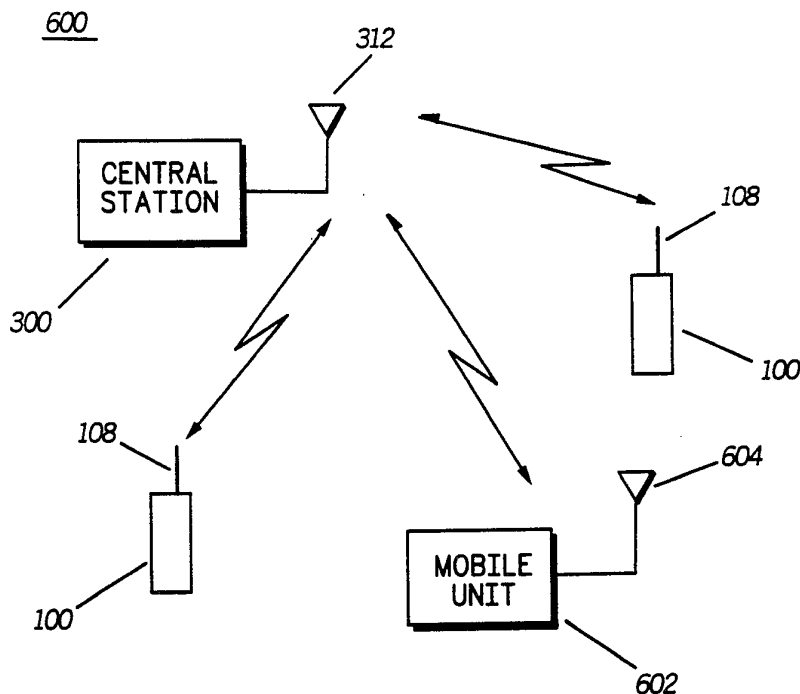




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(54) Title: COMMUNICATION UNIT WITH OVER THE AIR PROGRAMMING



(57) Abstract

A communication unit (100) for operation in a communication system (600). The communication system (600) includes a plurality of communication units (100) and a control resource (300). The communication unit (100) includes a transmitter (118) for transmitting a signal to the control resource (300) requesting programming information using a bootstrap mode of operation. The communication unit (100) also includes a receiver (106) for receiving programming information sent by the control resource (300). The communication unit (100) further includes a controller (112) coupled to the transmitter (118) and the receiver (106) for programming the communication unit (100) using the received programming information.

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10 **COMMUNICATION UNIT WITH OVER THE AIR
PROGRAMMING**

15 **Technical Field**

15

 This invention relates generally to communication devices
and more specifically to communication devices operating in a
communication system.

20 **Background**

 Radios operating in a communication system are generally
programmed at the factory or at a service center in accordance
with the requirements established by the user at the time of
25 purchase. In trunking systems, the programming of radios
includes assignment of frequencies, assignment of private line
channels, and fleet definitions. In conventional systems,
frequencies along with private line information are programmed
into the radios. Mixed systems require radios to be programmed
30 with all the fore-mentioned information. Currently, when a system
is built, frequencies are allocated to trunking and conventional
channels, and are set that way permanently. This is due to the
fact that all the subscribers have a certain knowledge of the
system that can not be changed without respective changes in the
35 radios. Therefore, the system resources stay that way, even if the

traffic on the trunking modes becomes very light and the conventional traffic becomes congested.

Additionally, radios operating in a communication system use code plugs, which are often Electronically Erasable Programmable Read Only Memory (EEPROM), to retain a portion of the system information. Generally these EEPROMs are programmed at the factory either plugged into the radio or outside the radio. Programming the code plug of a radio must be in concert with the requirements of the customer as set forth at the time of ordering the radio. These requirement may change as the radio is being built complicating the programming and opening more room to error. In some situations, the programming information is not available at the time the radio is ordered. In these situations the radio may be manufactured and stored for later programming. All these conditions add to the possibilities of error that are involved with local programming. As radio communications customers demand higher quality products, it is necessary for such products to be manufactured with the least amount of steps that would jeopardize product quality. It is therefore clear that a need exists for a radio that need not be programmed with customer operating information at the factory.

Summary of the Invention

Briefly, according to the invention, a communication unit for operation in a communication system is disclosed. The communication system includes a plurality of communication units and a control resource. The communication unit includes transmitter means for transmitting a signal to the control resource requesting programming information using a bootstrap mode of operation. The communication unit also includes a receiver means for receiving programming information sent by the control resource. The communication unit further include controller means coupled to the transmitter means and the receiver means and adapted for programming the communication unit using the received programming information.

Brief Description of the Drawings

FIG. 1 is a block diagram of the element of a
5 communication device in accordance with the present invention.

FIG. 2 is a flow chart of the operation of the communication
device of FIG. 1 in accordance with the present invention.

FIG. 3 is a block diagram of the elements of a central
station in accordance with the principles of the present invention.

10 FIG. 4 is a flow chart of the operation of the central station
of FIG. 3 in accordance with the present invention.

FIG. 5 is a subroutine flow chart of the flow chart of FIG. 4.

FIG. 6 is a communication system in accordance with the
present invention.

15

Detailed Description of the Preferred Embodiment

Referring first to FIG. 6, a communication system 600 is
shown in accordance with the present invention. The
20 communication system 600 includes a central station 300
coupled to an antenna 302. The central station 300 constitutes
the control resource of the present invention. The system 600
also includes a plurality of communication or subscriber units
100, each coupled to their individual antennas 108. Also
25 included in the system 600 is a mobile unit 602 with its associated
antenna 604. It is well known in the art that repeaters can be
used in order to improve area coverage. These repeaters have
not been shown in order to avoid unnecessary complication. For
the purpose of this embodiment, it is assumed that the central
30 station 300 includes repeaters. The communication unit 100
represents a number of portable units in the communication
system 600. Hereinafter, the terms radio, device, communication
unit, or subscriber unit will be commonly used to refer to the
communication unit 100. The communication system 600 may be
35 a trunked communication system in which case the software at
the central station 300 includes portions to cover trunking

operation. The operation of the mobile radio 602 and the radio 100 are generally the same as so far as the principles of the present invention apply. To avoid repetition, the operation of the radio 100 will be described in detail. It is understood that similar
5 description applies to the operation of the mobile radio 602.

Referring to FIG. 1, a block diagram of a communication device 100 is shown in accordance with the present invention. A controller 112 is at the heart of the device 100 and is coupled to most of its elements. The controller 112 is preferably a micro-
10 computer used in many communication devices. In the receive mode, the controller 112 directs an antenna switch 114 to couple an antenna 108 to the input of a receiver 106. A Radio Frequency (RF) signal available at the antenna 108 is received and demodulated by the receiver 106. The receiver 106 demodulates
15 the received signal and communicates portions of it to the controller 112. The controller 112 determines the nature of the received signal and directs the receiver 106 to route it accordingly. Demodulated voice signals are applied to a speaker 104 that may include an amplifier. Demodulated data signals
20 after having been decoded by the elements of the controller 112 are applied to a display 102 for presentation to a the user. As it will be demonstrated, some signals received by the receiver 106 are for internal use by the device 100. These received signals are programming information that were either solicited by the
25 device 100 or are system initiated changes.

In the transmit mode, the controller 112 directs the antenna switch 114 to couple the antenna 108 to the output of the transmitter 118. Voice signals intended for transmission are coupled to the transmitter 118 via a microphone 120. Data
30 signals are entered via a keyboard 122 which is coupled to the controller 112. These data signals are processed by the controller 112 and prepared for transmission by the transmitter 118. The operation of transmitters is well known in the art. The voice signals produced by the microphone 120 are used by the
35 transmitter 118 to modulate a carrier signal appropriate for transmission via the antenna 108. Data signals produced by the

controller 112 in response to the keyboard 122 are either simultaneously or separately used in the transmitter to modulate the carrier signal.

The device 100 includes two modes of operation; a bootstrap mode and a regular mode. In the bootstrap mode of operation, the radio 100 has limited communication ability with the central station 300. The controller 112, using the receiver 106 and the transmitter 118, communicates with the central station 300 in order to request and receive programming information on the radio 100. In the normal mode of operation, the received programming information is stored for later use by the radio 100, and the radio 100 communicates with the elements of the communication system 600 as required.

The controller 112 is coupled to two memory blocks Random Access Memory (RAM) 110 and Read Only Memory (ROM) 116. The RAM 110 may be replaced with any erasable memory component such as an Electronically Erasable Programmable Read Only Memory (EEPROM). If desired, the controller 112 may include both the memory components as necessitated by design of the radio 100. The ROM 116 contains information, otherwise known as code, on the bootstrap mode of operation. In this embodiment, the ROM 116, and the portion of the controller 112 communicating and servicing the ROM 116, constitute the bootstrap means of the device 100. This mode of operation is invoked when the device 100 is reset or reprogramming request has been made by the user. In the bootstrap mode, the controller 112 fetches operating code from the ROM 116 and proceeds to execute them. As part of this code, the controller 112 sends an information request signal to the central station 300 via the transmitter 118. This signal requests a download of the operating and parametric information from the central station 300. The operating and parametric information includes frequency information, fleet information, private line information, talk around channel information, etc. The central station 300 receives this request and proceeds to send the appropriate operating information to the device 100.

The receiver 106 receives and demodulates the information sent by the central station 300. This information is preferably in the form of data signals. The demodulated data signals are routed to the controller 112 for further processing.

5 The controller 112 decodes the information and stores what is necessary in the RAM 110. The information stored in the RAM 110 allows the radio 100 to operate in the normal mode of operation. At this point, the radio 100 is ready to operate as any other communication device would, having been programmed at
10 a fixed site. If desired, RAM 110 may be replaced with other erasable memory components.

In its other functions, the controller 112 operates to alert the radio user of an incoming signal and proceeds to present the received message in a variety of ways depending upon the
15 message type and optional features that may be enabled or disabled by the radio user. Thus, the controller 112 may send an alert signal to the speaker 104. After the alert, a voice message may be provided by the receiver 106 to the speaker 104. Data messages would follow the radio's address code to the controller
20 112. Such messages are subsequently analyzed by the controller 112 and, if appropriate, sent to the display 102 for presentation.

In summary, the radio 100 includes the controller 112 that sends a request for reprogramming to the central station 300 via
25 the transmitter 118. This request is accomplished using a bootstrap routine that is stored in the ROM 116. The bootstrap routine could be common for all the radios that are manufactured, eliminating the need for radio personalization at the factory. The receiver 106 receives programming details back from the central
30 station 300. This information is routed to the controller 112 where it is decoded and stored in the RAM 110. The information stored in the RAM 110 is the operating configuration of the radio 100 and is used by the radio 100 in sending or receiving communication signals. This procedure is followed whenever reprogramming is
35 requested making it possible to program radios remotely and over the air.

Referring to FIG. 2, a flow chart 200 of the operation of the radio 100 is shown in accordance with the principles of the present invention. The flow chart 200 is controlled and executed by the controller 112. From a start block 202, the operation
5 executes a bootstrap routine via block 204. The output of the execute bootstrap routine block 204 is coupled to a define scope block 206. At this block 206 the operator defines the scope of programming request. Various features (such as frequencies, fleet selection, or private line designation) can be requested by
10 the operator at this time. The operator requests these features by entering a series of commands using the keyboard 122. Upon defining the scope of the operation, a communication link with the central station 300 is established via a communicate to base block 208. Under block 208 the transmitter 118 transmits a signal
15 and registers with the central station 300.

The output of block 208 is coupled to a condition block 210 where a decision is made as to whether the registration was successful. The NO output of this decision block 210 is coupled to a condition block 212 where it is determined whether the
20 current value in the counter Y is equal to integer 3. The counter Y is a software counter maintained by the controller 112 and is intended to keep track of the number of registration trials. The YES output of the decision block 212 indicates that three unsuccessful attempts have been made to register the radio 100
25 with the central station 300. This number of registration trials is considered more than adequate in a fully operational system. The YES output of block 212 is therefore coupled to a notify operator block 213. At block 213, the operator is notified of the unsuccessful registration attempts. The failure to successfully
30 register with the central station 300 may be due to a radio or a system failure. In the later case and with some systems, the radio 100 may be equipped with an emergency routine included as part of the bootstrap mode of operation that would allow the operator to inform the central station 300 or the system manager of system
35 failures. With this feature, the operator can communicate to the system manager the suspected system failure. The NO output of

condition block 212 is connected to an increment counter Y by one block 209. At this block 209, the counter Y is incremented in order to keep track of the number of unsuccessful registration trials that have taken place. The output of block 209 is fed back
5 into block 208 where another attempt is made to register with the central station 300. The loop created by blocks 208, 210, 212 and 209 continues until either a successful registration is made or the counter Y has registered three registration failures.

The YES output of block 210 automatically resets the Y
10 counter and is subsequently coupled to a receive information block 214. At the block 214, the receiver 106 receives the programming information or otherwise the operating and parametric configuration from the central station 300 via the antenna 108 and the antenna switch 114. The output of block
15 214 is coupled to a normal radio operation block 216 where the radio 100 assumes normal operation. At block 216, the controller 112 decodes the programming information routed via the receiver 106, reconstructs the operating configuration of the radio 100, and stores the reconstructed operating configuration in the RAM
20 110. At this point, the radio is functioning as it would, had it been programmed at the factory. The normal radio operation block 216 continues to operate the radio 100 at the command of the operator. As part of the operation of the radio 100, a number of requests can be made by the operator. Those contributing to the
25 understanding of this invention are included here and are shown as outputs of block 216.

The output of normal radio operation block 216 is coupled to a condition block 220 where a decision is made as to whether the radio has been turned off. The YES output of block 220 is
30 coupled to a deregister with system block 224. At block 224, the transmitter 118 sends a deregister information packet created by the controller 112 to the central station 300 via the antenna 108. This signal contains information to the extent that the radio 100 has gone off the air and no further communication should be
35 directed to it. The NO output of the condition block 220 is coupled to another condition block 218 where a decision is made as to

whether a re-configuration command signal has been received by the radio 100. In some situations it is necessary for the central station 300 to transmit a re-configuration command signal to a particular radio in the communication system 600. One particular
5 example of such situation occurs when a frequency that is being used by the radio 100 is no longer operational, or part of the operating configuration that was programmed into the radio 100 earlier is no longer valid. Other situations may include fleet and/or Private Line changes. All these conditions warrant the
10 reprogramming of the radio 100 by the central station 300. The YES output of the condition block 218 is routed back to receive information block 214 and the loop continues. The NO output of the condition block 218 is connected to yet another condition block 222. The decision made at block 222 is whether the user
15 has requested a re-configuration. The NO output of the condition block 222 is connected back to the normal radio operation block 216. The loop created by the blocks 216, 218, and 222 continuous for so long as no re-configuration is either requested by the user or by the central station 300. The YES output of block
20 222 is connected to a re-register block 226, as shown in FIG. 2B. At block 226, the controller 118 proceeds to re-register the new user requests with the central station 300. As part of the operation of block 226, the new user requests are combined with the unchanged parameters available in the radio 100 to form a
25 new configuration. A request for new configuration is then made to the central station 300 in the form of a re-registration. The output of block 226 is coupled to a condition block 228 where a decision is made as to whether the re-registration was successful. The YES output of condition block 228 is coupled back to the
30 receive information block 214 of FIG. 2A via the interconnect B. The NO output of the condition block 228 is connected to an indicate unsuccessful re-registration block 230. The block 230 indicates to the user that the re-registration was not successful. Having the user been informed of the unsuccessful re-
35 registration, the output of block 230 is coupled to the normal radio operation block 216 of FIG. 2A via the interconnect C.

To summarize, the flow chart 200 is used to demonstrate the operation of the radio 100 in accordance with the present invention. From the the start block 202 a bootstrap mode is entered whereby the user defines a set of parameters and requests a re-configuration of the operating system of the radio 100. The re-configuration request is communicated to the central station 300. This communication is repeated three times until a successful registration of the radio 100 by the central station 300 is acknowledged as demonstrated by the YES output of the condition block 210. At this point, the radio 100 receives the operating information and continues normal radio operation as indicated by blocks 214 and 216 respectively. Provisions have been made to cover situations when the radio has been shut down. In such situations, the operation communicates a signal to the central station 300 to deregister the radio 100. Further provisions have been made to accommodate the re-configuration requests originated from the central station 300 or the radio 100. In these situations, a loop is created to receive the information and resume normal radio operation.

Referring now to FIG. 3, a block diagram of the internal elements of the central station 300 is shown in accordance with the principles of the present invention. The central station 300 includes a controller 304 that controls the operation of the various elements of the station 300. A receiver 306 and a transmitter 314 are connected to the controller 304 and process received signals and transmit signals respectively. An antenna switch 310 couples the transmitter 314 or the receiver 306 to an antenna 312 under the direction of the controller 304. A Read Only Memory (ROM) 316 and a data base block 302 are on the controller 304 bus. The earlier holds a firmware containing the operating system of the controller 304. The later contains configuration and parametric information on the radios operating in the communication system 600. The operation of the central station 300 is described as it communicates with the radio 100. It is understood that the central station 300 communicates with other elements of the communication system 600 in a similar fashion.

A radio frequency signal received at the antenna 312 is coupled to the receiver 306 by the antenna switch 310. The receiver 306 demodulates the received radio frequency signal and couples it to the controller 304. Controller 304 decodes the demodulated information and determines the request made by the received signal. In the event that the received signal is a registration or configuration request signal by the communication unit 100, the controller 304 proceeds to retrieve the information requested from the data base 302. This information is prepared for transmission in the controller 304 and submitted to the transmitter 314. The antenna switch 310 switches to the output of the transmitter 314 which proceeds to transmit the signal via the antenna 312. The receiver 306, the antenna 310, and the transmitter 314 are collectively shown to constitute the front end 308 of the central station 300. Several radio front ends that operate at different frequencies can be coupled to the controller 304 in parallel. These radio front ends are coupled to the controller 304 via a combined signal and control line 318. The use of several radio front ends accommodates several radios operating at different frequencies in the communication system 600. In systems where several repeaters are used, the controller 304 may be located at a central cite and be coupled to a number of front ends functioning as repeater. In effect, these additional front ends may represent repeaters that assist the radio 100 in communicating with the central station 300.

As mentioned, the information contained in the data base 302 is the radio programming information. Using this information, the central station 300 can remotely program the radio 100. The benefit of this remote programming is that the data base 302 is fully dynamic and located in a central location. Any changes to the operation of the radio 100 can be implemented at the data base 302. The latest configuration is always available at the central station 300 and ready to be solicited by the radio 100.

Referring now to FIG. 4, a flow chart 400 of the operation of the central station 400 is shown in accordance with the present invention. From a start block 402, the operation is coupled to a

condition block 404, where a decision is made as to whether any new bootstrap channels are down. The receiver 306 monitors all the bootstrap channels for activity as part of the operation of block 404. The YES output of the condition block 404 is connected to a block 406 where radios operating in the system 600 are notified of all bootstrap channels that are down. Upon completing such notification, the operation is coupled to a normal system operation block 408. The NO output of the condition block 404 is also coupled to the normal system operation block 408. The output of block 408 is coupled to a monitor bootstrap channels block 410. The operation of the block 410 includes the receiver 306 monitoring the air waves for activity on the bootstrap channels. A condition block 412 coupled to the output of block 410 determines whether channel activity has been detected. The NO output of this decision block 412 is routed back to the condition block 404 where the loop continues for as long as no channel activity is detected on the bootstrap channels. The YES output of the condition block 412 is coupled to receive signal block 414 followed by a subroutine block 416. The block 416 is a qualify request sub-routine which is explained later in conjunction with FIG. 5. The output of block 416 is coupled to a service request block 418. At the block 418, the request received by receiver 306 is serviced by the controller 304 and the transmitter 314. This includes loading the controller 304 with programming and configuration information from the data base 302. The loaded information is then processed and coded for transmission by the transmitter 314. The output of the service request block 418 is routed back to the condition block 404 and the operation of the flow chart 400 is repeated.

Referring to FIG. 5, a flow chart 416 of the operation of the qualify request sub-routine is shown. From a start block 502, the operation is coupled to a condition block 504 where the received password is evaluated. The block 504 compares the received password to those stored in the data base 302. The NO output of the condition block 504 indicates that the received password is invalid. This NO output is coupled to an increment counter N

block 506. The counter N is used to count the number of received invalid passwords. The output of block 506 is coupled to a condition block 512 where the content of the counter N is evaluated. Block 512 questions whether the counter N is less than or equal to 3. The YES output of the condition block 512 automatically resets the N counter and is subsequently coupled to a notify user of wrong password block 520. With block 520, the central station 300 transmits a signal to the communication unit 100 and informs the user of having entered a wrong password. The output of block 520 is routed back to the monitor bootstrap channels block 410 in anticipation that the user will enter and transmit the correct password. The NO output of the condition block 512 indicates that the counter N has a value higher than 3. This condition is coupled to a block 518 where a maintenance group is informed that the a wrong password has been received from the radio 100 more than three times. The output of block 518 is coupled to a disable radio block 522. At block 522, the central station 300 proceeds to disable the radio 100 based on the assumption that the reception of three invalid passwords indicates that the radio 100 is being illegally used.

The YES output of the condition block 504 is coupled to another condition block 508 where a decision is made as to whether requested resources are available. The NO output of the condition block 508 indicating that some of the resources are not available is connected to a block 510 where the non-available resources of the received signal are eliminated from the received requested configuration list. The output of block 510 is coupled to a condition block 514. This block 514 is also connected to the YES output of the condition block 508. At the condition block 514, a decision is made as to whether the requested resources should be allocated to the radio 100. The NO output of the condition block 514 indicates that some of the requested resources cannot be allocated, not because of failure, but because of priority or security reasons. This is particularly useful in applications where various level of management with varying degree of authority are operating in the communication system 600. The NO output of

block 514 is coupled to a block 516 where the non appropriate resources are eliminated from the requested configuration list. The output of block 516 is coupled to a return block 526. The YES output of the condition block 514 is also connected to the return block 526. The return block returns the subroutine operation to the service request block 418 of FIG. 4.

To summarize, the operation of the central station 300 is described using the flow chart 400. The flow chart 400 starts by informing the radio unit 100 of any down bootstrap channels. With this information available at the radio 100, reprogramming requests can be transmitted by the radio 100 and received by the central station 300 on other available bootstrap channels. The operation monitors the channel activities and receives available incoming signals. A received signal containing reprogramming requests is qualified by the sub-routine 416. The sub-routine 416 checks for valid passwords that are required in each reprogramming request made by the radio 100. A provision is made for situations where illegal use of the radio 100 is made. This is typically identified by the reception of false passwords for more than a specified number of trials. Other provisions are available to verify that the requested resources are available and that the requested radio 100 has the authority to request such programming information. Upon qualifying the request, the operations services the request and returns to monitoring airwaves for new programming requests.

Those skilled in the art will appreciate the use of other routines to achieve similar results. The presentation of the flow charts 200 and 400 are to present the preferred embodiment of the operation of the present invention. Several features may be added to the flow charts 200 and 400 to render a system more secure. It is understood from the flow charts 200 and 400 that they are basic flow charts needed for understanding the operation of the radio 100 and central station 300 respectively as it pertains to the essentials of the present invention.

A radio apparatus has been described that can be programmed remotely via a central station. With this invention

remote programming of radios operating in a communication system is possible. Radios no longer have to be brought into a service shop for reprogramming. Radios operate minimally using an onboard bootstrap mode. As part of this mode, they request programming information from a central station which has the latest programming information for all the radios operating in the communication system. A reprogramming request received at the central station is serviced by retrieving information from a data bank resident at the central station. The retrieved information is coded and subsequently transmitted to the requesting radio using bootstrap channels. Remote programming of radios is significant in situations where a manufacturer has to upgrade the configuration of a large number of radios. The available route to this manufacturer is to recall these radios and have them reprogrammed at a service shop. The cost of gathering and reprogramming these radios is significantly high. But with no other choices available, there is no decision to be made. Radios must be programmed without much delay. The over the air programming facilitates this costly procedure and eliminates any costs that are associated with the fixed programming. With this invention, the reprogramming of radios will become a routine procedure. System operators do not have to sacrifice performance improvements that may be realized with minor reprogramming changes.

Other significant benefits of this invention may be observed in manufacturing plants. With present procedures, radios are programmed following a customer request sheet that has to follow the radio in its various phases. Mistakes are common and occur at various levels. This invention allows all radios to be programmed similarly at the factory regardless of customers or systems. Customer-specific configurations are later programmed into the radios remotely. It is no longer necessary to associate radios in the factory or service center with specific customers.

Those skilled in the art will recognize that various modifications and changes could be made with respect to the above described invention, without departing from the spirit and

scope of the invention as set forth. Therefore, it should be understood that the claims are not to be considered as limited to the particular embodiments set forth in the absence of specific limitations expressly incorporating such embodiments.

Claims

1. A subscriber unit for operation in a communication system having a plurality of subscriber units and a control resource, the
5 subscriber unit comprising:
transmitter means;
receiver means; and
control means for controlling the operation of the
subscriber unit, including bootstrap means for allowing the
10 subscriber unit to be programmed remotely by providing limited
communication to the control resource in order to request and
receive programming information.
2. The subscriber unit of claim 1, further including storage means
15 for storing the programming information.
3. The subscriber unit of claim 1, wherein said subscriber unit is a
portable radio.
- 20 4. The subscriber unit of claim 1, wherein said subscriber unit is a
mobile radio.

5. A radio communicating to other radios using erasable operating and parametric information, the radio comprising:

bootstrap means coupled to the non-erasable memory unit and adapted for providing the radio with limited communication to a control resource in order to initiate a request for a download of the operating and parametric information;

transmitter means coupled to the bootstrap means responsive to the request for download;

receiver means for receiving the operating and parametric information; and

control means for storing the received operating and parametric information in the erasable memory unit and for providing the radio with full communication to other radios and the control resource using the received operating and parametric information

6. A radio communication unit, comprising:

transmitter means;

receiver means;

bootstrap means for providing limited communication to a central station to request and receive operating configuration;

erasable storage means for storing the operating configuration; and

controller means coupled to the erasable storage means for controlling the operation of the radio using the received operating configuration.

7. A subscriber unit operating in a communication system, the system having a plurality of subscriber units and a control resource, the subscriber unit comprising:
- 5 transmitter means for initiating a programming request to the control resource;
- receiver means for receiving programming data from the control resource; and
- 10 controller means, coupled to the transmitter means and the receiver means, for programming the subscriber unit using the received programming data.
8. The subscriber unit of claim 7, wherein the transmitter means includes a bootstrap means.
- 15
9. The subscriber unit of claim 7, wherein the controller means includes means for storing the received programming data.
10. A method for dynamically and remotely programming a communication unit, comprising the steps of:
- 20 transmitting a request for programming signal to a control resource using a bootstrap routine;
- receiving programming information from the central unit;
- and
- 25 programming the communication unit using the received programming information.

FIG. 1

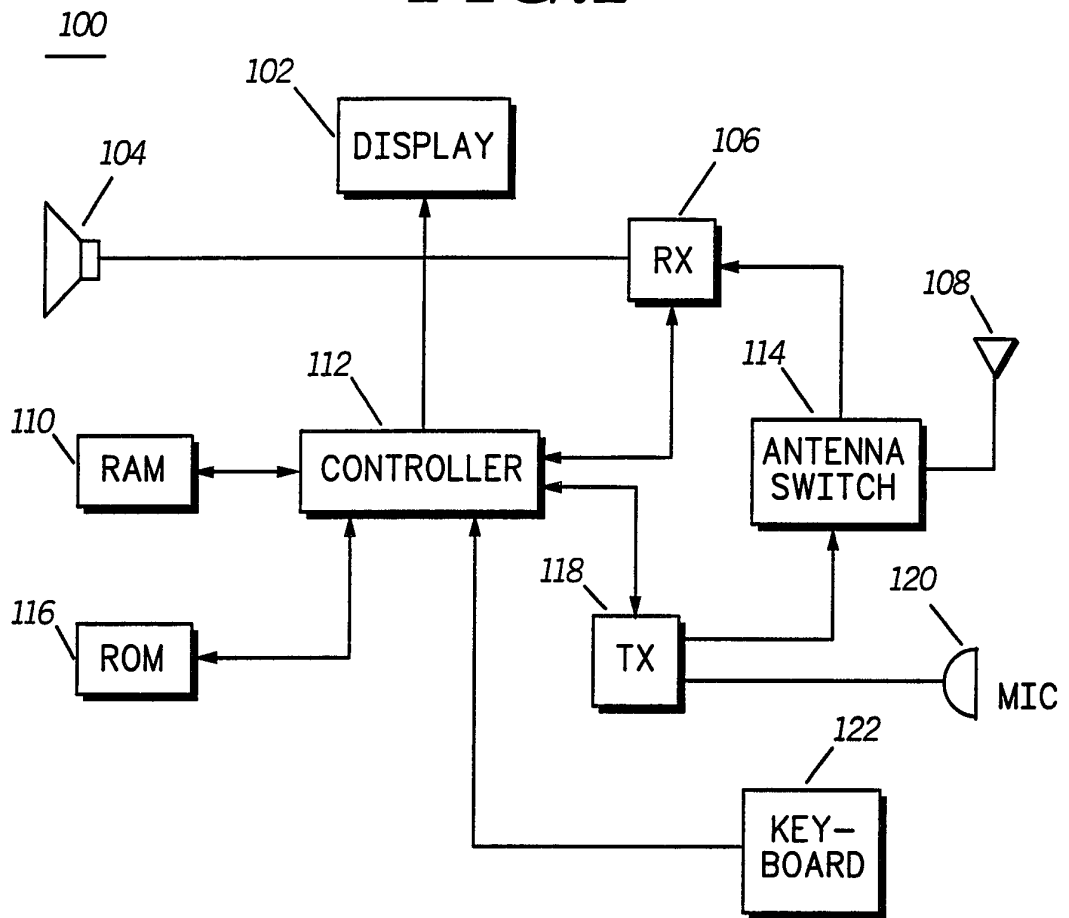
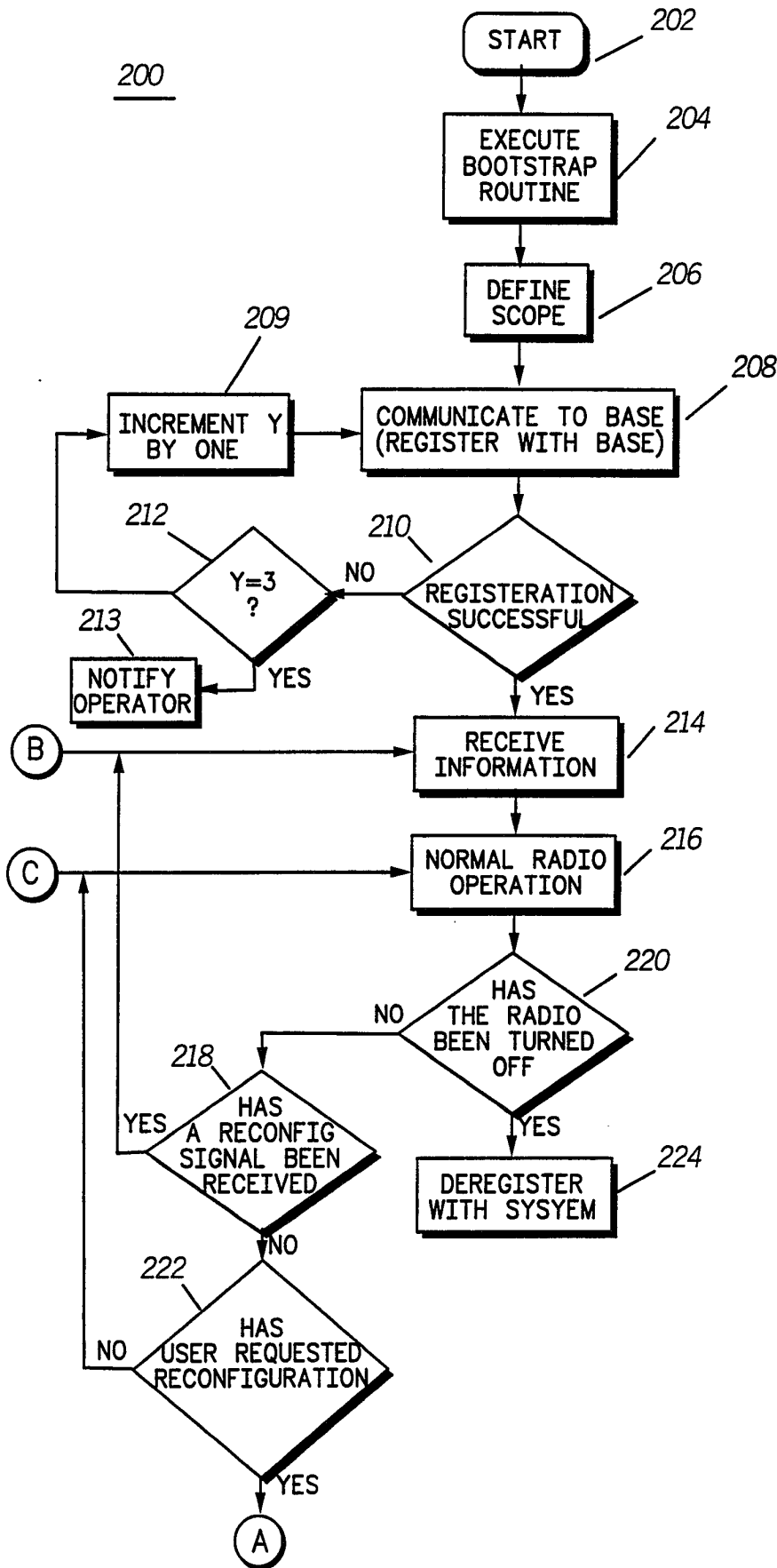


FIG. 2A



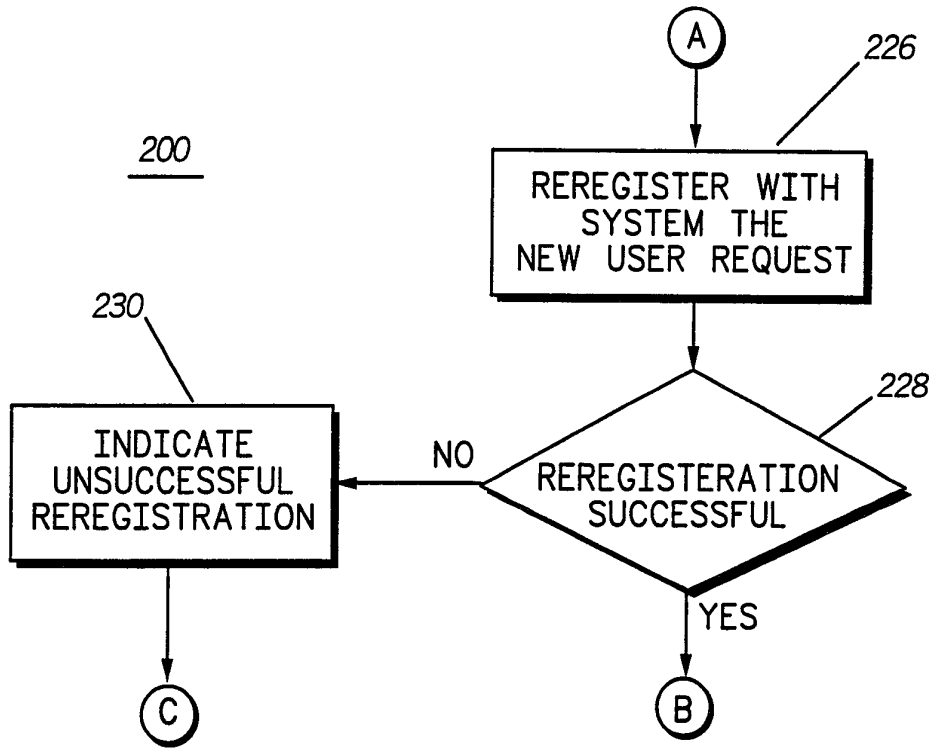


FIG.2B

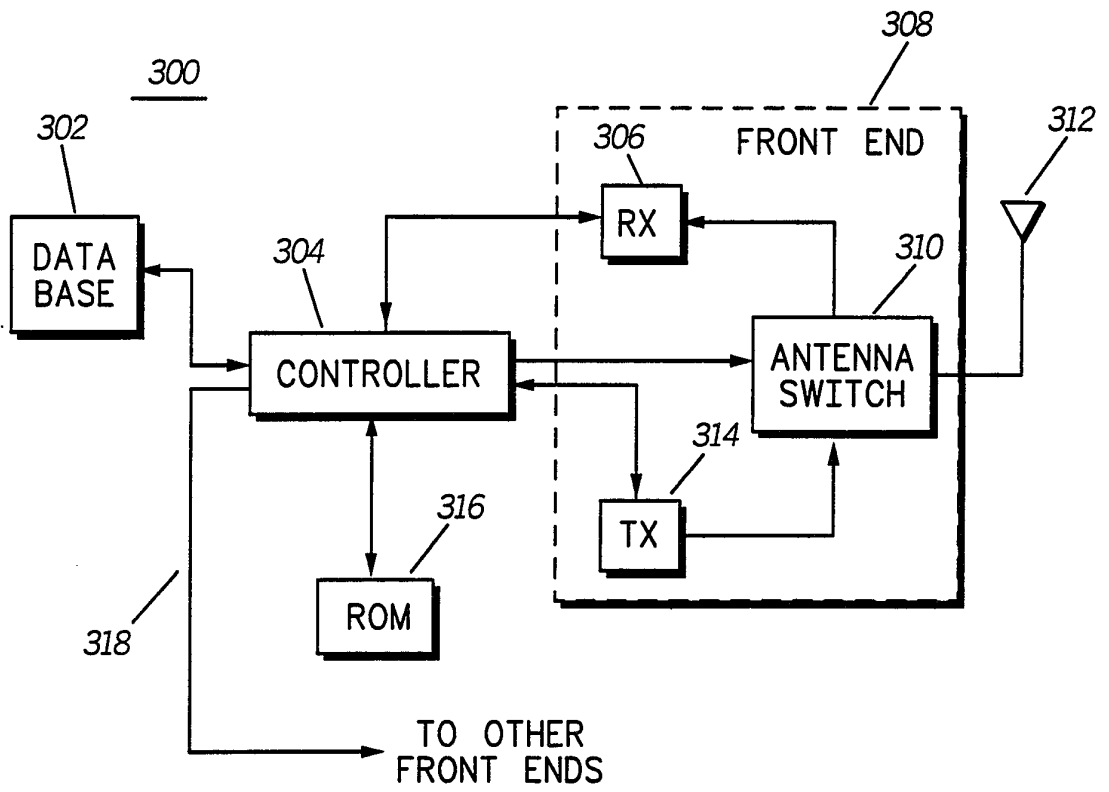
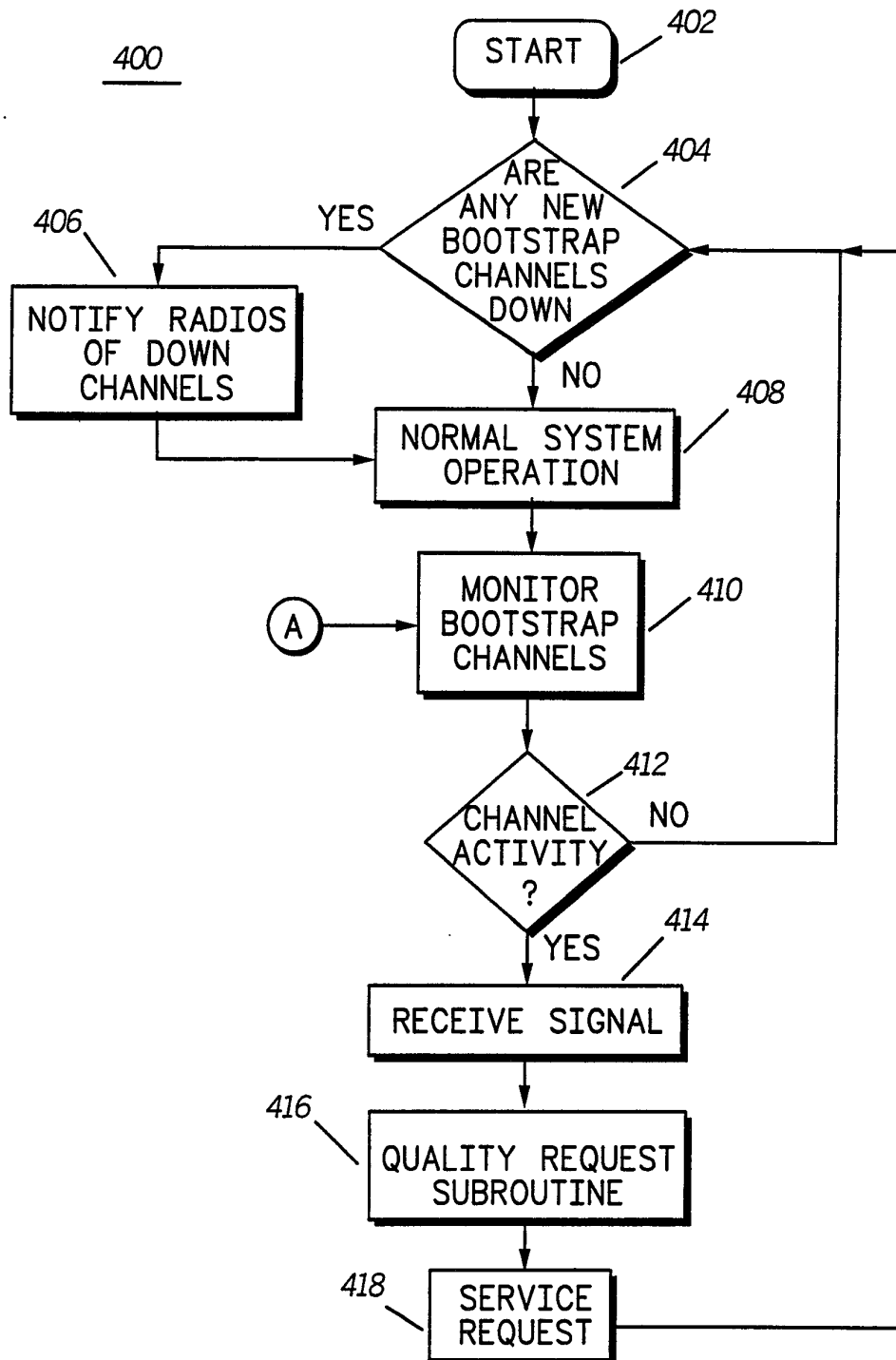


FIG. 3

FIG. 4



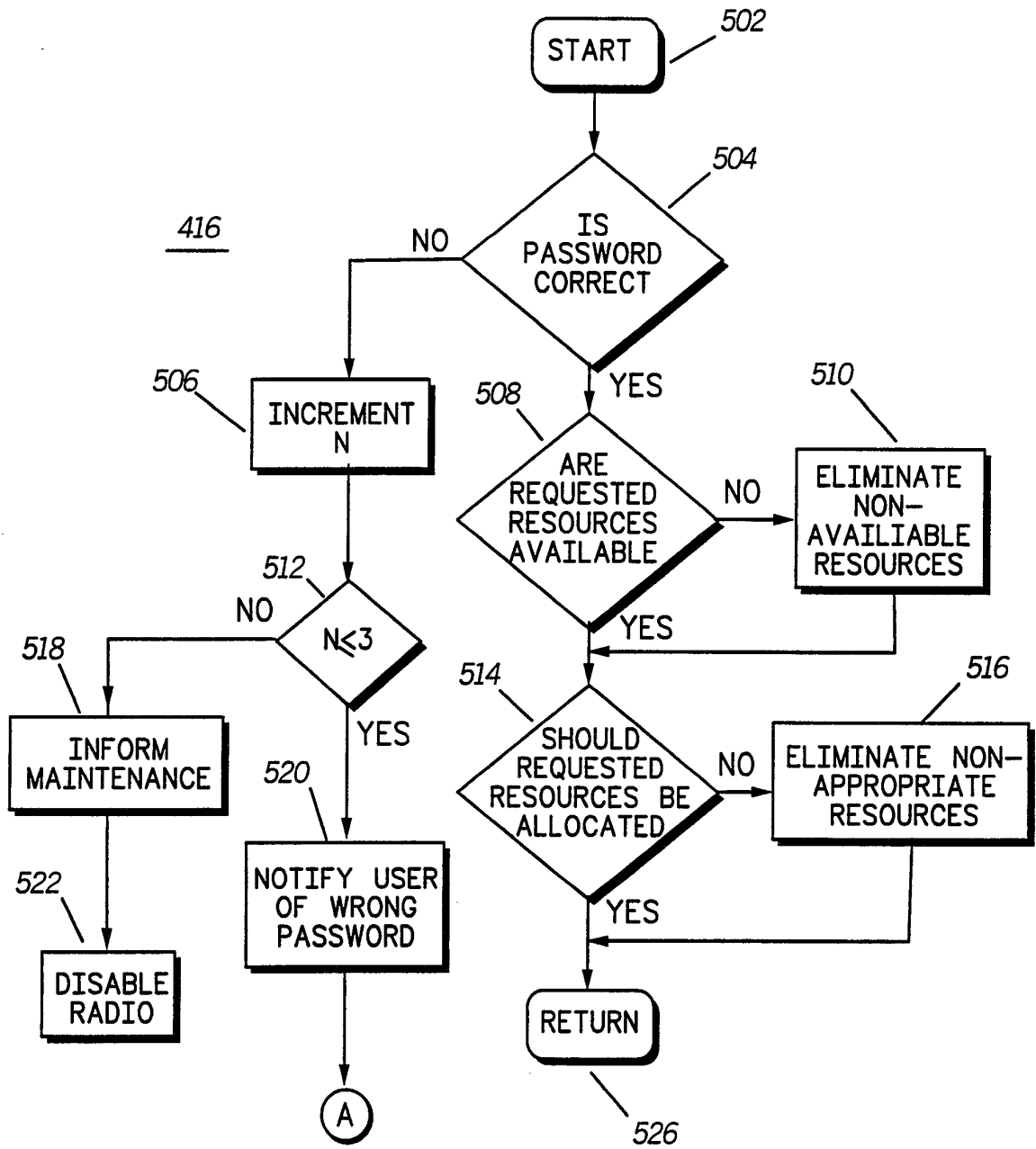


FIG. 5

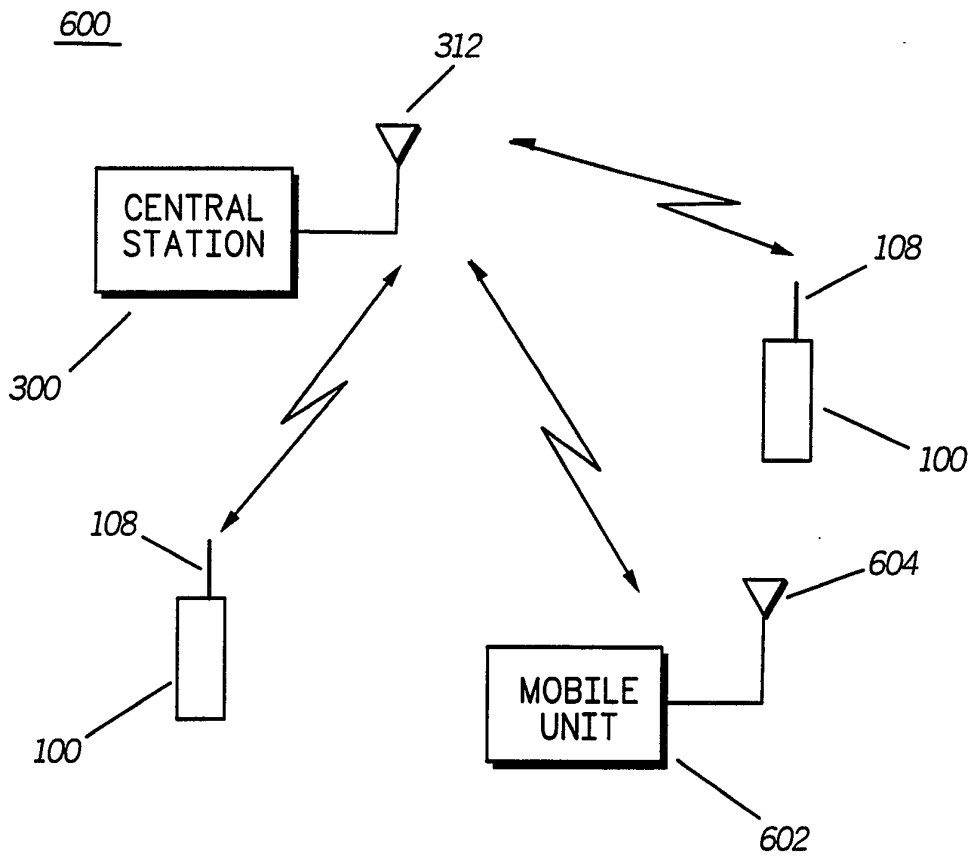


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US92/02580

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): H04B 1/00
U.S. CL. 455/70

ii. FIELDS SEARCHED

Minimum Documentation Searched ?

Classification System	Classification Symbols
U.S.	455/33.1, 54.1, 54.2, 56.1, 70, 186.1186.2 379/59, 60

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
Y,P	US,A, 5,012,234 (Dulanet et al.) 30 April 1991 See abstract, figure 4	1-10
Y	US,A, 4,935,732 (Andros et al.) 19 June 1990 See abstract.	1-10
Y	US,A, 4,839,628 (Davis et al) 13 June 1989 See abstract	1-10

* Special categories of cited documents: **

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
23 June 1992	13 JUL 1992
International Searching Authority	Signature of Authorized Officer
ISA/US	<i>Edward Urban</i> Edward Urban