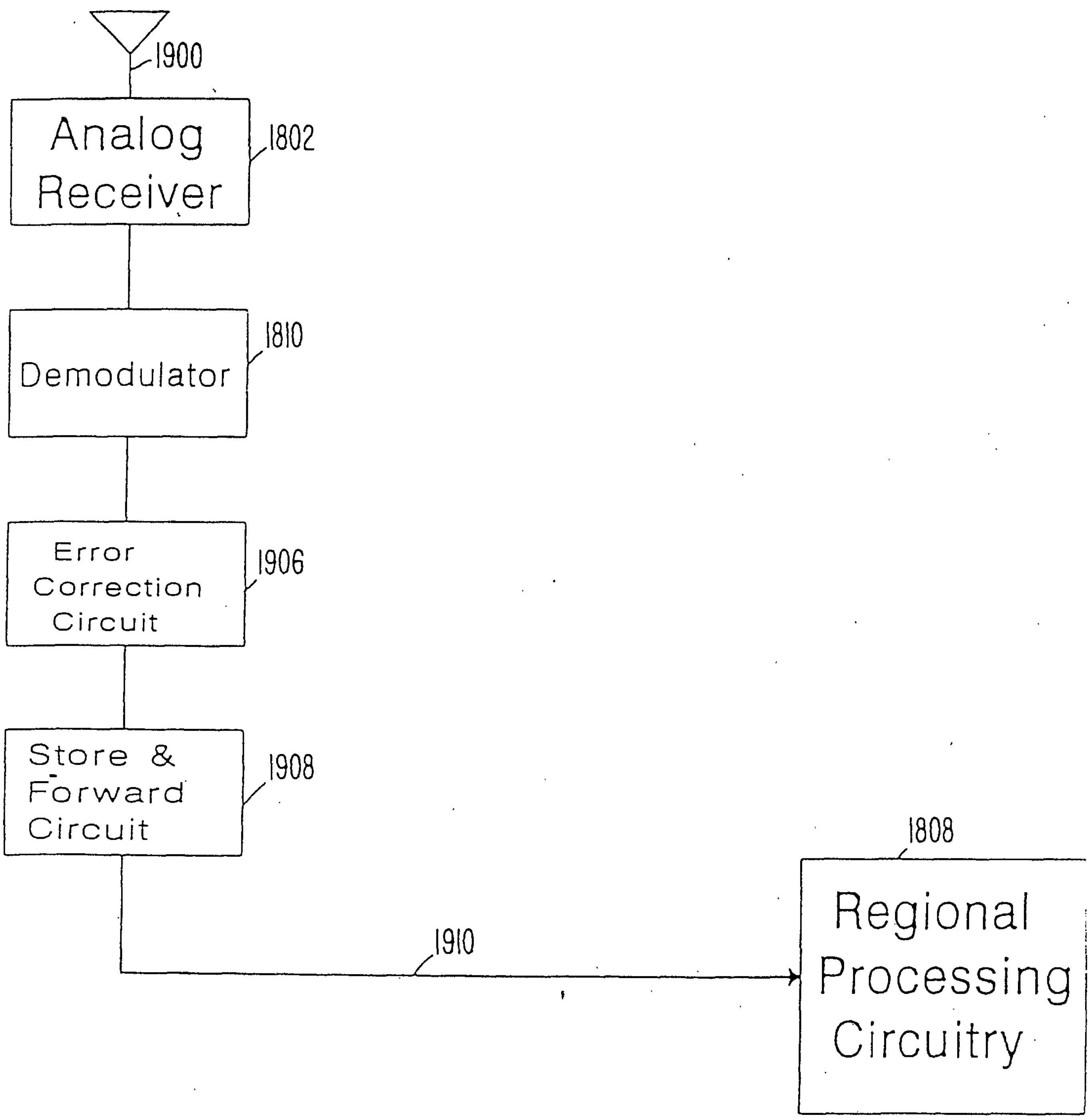
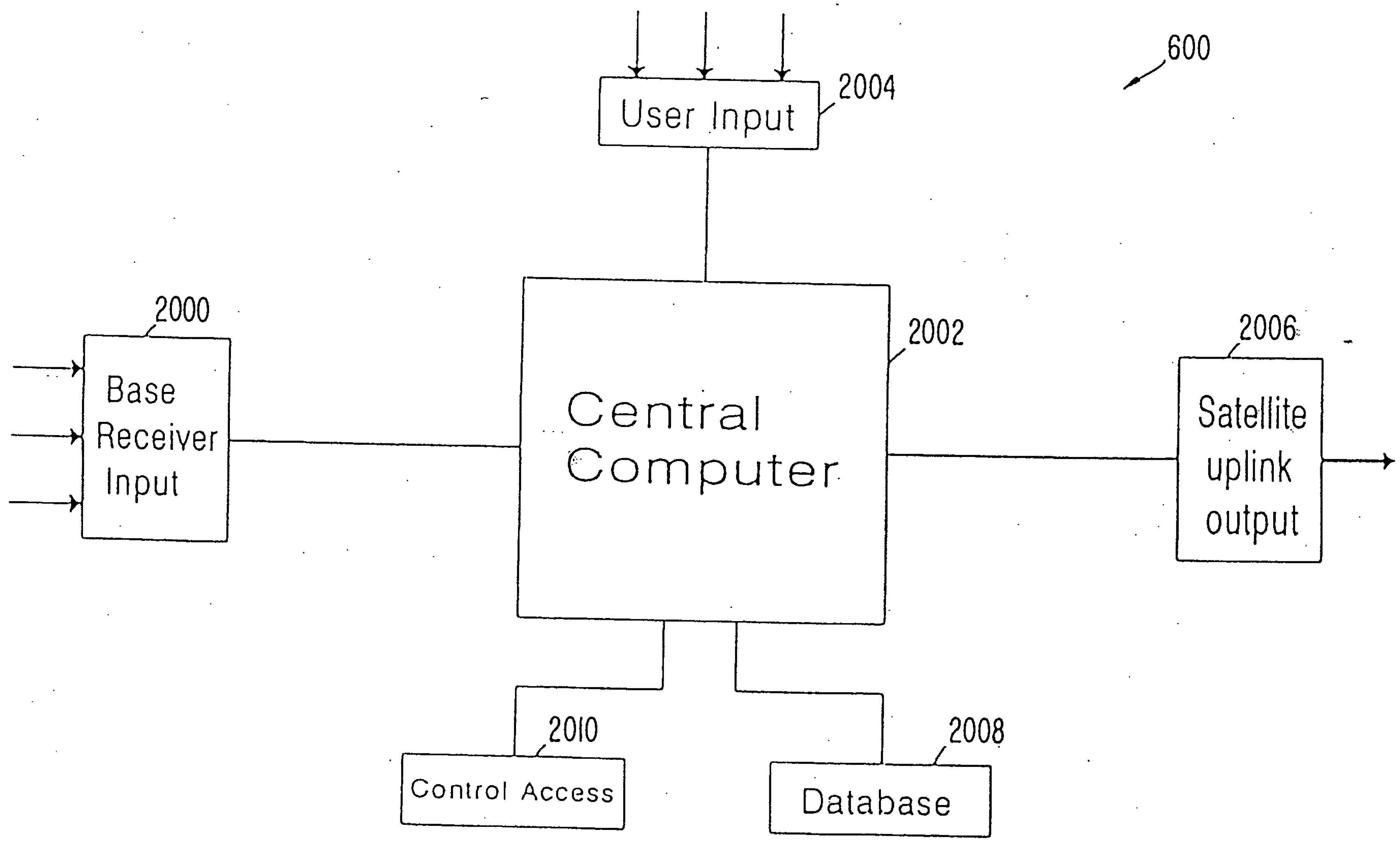


FIG. 20

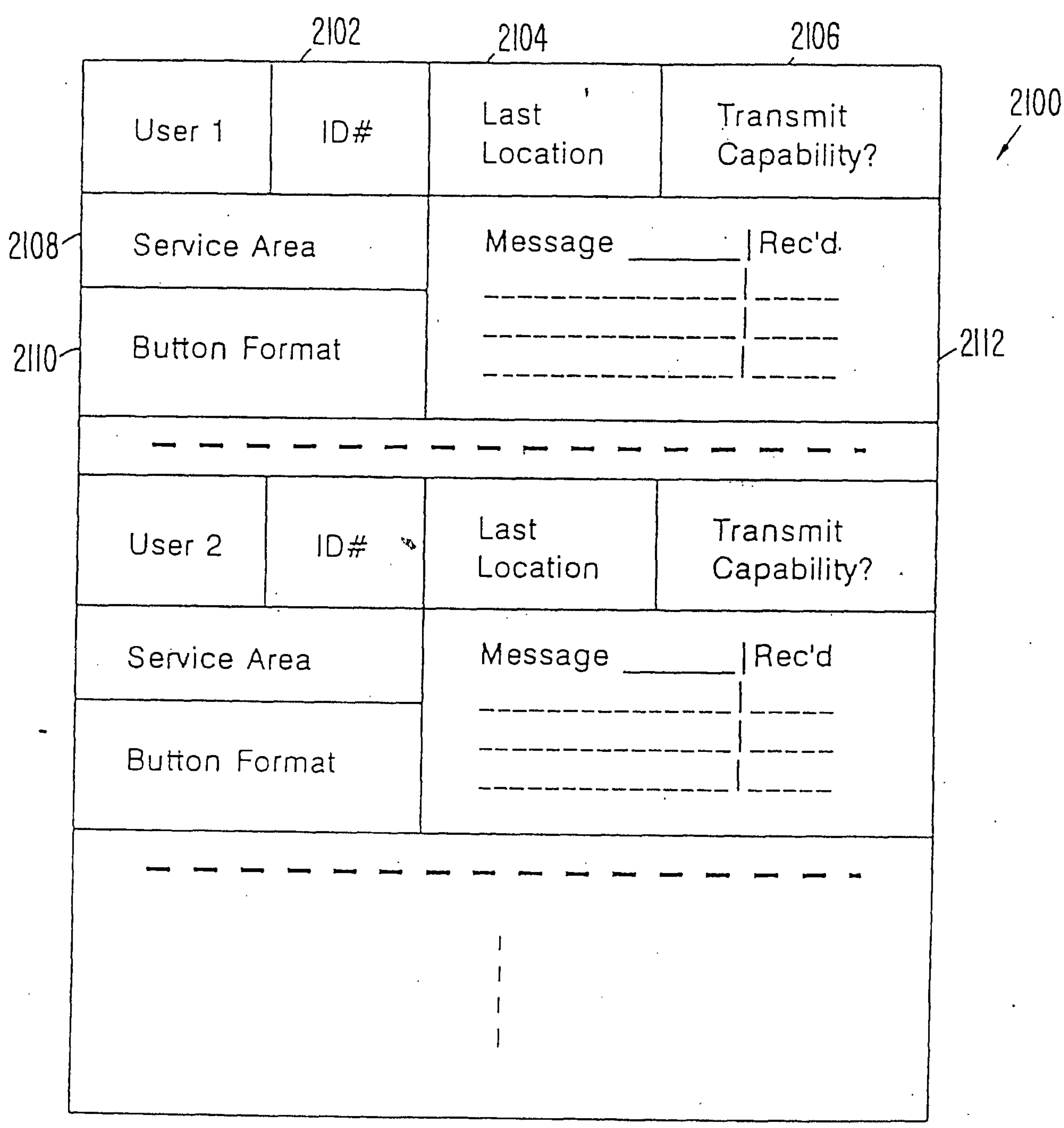
Network Operations Center



APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

FIG. 21



User Database

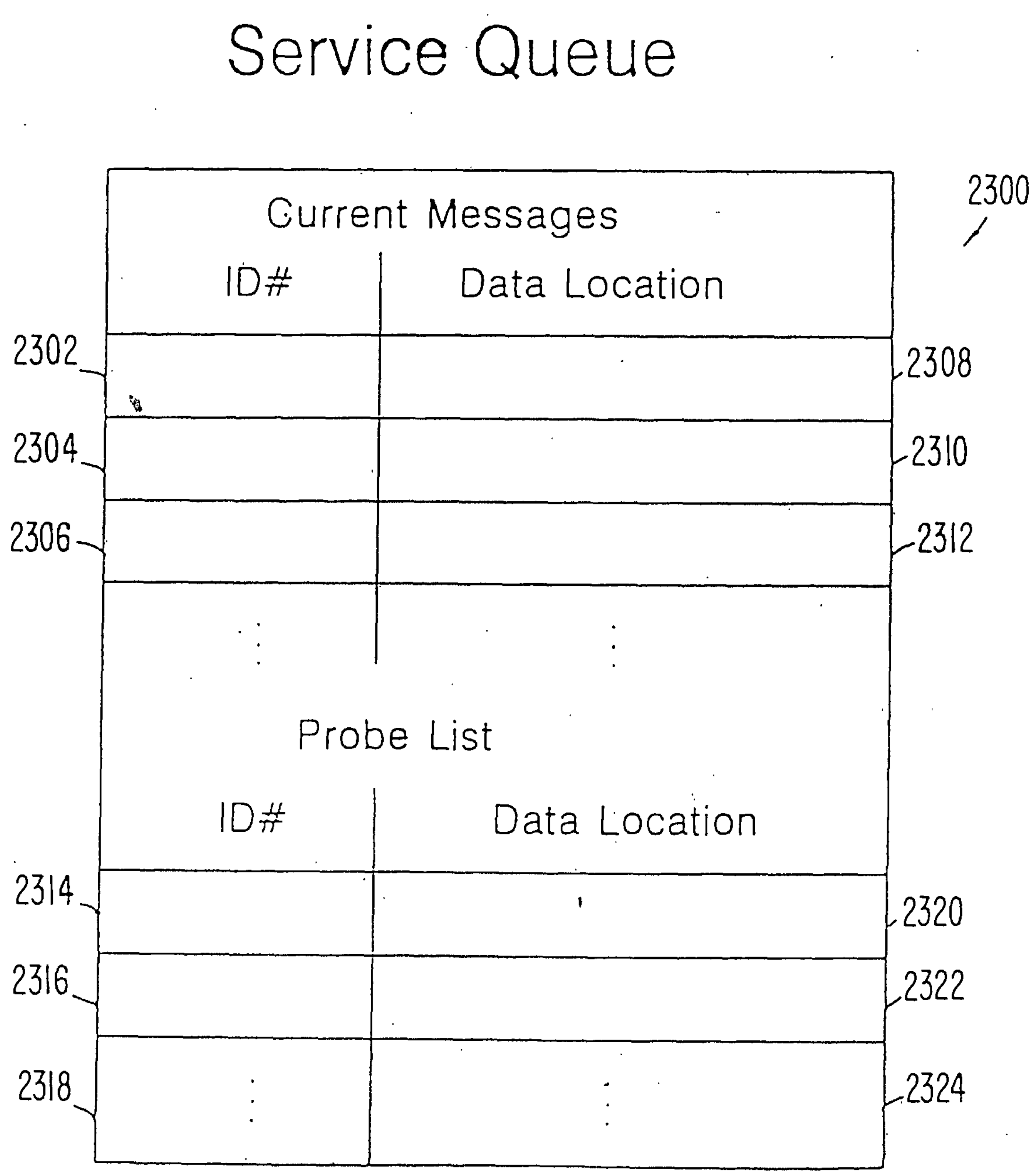
FIG. 22

2200

2202	2204	2206	2208	2210
User 1	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 2	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 3	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 4	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
. . .				

Traffic Database

FIG. 23


Service Queue
2300
Current Messages
ID#
Data Location
2302
2304
2306
2308
2310
2312
Probe List
ID#
Data Location
2314
2316
2318
2320
2322
2324

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 24

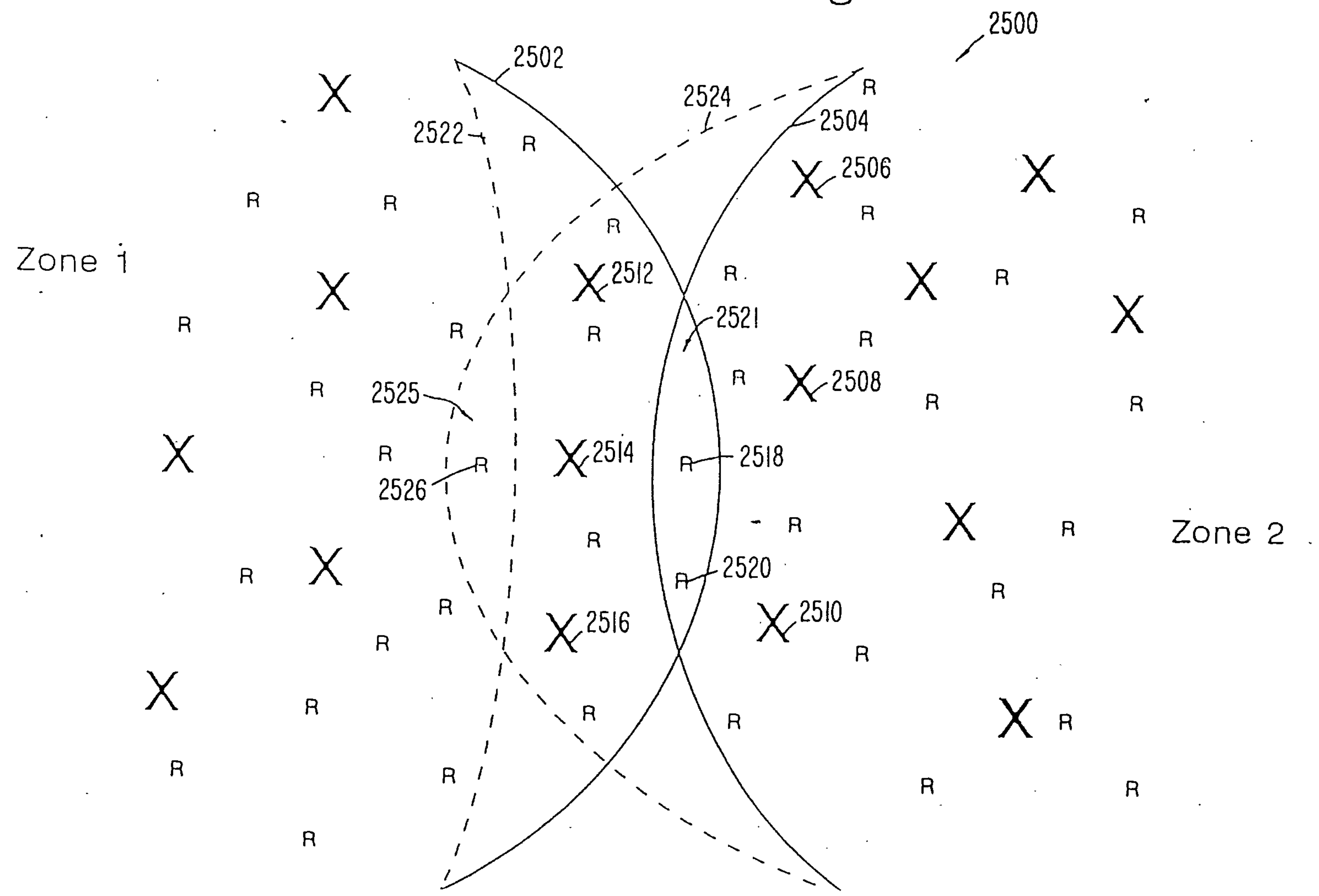
2400

2402	2404	2406	2408
Base Transmitter 1	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 2	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 3	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 4	Zonal Assignment	Base Receivers in Coverage Area	Other Data
	■ ■ ■		

Base Transmitter Database

FIG. 25

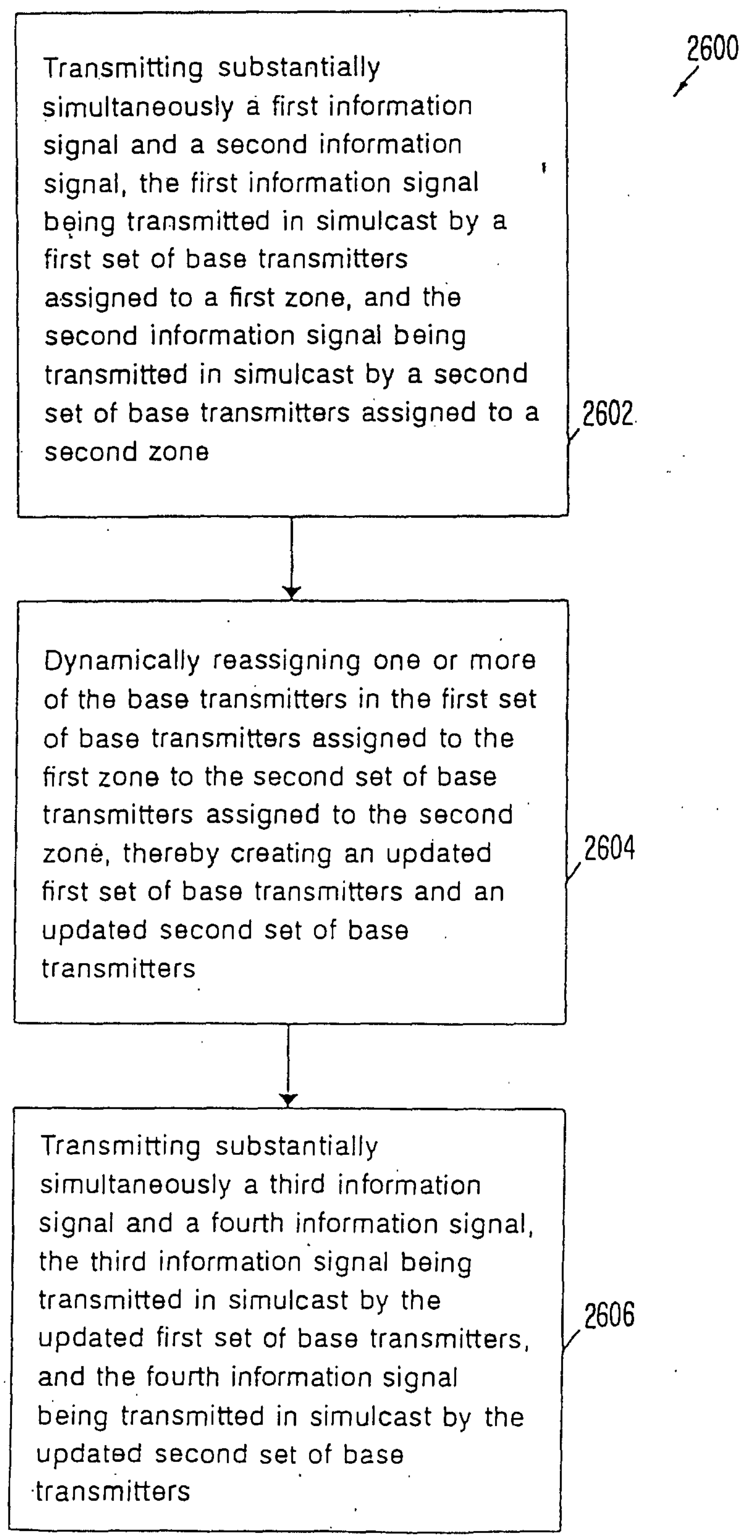
Zone Dithering



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 26



APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

FIG. 27(A)

Cycle Protocol

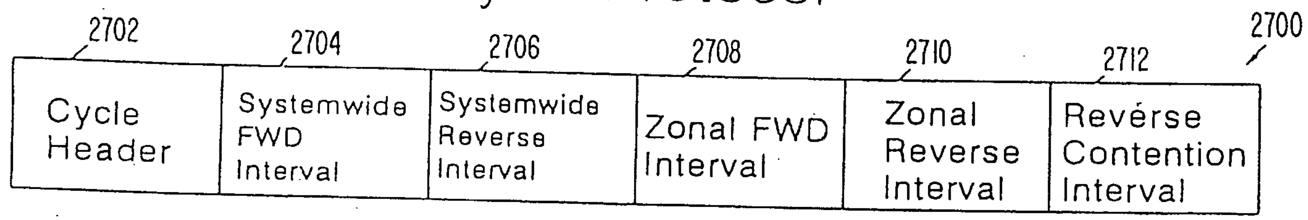


FIG. 27(B)

Forward Interval Protocol

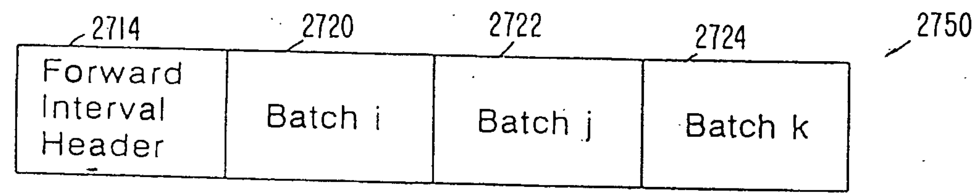
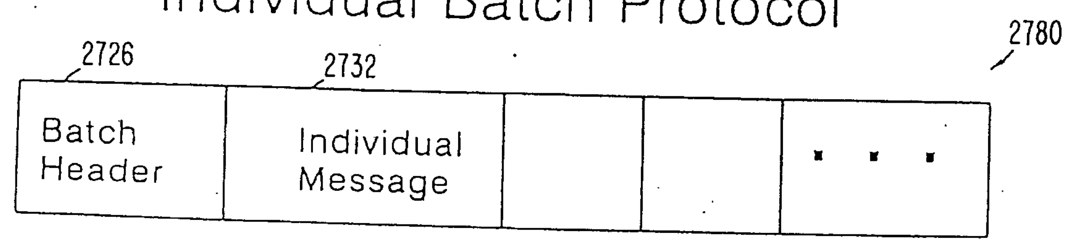


FIG. 27(C)

Individual Batch Protocol



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

FIG. 28(A)

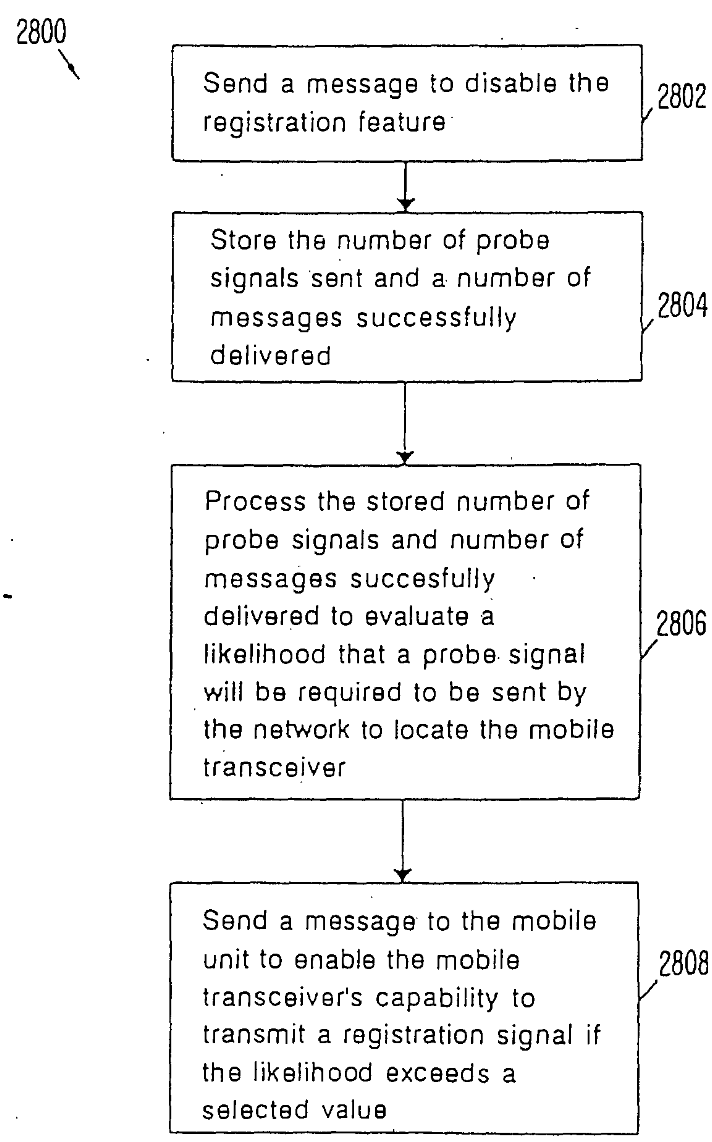


FIG. 28(B)

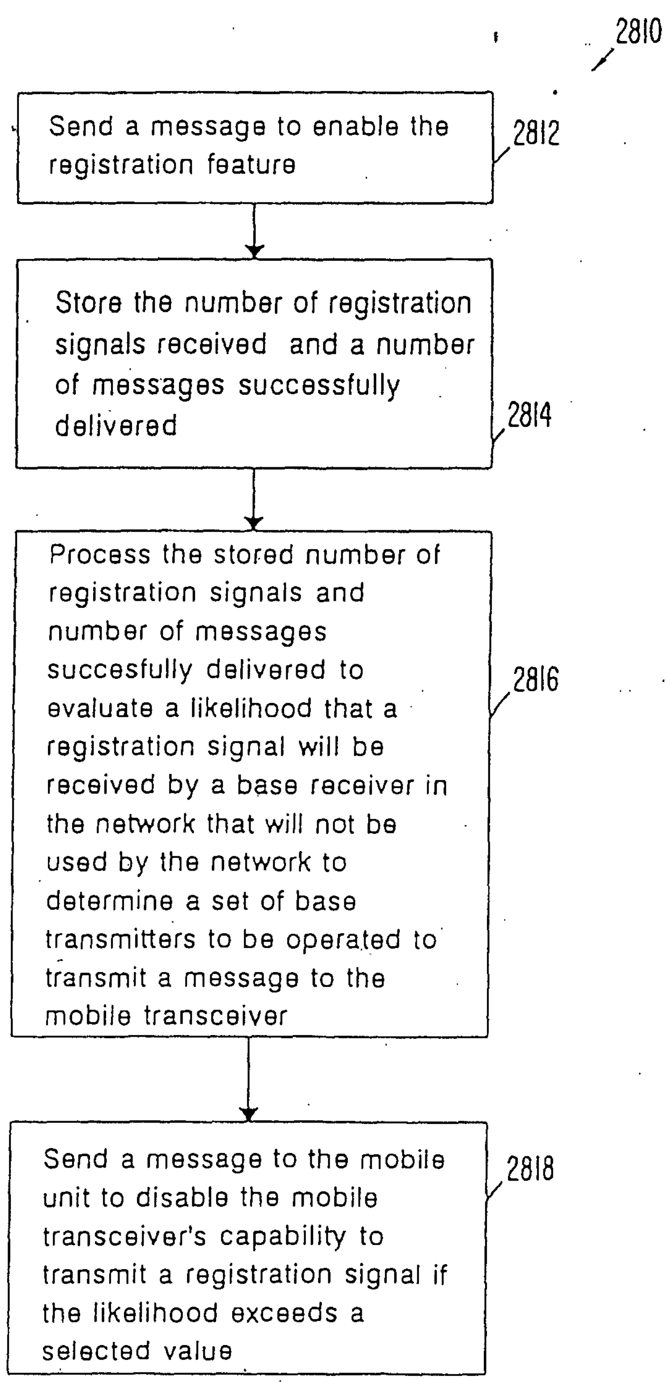

2810
Send a message to enable the registration feature
2812
Store the number of registration signals received and a number of messages successfully delivered
2814
Process the stored number of registration signals and number of messages succesfully delivered to evaluate a likelihood that a registration signal will be received by a base receiver in the network that will not be used by the network to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver
2816
Send a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2818

FIG. 29(A)

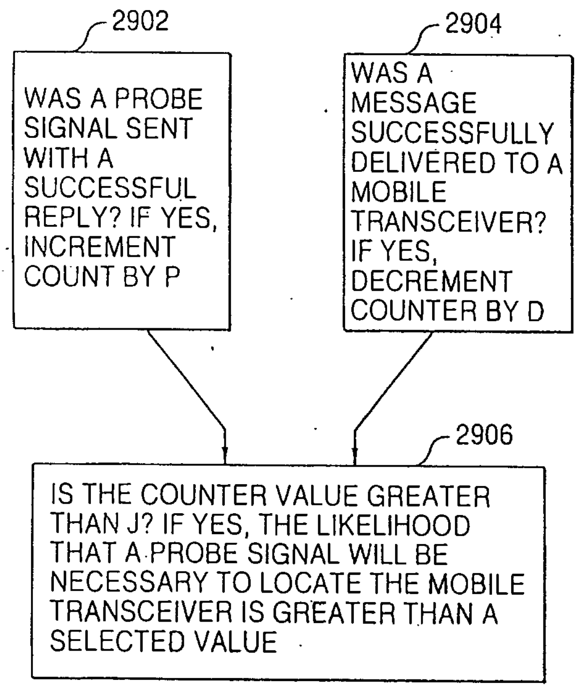
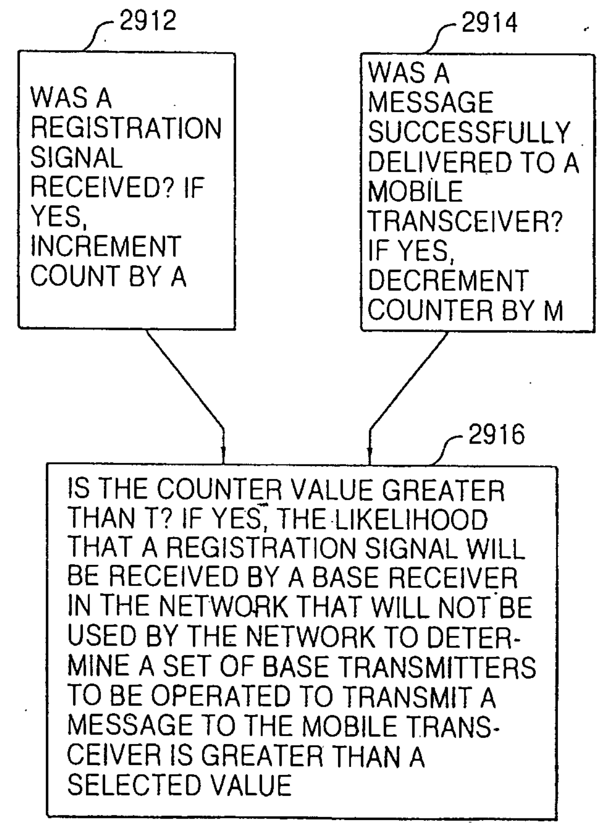


FIG. 29(B)



APPROVED BY DRAFTSMAN | O.G. FIG. | CLASS | SUBCLASS

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UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/899476	07/24/97	CAMERON D	3680.0083-05

7512/0723

FINNEGAN HENDERSON FARABOW GARRETT
AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

EXAMINER	
LE, T	
ART UNIT	PAPER NUMBER
2745	10

DATE MAILED: 07/23/98

NOTICE OF DRAWING REQUIREMENTS

☑ Corrected/substituted drawings for the above-identified application, received in the PTO on 6/16/98, are still considered informal for the reason(s) identified on the attached Form PTO-948.

☐ Applicant has the time remaining in the response period set in the Notice of Allowability or Notice of Drawing Requirements mailed ________________ to overcome the objections raised in the attached Form PTO-948. This response period may be extended under the provisions of 37 CFR 1.136 (a) by filing the appropriate request and fee before the end of the six month statutory period for response.

☐ The PTO delayed in reviewing the corrected drawings. Applicant is given ONE month time limit from the date of this letter to provide corrected drawings. NO EXTENSION OF THIS TIME LIMIT MAY BE GRANTED UNDER EITHER 37 CFR 1.136(a) or (b). See MPEP 714.03. However, the response period set in the Notice of Allowability or Notice of Drawing Requirements mailed ________________ may be extended under the provisions of 37 CFR 1.136(a) by filing the appropriate request and fee before the end of the six month statutory period for response.

☑ The PTO delayed in reviewing the corrected drawings. Applicant is given ONE month time limit from the date of this letter to provide corrected drawings. NO EXTENSION OF THIS TIME LIMIT MAY BE GRANTED UNDER EITHER 37 CFR 1.136(a) or (b). See MPEP 714.03

☑ ATTACHMENT: PTO-948

T. Le

PATENT AND TRADEMARK OFFICE

6/29/98

DATE

FORM PTOL-455 (REV. 8-95)

FORM PTO 948 (REV. 11-97) U.S. DEPARTMENT OF COMMERCE-Patent and Trademark Office Application No. 899476

NOTICE OF DRAFTPERSON'S PATENT DRAWING REVIEW

The drawing filed (insert date) 6/16/98 are:

A. ______ not objected to by the Draftperson under 37 CFR 1.84 or 1.152.

B. ✓ objected to by the Draftperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawings must be submitted according to the instructions on the back of this notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings: Black ink. Color.
   - ______ Color drawing are not acceptable until petition is granted. Fig.(s) ______
   - ______ Pencil and non black ink is not permitted. Fig(s) ______
2. PHOTOGRAPHS. 37 CFR 1.84(b)
   - ______ Photographs are not acceptable until petition is granted,
   - ______ 3 full-tone sets are required. Fig(s) ______
   - ______ Photographs not properly mounted (must brystol board or photographic double-weight paper). Fig(s) ______
   - ______ Poor quailty (half-tone). Fig(s) ______
3. TYPE OF PAPER. 37 CFR 1.84(e)
   - ______ Paper not flexible, strong, white and durable. Fig.(s) ______
   - ______ Erasures, alterations, overwritings, interlineations, folds, copy machine marks not acceptable. (too thin)
   - ______ Mylar, vellum paper is not acceptable (too thin). Fig(s) ______
4. SIZE OF PAPER. 37 CFR 1.84(F): Acceptable sizes:
   - ✓ 21.0 cm by 29.7 cm (DIN size A4)
   - ✓ 21.6 cm by 27.9 cm (8 1/2 x 11 inches)
   - ✓ All drawings sheets not the same size. Sheet(s) ______
5. MARGINS. 37 CFR 18.4(g): Acceptable margins:
   - Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm SIZE: A4 Size
   - Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm SIZE: 8 1/2 x 11
   - ______ Margins not acceptable. Fig(s) ______
   - ______ Top (T) ______ Left (L)
   - ______ Right (R) ______ Bottom (B)
6. VIEWS. CFR 1.84(h)
   REMINDER: Specification may require revision to correspond to drawing changes.
   - ______ Views connected by projection lines or lead lines. Fig.(s) ______

   Partial views. 37 CFR 1.84(h)(2)
   - ______ Brackets needed to show figure as one entity. Fig.(s) ______
   - ______ Views not labeled separately or properly. Fig.(s) ______
   - ______ Enlarged view not labeled separately or properly. Fig.(s) ______
7. SECTIONAL VIEWS. 37 CFR 1.84(h)(3)
   - ______ Hatching not indicated for sectional portions of an object. Fig.(s) ______
   - ______ Sectional designation should be noted with Arabic or Roman numbers. Fig.(s) ______
8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
   - ______ Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned, so that the top becomes the right side, except for graphs. Fig.(s) ______
   - ______ Views not on the same plane on drawing sheet. Fig.(s) ______
9. SCALE. 37 CFR 1.84(k)
   - ______ Scale not large enough to show mechansim without crowding when drawing is reduced in size to two-thirds in reproduction. Fig.(s) ______
10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
    - ______ Lines, numbers & letters not uniformly thick and well defined, clean, durable and black (poor line quality). Fig.(s) ______
11. SHADING. 37 CFR 1.84(m)
    - ______ Solid black areas pale. Fig.(s) ______
    - ______ Solid black shading not permitted. Fig.(s) ______
    - ______ Shade lines, pale, rough and blurred. Fig.(s)
12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.48(p)
    - ______ Numbers and reference characters not plain and legible. Fig.(s) ______
    - ______ Figure legends are poor. Fig.(s) ______
    - ______ Numbers and reference characters not oriented in the same direction as the view. 37 CFR 1.84(p)(3) Fig.(s) ______
    - ______ English alphabet not used. 37 CFR 1.84(p)(3) Fig.(s) ______
    - ______ Numbers, letters and reference characters must be at least .32 cm (1/8 inch) in height. 37 CFR 1.84(p)(3) Fig.(s) ______
13. LEAD LINES. 37 CFR 1.84(q)
    - ______ Lead lines cross each other. Fig.(s) ______
    - ______ Lead lines missing. Fig.(s) ______
14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.48(t)
    - ______ Sheets not numbered consecutively, and in Abadic numerals beginning with number 1. Fig.(s) ______
15. NUMBERING OF VIEWS. 37 CFR 1.84(u)
    - ______ Views not numbered consecutively, and in Abrabic numerals, beginning with number 1. Fig.(s) ______
16. CORRECTIONS. 37 CFR 1.84(w)
    - ______ Corrections not made from PTO-948 dated ______
17. DESIGN DRAWINGS. 37 CFR 1.152
    - ______ Surface shading shown not appropriate. Fig.(s) ______
    - ______ Solid black shading not used for color contrast. Fig.(s) ______

COMMENTS
– DWG. SHEETS NOT ACCEPTABLE SIZE
(SEE ITEM 4)

REVIEWER T. Kegler DATE 6/29/98 TELEPHONE NO. 305 8335

ATTACHMENT TO PAPER NO. 10

PTO COPY

#7
9/9/98

Attorney Docket No. 3680.0083-05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
Dennis W. CAMERON et al.	Group Art Unit: 2745
Serial No.: 08/899,476	Examiner: T. Le
Filed: July 24, 1997	**Allowed: April 16, 1998**
For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION	**Batch No. D05**

O I P E
AUG 14 1998
JC4
PATENT & TRADEMARK OFFICE

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

RESUBMISSION OF FORMAL DRAWINGS

Pursuant to the Draftsman's request of July 23, 1998 (Paper No. 10), and subject to the approval of the Examiner, Applicants resubmit thirty (30) sheets of formal drawings to replace those submitted on June 16, 1998. If the formal drawings for any reason are not in full compliance with the pertinent statutes and regulations, please so advise the undersigned. If any fees are necessary for the submission of these formal drawings, please charge our Deposit Account No. 06-0916.

Respectfully submitted,

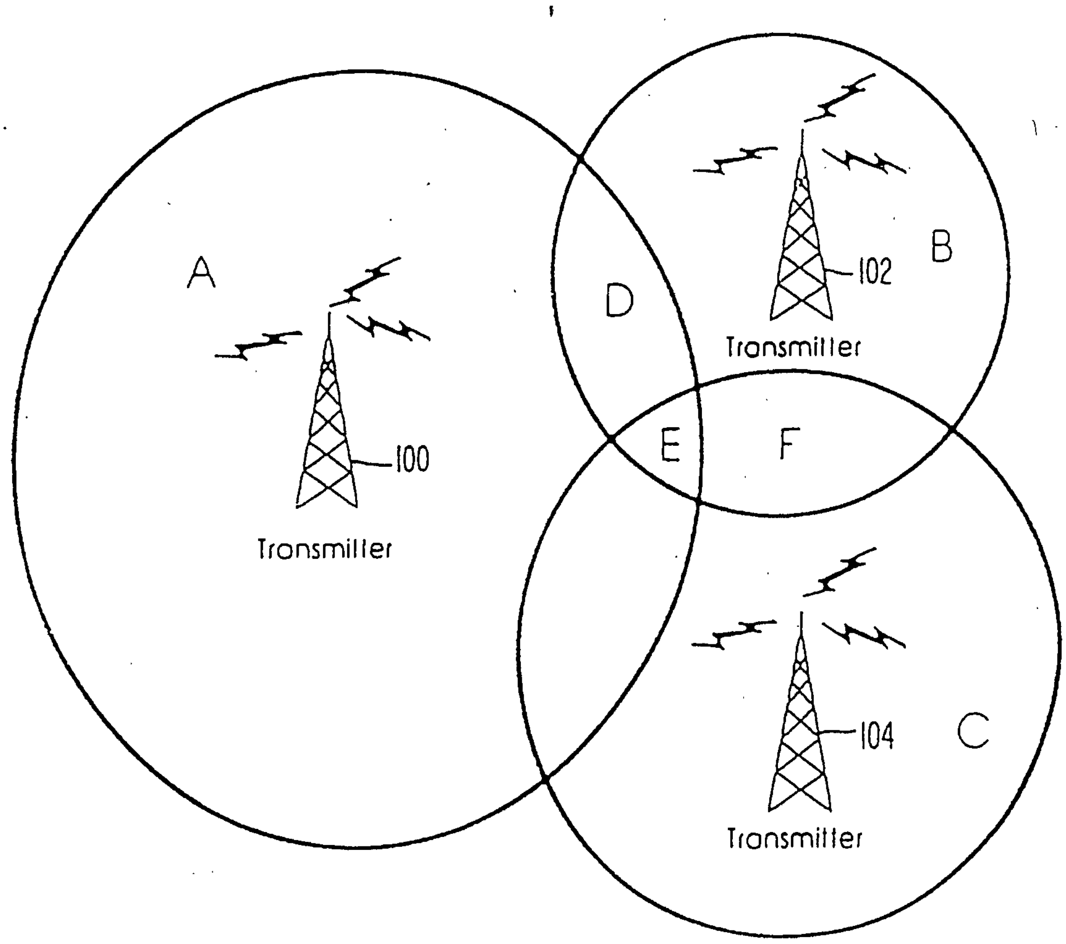
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: [signature] Reg. No. 19096
for John M. Romary
Reg. No. 26,331

Dated: August 14, 1998

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT
& DUNNER, L.L.P.
1300 I STREET, N.W.
WASHINGTON, D.C. 20005
202-408-4000

FIG. 1
PRIOR ART



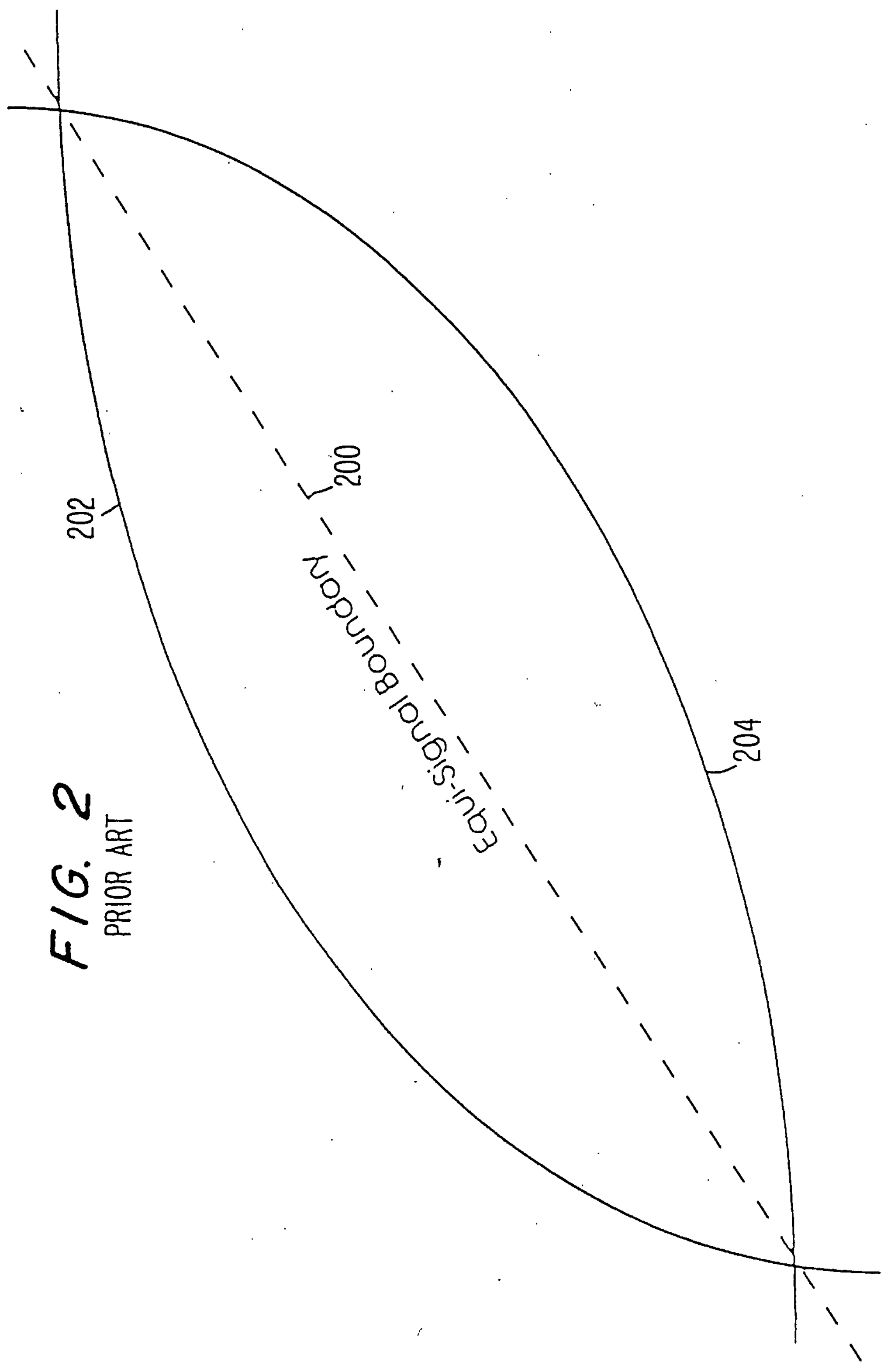


FIG. 2
PRIOR ART

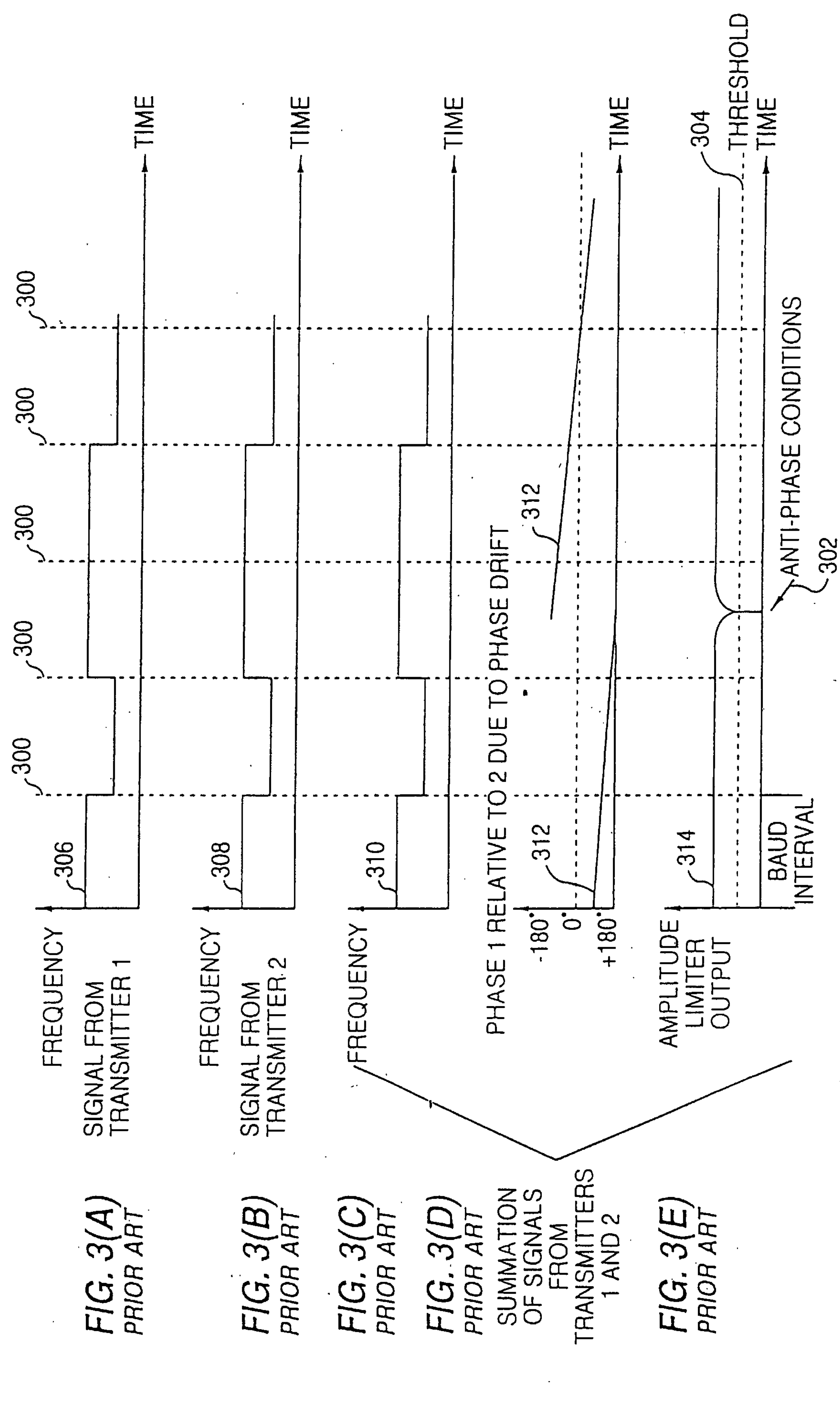


FIG. 3(A) PRIOR ART

FIG. 3(B) PRIOR ART

FIG. 3(C) PRIOR ART

FIG. 3(D) PRIOR ART

FIG. 3(E) PRIOR ART

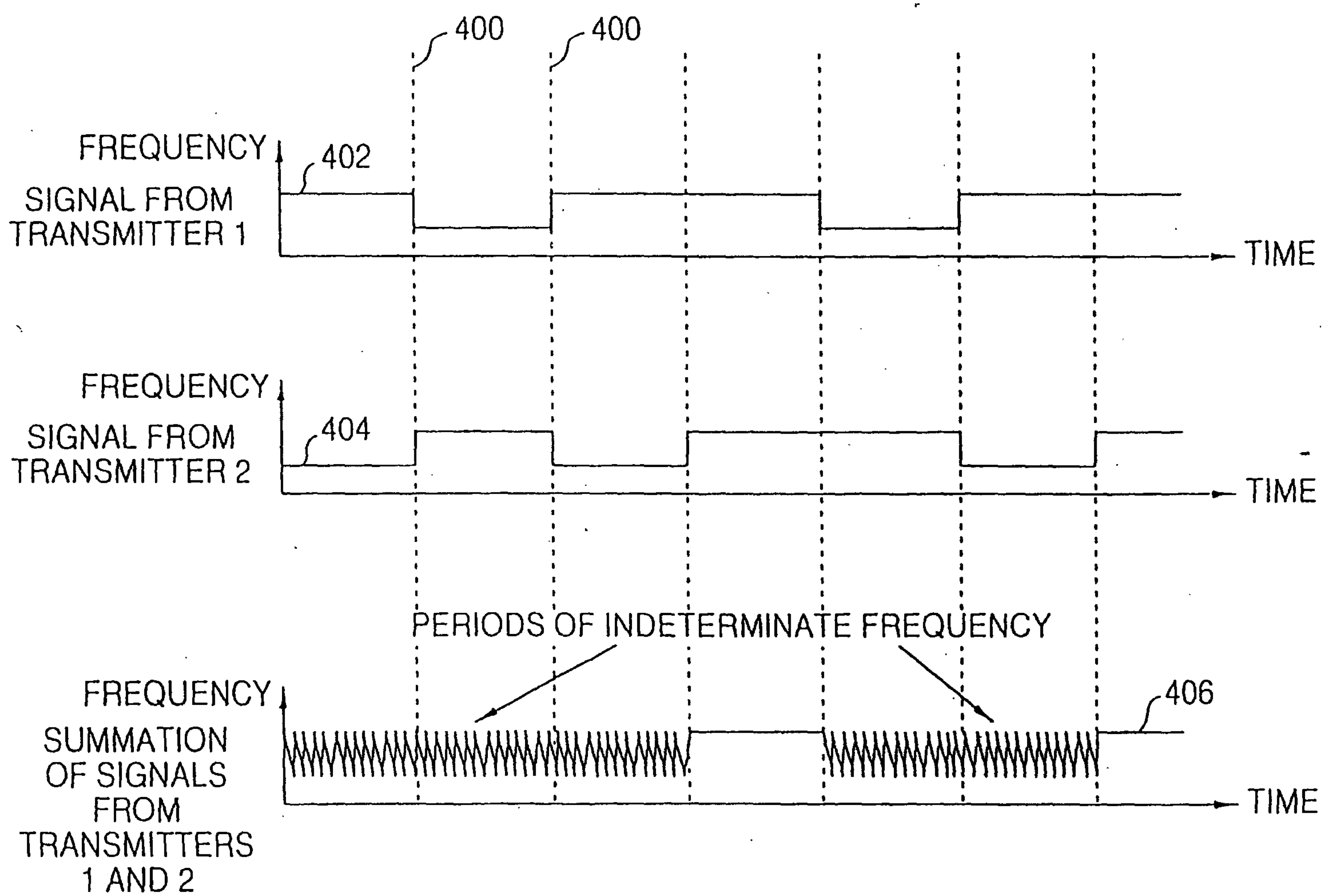
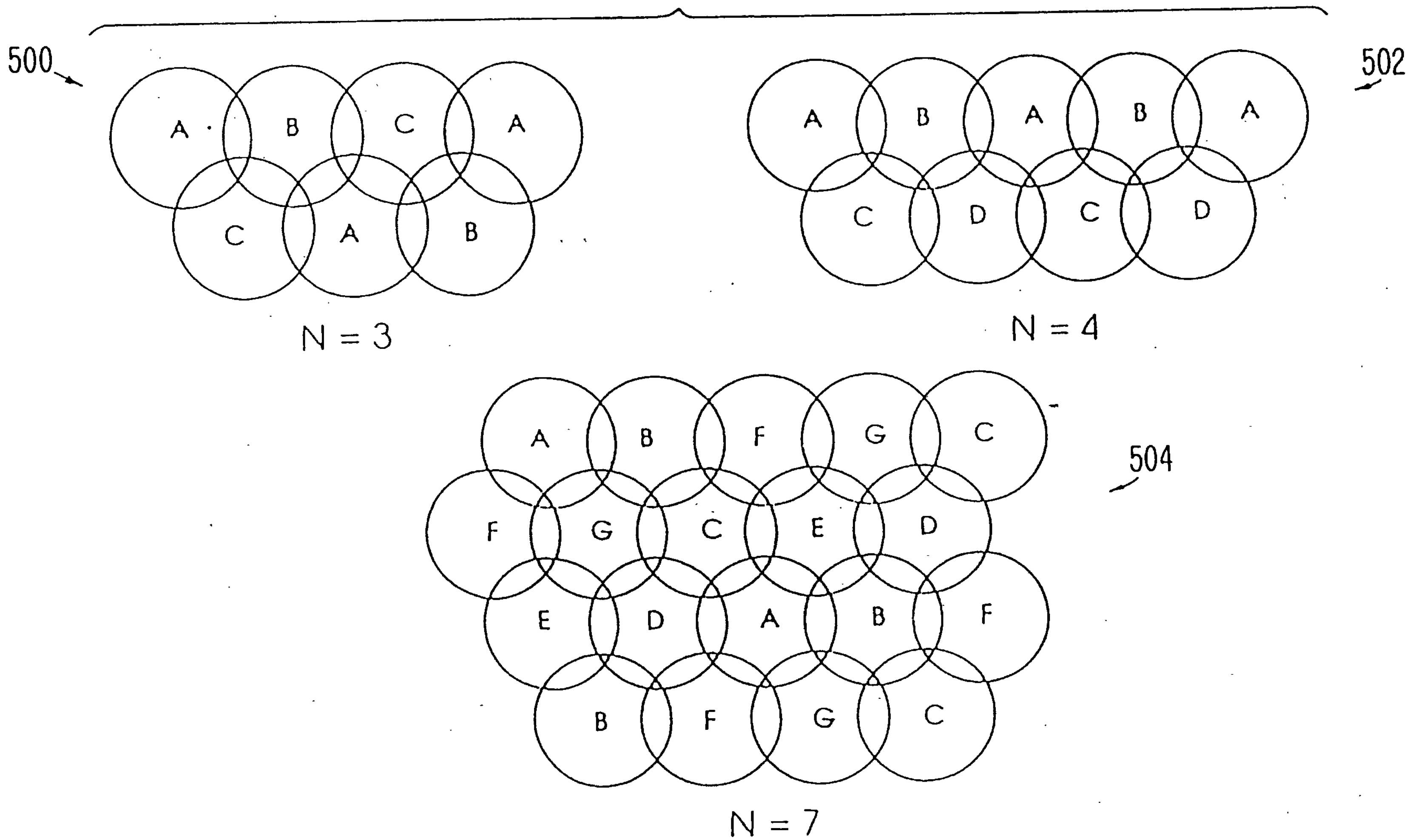


FIG. 4(A)
PRIOR ART

FIG. 4(B)
PRIOR ART

FIG. 4(C)
PRIOR ART

FIG. 5 PRIOR ART



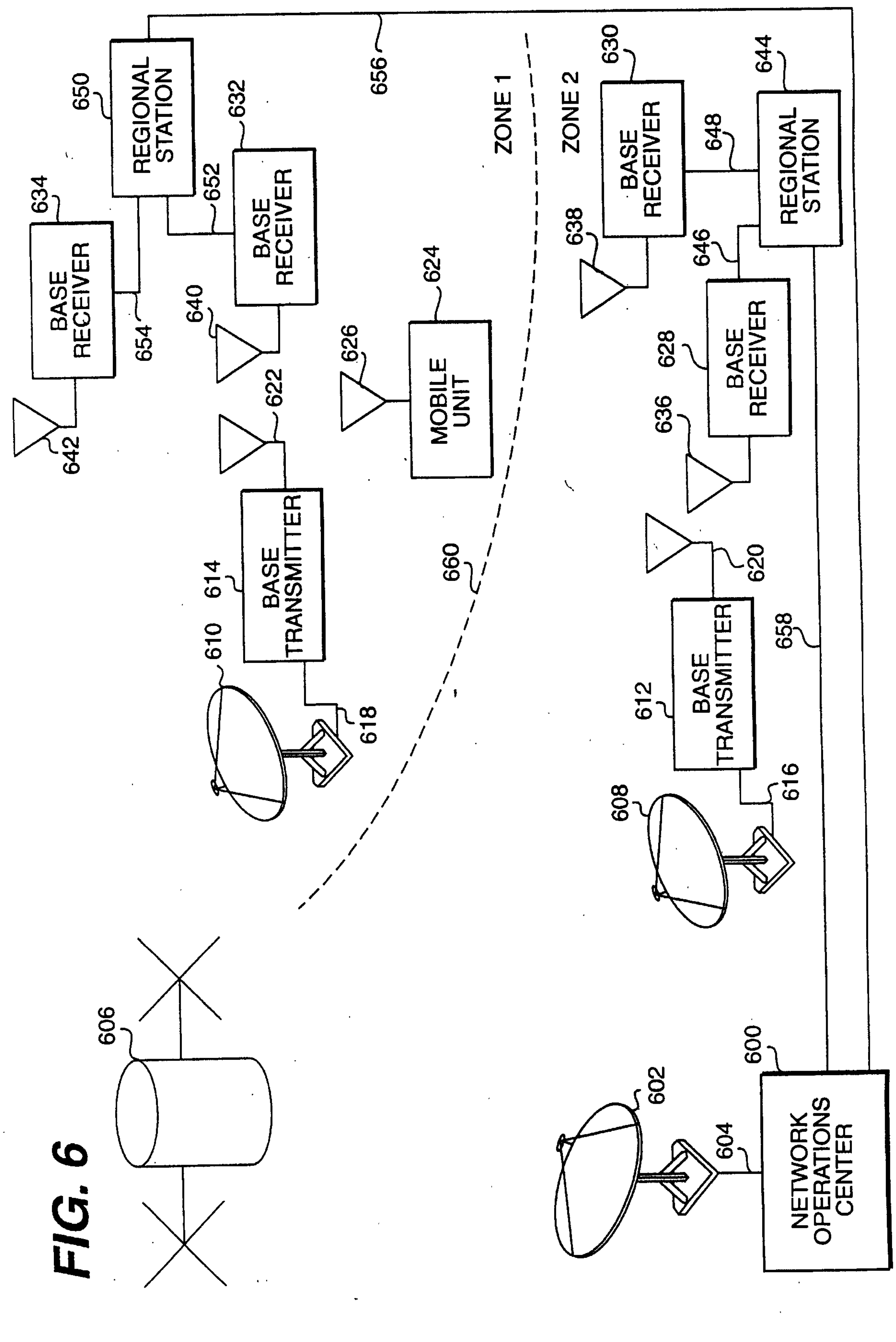

NETWORK OPERATIONS CENTER
REGIONAL STATION
BASE RECEIVER
BASE TRANSMITTER
MOBILE UNIT
ZONE 1
ZONE 2
600
602
604
606
608
610
612
614
616
618
620
622
624
626
628
630
632
634
636
638
640
642
644
646
648
650
652
654
656
658
660

FIG. 6

FIG. 7

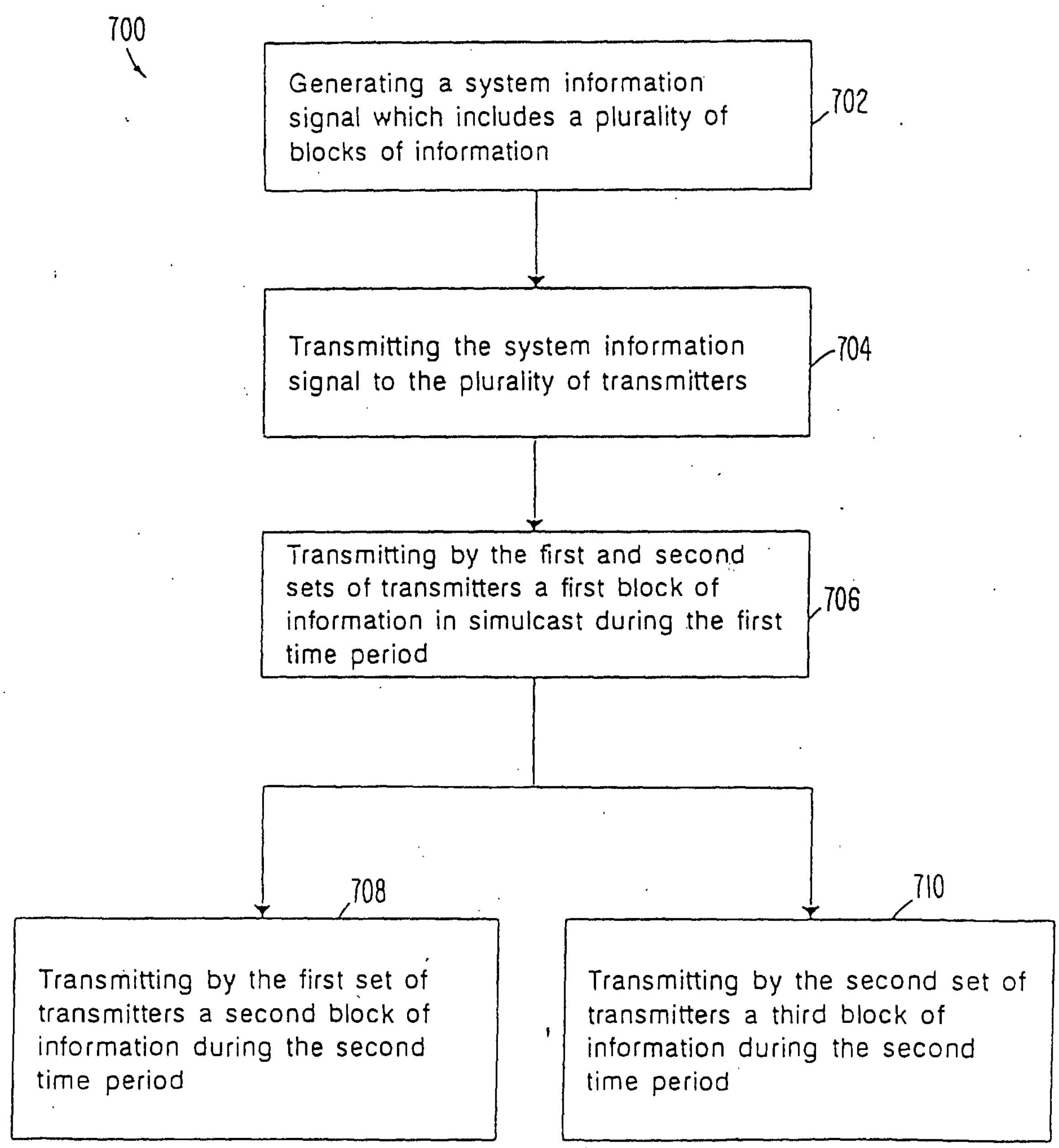

700
Generating a system information signal which includes a plurality of blocks of information
702
Transmitting the system information signal to the plurality of transmitters
704
Transmitting by the first and second sets of transmitters a first block of information in simulcast during the first time period
706
708
Transmitting by the first set of transmitters a second block of information during the second time period
710
Transmitting by the second set of transmitters a third block of information during the second time period

FIG. 8

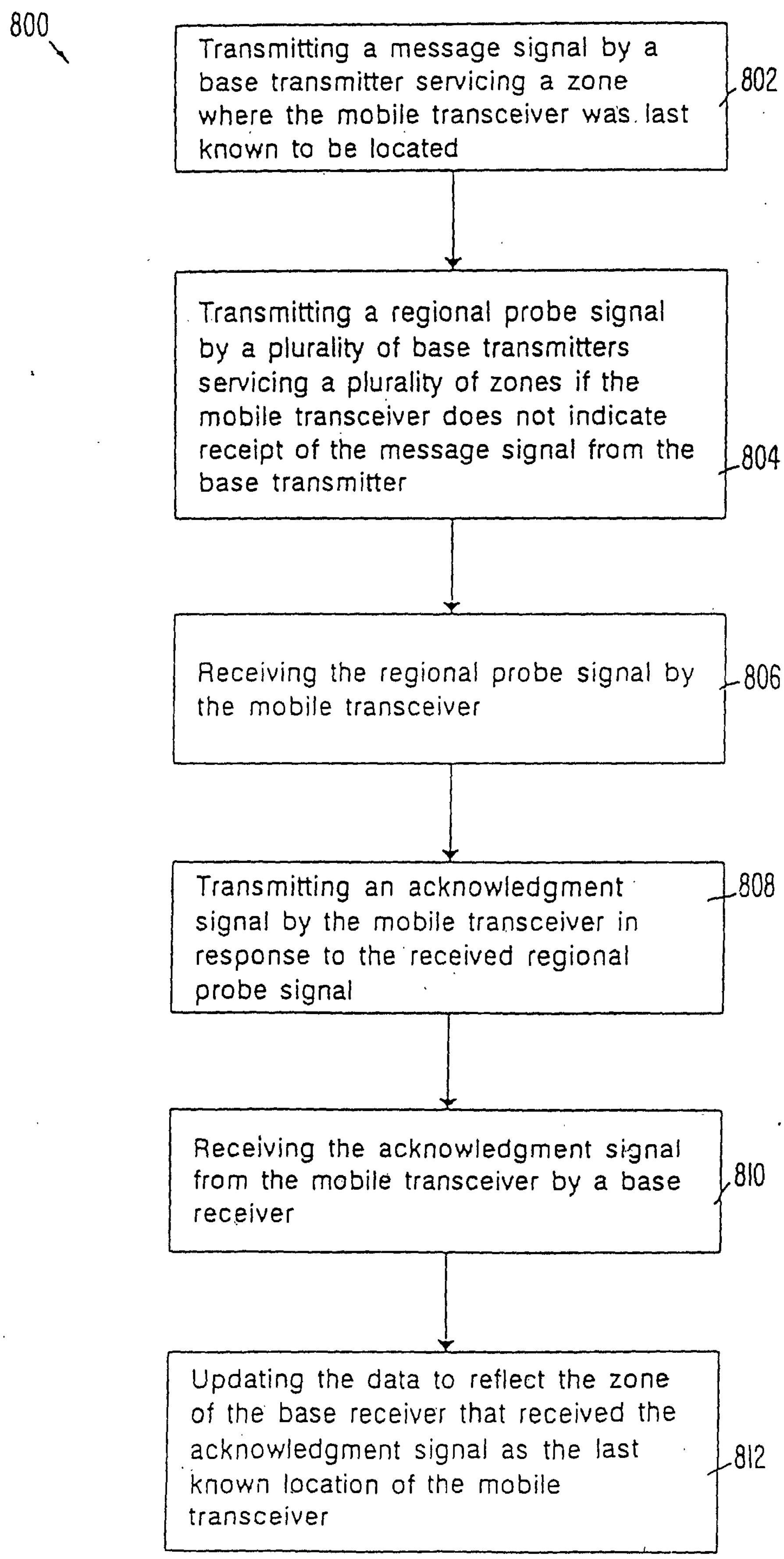

800
Transmitting a message signal by a base transmitter servicing a zone where the mobile transceiver was last known to be located
802
Transmitting a regional probe signal by a plurality of base transmitters servicing a plurality of zones if the mobile transceiver does not indicate receipt of the message signal from the base transmitter
804
Receiving the regional probe signal by the mobile transceiver
806
Transmitting an acknowledgment signal by the mobile transceiver in response to the received regional probe signal
808
Receiving the acknowledgment signal from the mobile transceiver by a base receiver
810
Updating the data to reflect the zone of the base receiver that received the acknowledgment signal as the last known location of the mobile transceiver
812

FIG. 9

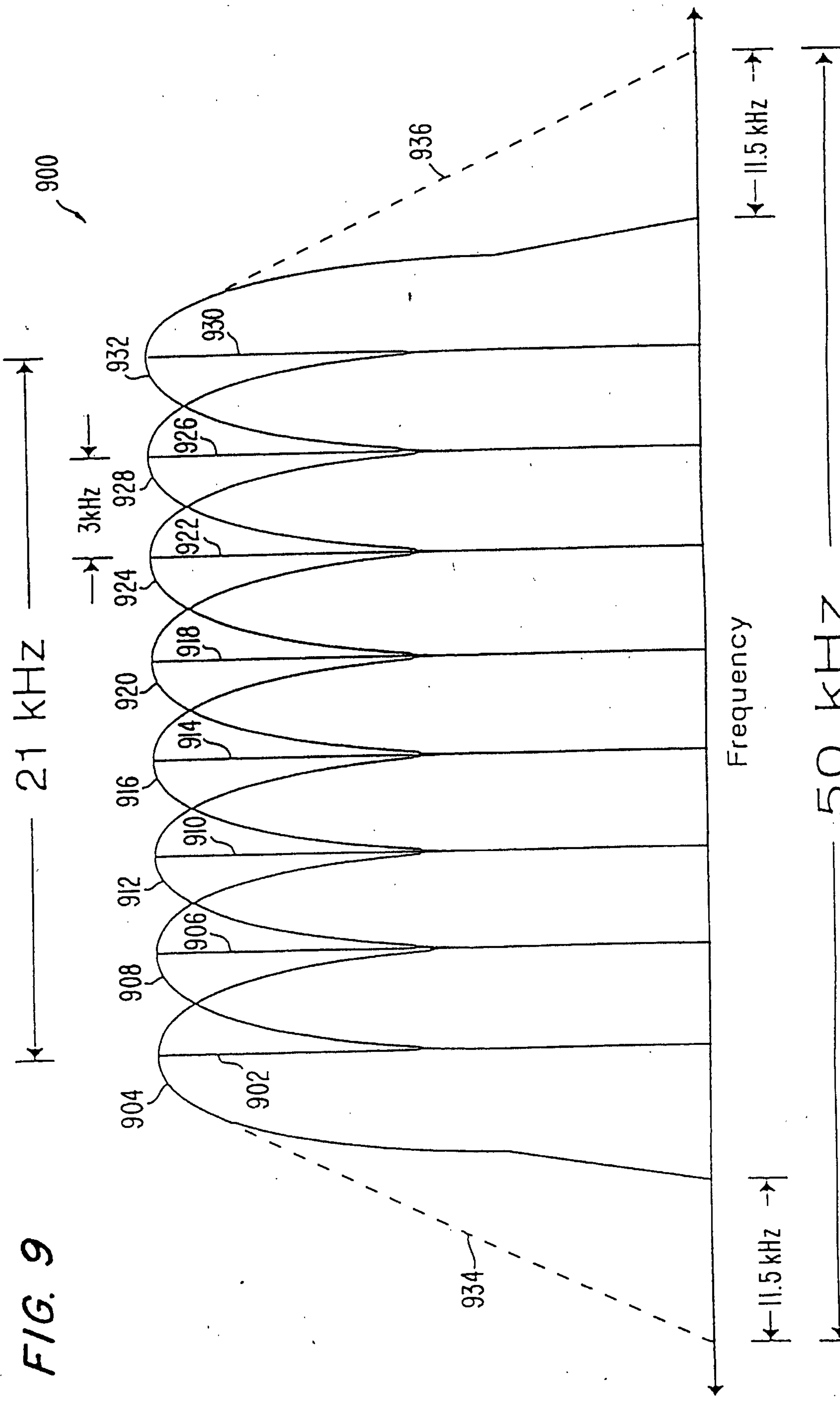
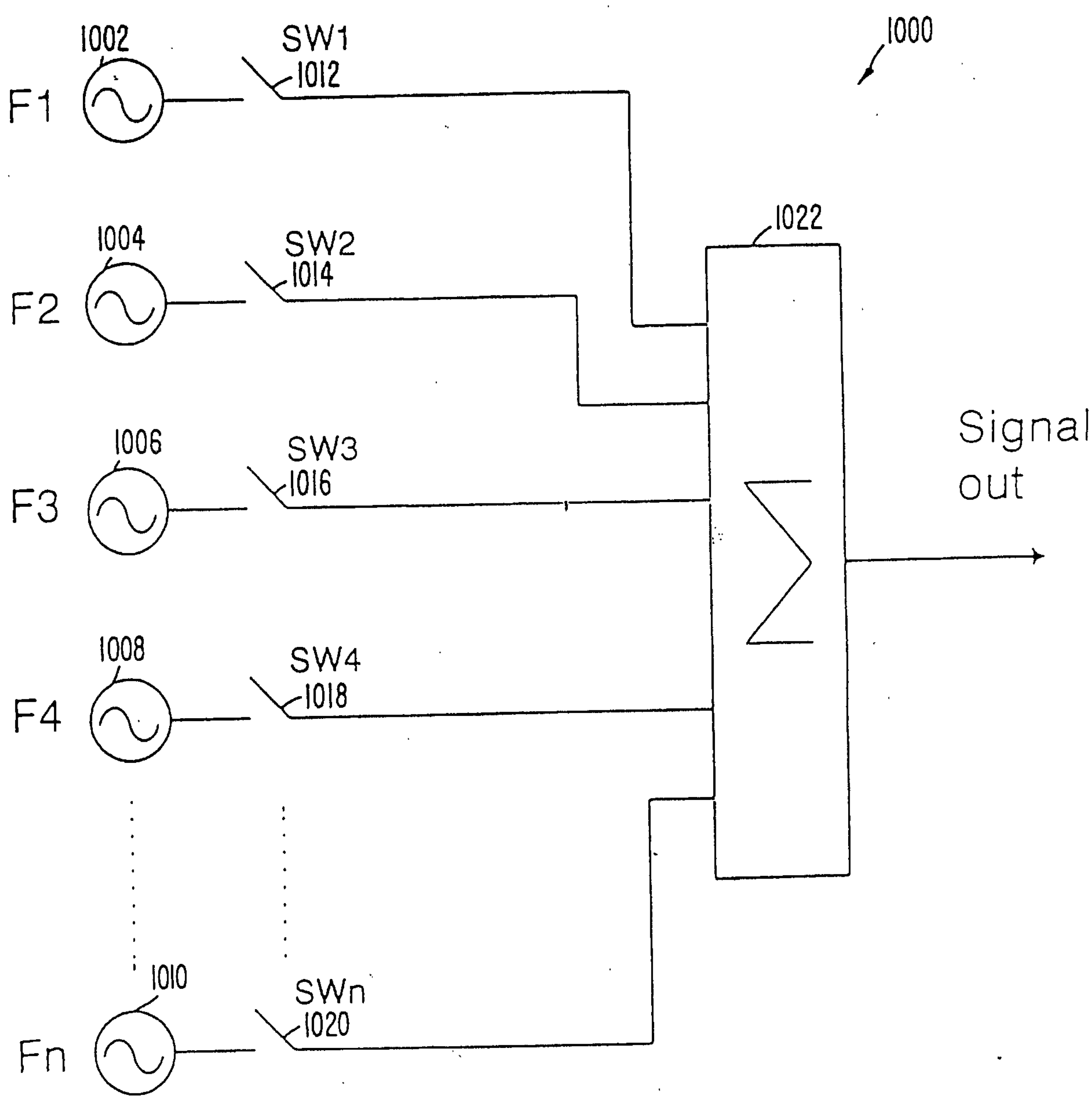
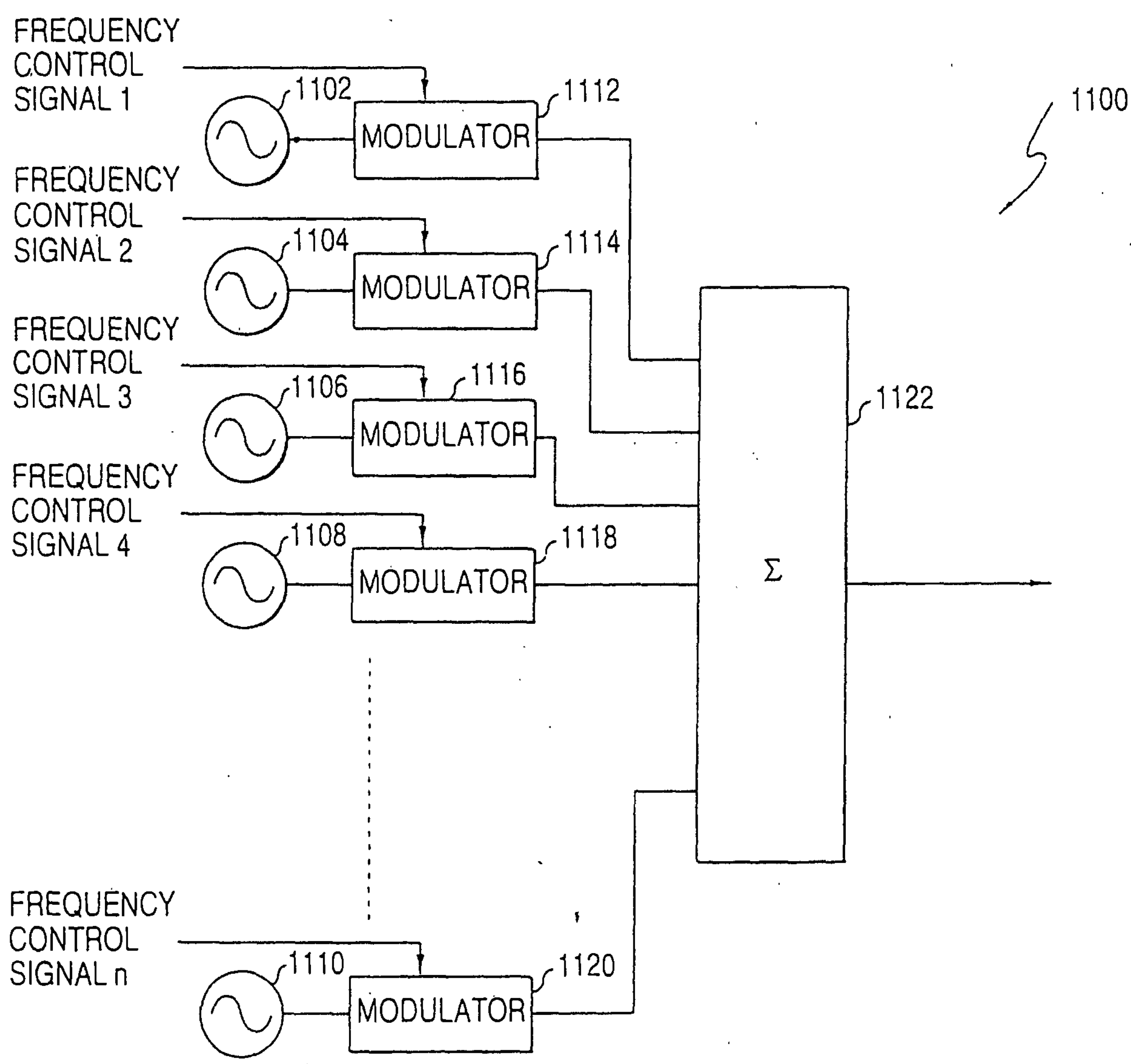

900
21 kHz
3kHz
902
904
906
908
910
912
914
916
918
920
922
924
926
928
930
932
934
936
Frequency
11.5 kHz
11.5 kHz
50 kHz

FIG. 10



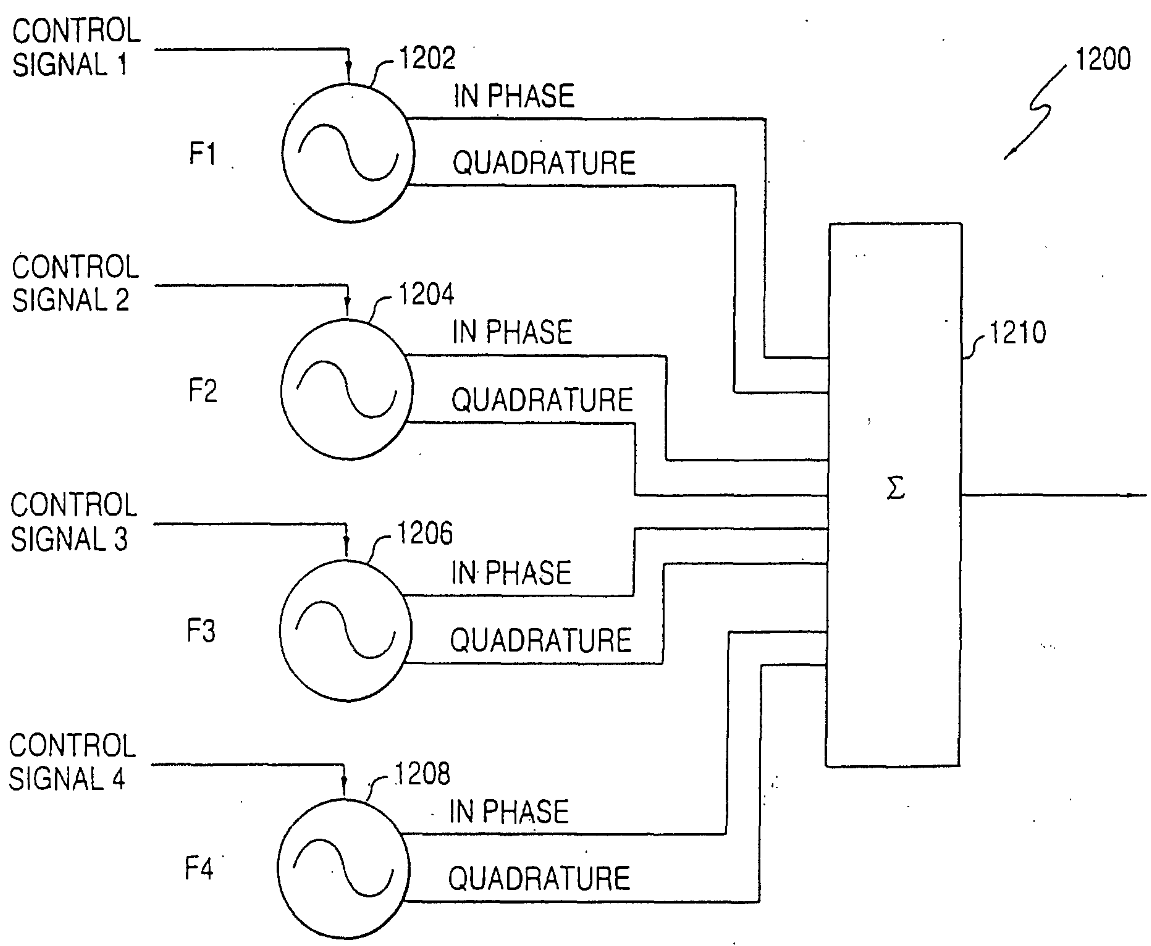
1000
1002
F1
SW1
1012
1004
F2
SW2
1014
1006
F3
SW3
1016
1008
F4
SW4
1018
1010
Fn
SWn
1020
1022
Σ
Signal out

FIG. 11



FREQUENCY CONTROL SIGNAL 1
1102
MODULATOR
1112
1100
FREQUENCY CONTROL SIGNAL 2
1104
MODULATOR
1114
FREQUENCY CONTROL SIGNAL 3
1106
MODULATOR
1116
1122
FREQUENCY CONTROL SIGNAL 4
1108
MODULATOR
1118
Σ
FREQUENCY CONTROL SIGNAL n
1110
MODULATOR
1120

FIG. 12



FOUR CARRIER QUADRATURE MODULATOR

FIG. 13

Base Transmitter

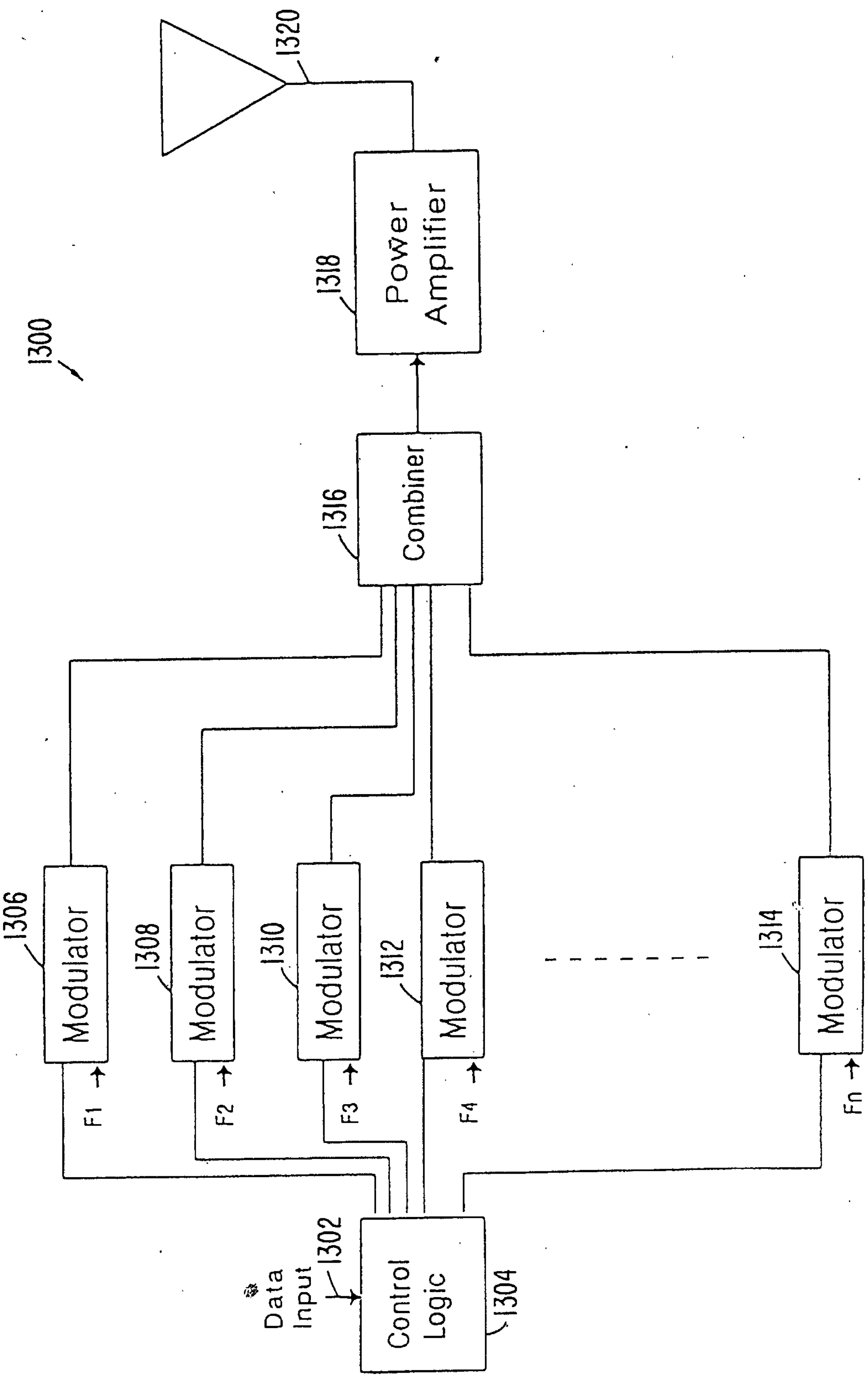


FIG. 14

Base Transmitter

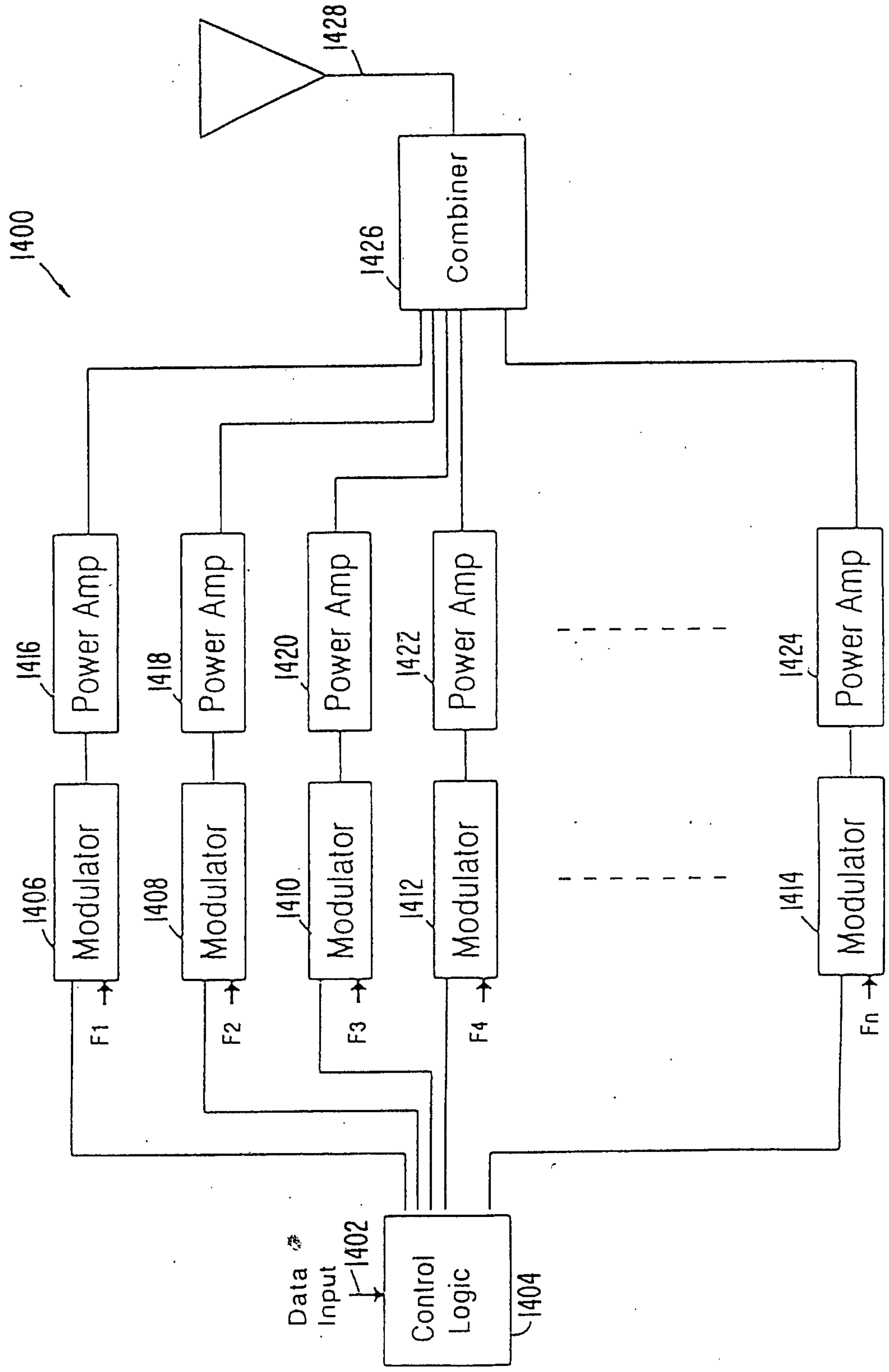
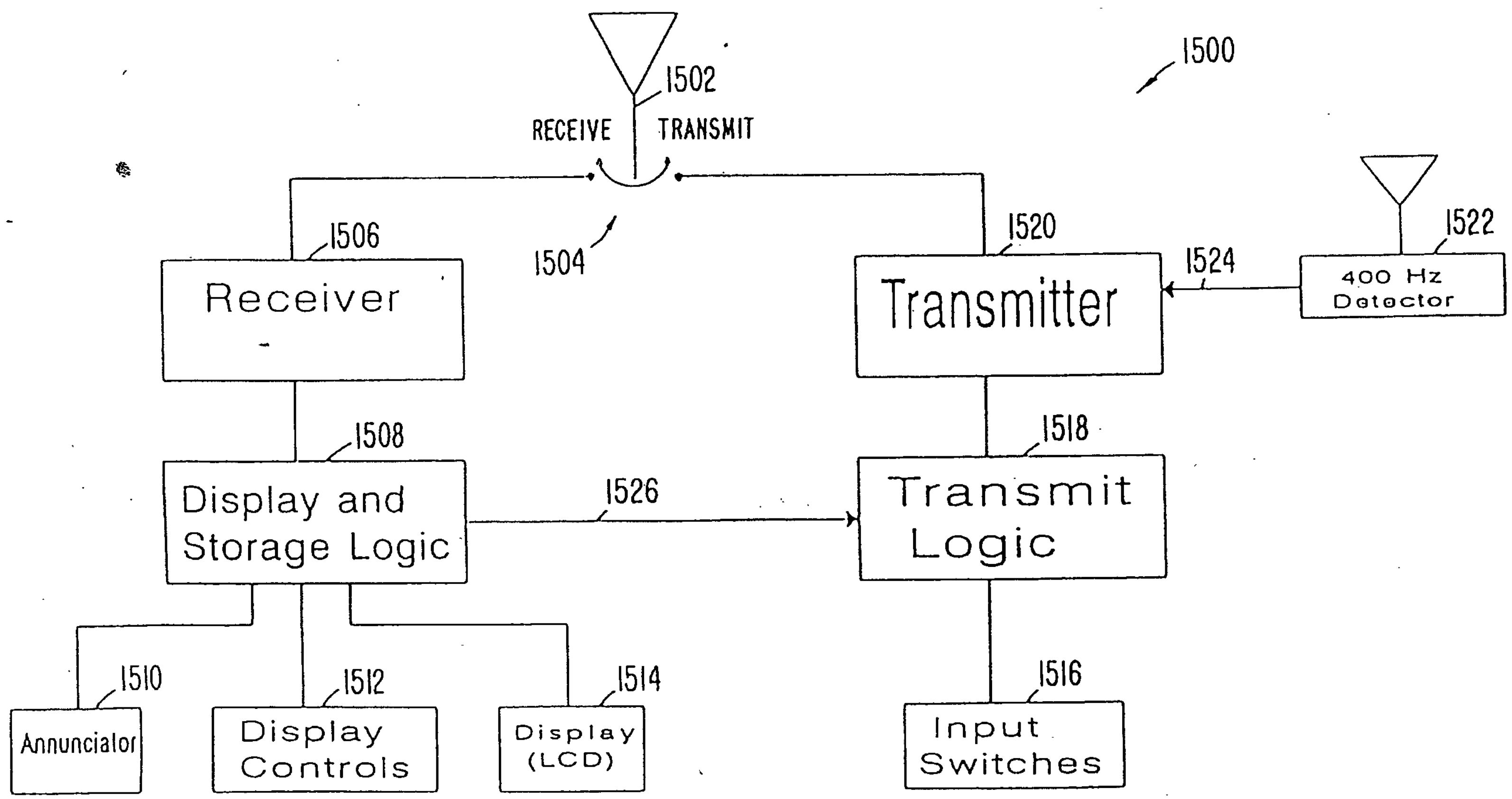


FIG. 15

Mobile Transceiver



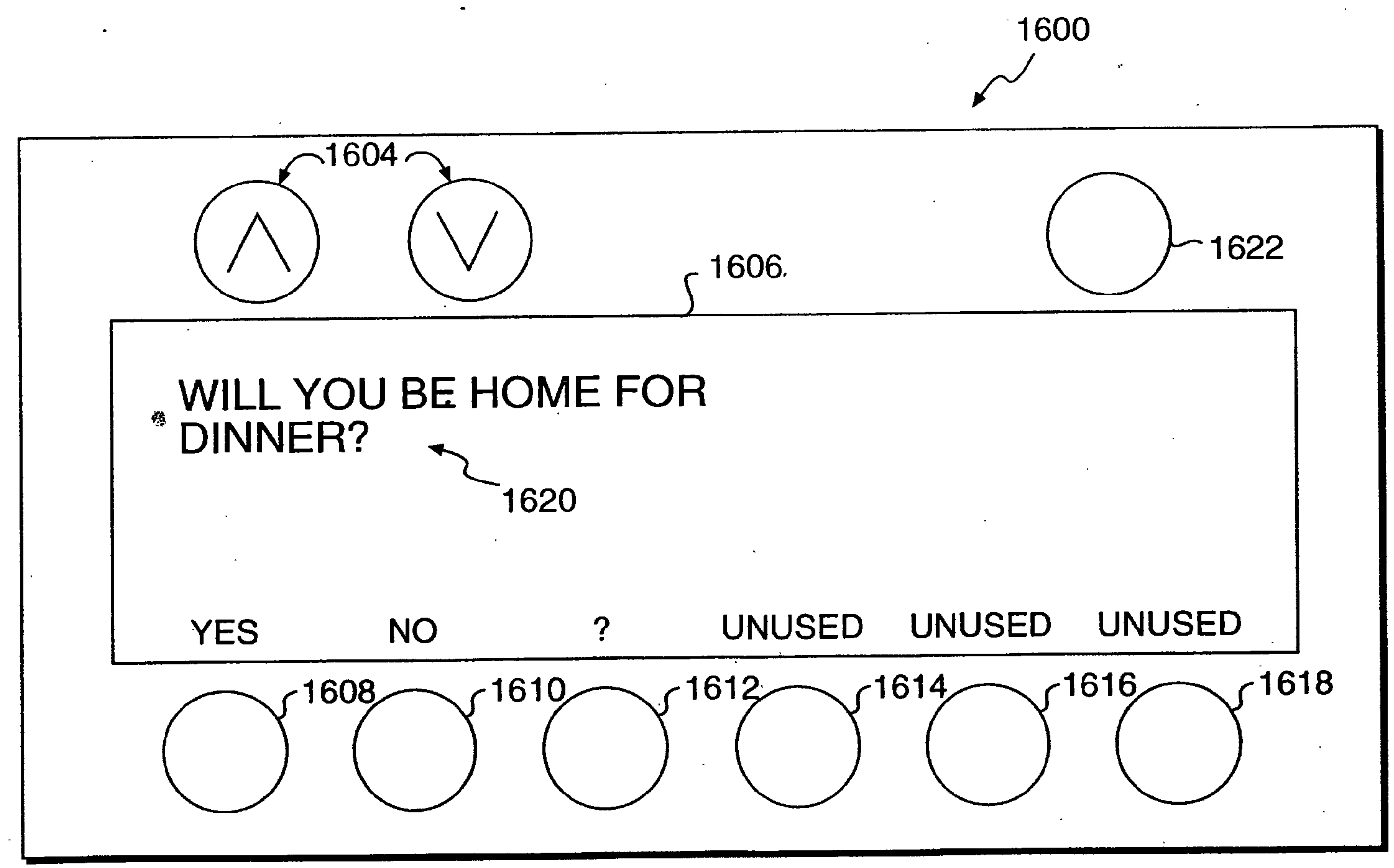

1600
1604
1622
1606
WILL YOU BE HOME FOR
DINNER?
1620
YES
NO
?
UNUSED
UNUSED
UNUSED
1608
1610
1612
1614
1616
1618

FIG. 16

FIG. 17

Mobile Receiver

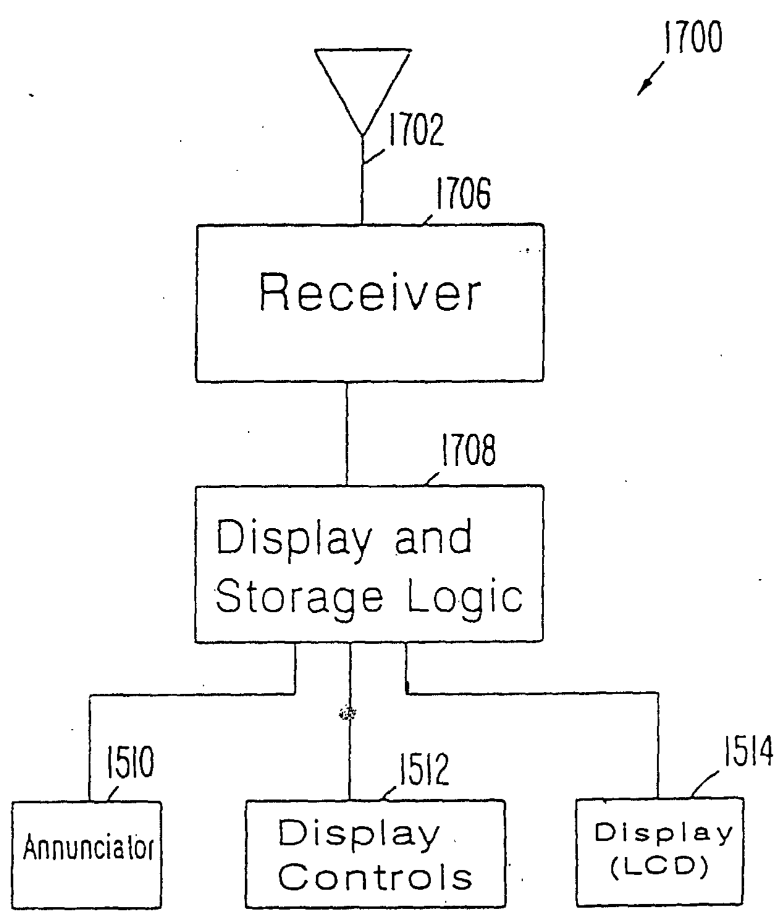


FIG. 18(A)

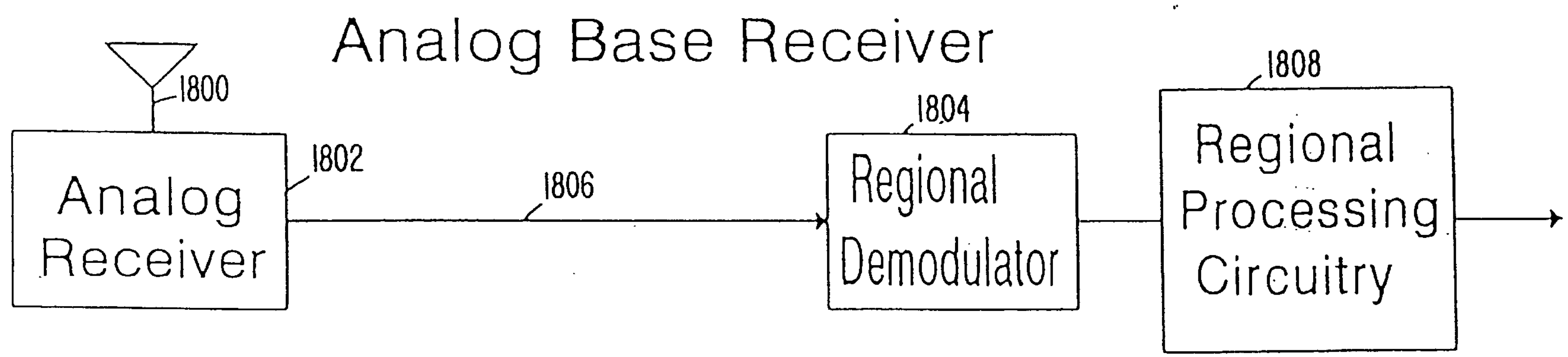


FIG. 18(B)

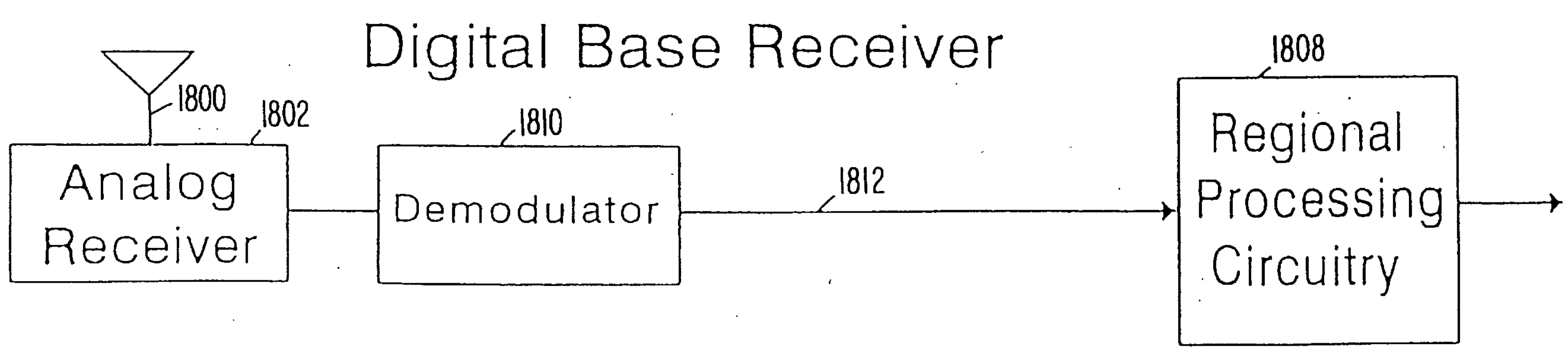


FIG. 19

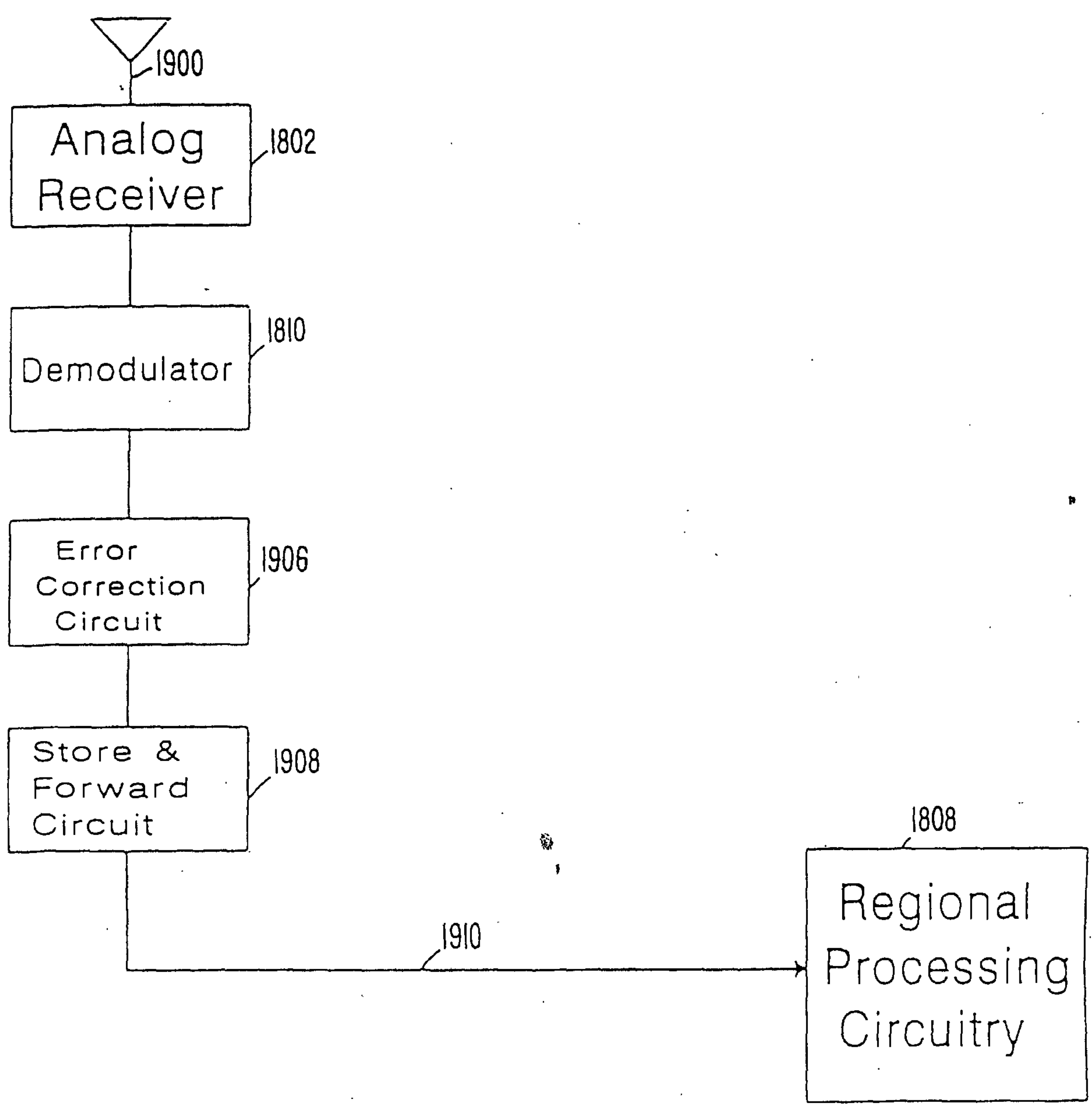

1900
Analog Receiver
1802
Demodulator
1810
Error Correction Circuit
1906
Store & Forward Circuit
1908
1910
1808
Regional Processing Circuitry

FIG. 20

Network Operations Center

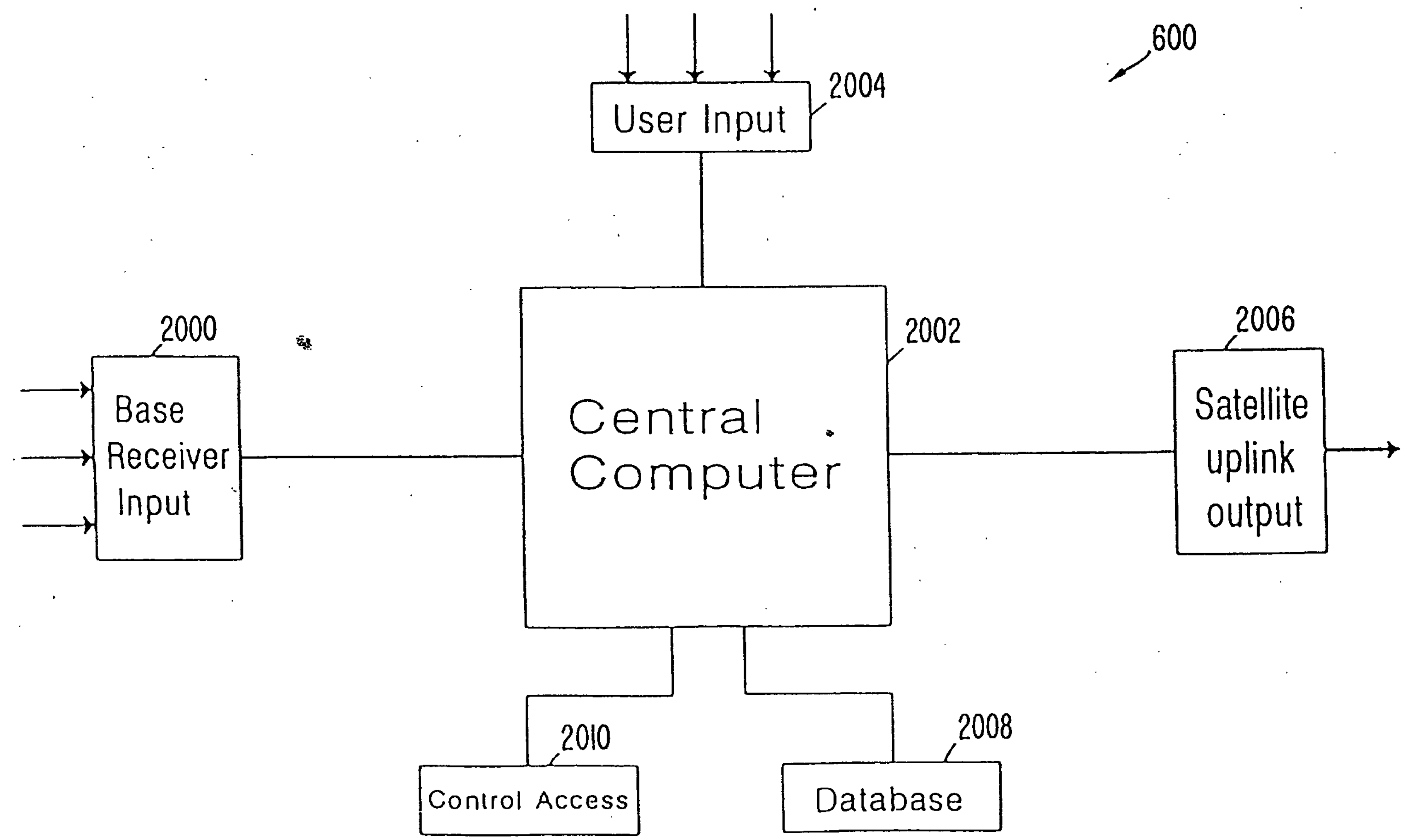
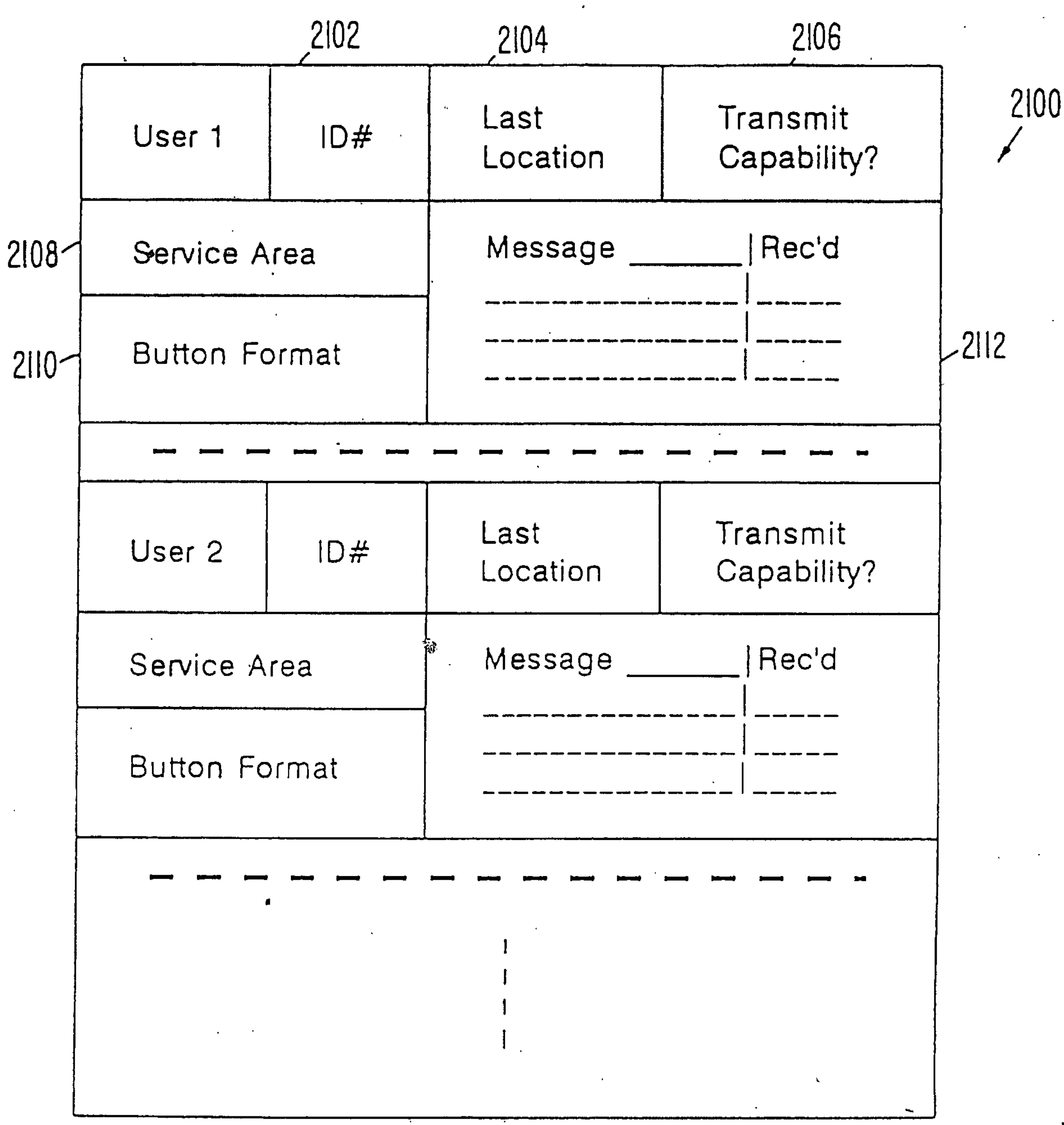


FIG. 21



User Database

FIG. 22

2200

2202	2204	2206	2208	2210
User 1	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 2	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 3	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
User 4	No. of Probe Signals Sent	No. of Registration Signals Received	No. of Messages Successfully Delivered	Other Traffic Data
	■ ■ ■			

Traffic Database

FIG. 23

Service Queue

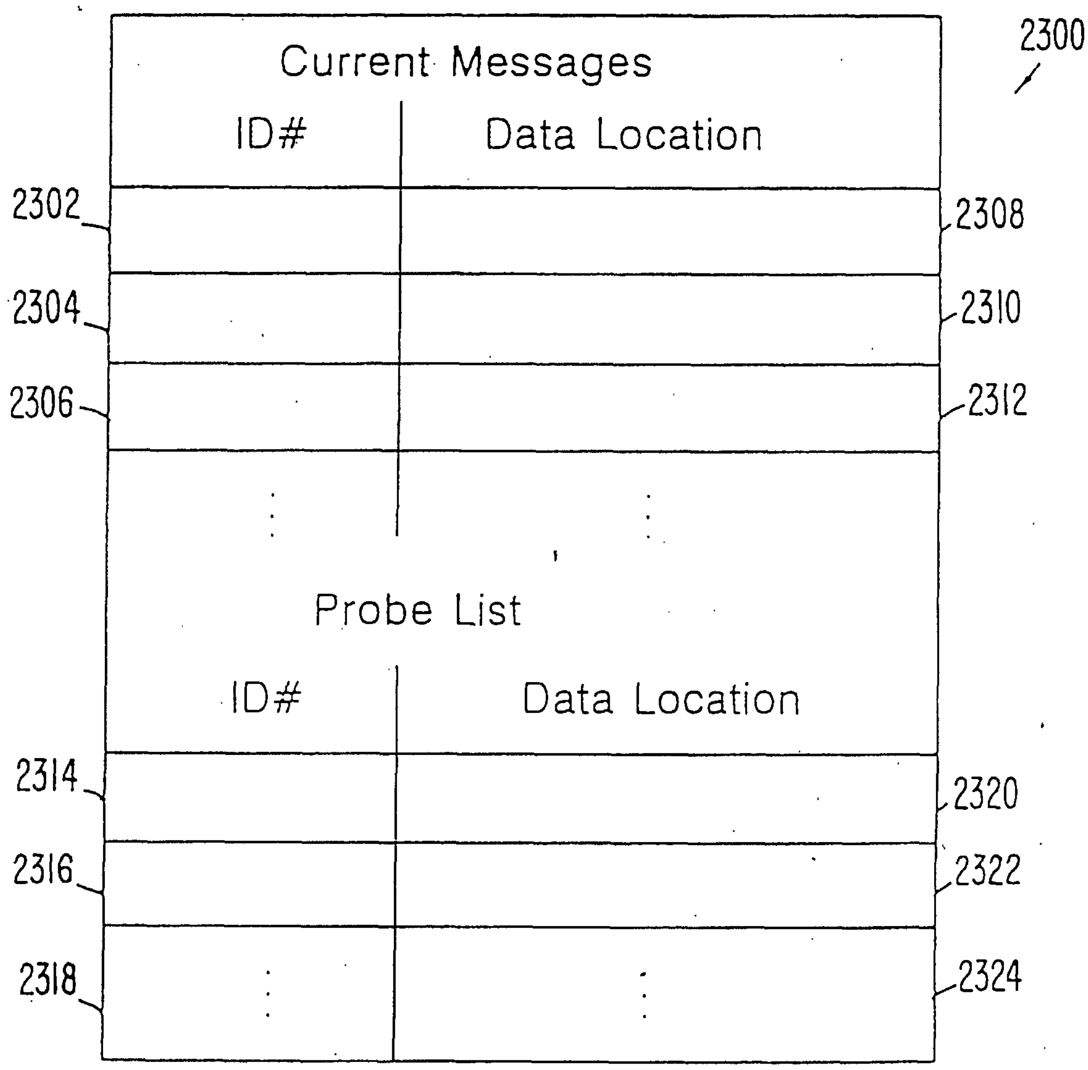


FIG. 24

2400

2402	2404	2406	2408
Base Transmitter 1	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 2	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 3	Zonal Assignment	Base Receivers in Coverage Area	Other Data
Base Transmitter 4	Zonal Assignment	Base Receivers in Coverage Area	Other Data
■ ■ ■			

Base Transmitter Database

FIG. 25

Zone Dithering

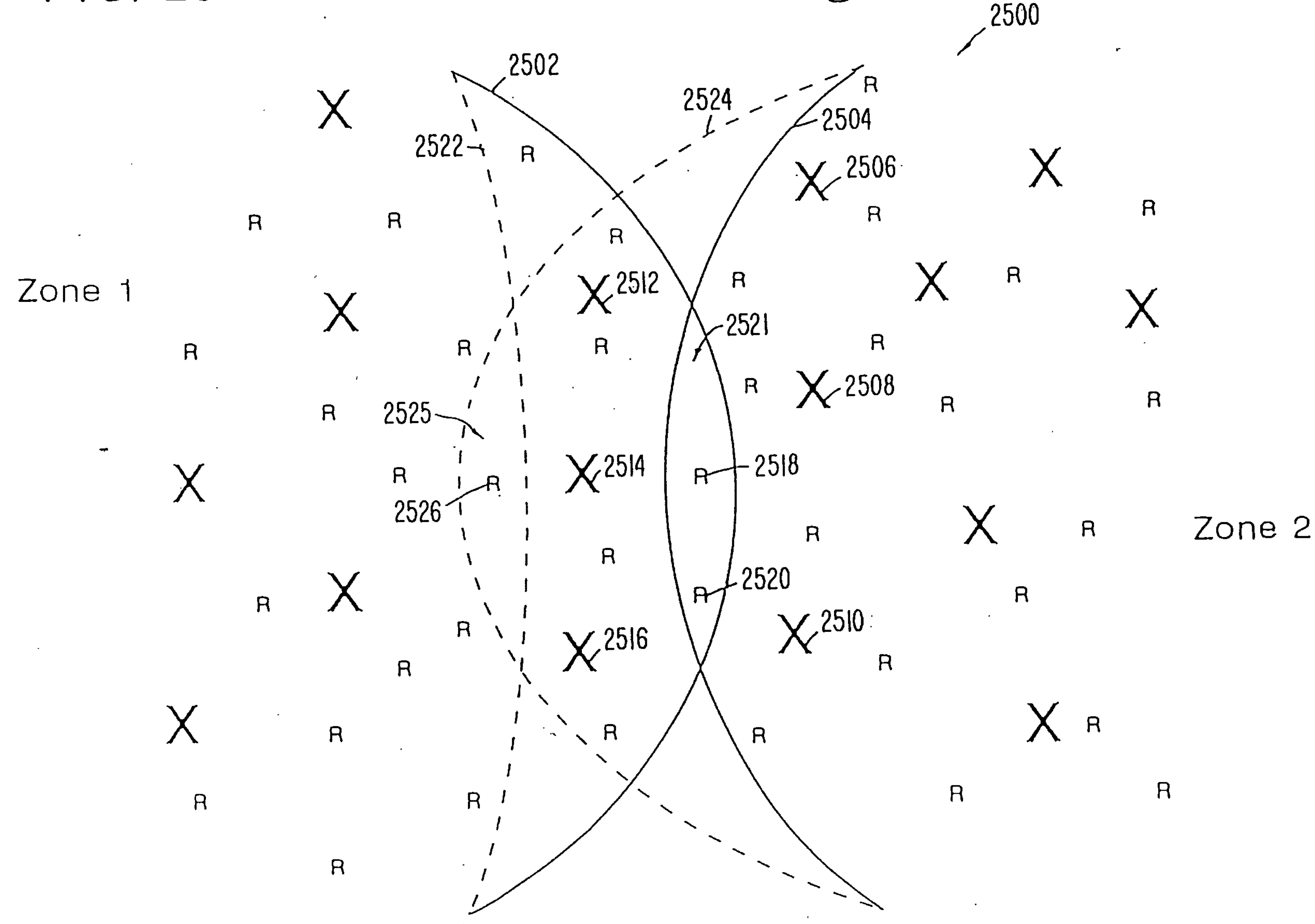


FIG. 26

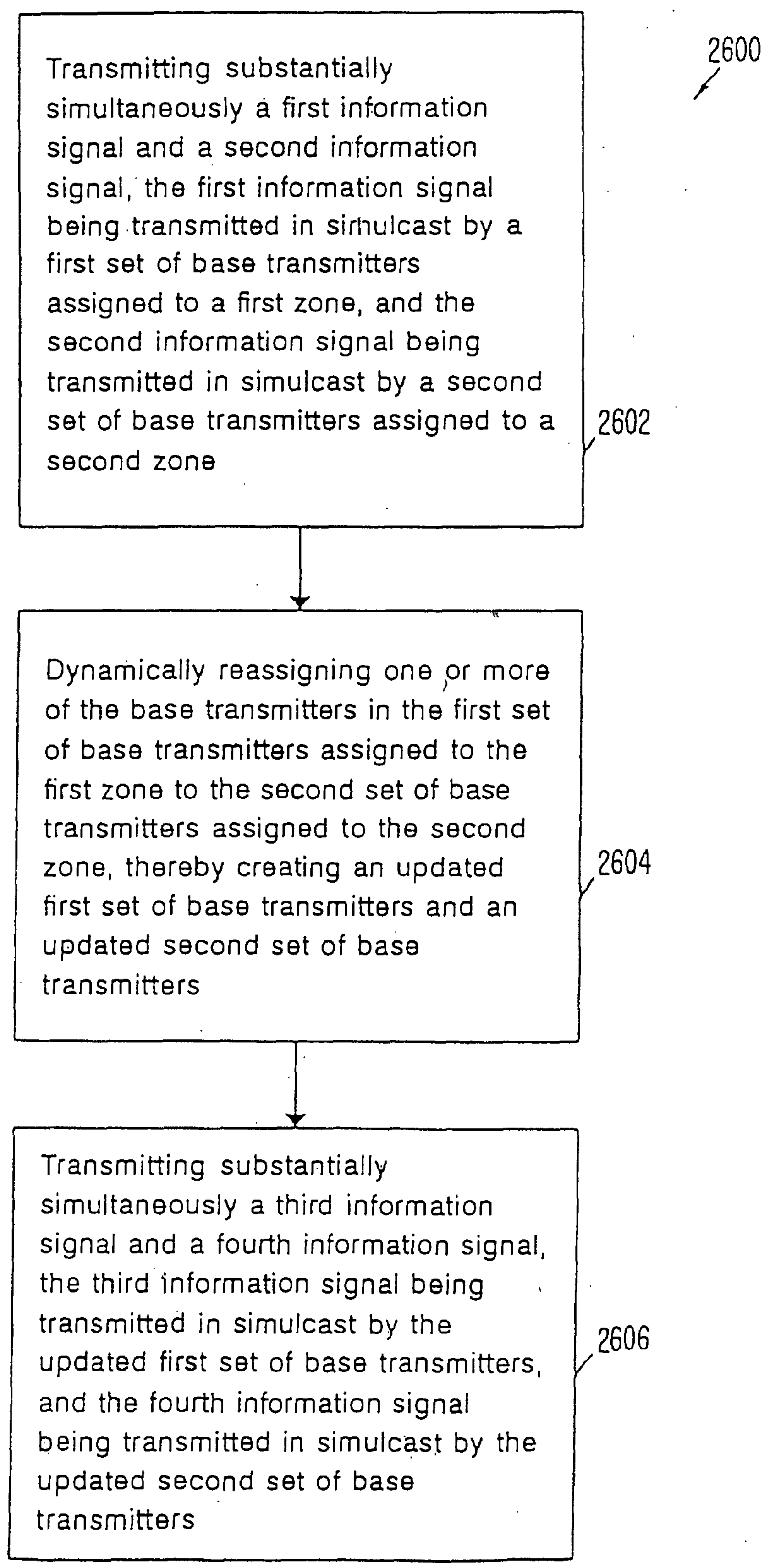

2600
Transmitting substantially simultaneously a first information signal and a second information signal, the first information signal being transmitted in simulcast by a first set of base transmitters assigned to a first zone, and the second information signal being transmitted in simulcast by a second set of base transmitters assigned to a second zone
2602
Dynamically reassigning one or more of the base transmitters in the first set of base transmitters assigned to the first zone to the second set of base transmitters assigned to the second zone, thereby creating an updated first set of base transmitters and an updated second set of base transmitters
2604
Transmitting substantially simultaneously a third information signal and a fourth information signal, the third information signal being transmitted in simulcast by the updated first set of base transmitters, and the fourth information signal being transmitted in simulcast by the updated second set of base transmitters
2606

FIG. 27(A)

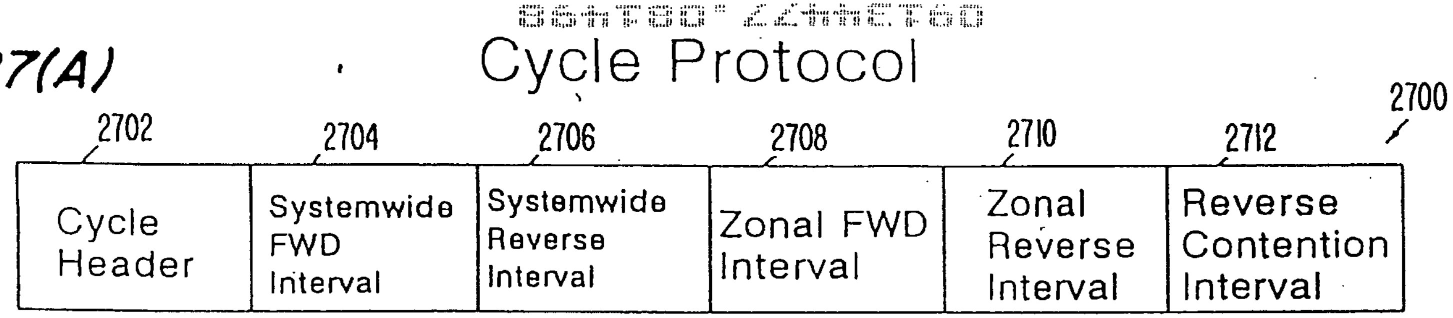


FIG. 27(B)

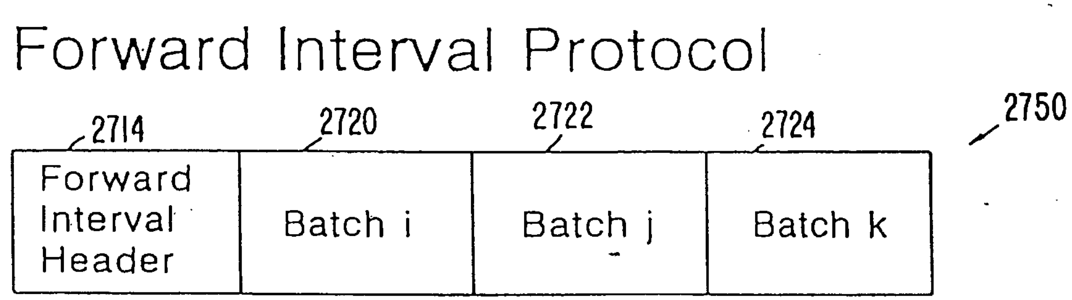


FIG. 27(C)

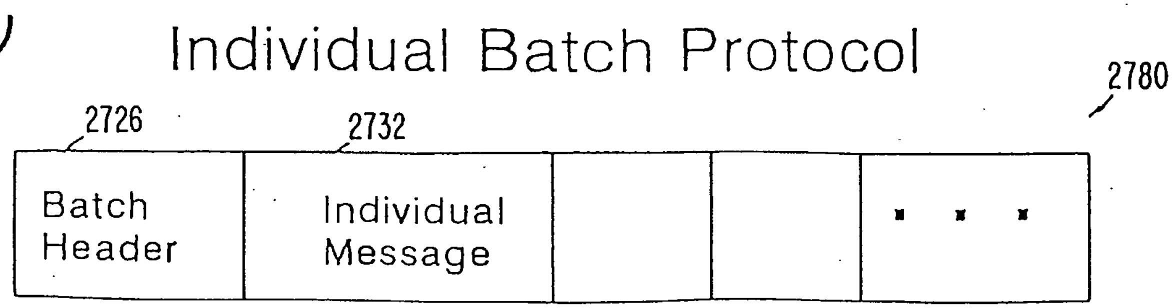


FIG. 28(A)

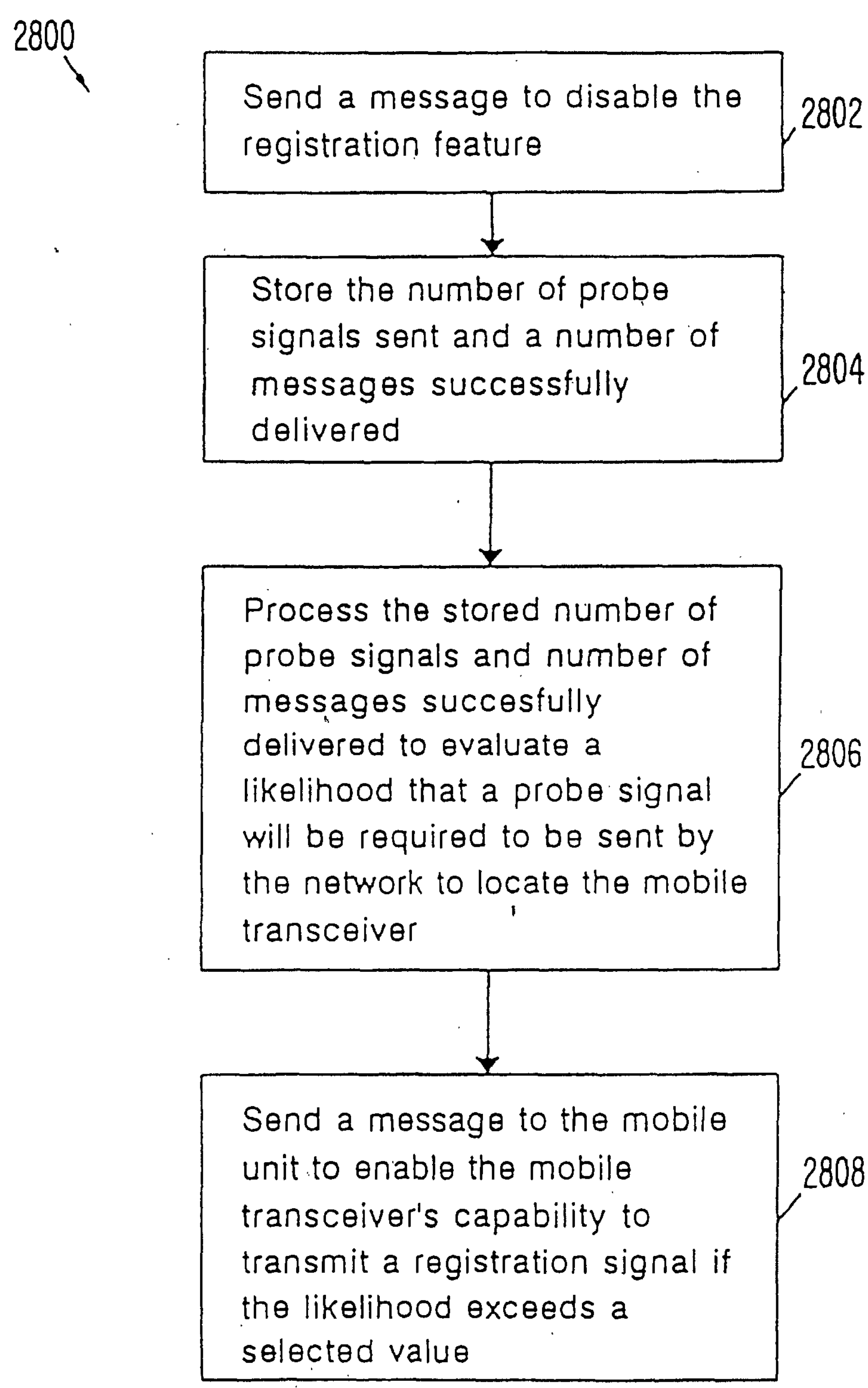

2800
Send a message to disable the registration feature
2802
Store the number of probe signals sent and a number of messages successfully delivered
2804
Process the stored number of probe signals and number of messages succesfully delivered to evaluate a likelihood that a probe signal will be required to be sent by the network to locate the mobile transceiver
2806
Send a message to the mobile unit to enable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2808

FIG. 28(B)

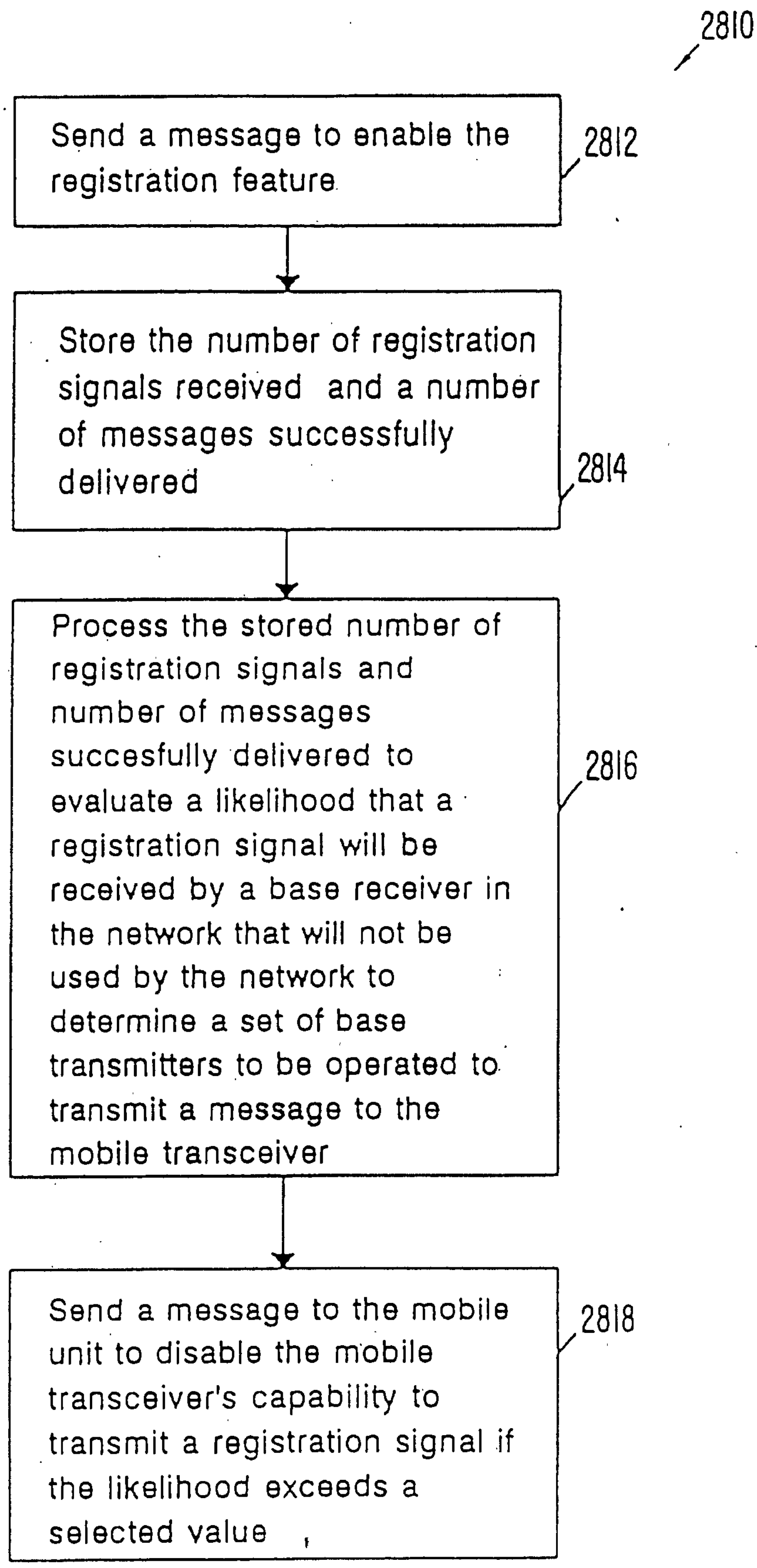

2810
Send a message to enable the registration feature
2812
Store the number of registration signals received and a number of messages successfully delivered
2814
Process the stored number of registration signals and number of messages succesfully delivered to evaluate a likelihood that a registration signal will be received by a base receiver in the network that will not be used by the network to determine a set of base transmitters to be operated to transmit a message to the mobile transceiver
2816
Send a message to the mobile unit to disable the mobile transceiver's capability to transmit a registration signal if the likelihood exceeds a selected value
2818

FIG. 29(A)

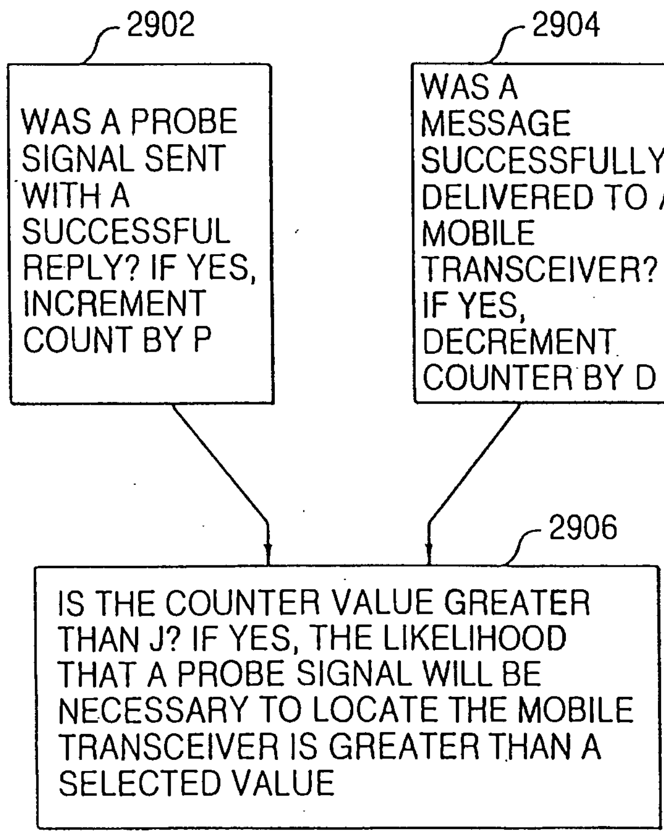
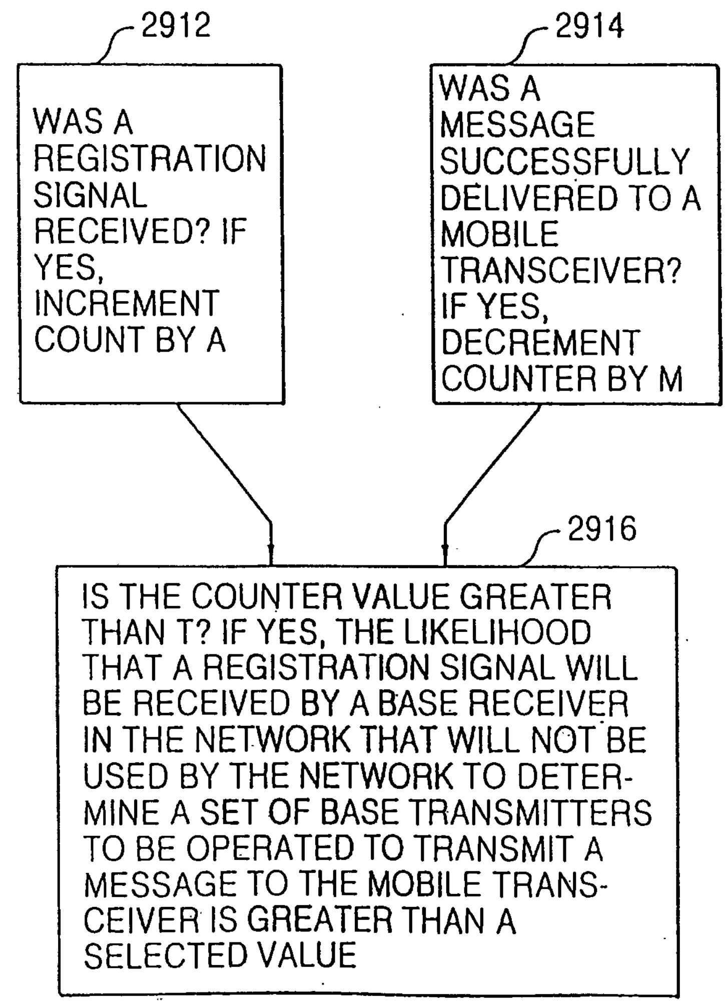


FIG. 29(B)



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/899,476	07/24/97	CAMERON	D 3680.0083-05

LM61/0923

FINNEGAN HENDERSON FARABOW GARRETT
AND DUNNER
1300 I STREET NW
WASHINGTON DC 20005-3315

EXAMINER	
LE,T	
ART UNIT	PAPER NUMBER
2745	

DATE MAILED: 09/23/98

A. ☐ The petition filed __________ under 37 CFR 1.312(b) is granted.
The paper has been forwarded to the examiner for consideration on the merits.

B. ☑ The amendment filed 9/12/98 under 37 CFR 1.312 has been considered, and has been:

1. ☑ entered
2. ☐ entered as directed to matters of form not affecting the scope of the invention (0:3311).
3. ☐ disapproved. A report appears below.
4. ☐ entered in part. A report appears below.

Report: Attachement of IDS filed 9/12/98 & 12/9/98

9/21/98
THANH CONG LE
PRIMARY EXAMINER
TC2700

PLEASE FURNISH YOUR ZIP CODE IN ALL CORRESPONDENCE

FORM PTOL-271 (REV. 7/89)

NO A DRAWING

OIPE
JAN - 6 1999
PATENT & TRADEMARK OFFICE

PATENT
Attorney Docket No. 3680.0083-05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
Dennis W. CAMERON et al.	Group Art Unit: 2745
Serial No.: 08/899,476	Examiner: Le, T.
Filed: July 24, 1997	NOTICE OF ALLOWANCE DATED: April 16, 1998
For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION	Batch No.: D05

BOX ISSUE FEE
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

STATUS INQUIRY

The above-application was filed in the United States Patent and Trademark Office on July 24, 1997. The Issue Fee Transmittal was paid on June 16, 1998 and no communication regarding the Issue Fee Transmittal has been received from the Examiner.

Please inform us of the status of this application.

Respectfully submitted,

By: John M. Romary
John M. Romary
Reg. No. 26,331

Dated: January 6, 1999

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, D. C. 20005
202-408-4000

Transaction History Date 1999-06-22
Date information retrieved from USPTO Patent
Application Information Retrieval (PAIR)
system records at www.uspto.gov

PTO UTILITY GRANT
Paper Number 15

The United States of America

The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to an statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.

Bruce Lehman
Commissioner of Patents and Trademarks

Sandra L Morton
Attest

Form PTO-1584 (Rev. 2/97)

(RIGHT INSIDE)

FPI-LOM

COFC

PATENT

Attorney Docket No. 3680.0083-05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OIPE AUG - 9 1999 PATENT & TRADEMARK OFFICE

In re U.S. Patent No.: 5,915,210)

Inventors: Dennis Wayne CAMERON et al.)

Issue Date: June 22, 1999)

For: METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION)

CERTIFICATE AUG 1 7 1999 OF CORRECTION

Certificate of Correction Branch

Assistant Commissioner for Patents
Washington, D.C. 20231

#16 Jones

Sir:

REQUEST FOR CERTIFICATE OF CORRECTION

Pursuant to 35 U.S.C. § 254 and 37 C.F.R. § 1.322, this is a request for the issuance of a Certificate of Correction in the above-identified patent. Specifically, Patentee requests the following corrections:

Claim 10, column 34, line 46, delete "[a]".

Claim 14, column 35, line 9, after "carrier" insert therefor --signals include an identical number of carrier signals, and wherein each carrier signal in--.

Two (2) copies of PTO Form 1050 are appended. The complete Certificate of Correction involves one (1) page.

The mistake identified in the appended Form occurred through the fault of the Office, as clearly disclosed by the records of the application which matured into this patent.

Issuance of the Certificate of Correction containing the correction is earnestly requested.

APPROVED LW OCT 27 1999 FOR ... OF PAT. & TM.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

By: Robert J. ..., Reg. No. 24,014
for John M. Romary
Reg. No. 26,331

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT, & DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

Dated: August 6, 1999

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.: 5,915,210

DATED: June 22, 1999

INVENTORS: CAMERON et al.

It is certified that an error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 10, column 34, line 46, delete "[a]". P ✓

Claim 14, column 35, line 9, after "carrier" insert therefor --signals include an identical number of carrier signals, and wherein each carrier signal in--. P ✓

Mailing Address of Sender:

Finnegan, Henderson, Farabow
Garrett & Dunner, L.L.P.
1300 I Street, N.W.
Washington, DC 20005-3315

PATENT NO. 5,915,210

No. of add'l copies
@ 50¢ per page

-

FORM PTO 1050 (Rev.2-93)

File History Content Report

The following content is missing from the original file history record obtained from the United States Patent and Trademark Office. No additional information is available.

Document Date - 1999-10-27

Document Title - Certificate of Correction - Post Issue Communication

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

CHANGE OF ADDRESS/POWER OF ATTORNEY

FILE LOCATION 9200 SERIAL NUMBER 08899476 PATENT NUMBER 5915210

THE CORRESPONDENCE ADDRESS HAS BEEN CHANGED TO CUSTOMER # 25537

THE PRACTITIONERS OF RECORD HAVE BEEN CHANGED TO CUSTOMER # 25537

THE FEE ADDRESS HAS BEEN CHANGED TO CUSTOMER # 25537

ON 11/21/00 THE ADDRESS OF RECORD FOR CUSTOMER NUMBER 25537 IS:

WORLDCOM, INC
TECHNOLOGY LAW DEPARTMENT
1133 19TH ST, NW
WASHINGTON DC 20036

AND THE PRACTITIONERS OF RECORD FOR CUSTOMER NUMBER 25537 ARE:

34958 40289 41467 42408 42761 43792

PTO INSTRUCTIONS: PLEASE TAKE THE FOLLOWING ACTION WHEN THE CORRESPONDENCE ADDRESS HAS BEEN CHANGED TO CUSTOMER NUMBER: RECORD, ON THE NEXT AVAILABLE CONTENTS LINE OF THE FILE JACKET, 'ADDRESS CHANGE TO CUSTOMER NUMBER'. LINE THROUGH THE OLD ADDRESS ON THE FILE JACKET LABEL AND ENTER ONLY THE 'CUSTOMER NUMBER' AS THE NEW ADDRESS. FILE THIS LETTER IN THE FILE JACKET. WHEN ABOVE CHANGES ARE ONLY TO FEE ADDRESS AND/OR PRACTITIONERS OF RECORD, FILE LETTER IN THE FILE JACKET.
THIS FILE IS ASSIGNED TO GAU 2745.

PTO-FMD
TALBOT-1/97

PATENT APPLICATION FEE DETERMINATION RECORD Effective October 1, 1996	Application or Docket Number 0 8899476

CLAIMS AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE				385.00	OR		770.00
TOTAL CLAIMS	18 minus 20 =	*	x$11=		OR	x$22=	
INDEPENDENT CLAIMS	2 minus 3 =	*	x40=		OR	x80=	
MULTIPLE DEPENDENT CLAIM PRESENT			+130=		OR	+260=	
			TOTAL		OR	TOTAL	770

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 10/96)

*U.S. Government Printing Office: 1996 - 413-288/49191

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Form PTO 1130
(REV 2/94)

PACE DATA ENTRY CODING SHEET

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

1ST EXAMINER | DATE

2ND EXAMINER | DATE

60245 U.S. PTO
08/899476
07/24/97

APPLICATION NUMBER | TYPE APPL | FILING DATE (MONTH DAY YEAR) | SPECIAL HANDLING | GROUP ART UNIT | CLASS | SHEETS OF DRAWING

TOTAL CLAIMS | INDEPENDENT CLAIMS | SMALL ENTITY? | FILING FEE | FOREIGN LICENSE | ATTORNEY DOCKET NUMBER

CONTINUITY DATA

CONT CODE	STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE (MONTH DAY YEAR)
			P C T / /		
			P C T / /		
			P C T / /		
			P C T / /		
			P C T / /		

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE (MONTH DAY YEAR)

MPI Family Report (Family Bibliographic and Legal Status)

In the MPI Family report, all publication stages are collapsed into a single record, based on identical application data. The bibliographic information displayed in the collapsed record is taken from the latest publication.

Report Created Date: 2013-03-08

Name of Report:

Number of Families: 1

Comments:

Table of Contents

Family1

23 records in the family, collapsed to 18 records.

AT162915T 19980215

[no drawing available]

(GER) MOBILES ZWEI-WEG-KOMMUNIKATIONSSYSTEM

Assignee: MOBILE TELECOMM TECH US

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR WALTER CHARLES JR US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: AT 94901305 T

Filing Date: 19931112

Issue/Publication Date: 19980215

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status:

Date	+/-	Code	Description
19980715	(-)	RER	CEASED AS TO PARAGRAPH 5 LIT. 3 LAW INTRODUCING PATENT TREATIES

AU5594494A 19940608

(ENG) Mobile two-way communication system

Assignee: MOBILE TELECOMM TECH

[no drawing available]

Inventor(s): CAMERON DENNIS WAYNE ; ROEHR WALTER CHARLES JR ; PETROVIC RADE ; BHAGAT JAI P ; GARAHI MASOOD ; HAYS WILLIAM D ; ACKERMAN DAVID W

Application No: AU 5594494 D

Filing Date: 19931112

Issue/Publication Date: 19940608

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 9310713 19931112 W W N; US 12421993 19930921 A Y; US 97391892 19921112 A Y;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status: There is no Legal Status information available for this patent

BR9307436A 19990601

(POR) Sistema de comunicação de duas vias móvel

Assignee: MOBILE TELECOMM TECH US

[no drawing available]

Inventor(s): CAMERON DENNIS WAYNE ; ROEHR WALTER CHARLES JR ; PETROVIC RADE ; BHAGAT JAI P ; GARAHI MASOOD ; HAYS WILLIAM D ; ACKERMAN DAVID W

Application No: BR 9307436 A

Filing Date: 19931112

Issue/Publication Date: 19990601

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y; US 9310713 19931112 W W N;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status:

Date	+/-	Code	Description
20000418	(-)	EG	TECHNICAL EXAMINATION (OPINION): PUBLICATION OF TECHNICAL EXAMINATION (OPINION)
20000818	(+)	NO	EXTENSION OF TIME ALLOWED
20001005	(-)	NB36	TECHNICAL AND FORMAL REQUIREMENTS: REQUIREMENT - ARTICLE 36 OF INDUSTRIAL PROPERTY LAW
20021106	(+)	FB36	DECISION: GRANTING
20021006	()	FHFI	DECISION: RECTIFICATION
20021005	(+)	FG9A	PATENT OR CERTIFICATE OF ADDITION GRANTED
20030812	()	FC9A	PUBLICATION DELETED
20030814	()	B24C	: REFERENTE A 12A, 13A, 14A, 15A, 16A E 17A ANUIDADE(E).;

CA2149125C 20040330
CA2149125A1 19940526

(ENG) MOBILE TWO-WAY COMMUNICATION SYSTEM

[no drawing available]

Assignee: MOBILE TELECOMM TECHNOLOGIES US

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR WALTER CHARLES JR US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: CA 2149125 A

Filing Date: 19931112

Issue/Publication Date: 20040330

Abstract: (ENG) A two-way communication system for communication between a system network an d a mobile unit. The system network includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximize information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch tha t allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y; US 9310713 19931112 W W N;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Publication Language: ENG

Legal Status:

Date	+/-	Code	Description
19950510	(+)	AFNE	NATIONAL PHASE ENTRY

20001110	(+)	EEER	EXAMINATION REQUEST
20030403	(+)	AFNE	NATIONAL PHASE ENTRY Effective date: 19950510;
20030403	(+)	AFNE	NATIONAL PHASE ENTRY Effective date: 19950510;
20030403	(+)	EEER	EXAMINATION REQUEST Effective date: 20001110;
20030403	(+)	EEER	EXAMINATION REQUEST Effective date: 20001110;
20051114	(-)	MKLA	LAPSED

CA2442424A1 19940526

(ENG) MOBILE TWO-WAY COMMUNICATION SYSTEM

Assignee: MOBILE TELECOMM TECHNOLOGIES US

[no drawing available]

Inventor(s): ROEHR WALTER CHARLES JR US ; GARAHI MASOOD US ; PETROVIC RADE US ; BHAGAT JAI P US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US ; CAMERON DENNIS WAYNE US

Application No: CA 2442424 A

Filing Date: 19931112

Issue/Publication Date: 19940526

Priority Data: CA 2149125 19931112 A X; US 97391892 19921112 A X; US 12421993 19930921 A X;

IPC (International Class): H04H00300; H04Q00736; H04L01254

Publication Language: ENG

Legal Status:

Date	+/-	Code	Description
20031001	(+)	EEER	EXAMINATION REQUEST
20051114	(-)	FZDE	DEAD

DE69316771D1 19980305

(GER) MOBILES ZWEI-WEG-KOMMUNIKATIONSSYSTEM

[no drawing available]

Assignee: MOBILE TELECOMM TECH US

Inventor(s): CAMERON DENNIS US ; ROEHR WALTER US ; PETROVIC RADE US ; BHAGAT JAI US ; GARAHI MASOOD US ; HAYS WILLIAM US ; ACKERMAN DAVID US

Application No: DE 69316771 A

Filing Date: 19931112

Issue/Publication Date: 19980305

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y; US 9310713 19931112 W W N;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status:

Date	+/-	Code	Description
19990304	(+)	8364	NO OPPOSITION DURING TERM OF OPPOSITION
20030618	( )	8328	CHANGE IN THE PERSON/NAME/ADDRESS OF THE AGENT Representative's name: GROSSE, BOCKHORNI, SCHUMACHER, 81476 MueNCHEN;
20080703	( )	8328	CHANGE IN THE PERSON/NAME/ADDRESS OF THE AGENT Representative's name: BOCKHORNI & KOLLEGEN, 80687 MUENCHEN;

DE69316771T2 19980924

(GER) MOBILES ZWEI-WEG-KOMMUNIKATIONSSYSTEM

[no drawing available]

Assignee: MOBILE TELECOMM TECH US

Inventor(s): CAMERON DENNIS US ; ROEHR WALTER US ; PETROVIC RADE US ; BHAGAT JAI US ; GARAHI MASOOD US ; HAYS WILLIAM US ; ACKERMAN DAVID US

Application No: DE 69316771 T

Filing Date: 19931112

Issue/Publication Date: 19980924

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y; US 9310713 19931112 W W N;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status:

Date	+/-	Code	Description
19990304	(+)	8364	NO OPPOSITION DURING TERM OF OPPOSITION
20030618	( )	8328	CHANGE IN THE PERSON/NAME/ADDRESS OF THE AGENT Representative's name: GROSSE, BOCKHORNI, SCHUMACHER, 81476 MueNCHEN;
20080703	( )	8328	CHANGE IN THE PERSON/NAME/ADDRESS OF THE AGENT Representative's name: BOCKHORNI & KOLLEGEN, 80687 MUENCHEN;

DE69333552D1 20040722

(GER) Bidirektionales Mobilfunksystem

Assignee: MOBILE TELECOMM TECHNOLOGIES J US

[no drawing available]

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR JR US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM US ; ACKERMAN DAVID W US

Application No: DE 69333552 A

Filing Date: 19931112

Issue/Publication Date: 20040722

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status:

Date	+/-	Code	Description
20050728	(+)	8364	NO OPPOSITION DURING TERM OF OPPOSITION
20070913	(-)	8339	CEASED/NON-PAYMENT OF THE ANNUAL FEE

DE69333552T2 20050623

(GER) Bidirektionales Mobilfunksystem

Assignee: MOBILE TELECOMM TECHNOLOGIES J US

[no drawing available]

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR JR US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM US ; ACKERMAN DAVID W US

Application No: DE 69333552 T

Filing Date: 19931112

Issue/Publication Date: 20050623

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone

boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y;

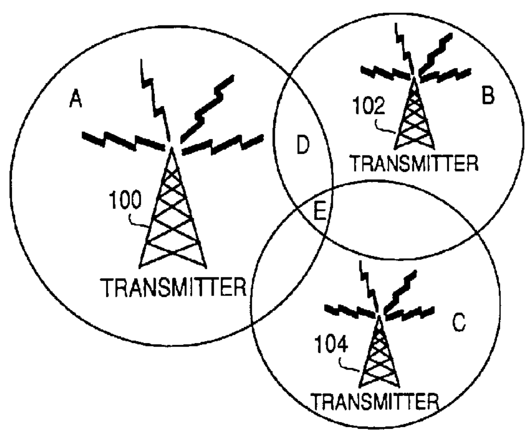
IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status:

Date	+/-	Code	Description
20050728	(+)	8364	NO OPPOSITION DURING TERM OF OPPOSITION
20070913	(-)	8339	CEASED/NON-PAYMENT OF THE ANNUAL FEE

EP0669062B1 19980128
EP0669062A1 19950830

FIG. 1



(ENG) MOBILE TWO-WAY COMMUNICATION SYSTEM

Assignee: MOBILE TELECOMM TECH US

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR WALTER CHARLES JR US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: EP 94901305 A

Filing Date: 19931112

Issue/Publication Date: 19980128

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 9310713 19931112 W W N; US 97391892 19921112 A Y; US 12421993 19930921 A Y;

Related Application(s):

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

ECLA (European Class): H04Q00738P; H04H02067; H04L02726M; H04L02726M3A5; H04Q00708; H04Q00712

Designated Countries:

Publication Language: ENG

Filing Language: ENG

Agent(s): Hale, Peter Kilburn & Strode, 20 Red Lion Street, London WC1R 4PJ, GB GB

Legal Status:

Date	+/-	Code	Description

19950830	(+)	17P	REQUEST FOR EXAMINATION FILED Effective date: 19950612;
19950830	(+)	AK	DESIGNATED CONTRACTING STATES: Kind code of corresponding patent document: A1; List of designated states: AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE;
19951227	(+)	17Q	FIRST EXAMINATION REPORT Effective date: 19951110;
19980128	(+)	AK	DESIGNATED CONTRACTING STATES: Kind code of corresponding patent document: B1; List of designated states: AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE;
19980128	( )	DX	MISCELLANEOUS: (DELETED)
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): AT; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): BE; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): ES; : THE PATENT HAS BEEN ANNULLED BY A DECISION OF A NATIONAL AUTHORITY; Effective date: 19980128;
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 19980128;
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IT; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;
19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;

19980128	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): NL; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;
19980128	( )	REF	CORRESPONDS TO: Corresponding patent document: 162915; Country code of corresponding patent document: AT; Publication date of corresponding patent document: 19980215; Kind code of corresponding patent document: T;
19980130	( )	REG	REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): CH; Corresponding EP Code 1 for PRS Code (EP REG): EP;
19980305	( )	REF	CORRESPONDS TO: Corresponding patent document: 69316771; Country code of corresponding patent document: DE; Publication date of corresponding patent document: 19980305;
19980428	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): DK; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980428;
19980428	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): PT; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980428;
19980428	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): SE; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980428;
19980605	(+)	ET	FR: TRANSLATION FILED
19980617	( )	REG	REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): IE; Corresponding EP Code 1 for PRS Code (EP REG): FG4D; : 78693;
19980701	(-)	NLV1	NL: LAPSED OR ANNULED DUE TO FAILURE TO FULFILL THE REQUIREMENTS OF ART. 29P AND 29M OF THE PATENTS ACT; NO LEGAL EFFECT FROM
19980814	( )	REG	REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): CH; Corresponding EP Code 1 for PRS Code (EP REG): PL;
19981123	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): MC; Payment date: 19981123; Year of fee payment: 06;
19981207	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): IE; Payment date: 19981207; Year of fee payment: 06;

19981209	(-)	R25	LAPSED IN A CONTRACTING STATE DURING THE OPPOSITION PERIOD (CORRECTION) Corresponding country code for PRS Code (EP REG): AT; Effective date: 19980128;
19981209	(-)	R25	LAPSED IN A CONTRACTING STATE DURING THE OPPOSITION PERIOD (CORRECTION) Corresponding country code for PRS Code (EP REG): BE; Effective date: 19980128;
19981209	(-)	R25	LAPSED IN A CONTRACTING STATE DURING THE OPPOSITION PERIOD (CORRECTION) Corresponding country code for PRS Code (EP REG): CH; Effective date: 19980128;
19981209	(-)	R25	LAPSED IN A CONTRACTING STATE DURING THE OPPOSITION PERIOD (CORRECTION) Corresponding country code for PRS Code (EP REG): LI; Effective date: 19980128;
19981209	(-)	R25	LAPSED IN A CONTRACTING STATE DURING THE OPPOSITION PERIOD (CORRECTION) Corresponding country code for PRS Code (EP REG): PT; Effective date: 19980428;
19981209	(-)	R25	LAPSED IN A CONTRACTING STATE DURING THE OPPOSITION PERIOD (CORRECTION) Corresponding country code for PRS Code (EP REG): SE; Effective date: 19980428;
19981215	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): LU; Payment date: 19981215; Year of fee payment: 06;
19990120	(+)	26N	NO OPPOSITION FILED
19991112	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IE; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 19991112;
19991112	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LU; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 19991112;
20000531	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): MC; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20000531;
20000920	( )	REG	REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): IE; Corresponding EP Code 1 for PRS Code (EP REG): MM4A;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): AT; Effective date: 19980128;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): BE; Effective date: 19980128;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 19980128;

20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; Effective date: 19980128;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IT; Effective date: 19980128;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 19980128;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): PT; Effective date: 19980428;
20010606	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): SE; Effective date: 19980428;
20020101	( )	REG	REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): GB; Corresponding EP Code 1 for PRS Code (EP REG): IF02;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): AT; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): BE; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): ES; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IT; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 19980128;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA

			POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): PT; Effective date: 19980428;
20020626	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): SE; Effective date: 19980428;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): AT; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): BE; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): ES; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IT; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): NL; Effective date: 19980128;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): PT; Effective date: 19980428;
20030219	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): SE; Effective date: 19980428;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): AT; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA

			POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): BE; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): DK; Effective date: 19980428;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): ES; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IT; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): NL; Effective date: 19980128;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): PT; Effective date: 19980428;
20031105	(-)	25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): SE; Effective date: 19980428;
20061117	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): FR; Payment date: 20061117; Year of fee payment: 14;
20061117	()	PGFP	Corresponding country code for PRS Code (EP REG): FR; Payment date: 20061117; Year of fee payment: 14;
20061122	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): GB; Payment date: 20061122; Year of fee payment: 14;
20061122	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20061122; Year of fee payment: 14;
20070102	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): DE; Payment date: 20070102; Year of fee payment: 14;

20070102	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20070102; Year of fee payment: 14;
20080102	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IT; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 19980128;
20080430	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): GB; Payment date: 20071128; Year of fee payment: 15;
20080430	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20071128; Year of fee payment: 15;
20080530	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): DE; Payment date: 20071221; Year of fee payment: 15;
20080530	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20071221; Year of fee payment: 15;
20081031	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): GB; Payment date: 20051109; Year of fee payment: 13;
20081031	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20051109; Year of fee payment: 13;
20081128	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): FR; Payment date: 20080529; Year of fee payment: 15;
20090529	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20081223; Year of fee payment: 16;
20090529	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20081223; Year of fee payment: 16;
20090630	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20081128; Year of fee payment: 16;
20090630	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20081128; Year of fee payment: 16;
20090911	()	REG	Corresponding country code for PRS Code (EP REG): FR; Corresponding EP Code 1 for PRS Code (EP REG): ST; Effective date: 20090731;
20100129	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20091127; Year of fee payment: 17;
20100129	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20091127; Year of fee payment: 17;
20100430	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20091125; Year of fee payment: 17;
20100430	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20091125; Year of fee payment: 17;
20110228	()	PGFP	Corresponding country code for PRS Code (EP REG): DE; Payment date: 20101126; Year of fee payment: 18;
20110331	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20101124; Year of fee payment: 18;
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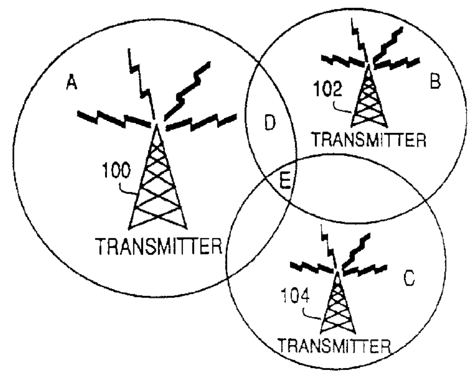
20120629	()	PGFP	Corresponding country code for PRS Code (EP REG): GB; Payment date: 20120224; Year of fee payment: 19;

EP0789464B1 20040616
EP0789464A3 19980114
EP0789464A2 19970813

FIG. 1



(ENG) Mobile two-way communication system

Assignee: MOBILE TELECOMM TECHNOLOGIES US

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR WALTER CHARLES JR US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM US ; ACKERMAN DAVID W US

Application No: EP 97201162 A

Filing Date: 19931112

Issue/Publication Date: 20040616

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: EP 94901305 19931112 A 3 N; US 97391892 19921112 A Y; US 12421993 19930921 A Y; US 9310713 19931112 W W N;

Related Application(s): 94901305.6 0669062 19940526

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Designated Countries:

Publication Language: ENG

Filing Language: ENG

Agent(s): Hale, Peter et al 00060281 Kilburn & Strode 20 Red Lion Street London WC1R 4PJ GB

Date of Deferred Publication of Search Report:
--19980114

Legal Status:

Date	+/-	Code	Description
20040722	( )	REF	CORRESPONDS TO: Corresponding patent document: 69333552; Country code of corresponding patent document: DE; Publication date of corresponding patent document: 20040722; Kind code of corresponding patent document: P;
20050325	(+)	ET	FR: TRANSLATION FILED
20050608	(+)	26N	NO OPPOSITION FILED Effective date: 20050317;
20051109	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): GB; Payment date: 20051109; Year of fee payment: 13;
20051117	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): FR; Payment date: 20051117; Year of fee payment: 13;

20060102	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): DE; Payment date: 20060102; Year of fee payment: 13;
20070601	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): DE; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20070601;
20070725	(-)	GBPC	GB: EUROPEAN PATENT CEASED THROUGH NON-PAYMENT OF RENEWAL FEE Effective date: 20061112;
20070803	( )	REG	REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): FR; Corresponding EP Code 1 for PRS Code (EP REG): ST; Effective date: 20070731;
20071124	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GB; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20061112;
20080430	(-)	PG25	LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): FR; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20061130;
20081031	(+)	PGFP	POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): GB; Payment date: 20051109; Year of fee payment: 13;

MX9307095A 19940630

(SPA) SISTEMA Y METODO DE COMUNICACIONES A ESCALA NACIONAL.

[no drawing available]

Assignee: MOBILE TELECOMUNICATION TECHNO US

Inventor(s): BHAGAT JAI P US ; GARAHI MASSOD ; HAYS WILLIAM D ; ACKERMAN DAVID W ; CAMERON DENNIS WAYNE ; ROEHR WALTER CHARLES JR ; PETROVIC RADE

Application No: MX 9307095 A

Filing Date: 19931112

Issue/Publication Date: 19940630

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 97391892 19921112 A Y; US 12421993 19930921 A Y;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

Legal Status: There is no Legal Status information available for this patent

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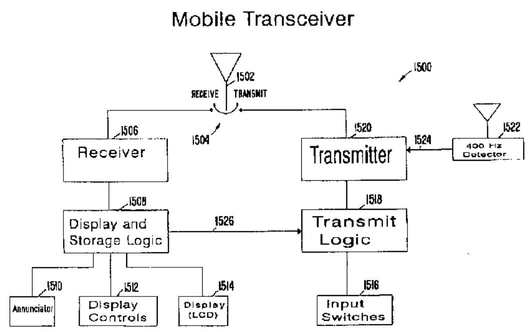


US5754946A 19980519

(ENG) Nationwide communication system

Assignee: MOBILE TELECOMM TECH US

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR WALTER CHARLES US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: US 12421993 A

Filing Date: 19930921

Issue/Publication Date: 19980519

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximize information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 12421993 19930921 A Y; US 97391892 19921112 A 2 Y;

Related Application(s): 07/973918 19921112 5590403 US GRANTED

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

ECLA (European Class): H04Q00738P; H04H02067; H04L02726M; H04L02726M3A5; H04Q00708; H04Q00712; H04W06800; H04W06810; H04W08402S; H04W08402S2

US Class: 34000722; 34000726; 34000727; 4550677; 455517

Publication Language: ENG

Filing Language: ENG

Agent(s): Finnegan, Henderson, Farabow, Garrett & Dunner, LP.

Examiner Primary: Eisenzopf, Reinhard J.

Examiner Assistant: Le, Thanh

Assignments Reported to USPTO:

Reel/Frame: 06870/0558 **Date Signed:** 19931001 **Date Recorded:** 19940125

Assignee: MOBILE TELECOMMUNICATION TECHNOLOGIES 200 S. LAMAR STREET JACKSON MISSISSIPPI 39201

Assignor: CAMERON, DENNIS WAYNE; ROEHR, WALTER CHARLES; PETROVIC, RADE; BHAGAT, JAI P.; GARAHI, M BHAGAT, JAI P.; GARAHI, MASOOD; HAYS, WILLIAM D.; ACKERMAN, DAVID W.

Corres. Addr: VINCENT P. KOVALICK FINNEGAN, HENDERSON, FARABOW, ET AL. 1300 I ST., N.W. WASHINGTON, DC 20005
Brief: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 07330/0969 **Date Signed:** 19950113 **Date Recorded:** 19950201
Assignee: DESTINEER CORPORATION 200 S. LAMAR STREET JACKSON MISSISSIPPI 39201

Assignor: MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION

Corres. Addr: VINCENT P. KOVALICK FINNEGAN, HENDERSON, FARABOW ET AL. 1300 I STREET, N.W. WASHINGTON, DC 20005-3315
Brief: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 15074/0637 **Date Signed:** 19990129 **Date Recorded:** 20040823
Assignee: SKYTEL CORP. 22001 LOUDON COUNTY ASHBURN VIRGINIA 20147

Assignor: DESTINEER CORPORATION

Corres. Addr: MICHAEL A. WRENN 1133 19TH STREET NW 9854/003 WASHINGTON, DC 20036
Brief: MERGER (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 18826/0503 **Date Signed:** 20070131 **Date Recorded:** 20070131
Assignee: WELLS FARGO FOOTHILL, INC., AS AGENT 2450 COLORADO AVENUE, SUITE 3000 WEST SANTA MONICA CALIFORNIA 90404

Assignor: BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION; BELL INDUSTRIES, INC., A MINNESOTA CORPO
MINNESOTA CORPORATION

Corres. Addr: PAUL HASTINGS JANOFSKY & WALKER LLP 515 SOUTH FLOWER STREET, 25TH FLOOR LOS ANGELES, CA 90071
Brief: PATENT SECURITY AGREEMENT

Reel/Frame: 19009/0529 **Date Signed:** 20070312 **Date Recorded:** 20070314
Assignee: NEWCASTLE PARTNERS, L.P. 200 CRESCENT COURT SUITE 1400 DALLAS TEXAS 75201

Assignor: BELL INDUSTRIES, INC.; BELL INDUSTRIES, INC.

Corres. Addr: RANDY M. FRIEDBERG, ESQ. OLSHAN GRUNDMAN FROME ROSENSZWEIG ET AL PARK AVENUE TOWER 65 EAST 55TH STREET NEW YORK, NY 10022
Brief: SECURITY AGREEMENT

Legal Status:

Date	+/-	Code	Description
19940125	()	AS	New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES, MISSISSIPPI; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:CAMERON, DENNIS WAYNE;ROEHR, WALTER CHARLES;PETROVIC, RADE;AND OTHERS;REEL/FRAME:006870/0558;SIGNING DATES FROM 19931001 TO 19931007;
19940125	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES 200 S. LAMAR; Effective date: 19931004;
19940125	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: CAMERON, DENNIS WAYNE; Effective date: 19931004;

19940125	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: ROEHR, WALTER CHARLES; Effective date: 19931007;
19940125	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: PETROVIC, RADE; Effective date: 19931001;
19940125	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: BHAGAT, JAI P.; Effective date: 19931004;
19940125	()	AS02	New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES 200 S. LAMAR; Effective date: 19931004;
19940125	()	AS02	New owner name: CAMERON, DENNIS WAYNE; Effective date: 19931004;
19940125	()	AS02	New owner name: ROEHR, WALTER CHARLES; Effective date: 19931007;
19940125	()	AS02	New owner name: PETROVIC, RADE; Effective date: 19931001;
19940125	()	AS02	New owner name: BHAGAT, JAI P.; Effective date: 19931004;
19950201	()	AS	New owner name: DESTINEER CORPORATION, MISSISSIPPI; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION;REEL/FRAME:007330/0969; Effective date: 19950113;
19950201	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: DESTINEER CORPORATION 200 S. LAMAR STREET JACKSON,; Effective date: 19950113;
19950201	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION; Effective date: 19950113;
19950201	()	AS02	New owner name: DESTINEER CORPORATION 200 S. LAMAR STREET JACKSON,; Effective date: 19950113;
19950201	()	AS02	New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION; Effective date: 19950113;
20011012	()	FPAY	Year of fee payment: 4;
20040823	( )	AS	ASSIGNMENT New owner name: SKYTEL CORP. 22001 LOUDON COUNTYASHBURN, VIRGINIA,; : MERGER;ASSIGNOR:DESTINEER CORPORATION /AR;REEL/FRAME:015074/0637; Effective date: 19990129;
20040823	()	AS	New owner name: SKYTEL CORP., VIRGINIA; : MERGER;ASSIGNOR:DESTINEER CORPORATION;REEL/FRAME:015074/0637; Effective date: 19990129;
20040823	()	AS	New owner name: SKYTEL CORP. 22001 LOUDON COUNTYASHBURN, VIRGINIA,; : MERGER;ASSIGNOR:DESTINEER CORPORATION /AR;REEL/FRAME:015074/0637; Effective date: 19990129;
20051121	()	FPAY	Year of fee payment: 8;
20070131	( )	AS	ASSIGNMENT New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY

			AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070314	( )	AS	ASSIGNMENT New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20091119	()	FPAY	Year of fee payment: 12;

US5581804A 19961203

(ENG) Nationwide communication system

Assignee: DESTINEER CORP US

[no drawing available]

Inventor(s): CAMERON DENNIS W US ; ROEHR JR WALTER C US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: US 38722895 A

Filing Date: 19950213

Issue/Publication Date: 19961203

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximize information throughput. The preferred mobile unit includes a noise detector circuit to prevent unwanted transmissions. The system network further provides an adaptive registration feature for mobile units which controls the registration operations by the mobile units to maximize information throughput.

Priority Data: US 38722895 19950213 A N; US 97391892 19921112 A 3 Y;

Related Application(s): 07/973918 19921112 US PENDING

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W08406; H04W00412

ECLA (European Class): H04Q00738P; H04H02067; H04L02726M; H04L02726M3A5; H04Q00708; H04Q00712; H04W06800; H04W06810; H04W08402S; H04W08402S2

US Class: 4554561; 455524

Publication Language: ENG

Filing Language: ENG

Agent(s): Finnegan, Henderson, Farabow, Garrett & Dunner, LP.

Examiner Primary: Eisenzopf, Reinhard J.

Examiner Assistant: Le, Thanh

Assignments Reported to USPTO:

Reel/Frame: 18826/0503 **Date Signed:** 20070131 **Date Recorded:** 20070131
Assignee: WELLS FARGO FOOTHILL, INC., AS AGENT 2450 COLORADO AVENUE, SUITE 3000 WEST SANTA MONICA CALIFORNIA 90404

Assignor: BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION; BELL INDUSTRIES, INC., A MINNESOTA CORPO MINNESOTA CORPORATION

Corres. Addr: PAUL HASTINGS JANOFSKY & WALKER LLP 515 SOUTH FLOWER STREET, 25TH FLOOR LOS ANGELES, CA 90071
Brief: PATENT SECURITY AGREEMENT

Reel/Frame: 19009/0529 **Date Signed:** 20070312 **Date Recorded:** 20070314
Assignee: NEWCASTLE PARTNERS, L.P. 200 CRESCENT COURT SUITE 1400 DALLAS TEXAS 75201

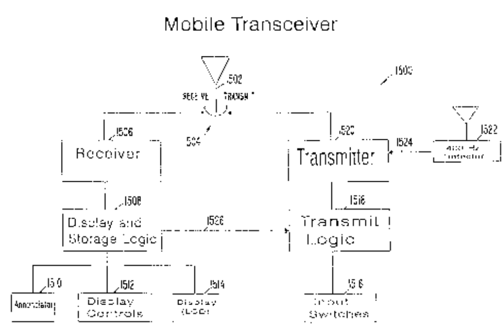
Assignor: BELL INDUSTRIES, INC.; BELL INDUSTRIES, INC.

Corres. Addr: RANDY M. FRIEDBERG, ESQ. OLSHAN GRUNDMAN FROME ROSENSZWEIG ET AL PARK AVENUE TOWER 65 EAST 55TH STREET NEW YORK, NY 10022
Brief: SECURITY AGREEMENT

Legal Status:

Date	+/-	Code	Description
20000223	()	FPAY	Year of fee payment: 4;
20040603	()	FPAY	Year of fee payment: 8;
20070131	( )	AS	ASSIGNMENT New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;

20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070314	( )	AS	ASSIGNMENT New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20080603	()	FPAY	Year of fee payment: 12;
20080609	()	REMI	



US5634198A 19970527

(ENG) Nationwide communication system

Assignee: DESTINEER CORP US

Inventor(s): CAMERON DENNIS W US ; ROEHR JR WALTER C US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: US 38722995 A

Filing Date: 19950213

Issue/Publication Date: 19970527

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximize information throughput. The preferred mobile unit includes a noise detector circuit to prevent unwanted transmissions. The system network further provides an adaptive registration feature for mobile units which controls the registration operations by the mobile units to maximize information throughput.

Priority Data: US 38722995 19950213 A N; US 97391892 19921112 A 3 Y;

Related Application(s): 07/973918 19921112 5590403 US GRANTED

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W08406; H04W00412

ECLA (European Class): H04Q00738P; H04H02067; H04L02726M; H04L02726M3A5; H04Q00708; H04Q00712; H04W06800; H04W06810; H04W08402S; H04W08402S2

US Class: 4550631; 370312; 455503; 455566

Publication Language: ENG

Filing Language: ENG

Agent(s): Finnegan, Henderson, Farabow, Garrett & Dunner, LP.

Examiner Primary: Eisenzopf, Reinhard J.

Examiner Assistant: Le, Thanh

Assignments Reported to USPTO:

Reel/Frame: 18826/0503 **Date Signed:** 20070131 **Date Recorded:** 20070131
Assignee: WELLS FARGO FOOTHILL, INC., AS AGENT 2450 COLORADO AVENUE, SUITE 3000 WEST SANTA MONICA CALIFORNIA 90404

Assignor: BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION; BELL INDUSTRIES, INC., A MINNESOTA CORPO MINNESOTA CORPORATION

Corres. Addr: PAUL HASTINGS JANOFSKY & WALKER LLP 515 SOUTH FLOWER STREET, 25TH FLOOR LOS ANGELES, CA 90071
Brief: PATENT SECURITY AGREEMENT

Reel/Frame: 19009/0529 **Date Signed:** 20070312 **Date Recorded:** 20070314
Assignee: NEWCASTLE PARTNERS, L.P. 200 CRESCENT COURT SUITE 1400 DALLAS TEXAS 75201

Assignor: BELL INDUSTRIES, INC.; BELL INDUSTRIES, INC.

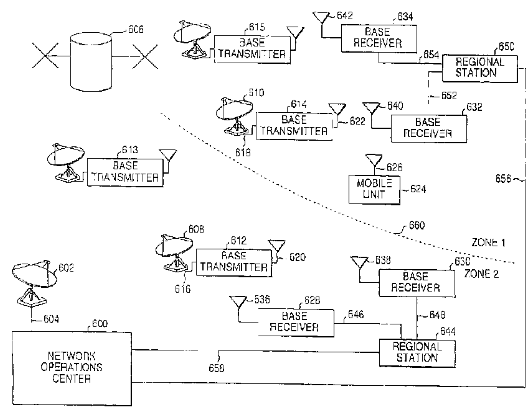
Corres. Addr: RANDY M. FRIEDBERG, ESQ. OLSHAN GRUNDMAN FROME ROSENSZWEIG ET AL PARK AVENUE TOWER 65 EAST 55TH STREET NEW YORK, NY 10022
Brief: SECURITY AGREEMENT

Legal Status:

Date	+/-	Code	Description
20000330 [illegible]	()	[illegible]	Year of fee payment: 4;
20040320 [illegible]	()	[illegible]	Year of fee payment: 8;
20070131	( )	AS	ASSIGNMENT New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;

20070314	( )	AS	ASSIGNMENT New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20081126	()	FPAY	Year of fee payment: 12;
20081201	()	REMI	

US5915210A 19990622



(ENG) Method and system for providing multicarrier simulcast transmission

Assignee: DESTINEER CORP US

Inventor(s): CAMERON DENNIS WAYNE US ; ROEHR JR WALTER CHARLES US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: US 89947697 A

Filing Date: 19970724

Issue/Publication Date: 19990622

Abstract: (ENG) A two-way communication system for communication betweeen a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers include in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in suimulcast during both systemwide and zone boundaries to maximize information throughout. The preferred mobile unit inlcudes a noise detector circuit to prevent unwanted transmissions. The system network further provides an adaptive registration feature for mobile units which controls the registration operation by the mobile units to maximize information throughout.

Priority Data: US 89947697 19970724 A N; US 76045796 19961206 A B N; US 97391892 19921112 A 1 Y;

Related Application(s): 08/760457 19961206 US ABANDONED; 07/973918 19921112 5590403 US GRANTED

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W08406; H04W00412

ECLA (European Class): H04Q00738P; H04H02067; H04L02726M; H04L02726M3A5; H04W06800; H04W06810

US Class: 455059; 455102; 455103

Publication Language: ENG

Filing Language: ENG

Agent(s): Finnegan, Henderson, Farabow, Garrett & Dunner

Examiner Primary: Le, Thanh Cong

US Post Issuance:
--US Certificate of Correction: 19991123 a Certificate of Correction was issued for this patent

Assignments Reported to USPTO:
Reel/Frame: 18826/0503 **Date Signed:** 20070131 **Date Recorded:** 20070131
Assignee: WELLS FARGO FOOTHILL, INC., AS AGENT 2450 COLORADO AVENUE, SUITE 3000 WEST SANTA MONICA CALIFORNIA 90404

Assignor: BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION; BELL INDUSTRIES, INC., A MINNESOTA CORPOI MINNESOTA CORPORATION

Corres. Addr: PAUL HASTINGS JANOFSKY & WALKER LLP 515 SOUTH FLOWER STREET, 25TH FLOOR LOS ANGELES, CA 90071
Brief: PATENT SECURITY AGREEMENT

Reel/Frame: 19009/0529 **Date Signed:** 20070312 **Date Recorded:** 20070314
Assignee: NEWCASTLE PARTNERS, L.P. 200 CRESCENT COURT SUITE 1400 DALLAS TEXAS 75201

Assignor: BELL INDUSTRIES, INC.; BELL INDUSTRIES, INC.

Corres. Addr: RANDY M. FRIEDBERG, ESQ. OLSHAN GRUNDMAN FROME ROSENSZWEIG ET AL PARK AVENUE TOWER 65 EAST 55TH STREET NEW YORK, NY 10022
Brief: SECURITY AGREEMENT

Legal Status:

Date	+/-	Code	Description
19991123	( )	CC	CERTIFICATE OF CORRECTION
20021220	()	FPAY	Year of fee payment: 4;
20061222	()	FPAY	Year of fee payment: 8;
20070131	( )	AS	ASSIGNMENT New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;

20070314	( )	AS	ASSIGNMENT New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20101222	()	FPAY	Year of fee payment: 12;

WO9411960A3 19940707
WO9411960A2 19940526

(ENG) MOBILE TWO-WAY COMMUNICATION SYSTEM

Assignee: MOBILE TELECOMM TECH US

[no drawing available]

Inventor(s): CAMERON DENNIS WAYNE ; ROEHR WALTER CHARLES JR ; PETROVIC RADE ; BHAGAT JAI P ; GARAHI MASOOD ; HAYS WILLIAM D ; ACKERMAN DAVID W

Application No: US 9310713 W

Filing Date: 19931112

Issue/Publication Date: 19940707

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximise information throughput. The system also uses a mobile unit which receives messages from the network and transmits messages to the network. The mobile unit includes a switch that allows a user to request the network to retransmit a received message that contains errors.

Priority Data: US 12421993 19930921 A Y; US 97391892 19921112 A Y;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W00412

ECLA (European Class): H04Q00738P; H04H02067; H04L02726M; H04L02726M3A5; H04Q00708; H04Q00712; H04W06800; H04W08402S; H04W08402S2

Designated Countries:

Publication Language: ENG

Filing Language: ENG

Legal Status:

Date	+/-	Code	Description

19940526	(+)	AK	DESIGNATED STATES Kind code of corresponding patent document: A2; List of designated states: AT AU BB BG BR BY CA CH CZ DE DK ES FI GB HU JP KP KR KZ LK LU LV MG MN MW NL NO NZ PL PT RO RU SD SE SK UA UZ VN;
19940526	(+)	AL	DESIGNATED COUNTRIES FOR REGIONAL PATENTS Kind code of corresponding patent document: A2; List of designated states: AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE BF BJ CF CG CI CM GA GN ML MR NE SN TD TG;
19940707	(+)	AK	DESIGNATED STATES Kind code of corresponding patent document: A3; List of designated states: AT AU BB BG BR BY CA CH CZ DE DK ES FI GB HU JP KP KR KZ LK LU LV MG MN MW NL NO NZ PL PT RO RU SD SE SK UA UZ VN;
19940707	(+)	AL	DESIGNATED COUNTRIES FOR REGIONAL PATENTS Kind code of corresponding patent document: A3; List of designated states: AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE BF BJ CF CG CI CM GA GN ML MR NE SN TD TG;
19940818	( )	DFPE	REQUEST FOR PRELIMINARY EXAMINATION FILED PRIOR TO EXPIRATION OF 19TH MONTH FROM PRIORITY DATE (PCT APPLICATION FILED BEFORE 20040101)
19940831	( )	121	EP: THE EPO HAS BEEN INFORMED BY WIPO THAT EP WAS DESIGNATED IN THIS APPLICATION
19950510	( )	ENP	ENTRY INTO THE NATIONAL PHASE IN: Corresponding country code for PRS Code (EP REG): CA; Corresponding patent document: 2149125; Kind code of corresponding patent document: A;
19950612	(+)	WWE	WIPO INFORMATION: ENTRY INTO NATIONAL PHASE Corresponding patent document: 1994901305; Country code of corresponding patent document: EP;
19950830	(+)	WWP	WIPO INFORMATION: PUBLISHED IN NATIONAL OFFICE Corresponding patent document: 1994901305; Country code of corresponding patent document: EP;
19950831	( )	REG	REFERENCE TO NATIONAL CODE Corresponding country code for PRS Code (EP REG): DE; Corresponding EP Code 1 for PRS Code (EP REG): 8642;
19951214	( )	EX32	EXTENSION UNDER RULE 32 EFFECTED AFTER COMPLETION OF TECHNICAL PREPARATION FOR INTERNATIONAL PUBLICATION Corresponding country code for PRS Code (EP REG): GE;
19951221	( )	LE32	LATER ELECTION FOR INTERNATIONAL APPLICATION FILED PRIOR TO EXPIRATION OF 19TH MONTH FROM PRIORITY DATE OR ACCORDING TO RULE 3 Corresponding country code for PRS Code (EP REG): GE;
19980128	(+)	WWG	WIPO INFORMATION: GRANT IN NATIONAL OFFICE Corresponding patent document: 1994901305; Country code of corresponding patent document: EP;

US5590403A 19961231

(ENG) Method and system for efficiently providing two way communication between a central network and mobile unit

[no drawing available]

Assignee: DESTINEER CORP US

Inventor(s): CAMERON DENNIS W US ; ROEHR JR WALTER C US ; PETROVIC RADE US ; BHAGAT JAI P US ; GARAHI MASOOD US ; HAYS WILLIAM D US ; ACKERMAN DAVID W US

Application No: US 97391892 A

Filing Date: 19921112

Issue/Publication Date: 19961231

Abstract: (ENG) A two-way communication system for communication between a system network and a mobile unit. The system network includes a plurality of base transmitters and base receivers included in the network. The base transmitters are divided into zonal assignments and broadcast in simulcast using multi-carrier modulation techniques. The system network controls the base transmitters to broadcast in simulcast during both systemwide and zonal time intervals. The system network dynamically alters zone boundaries to maximize information throughput. The preferred mobile unit includes a noise detector circuit to prevent unwanted transmissions. The system network further provides an adaptive registration feature for mobile units which controls the registration operations by the mobile units to maximize information throughput.

Priority Data: US 97391892 19921112 A Y;

IPC (International Class): H04W06810; H04L02726; H04W06800; H04H02067; H04W08402; H04W08406; H04W00412

ECLA (European Class): H04W08402S2; H04H02067; H04L02726M; H04L02726M3A5; H04W06810; H04W08402S

US Class: 455503; 375299; 455059; 455101; 455440; 455443; 455524

Publication Language: ENG

Filing Language: ENG

Agent(s): Finnegan, Henderson, Farabow, Garrett & Dunner, LP.

Examiner Primary: Eisenzopf, Reinhard J.

Examiner Assistant: Le, Thanh

US Post Issuance:

--US Litigations: Mobile Telecommunications Technologies, LLC Mobile Telecommunications Technologies, LLC E.D. Texas 2:12cv00308

Assignments Reported to USPTO:

Reel/Frame: 06436/0460 **Date Signed:** 19930106 **Date Recorded:** 19930127

Assignee: MOBILE TELECOMMUNICATION TECHNOLOGIES P.O. BOX 2469 JACKSON MISSISSIPPI 39225

Assignor: CAMERON, DENNIS W.; ROEHR, WALTER C.; PETROVIC, RADE; BHAGAT, JAI P.; GARAHI, MASOOD;HAY GARAHI, MASOOD;HAYS, WILLIAM D.; ACKERMAN, DAVID W.

Corres. Addr: VINCENT P.KOVALICK FINNEGAN, HENDERSON ET AL. 1300 I STREET, N.W., SUITE 600 WASHINGTON, DC 20005-3315
Brief: ASSIGNMENT OF ASSIGNORSINTEREST.

Reel/Frame: 07330/0969 **Date Signed:** 19950113 **Date Recorded:** 19950201
Assignee: DESTINEER CORPORATION 200 S. LAMAR STREET JACKSON MISSISSIPPI 39201

Assignor: MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION

Corres. Addr: VINCENT P. KOVALICKFINNEGAN, HENDERSON, FARABOW ET AL. 1300 I STREET, N.W. WASHINGTON, DC 20005-3315
Brief: ASSIGNMENT OF ASSIGNORS INTEREST (SEEDOCUMENT FOR DETAILS).

Reel/Frame: 15074/0621 **Date Signed:** 19990129 **Date Recorded:** 20040823
Assignee: SKYTEL CORP. 22001 LOUDON COUNTY ASHBURN VIRGINIA 20147

Assignor: DESTINEERCORPORATION

Corres. Addr: MICHAEL A. WRENN 9854/003 113319TH STREET, NW WASHINGTON, D.C. 20036
Brief: MERGER (SEE DOCUMENT FOR DETAILS).

Reel/Frame: 18826/0503 **Date Signed:** 20070131 **Date Recorded:** 20070131
Assignee: WELLS FARGO FOOTHILL, INC., AS AGENT 2450 COLORADO AVENUE, SUITE 3000 WEST SANTA MONICACALIFORNIA 90404

Assignor: BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION; BELL INDUSTRIES, INC., AMINNESOTA CORPOF AMINNESOTA CORPORATION

Corres. Addr: PAUL HASTINGS JANOFSKY & WALKER LLP 515 SOUTH FLOWER STREET, 25TH FLOOR LOS ANGELES, CA 90071
Brief: PATENTSECURITY AGREEMENT

Reel/Frame: 19009/0529 **Date Signed:** 20070312 **Date Recorded:** 20070314
Assignee: NEWCASTLE PARTNERS, L.P. 200 CRESCENT COURT SUITE 1400 DALLAS TEXAS 75201

Assignor: BELL INDUSTRIES, INC.; BELL INDUSTRIES, INC.

Corres. Addr: RANDY M.FRIEDBERG, ESQ. OLSHAN GRUNDMAN FROME ROSENSZWEIG ET AL PARK AVENUE TOWER 65 EAST 55TH STREET NEW YORK, NY 10022
Brief: SECURITYAGREEMENT

Legal Status:

Date	+/-	Code	Description
19930127	()	AS	New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES, MISSISSIPPI; : ASSIGNMENT OF ASSIGNORS INTEREST.;ASSIGNORS:CAMERON, DENNIS W.;ROEHR, WALTER C.;PETROVIC, RADE;AND OTHERS;REEL/FRAME:006436/0460;SIGNING DATES FROM 19930106 TO 19930111;
19930127	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES P.O. BOX 246; Effective date: 19930108;
19930127	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: CAMERON, DENNIS W.; Effective date: 19930108;

19930127	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: ROEHR, WALTER C.; Effective date: 19930108;
19930127	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: PETROVIC, RADE; Effective date: 19930111;
19930127	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: BHAGAT, JAI P.; Effective date: 19930106;
19930127	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: GARAHI; Effective date: 19930107;
19930127	()	AS02	New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES P.O. BOX 246; Effective date: 19930108;
19930127	()	AS02	New owner name: CAMERON, DENNIS W.; Effective date: 19930108;
19930127	()	AS02	New owner name: ROEHR, WALTER C.; Effective date: 19930108;
19930127	()	AS02	New owner name: PETROVIC, RADE; Effective date: 19930111;
19930127	()	AS02	New owner name: BHAGAT, JAI P.; Effective date: 19930106;
19930127	()	AS02	New owner name: GARAHI; Effective date: 19930107;
19950201	()	AS	New owner name: DESTINEER CORPORATION, MISSISSIPPI; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION;REEL/FRAME:007330/0969; Effective date: 19950113;
19950201	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: DESTINEER CORPORATION 200 S. LAMAR STREET JACKSON,; Effective date: 19950113;
19950201	( )	AS02	ASSIGNMENT OF ASSIGNOR'S INTEREST New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION; Effective date: 19950113;
19950201	()	AS02	New owner name: DESTINEER CORPORATION 200 S. LAMAR STREET JACKSON,; Effective date: 19950113;
19950201	()	AS02	New owner name: MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION; Effective date: 19950113;
20000223	()	FPAY	Year of fee payment: 4;
20040630	()	FPAY	Year of fee payment: 8;
20040823	( )	AS	ASSIGNMENT New owner name: SKYTEL CORP. 22001 LOUDON COUNTYASHBURN, VIRGINIA,; : MERGER;ASSIGNOR:DESTINEER CORPORATION /AR;REEL/FRAME:015074/0621; Effective date: 19990129;
20040823	()	AS	New owner name: SKYTEL CORP., VIRGINIA; : MERGER;ASSIGNOR:DESTINEER CORPORATION;REEL/FRAME:015074/0621; Effective date: 19990129;
20040823	()	AS	New owner name: SKYTEL CORP. 22001 LOUDON COUNTYASHBURN, VIRGINIA,; : MERGER;ASSIGNOR:DESTINEER CORPORATION /AR;REEL/FRAME:015074/0621; Effective date: 19990129;
20070131	( )	AS	ASSIGNMENT New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;

20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070131	()	AS	New owner name: WELLS FARGO FOOTHILL, INC., AS AGENT, CALIFORNIA; : PATENT SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC., A CALIFORNIA CORPORATION;BELL INDUSTRIES, INC., A MINNESOTA CORPORATION;REEL/FRAME:018826/0503; Effective date: 20070131;
20070314	( )	AS	ASSIGNMENT New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20070314	()	AS	New owner name: NEWCASTLE PARTNERS, L.P., TEXAS; : SECURITY AGREEMENT;ASSIGNORS:BELL INDUSTRIES, INC.;BELL INDUSTRIES, INC.;REEL/FRAME:019009/0529; Effective date: 20070312;
20080630	()	FPAY	Year of fee payment: 12;
20080707	()	REMI	

USPTO Maintenance Report					
Patent Bibliographic Data			03/08/2013 01:34 AM		
Patent Number:	5915210		Application Number:	08899476	
Issue Date:	06/22/1999		Filing Date:	07/24/1997	
Title:	METHOD AND SYSTEM FOR PROVIDING MULTICARRIER SIMULCAST TRANSMISSION				
Status:	4th, 8th and 12th year fees paid			Entity:	LARGE
Window Opens:	N/A	Surcharge Date:	N/A	Expiration:	N/A
Fee Amt Due:	Window not open	Surchg Amt Due:	Window not open	Total Amt Due:	Window not open
Fee Code:					
Surcharge Fee Code:					
Most recent events (up to 7):	12/22/2010 12/22/2006 12/20/2002	Payment of Maintenance Fee, 12th Year, Large Entity. Payment of Maintenance Fee, 8th Year, Large Entity. Payment of Maintenance Fee, 4th Year, Large Entity. --- End of Maintenance History ---			
Address for fee purposes:	VERIZON PATENT MANAGEMENT GROUP 1320 North Court House Road 9th Floor ARLINGTON VA 22201-2909				