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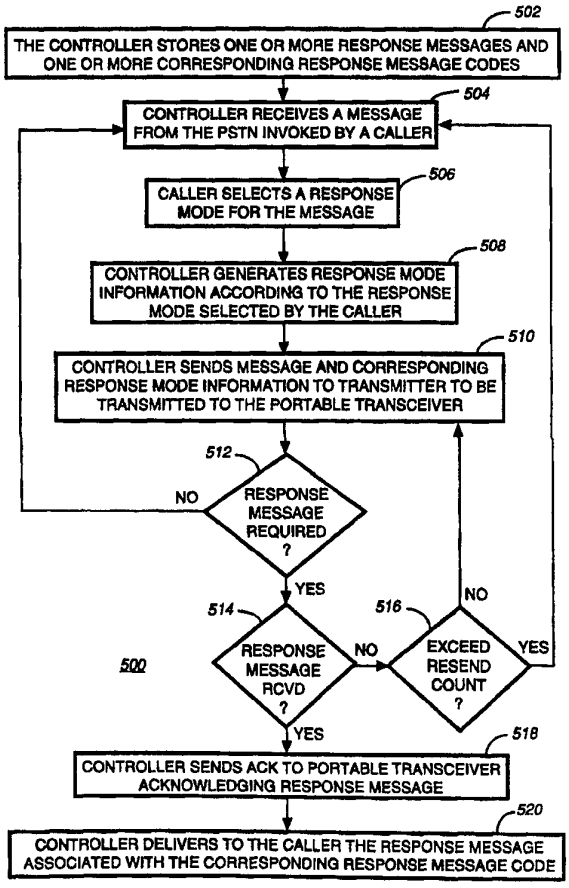
(57) Abstract

A method and apparatus providing a caller the capability to receive a response message from a portable transceiver (122). The caller also selects a response mode for the message from a group of response modes. A fixed portion (102) of the radio communication system generates response mode information according to the response mode selected by the caller, and transmits the message together with the response mode information to the portable transceiver (122). The portable transceiver (122) receives the message and response mode information, and alerts a user to the pending message. The user selects a response message in accordance with the response mode information. The portable transceiver (122) transmits the response message selected by the user to the fixed portion. The fixed portion transmits an acknowledgement to the portable transceiver (122), and delivers to the caller the response message. The portable transceiver (122) displays the status of the response message acknoledged by the fixed portion (102).



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METHOD AND APPARATUS FOR FLEXIBLE RESPONSE MESSAGING IN A RADIO COMMUNICATION SYSTEM

Field of the Invention

This invention relates in general to two-way messaging in a radio communication system, and more specifically to a method and apparatus for providing flexibility in the manner of generating response (inbound) messages.

Background of the Invention

A radio communication system with two-way communication between base stations and portable transceivers provides an important means for the base stations to determine the reliability of a message transaction. Two-way communication can be used by a caller accessing the radio communication system to determine that the called party has received the caller's page. There are times, however, when a caller may desire a certain type of response message from the called party.

In prior art systems, the called party typically responds to messages by way of a conventional telephone. However, this approach may be impractical when the called party, for example, is traveling in an automobile and a cellular phone or other suitable communication device is unavailable.

Thus, what is needed is a method and apparatus for flexible response messaging in a radio communication system. In particular, it is desirable that a response mode be made available to a portable transceiver to respond to messages generated by a caller. It is also advantageous to alert the user of the portable transceiver to the status of the response message transmitted by the portable transceiver.

Brief Description of the Drawings

FIG. 1 is an electrical block diagram of a radio communication system in accordance with the preferred embodiment of the present invention.

FIG. 2 is an electrical block diagram of elements of a fixed portion (base station and controller) of the radio communication system in accordance with the preferred embodiment of the present invention.

FIG. 3 is an electrical block diagram of a portable transceiver in accordance with the preferred embodiment of the present invention.

FIG. 4 is a timing diagram illustrating elements of an outbound protocol and an inbound protocol of the fixed and portable portions of the radio communication system in accordance with the preferred embodiment of the present invention.

FIG. 5 is a flow chart depicting operation of the fixed portion of the radio communication system in accordance with the preferred embodiment of the present invention.

FIGs. 6 and 7 are flow charts depicting operation of the portable transceiver in accordance with the preferred embodiment of the present invention.

Description of the Preferred Embodiment

FIG. 1 is an electrical block diagram of a radio communication system in accordance with the preferred embodiment of the present invention. The radio communication system comprises a fixed portion 102 and a portable portion 104. The fixed portion 102 includes a plurality of base stations 116, for communicating with the portable portion 104, utilizing conventional radio frequency (RF) techniques, and coupled by communication links 114 to a controller 112 which controls the base stations 116. The hardware of the controller 112 is, for example, a combination of the Wireless Messaging Gateway (WMG™) Administrator! paging terminal, and the RF-Conductor!™ message distributor manufactured by Motorola, Inc. The hardware of the base stations 116 is preferably a combination of the Nucleus® Orchestra! transmitter and RF-Audience!™ receivers manufactured by Motorola, Inc. It will be appreciated that other similar hardware can be utilized for the controller 112 and the base stations 116.

Each of the base stations 116 transmits RF signals to the portable portion 104 comprising a plurality of first portable transceivers 122, referred to herein as portable transceivers 122, via a transmitting antenna 120. The base stations 116 each receive RF signals from the plurality of portable

transceivers 122 via a receiving antenna 118. The RF signals transmitted by the base stations 116 to the portable transceivers 122 (outbound messages) comprise selective call addresses identifying the portable transceiver 122 along with data or voice messages originated by a caller. Outbound messages can also consist of a response message status as will be described below.

The RF signals transmitted by the portable transceivers 122 to the base stations 116 (inbound messages) comprise positive acknowledgments (ACKs) which indicate the message was received reliably by the portable transceiver 122, or negative acknowledgments (NAKs) which indicate the portable transceiver 122 did not receive the message reliably. The portable transceiver 122 also transmits unscheduled messages such as response messages, which will be described in more detail below. A detailed description of inbound acknowledge-back messaging is more fully described in U.S. Patent No. 4,875,038 issued October 17, 1989 to Siwiak et al.

The controller 112 preferably is coupled by telephone links 101 to a public switched telephone network (PSTN) 110 for receiving selective call originations therefrom. Selective call originations comprising voice and data messages from the PSTN 110 can be generated, for example, from a conventional telephone 111 coupled to the PSTN 110.

The outbound messages are similar to Motorola's well-known FLEX™ digital selective call signaling protocol as described more fully in U.S. Patent No. 5,168,493 issued December 1, 1992 to Nelson et al. This protocol utilizes well-known error detection and error correction techniques and is therefore tolerant to bit errors occurring during transmission, provided that the bit errors are not too numerous in any one code word.

Outbound channel transmissions of the base stations 116 utilize, for example, two and four-level frequency shift keyed (FSK) modulation, operating at sixteen hundred or thirty two hundred symbols-per-second (sps), depending on traffic requirements and system transmission gain. Inbound channel transmissions from the portable transceivers 122 to the base stations 116 utilize, for example, four-level FSK modulation at a rate of ninety-six hundred bits per second (bps). Inbound channel transmissions preferably occur during predetermined data packet time slots synchronized with the outbound channel transmissions.

The outbound and inbound channels preferably operate on separate carrier frequencies utilizing conventional frequency division multiplex (FDM) techniques. A detailed description of FDM techniques is more fully described in U.S. Patent No. 4,875,038 issued to Siwiak et al. It will be appreciated that, alternatively, the outbound and inbound channels can operate on a single carrier frequency using time division duplex (TDD) techniques as described more fully in U.S. Patent No. 5,168,493 issued to Nelson et al. It will be further appreciated that, alternatively, other signaling protocols, modulation schemes, and transmission rates can be utilized for either or both transmission directions.

FIG. 2 is an electrical block diagram 200 of elements of the fixed portion 102 in accordance with the preferred embodiment of the present invention. The diagram 200 comprises portions of the controller 112 and the base stations 116. The controller 112 includes a processing module 210 for directing operation of the controller 112. The processing module 210 preferably is coupled through a transmitter controller 204 to a transmitter 202 via the communication links 114. The communication links 114 preferably utilize conventional means such as a direct wire line (telephone) link, a data communication link, or any number of radio frequency links, such as a radio frequency (RF) transceiver link, a microwave transceiver link, or a satellite link, just to mention a few.

The transmitter 202 is for transmitting outbound information (in the form of, for example, two and four-level FSK data messages) to the portable transceivers 122 during outbound messaging. The processing module 210 is also coupled to at least one receiver 206 through a receiver controller 208 via the communication links 114. The receiver 206 is for receiving inbound information in form of four-level FSK and is preferably collocated with the base stations 116, as implied in FIG. 2, but can be positioned remote from the base stations 116 to avoid interference from the transmitter 202. The receiver 206 is for receiving one or more acknowledgments (ACKs, NAKs, or response messages) from the portable transceivers 122.

The processing module 210 is also coupled to a telephone interface 218 for communicating with the PSTN 110 through the telephone links 101 for receiving selective call originations.

In order to perform the functions necessary in controlling the elements of the controller 112, as well as the elements of the base stations 116, the processing module 210 preferably includes a computer system 212,

and mass storage media 214. The mass storage media 214 is a memory device for including subscriber user information such as, for example, portable transceiver 122 addressing, and programming options, just to name a few. The mass storage media 214 is preferably a conventional hard disk mass storage device.

The computer system 212 is preferably programmed by way of software included in the mass storage media 214. The computer system 212, for example, comprises a plurality of processors such as VME Sparc processors manufactured by Sun Microsystems, Inc. These processors include memory such as dynamic random access memory (DRAM), which serves as a temporary memory storage device for program execution, and scratch pad processing such as, for example, storing messages originated by callers using the PSTN 110, processing acknowledgments received from the portable transceivers 122, protocol processing of messages destined for the portable transceivers 122, and storing custom (multiple choice) response messages generated by a caller which are stored and transmitted to a portable transceiver 122, as will be described below.

It will be appreciated that other types of conventional computer systems 212 can be utilized, and that additional computer systems 212 and mass storage media 214 of the same or alternative type can be added as required to handle the processing requirements of the processing module 210.

The processing module 210 is programmed for processing incoming messages generated by callers utilizing the PSTN 110, and for processing outbound and inbound messages transmitted to and from the portable transceiver 122. In an alternative embodiment, the processing module includes a caller interface module 213 for providing the caller with an option to select a response mode for a message originated by a caller using the PSTN 110. The caller interface module 213 further provides the caller with an option to select a destination for the response message generated by the portable transceiver 122.

The processing module 210 is further programmed to store in the mass storage media 214 a default response message list and corresponding response message codes. The default response message list preferably includes a list of canned voice messages which a user of a portable transceiver 122 can select from a remote location. The processing module 210 is also programmed to receive from the caller interface module 213 the

caller's message and response mode selected by a caller. The caller selects the response mode from a group of response modes consisting of (a) a no response request, (b) a response request from a default response message list, and (c) a response request from a custom response message list provided by the caller. The caller further selects from a group of destinations for the response message consisting of, for example, a telephone number, a data terminal, and a second portable transceiver 122. The second portable transceiver 122 is, for example, the portable transceiver 122 utilized by the caller.

When a caller selects a response mode consisting of a custom response message list, the caller preferably enters the multiple choice responses utilizing a teletype or equivalent computer system which delivers digital code information understood by the controller 112. Alternatively, the caller can request for a service provider operator which can receive the information orally by way of the PSTN 110 being utilized by the caller, and have the service provider operator enter the custom response message list by way of a teletype or computer system capable of programming the controller 112. For both cases, the custom response message list is programmed into the controller 112, and stored in temporary memory (e.g. DRAM). The controller 112, then generates response message codes corresponding to each response message listed in the custom response message list. Both the custom response message list and associated response message codes are included in the response mode information.

In response to the caller selecting a response mode, the processing module 210 generates response mode information. The response mode information includes, for example, two bits corresponding to an information flag which represents one of three possible response modes. For the case when the caller selects no response request from the portable transceiver 122, the information flag indicates to the portable transceiver 122 that no response is necessary. When the caller selects a default response request from the portable transceiver 122, the information flag indicates to the portable transceiver 122 that a response is to be selected by the user of the portable transceiver from the default response message list. When the caller selects a custom response request from the portable transceiver 122, the response mode information consists of an information flag, and a custom response message list which comprises a multiple choice response list the portable transceiver 122 displays to the user for selecting a response

message to the caller's initiated message. The information flag indicates to the portable transceiver 122 that a custom response list is to be utilized. The custom response message list comprises digital information representing each response, and corresponding response message code.

Once the processing module 210 generates the response mode information, the processing module 210 then sends via the transmitter controller 204 the message together with its corresponding response mode information, and a message sequence number (identifying the message uniquely to other previously sent messages) to the transmitter 202 which transmits the information to the intended portable transceiver 122. In response to the user of the portable transceiver 122 selecting a response message, the processing module 210 receives via the receiver controller 208 coupled to the base station receiver 206 a corresponding response message code and a portable transceiver identification number associated with the portable transceiver 122.

The processing module 210 then delivers to the caller the response message associated with the corresponding response message code. The delivery location of the response message can be a data terminal, a telephone number, or second portable transceiver 122 as described above. It will be appreciated that when the destination is a second portable transceiver 122 with alpha-numeric capability only, the response canned voice messages can be replaced with an equivalent text or data message.

Preferably the processing module 210 is also programmed to send a response message status to the portable transceiver 122 which sent the response message. The response message status preferably consists of a response acknowledgment message acknowledging the reception of the response message by the receiver 206 of the base station 116. In an alternative embodiment, the response message status can consists of a response acknowledgment message acknowledging to the user of the portable transceiver 122 the reception of the response message by the caller.

FIG. 3, an electrical block diagram of the portable transceiver 122 in accordance with the preferred embodiment of the present invention. The portable transceiver 122 comprises a transmitter antenna 302 for transmitting RF signals to the base stations 116, and a receiver antenna 305 for intercepting RF signals from the base stations 116. The transmitter antenna 302 is coupled to a conventional transmitter 304. Similarly, the receiver antenna 305 is coupled to a conventional receiver 306. The RF

signals received from the base stations 116 are received as two and four-level FSK signals. The RF signals transmitted by the portable transceiver 122 to the base stations 116 are transmitted as four-level FSK signals.

Radio signals received by the receiver 306 produce demodulated information at the output. The demodulated information is coupled to the input of a processing unit 310 for directing operations of the portable transceiver 122, which processes outbound messages. Similarly, inbound acknowledgment messages are processed by the processing unit 310 and delivered to the transmitter 304 for transmission. A conventional power switch 308, coupled to the processing unit 310, is used to control the supply of power to the transmitter 304 and receiver 306, thereby providing a battery saving function.

To perform the necessary functions of the portable transceiver 122, the processing unit 310 includes a microprocessor 316, a RAM 312, a ROM 314, and an EEPROM 318. Preferably, the microprocessor 316 is similar to the M68HC08 micro-controller manufactured by Motorola, Inc. It will be appreciated that other similar processors can be utilized for the microprocessor 316, and that additional processors of the same or alternative type can be added as required to handle the processing requirements of the processing unit 310. It will be appreciated that other types of memory, e.g., EEPROM or FLASH, can be utilized for the ROM 314, as well as the RAM 312. It will be further appreciated that the RAM 312 and the ROM 314, singly or in combination, can be an integral portion of the microprocessor 316.

The microprocessor 316 is programmed by way of the ROM 314 to process incoming messages on the outbound channel, and for creating acknowledgment messages on the inbound channel. During outbound message processing, the microprocessor 316 samples the demodulated signal generated by the receiver 306. The microprocessor 316 then decodes an address in the demodulated data of the outbound message, compares the decoded address with one or more addresses stored in the EEPROM 318, and when a match is detected, the microprocessor 316 proceeds to process the remaining portion of the message. The EEPROM 318 memory is also utilized for storing a default response message list and corresponding response message codes, to be explained in greater detail hereinafter.

Once the microprocessor 316 has processed the message, it stores the message in the RAM 312, and a call alerting signal is generated to alert a user that a message has been received. The call alerting signal is directed to a conventional audible or tactile alerting device 322 for generating an audible or tactile call alerting signal. In addition, the microprocessor 316 is programmed to send the ACK or NAK acknowledgments depending on the quality of the received message. To send an acknowledgment, the microprocessor 316 controls the modulation circuit (not shown) of the transmitter 304 to send the FSK data corresponding to the appropriate acknowledgment message.

Outbound messages are accessed by the user through user controls 320, which provide functions such as lock, unlock, delete, read, etc. More specifically, by the use of appropriate functions provided by the user controls 320, the message is recovered from the RAM 312, and then displayed on a display 324, e.g., a conventional liquid crystal display (LCD), or played out audibly, in the case of a voice message, by the combination of an audio amplifier 326 and a speaker 328.

As described above for the controller 112, outbound messages include response mode information. For the case when the caller chooses not to receive a response message from the user of the portable transceiver 122, the portable transceiver 122 displays a message on the display 324 indicating no response is available. For the case when the caller selects default response messages, the portable transceiver 122 displays the received outbound message with an indication that a default response message is requested by the caller. The user of the portable transceiver 122 may then select a response message from the default response message list stored in the EEPROM 318. For the case when the caller generates a custom response message list (CRML), the CRML is received in the response mode information. The portable transceiver 122 stores the CRML in the RAM 312, and displays to the user of the portable transceiver 122 the message with an indication that a CRML is available for selecting a response message.

Once the user of the portable transceiver 122 selects a response message, the processing unit 310 sends to the transmitter 304 the corresponding response message code of the response message selected by the user, and a portable transceiver identification number corresponding to the portable transceiver 122 to the fixed portion 102 of the radio

communication system. In one embodiment, a single digital code is utilized to represent both the portable transceiver identification number and a message sequence number identifying the message being responded to by the portable transceiver 122. In an alternative embodiment, the portable transceiver identification number and the message sequence number are two separate digital codes. In response to transmitting the response message, the processing unit 310 displays the message with an indication the response message has been transmitted, and that an acknowledgment to the response message from the fixed portion 102 of the radio communication system is pending.

Once the portable transceiver 122 receives an acknowledgment for the response message received by the fixed portion 102 of the radio communication system, the processing unit 310 selects an alert from a group of alert status signals consisting of an audible alert status signal, a tactile alert status signal, and a display alert status signal. The alert mode is pre-selected by the user of the portable transceiver 122 by utilizing appropriate functions provided by the user controls 320. The display alert status signal consists of an icon indicating the response message was received by the fixed portion 102 of the radio communication system.

When, however, the fixed portion 102 of the radio communication system does not respond with an acknowledgment within a predetermined time period, the portable transceiver 122 will resend the response message for a predetermined number of attempts. If the predetermined number of re-transmission attempts fail, then the user of the portable transceiver 122 is alerted preferably with an audible alert to the possible failure of transmitting the response message. The processing unit 310 displays the message with an indication that acknowledgment for the response message by the fixed portion 102 of the radio communication system has not occurred.

FIG. 4 is a timing diagram 400 of elements of an outbound protocol and an inbound protocol of the fixed portion 102 and portable portion 104 of the radio communication system in accordance with the preferred embodiment of the present invention. The signaling format operating on the outbound and inbound channels preferably operates on independent frequencies utilizing FDM as described above. Using FDM transmission both outbound and inbound RF channel transmissions are depicted during a time interval 401.

The elements of the outbound protocol comprise an outbound sync 407, a selective call address 412, a message vector 414 and an outbound message 416. The outbound sync 407 provides the portable transceiver 122 a means for synchronization utilizing techniques well known in the art. The selective call address 412 identifies the portable transceiver 122 for which the outbound message 416 is intended. The message vector 414 points in time within the signal format to the position of the outbound message 416 to be received by the portable transceiver 122. The message vector 414 further provides information to the portable transceiver 122 identifying a scheduled time slot for acknowledging the message transaction.

The outbound message 416 can comprise either a selective call message, or a response message status transmitted by the base stations 116. Selective call messages comprise a message 408, a response mode information block 410, and a message sequence number 411. The message 408 corresponds to the message initiated by a caller. The response mode information block 410 includes the response mode information selected by the caller. The response mode information block 410 comprises an information flag 409, one or more custom response messages 413, and one or more corresponding response message codes 415. The information flag 409 instructs the portable transceiver 122 to the expected response mode. The information flag 409 is indicative of a group of response modes consisting of a no response, a response from a default response message list programmed into the portable transceiver 122, and a response from a custom response message list 413. When a custom response message list 413 is utilized a corresponding set of response message codes 415 is included in the response mode information 410. The message sequence number 411 identifies the message uniquely from messages previously transmitted to the portable transceiver 122 from the fixed portion of the radio communication system.

The elements of the inbound protocol comprise an inbound sync 426, scheduled time slots 428, and unscheduled time slots 430. The inbound sync 426 provides the base stations 116 a means for synchronization utilizing techniques well known in the art. Scheduled messages commence after the inbound sync 426 at and before a time boundary 403. A transmission time interval 402 depicts the time interval for scheduled transmissions on scheduled time slots 428 from the portable transceivers 122. Unscheduled messages commence after a time boundary 405 which

depicts the end of scheduled transmissions from the portable transceivers 122. The duration of unscheduled transmissions on unscheduled time slots 430 is depicted by a transmission time interval 404.

Unscheduled time slots 430 may be used by any portable transceiver 122 located in a coverage area. In certain cases, more portable transceivers 122 may be attempting to utilize unscheduled time slots 430 than are available in the coverage area. To overcome this limitation, the well-known ALOHA protocol is utilized for unscheduled messaging.

Scheduled inbound messages preferably comprise ACKs, or NAKs, while unscheduled transmissions preferably comprise response messages. Scheduled and unscheduled inbound messages include a portable transceiver identification number 420 (preferably the address of the portable transceiver 122). Response messages further include a response message code 418 corresponding to a response message selected by the user of the portable transceiver 122.

FIG. 5 is a flow chart 500 depicting operation of the fixed portion 102 of the radio communication system in accordance with the preferred embodiment of the present invention. The flow chart 500 begins with step 502 where the controller 112 stores one or more response messages and one or more corresponding response message codes preferably in the mass storage media 214 of the processing module 210. In step 504 the controller 112 receives a message from the PSTN 110 invoked by a caller. The message is intended for at least one portable transceiver 122. Once the message has been received from the caller, in step 506 the caller selects a response mode for the message. As described above, the caller selects from a group of response modes for the portable transceiver(s) 122 consisting of a response from a default response message list, a custom response message list generated by the caller comprising of multiple choice responses, and an option for no response at all. The caller also selects the destination of the response message from a group of destinations consisting of a telephone number, a data terminal, or a second portable transceiver 122 (preferably a portable transceiver utilized by the caller).

In response to the caller's selections, in step 508 the controller 112 generates response mode information. In step 510 the controller 112 sends the message and its corresponding response mode information to the transmitter 202 (via the transmitter controller 204) for transmission to the portable transceiver 122. In step 512 the controller 112 determines if a

response message is required from the portable transceiver 122. If not, the controller 112 proceeds to step 504 where it receives messages from subsequent callers. If a response message is required, then the controller 112 proceeds to step 514 where it checks if a response message has been received from the portable transceiver 122. If a response message has not been received within a predetermined time period, then the controller proceeds to step 516 where it checks if re-transmission attempts have been exceeded. If re-transmission attempts have been exceeded, then the controller 112 stops waiting for a response message from the portable transceiver 122, and continues to step 504 where it awaits further message transactions from callers utilizing the PSTN 110.

If re-transmission attempts have not been exceeded, then the controller 112 proceeds to step 510 where the message and corresponding response mode information is re-transmitted. Once a response message has been received from the portable transceiver 122, the controller 112 in step 518 sends an acknowledgment to portable transceiver 122 acknowledging the response message. The controller 112 then proceeds to step 520 where it delivers to the caller (at the destination initially specified by the caller) the response message associated with the corresponding response message code received from the portable transceiver 122.

FIGs. 6 and 7 illustrate a flow chart 600 depicting operation of the portable transceiver 122 in accordance with the preferred embodiment of the present invention. The flow chart 600 begins with step 602 where the portable transceiver 122 stores one or more default response messages, and one or more corresponding default response message codes in the EEPROM 318. This is done by the service provider before establishing service for a user of the portable transceiver 122, for example. In step 604 the portable transceiver 122 receives a message together with its corresponding response mode information. In step 606 the portable transceiver decodes the response mode information to determine the response message mode. Once the response message mode is determined, in step 608 the portable transceiver 122 alerts the user, and displays the message on the preview screen of the display 324 with the appropriate icon indicating the one of three response modes expected.

If no response mode is required, in step 610 the portable transceiver 122 proceeds to step 604 for receiving subsequent messages. If a response is required from the default list, then the portable transceiver 122 proceeds to

step 612 where the user of the portable transceiver generates input information by selecting a response message utilizing appropriate functions provided by the user controls 320 in accordance with the response mode information from a default response message list. If a response is required from the custom list, then the portable transceiver 122 proceeds to step 614 where the user of the portable transceiver selects a response message in accordance with the response mode information from a custom response message list which was transmitted with the message. Steps 612 and 614 proceed to step 616 of FIG. 7.

Once the user has selected a response message, in step 616 the portable transceiver 122 displays a responding status indication next to the message. In step 618 the portable transceiver 122 controls the transmitter 304 to transmit a response message code corresponding to the response message selected by the user, and a portable transceiver identification number 420 corresponding to the portable transceiver 122. In an alternative embodiment, the message sequence number 422 identifying the message being responded is transmitted in the inbound message in addition to the portable transceiver identification number 420.

In step 620 the portable transceiver 122 waits for a response message status acknowledgment from the fixed portion 102 of the radio communication system. If a response message status is received, then the portable transceiver 122 proceeds to step 628 where it changes the response message icon to a response accepted status. If an acknowledgment is not received within a predetermined time, then the portable transceiver 122 checks in step 622 if re-transmission attempts have been exceeded. If the resend count has not been exceeded, then the portable transceiver continues to step 618 where the response message is re-transmitted. If re-transmissions have been exceeded, then the portable transceiver 122 in step 624 moves the response message to the top of the preview screen of the display 324, and displays an acknowledgment failure status icon next to the message. The portable transceiver 122 then proceeds to step 626 where the user is alerted to the failed response message status.

Thus, it should be apparent that the present invention provides a method and apparatus for flexible response messaging in a radio communication system. In particular, the method and apparatus advantageously provides a method for a caller to select the response message mode utilized by the portable transceiver 122. In addition, the

invention provides the caller a method to designate the destination of the response message to any one of three destinations, as described above. The portable transceiver 122 also provides a method for displaying the status of the response message transmitted by the portable transceiver 122 to the fixed portion 102 of the radio communication system.

What is claimed is:

CLAIMS

1. A method in a radio communication system for a caller to receive a response message from a first portable transceiver to a message initiated by the caller, the method comprising the steps of:

storing at least one response message and a corresponding at least one response message code in a fixed portion of the radio communication system;

receiving a message from a caller designated for transmission to the first portable transceiver;

the caller selecting a response mode for the message;

the fixed portion of the radio communication system generating response mode information according to the response mode selected by the caller;

transmitting from the fixed portion of the radio communication system the message together with its corresponding response mode information to the first portable transceiver;

the first portable transceiver receiving the message together with its corresponding response mode information from the fixed portion of the radio communication system;

selecting from the first portable transceiver a response message in accordance with the response mode information;

the first portable transceiver transmitting a response message code corresponding to the response message, and a portable transceiver identification number corresponding to the first portable transceiver to the fixed portion of the radio communication system;

the fixed portion of the radio communication system receiving from the first portable transceiver the response message code, and the portable transceiver identification number; and

delivering to the caller from the fixed portion of the radio communication system the response message associated with the response message code.

2. The method of claim 1, further including the step of transmitting a response message status from the fixed portion of the radio communication system to the first portable transceiver.

3. The method of claim 2, wherein the first portable transceiver includes the step of alerting a user of the first portable transceiver in response to receiving the response message status.

4. The method of claim 1, wherein the caller selects the response mode from a group of response modes consisting of (a) a no response request, (b) a response request from a default response message list, and (c) a response request from a custom response message list provided by the caller.

5. The method of claim 1, wherein the response mode consists of a default response message list, and wherein the default response message list is stored in the first portable transceiver.

6. The method of claim 1, wherein the response mode consists of a custom response message list, wherein the response mode information includes the custom response message list, and wherein the custom response message list is temporarily stored in the first portable transceiver.

7. The method of claim 1, wherein the portable transceiver identification number includes a message sequence number corresponding to the message.

8. The method of claim 1, wherein the first portable transceiver further transmits a message sequence number corresponding to the message in addition to the portable transceiver identification number together with the response message code.

9. The method of claim 8, wherein the caller selects from a group of destinations for the response message consisting of a telephone number, a data terminal and a second portable transceiver .

10. A controller in a radio communication system for delivering a response message to a message initiated by a caller, the controller comprising:

a processing module for directing operations of the controller;

a telephone interface coupled to the processing module for communicating with a public switched telephone network;

a transmitter coupled to the processing module for transmitting outbound information;

a receiver coupled to the processing module for receiving inbound information; and

wherein the processing module is programmed to

(a) store a response message and a corresponding response message code,

(b) receive a message from a caller utilizing the public switched telephone network designated for transmission to a first portable transceiver,

(c) receive from the caller a response mode selected by the caller,

(d) generate response mode information according to the response mode selected by the caller,

(e) send the message together with its corresponding response mode information transmitted by the transmitter to the first portable transceiver,

(f) receive via the receiver from the first portable transceiver the corresponding response message code and a portable transceiver identification number corresponding to the first portable transceiver, and

(g) deliver to the caller the response message associated with the corresponding response message code.

11. The controller of claim 10, wherein the processing module further includes a memory for storing the response message and a corresponding response message code.

12. The controller of claim 10, wherein the processing module further includes a caller interface module for providing the caller an option to select the response mode for the message.

13. The controller of claim 12, wherein the caller interface module further provides the caller an option to select a destination for the response message.

14. The controller of claim 10, wherein the controller further includes a transmitter controller coupled to the processing module and to the transmitter for controlling the transmitter to transmit outbound information to the first portable transceiver, and wherein the controller further includes a receiver controller coupled to the processing module and to the receiver for controlling the receiver to receive inbound information from the first portable transceiver.

15. The controller of claim 10, wherein the processing module is further programmed to send a response message status to the first portable transceiver.

16. The controller of claim 10, wherein the processing module is further programmed to permit the caller to select the response mode from a group of response modes consisting of (a) a no response request, (b) a response request from a default response message list, and (c) a response request from a custom response message list provided by the caller.

17. The controller of claim 16, wherein the processing module is further programmed to permit the caller to select from a group of destinations for the response message consisting of a telephone number, a data terminal, and a second portable transceiver .

18. The controller of claim 10, wherein the processing module is further programmed to permit the caller to select the response mode consisting of a default response message list, and wherein the default response message list is stored in the first portable transceiver.

19. The controller of claim 10, wherein the processing module is further programmed to permit the caller to select the response mode consisting of a custom response message list, wherein the response mode information which is transmitted to the first portable transceiver includes the custom response message list, and wherein the custom response message list is temporarily stored in the first portable transceiver.

20. A portable transceiver in a radio communication system for delivering a response message to a message initiated by a fixed portion of the radio communication system, the portable transceiver comprising:

a processing unit for directing operations of the portable transceiver;

a memory coupled to the processing unit for storing a response message and a corresponding response message code;

a receiver coupled to the processing unit for receiving outbound information from the fixed portion of the radio communication system;

a transmitter coupled to the processing unit for transmitting inbound information to the fixed portion of the radio communication system; and

wherein the processing unit is programmed to

(a) receive the message together with its corresponding response mode information from the fixed portion of the radio communication system,

(c) receive input information from a user of the portable transceiver comprising a selection of a response message,

(b) select a response message in accordance with the response mode information and an input information provided by the user of the portable transceiver, and

(c) send the corresponding response message code of the response message, and a portable transceiver identification number corresponding to the portable transceiver to the fixed portion of the radio communication system.

21. The portable transceiver of claim 20, wherein the portable transceiver receives a response message status from the fixed portion of the radio communication system, and the processing unit in response thereto, generates a signal to alert a user of the portable transceiver of the response message status.

22. The portable transceiver of claim 21, wherein the processing unit is responsive to the response message status to generate a group of alert status signals consisting of an audible alert status signal, a tactile alert status signal, and a display alert status signal.

23. The portable transceiver of claim 22, wherein processing unit generates the portable transceiver identification number which includes a message sequence number corresponding to the message.

24. The portable transceiver of claim 23, wherein the processing unit is further programmed to send to the fixed portion of the radio communication system a message sequence number corresponding to the message in addition to the portable transceiver identification number.

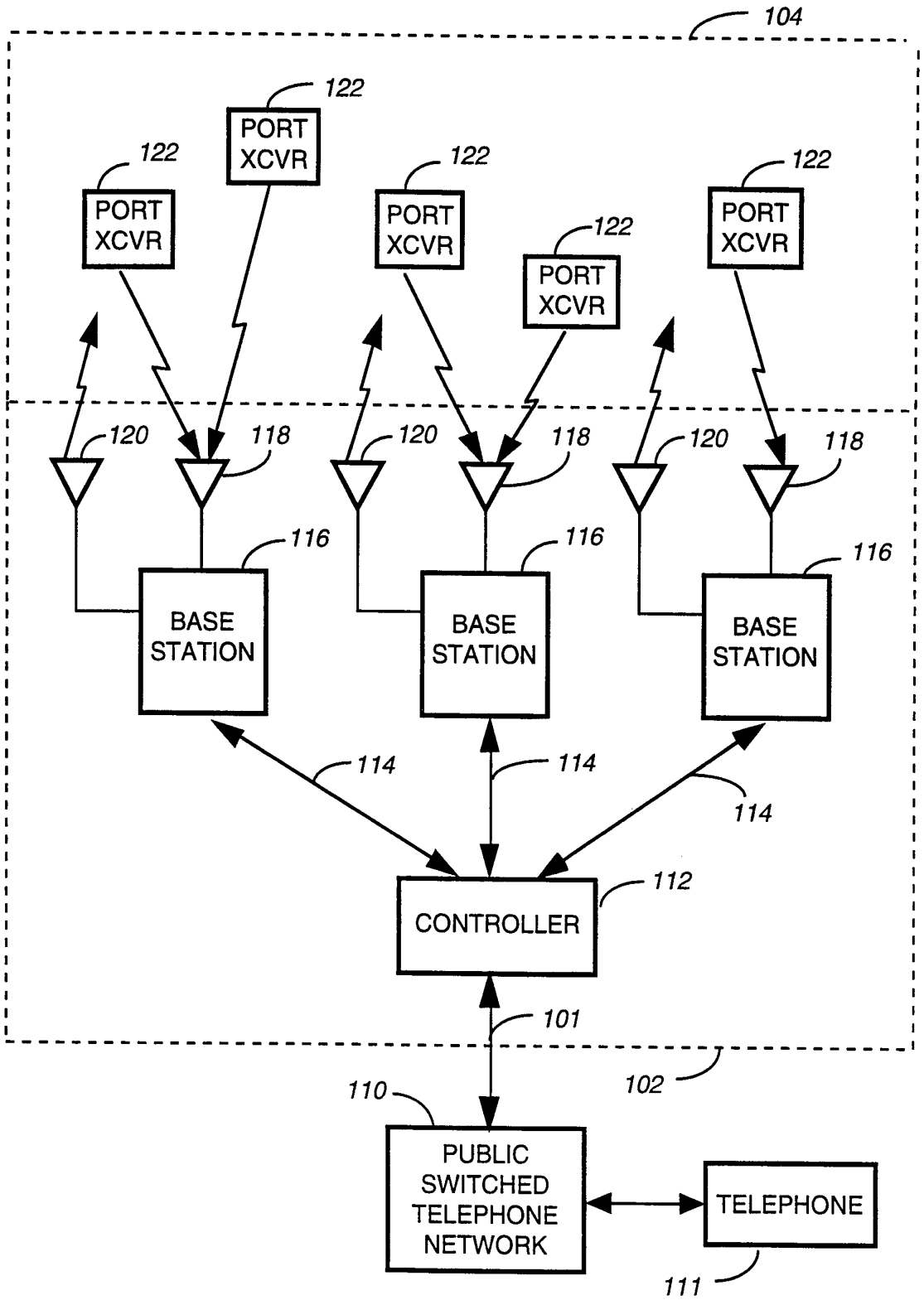

104
122
PORT XCVR
122
PORT XCVR
122
PORT XCVR
122
PORT XCVR
122
PORT XCVR
120
118
120
118
120
118
116
116
116
BASE STATION
BASE STATION
BASE STATION
114
114
114
112
CONTROLLER
101
102
110
PUBLIC SWITCHED TELEPHONE NETWORK
TELEPHONE
111

FIG. 1

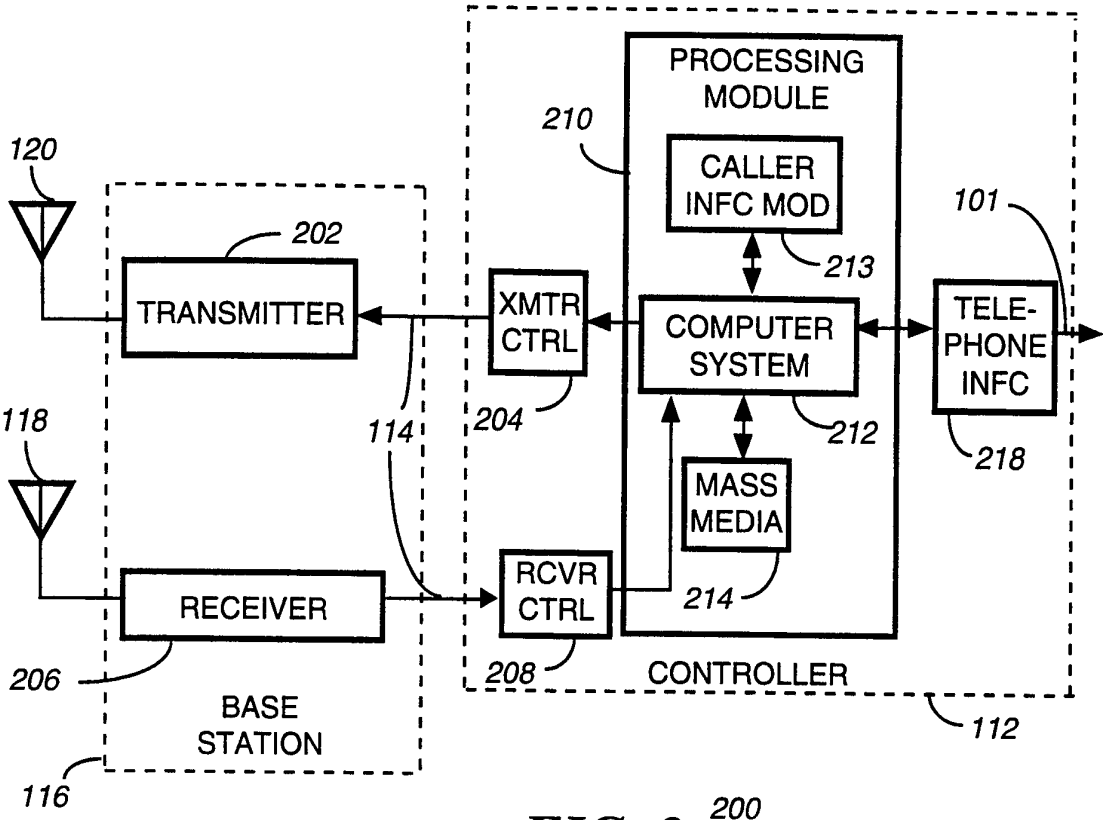


FIG. 2 200

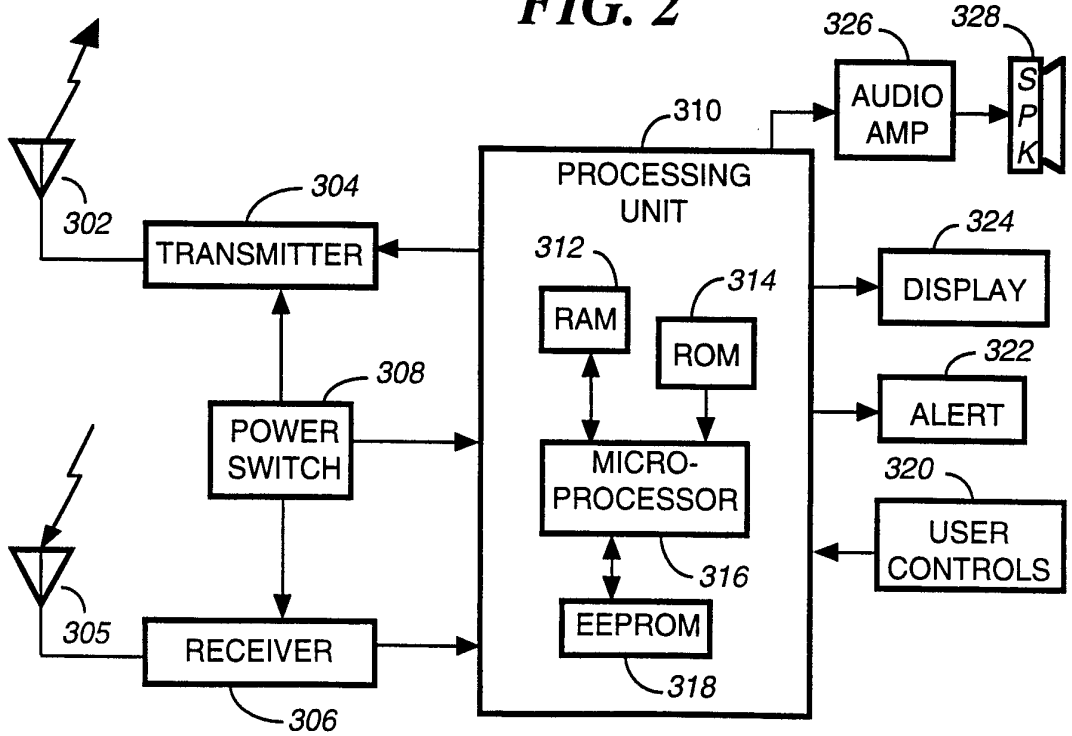


FIG. 3 122

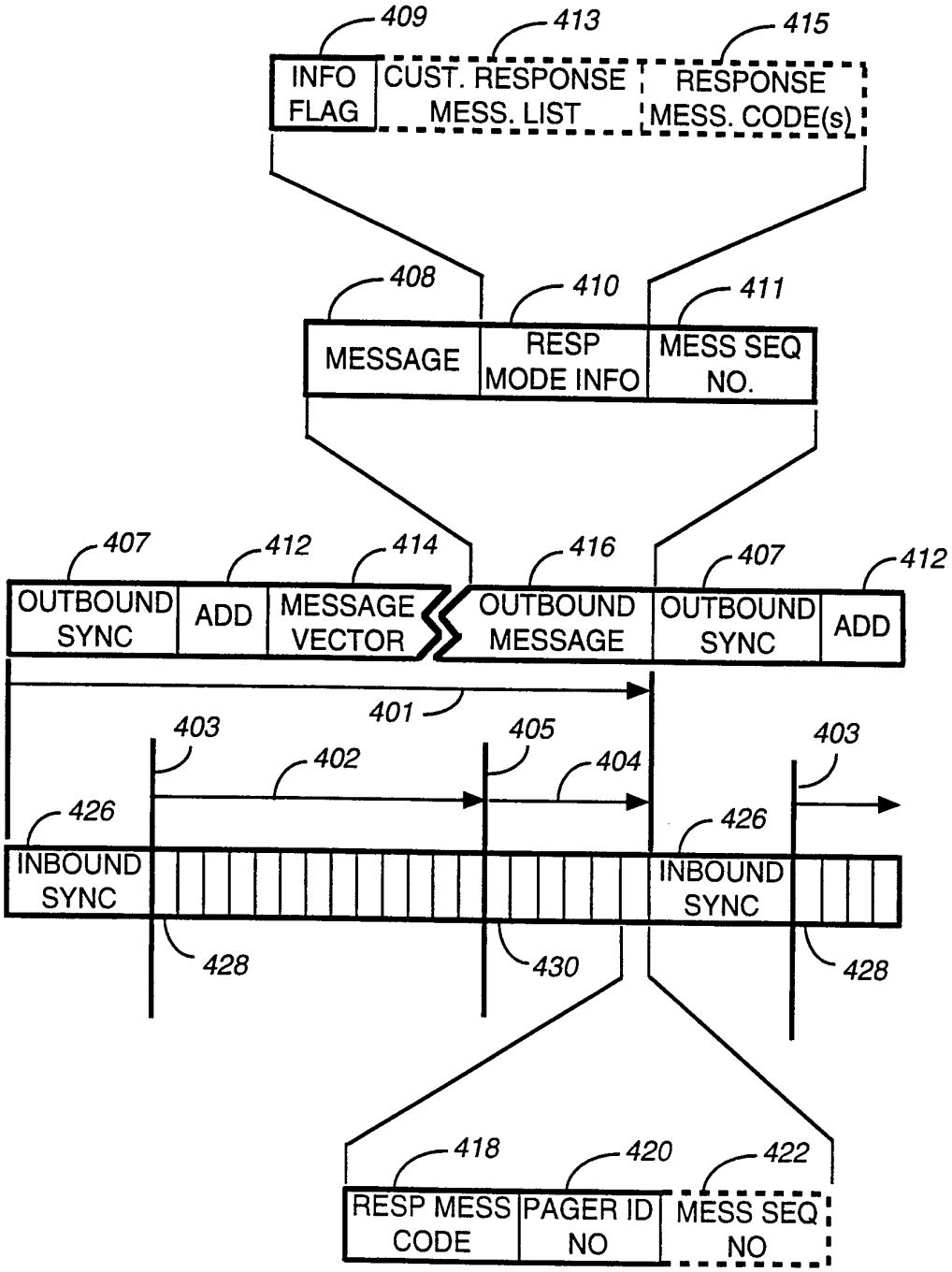

409
413
415
INFO FLAG
CUST. RESPONSE MESS. LIST
RESPONSE MESS. CODE(s)
408
410
411
MESSAGE
RESP MODE INFO
MESS SEQ NO.
407
412
414
416
407
412
OUTBOUND SYNC
ADD
MESSAGE VECTOR
OUTBOUND MESSAGE
OUTBOUND SYNC
ADD
401
403
405
403
402
404
426
426
INBOUND SYNC
INBOUND SYNC
428
430
428
418
420
422
RESP MESS CODE
PAGER ID NO
MESS SEQ NO

FIG. 4 400

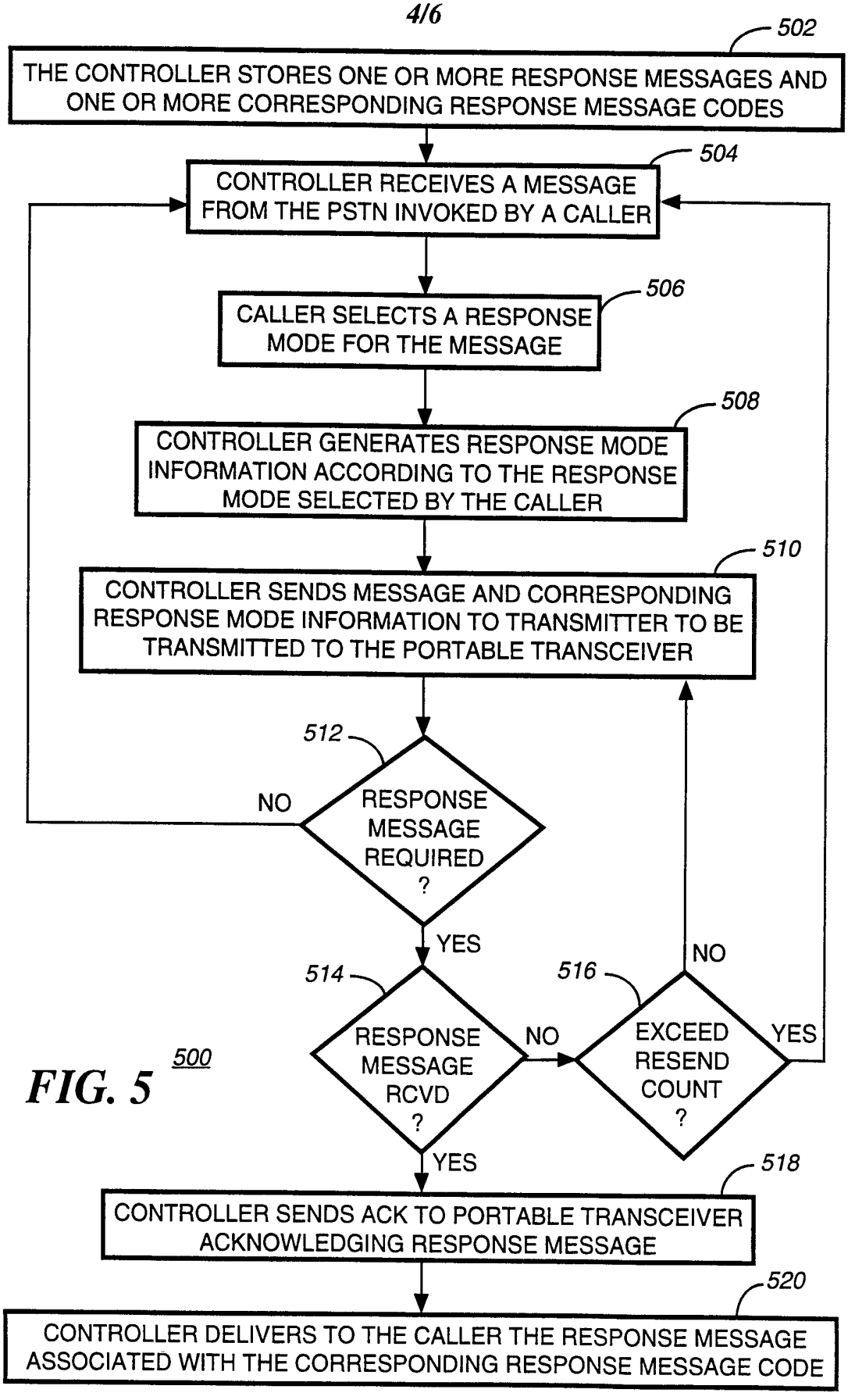
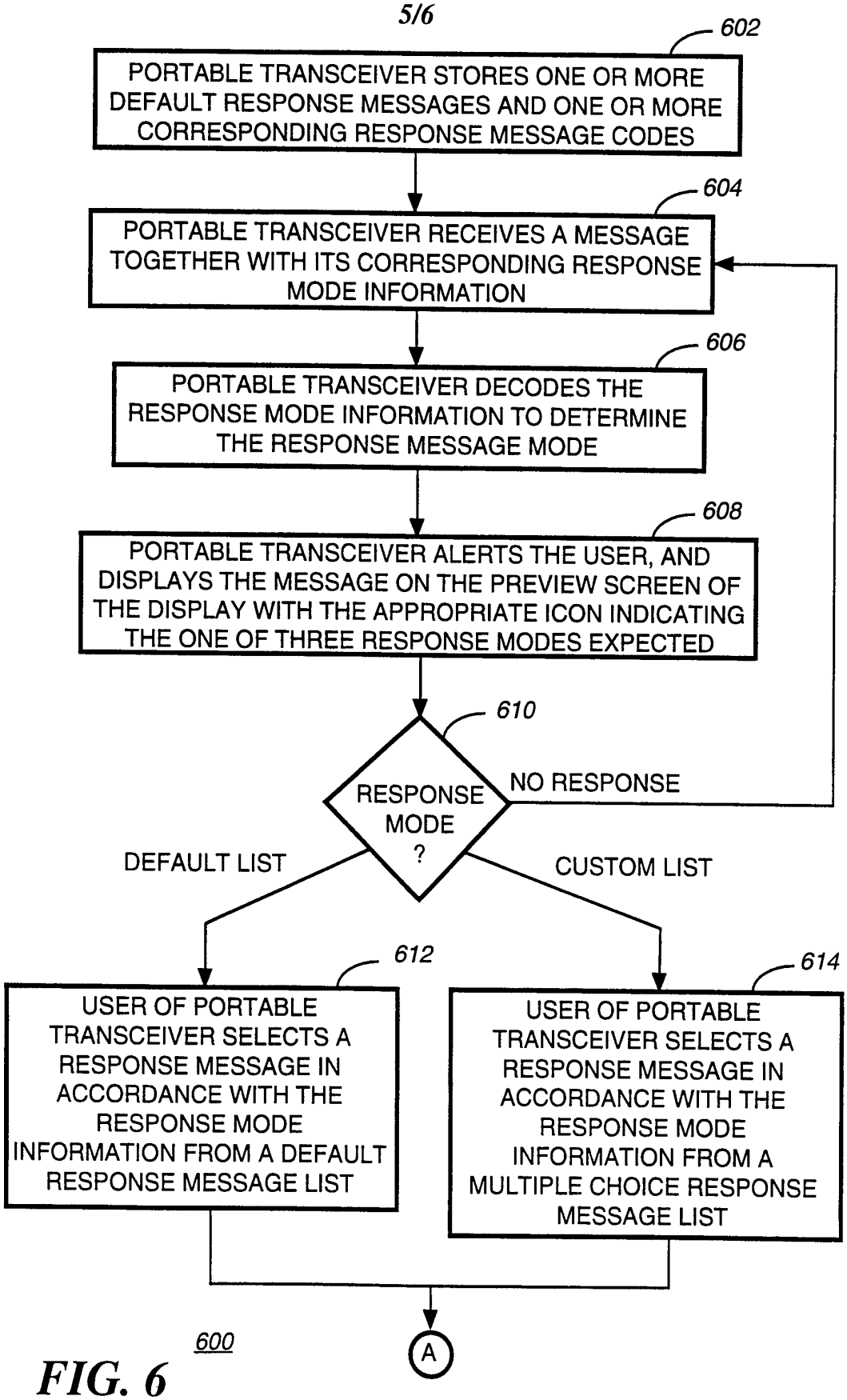

502
THE CONTROLLER STORES ONE OR MORE RESPONSE MESSAGES AND ONE OR MORE CORRESPONDING RESPONSE MESSAGE CODES
504
CONTROLLER RECEIVES A MESSAGE FROM THE PSTN INVOKED BY A CALLER
506
CALLER SELECTS A RESPONSE MODE FOR THE MESSAGE
508
CONTROLLER GENERATES RESPONSE MODE INFORMATION ACCORDING TO THE RESPONSE MODE SELECTED BY THE CALLER
510
CONTROLLER SENDS MESSAGE AND CORRESPONDING RESPONSE MODE INFORMATION TO TRANSMITTER TO BE TRANSMITTED TO THE PORTABLE TRANSCEIVER
512
RESPONSE MESSAGE REQUIRED ?
NO
YES
514
RESPONSE MESSAGE RCVD ?
NO
516
EXCEED RESEND COUNT ?
NO
YES
YES
518
CONTROLLER SENDS ACK TO PORTABLE TRANSCEIVER ACKNOWLEDGING RESPONSE MESSAGE
520
CONTROLLER DELIVERS TO THE CALLER THE RESPONSE MESSAGE ASSOCIATED WITH THE CORRESPONDING RESPONSE MESSAGE CODE

FIG. 5 500


602
PORTABLE TRANSCEIVER STORES ONE OR MORE DEFAULT RESPONSE MESSAGES AND ONE OR MORE CORRESPONDING RESPONSE MESSAGE CODES
604
PORTABLE TRANSCEIVER RECEIVES A MESSAGE TOGETHER WITH ITS CORRESPONDING RESPONSE MODE INFORMATION
606
PORTABLE TRANSCEIVER DECODES THE RESPONSE MODE INFORMATION TO DETERMINE THE RESPONSE MESSAGE MODE
608
PORTABLE TRANSCEIVER ALERTS THE USER, AND DISPLAYS THE MESSAGE ON THE PREVIEW SCREEN OF THE DISPLAY WITH THE APPROPRIATE ICON INDICATING THE ONE OF THREE RESPONSE MODES EXPECTED
610
RESPONSE MODE ?
NO RESPONSE
DEFAULT LIST
CUSTOM LIST
612
USER OF PORTABLE TRANSCEIVER SELECTS A RESPONSE MESSAGE IN ACCORDANCE WITH THE RESPONSE MODE INFORMATION FROM A DEFAULT RESPONSE MESSAGE LIST
614
USER OF PORTABLE TRANSCEIVER SELECTS A RESPONSE MESSAGE IN ACCORDANCE WITH THE RESPONSE MODE INFORMATION FROM A MULTIPLE CHOICE RESPONSE MESSAGE LIST
A

600

FIG. 6

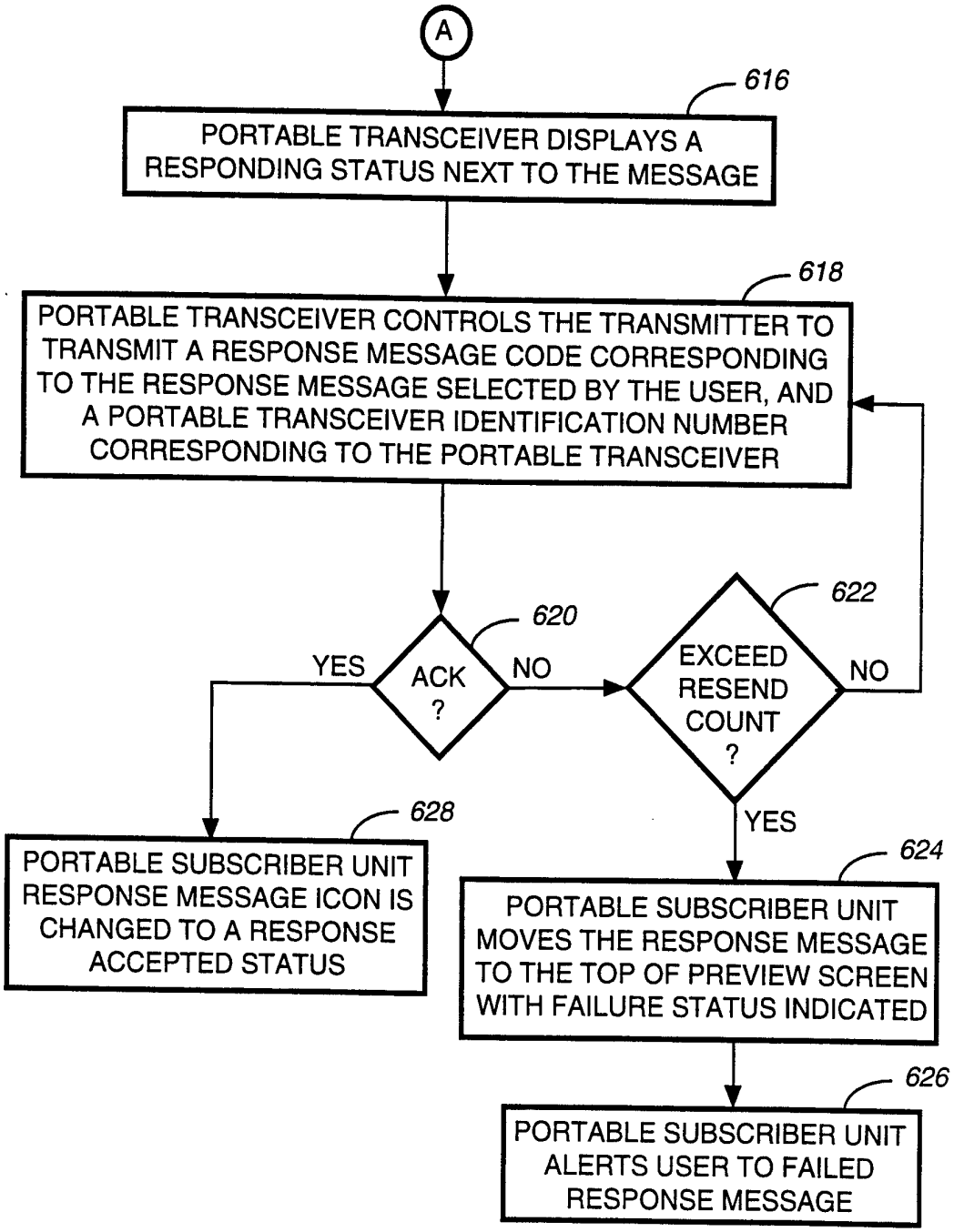

A
616
PORTABLE TRANSCEIVER DISPLAYS A RESPONDING STATUS NEXT TO THE MESSAGE
618
PORTABLE TRANSCEIVER CONTROLS THE TRANSMITTER TO TRANSMIT A RESPONSE MESSAGE CODE CORRESPONDING TO THE RESPONSE MESSAGE SELECTED BY THE USER, AND A PORTABLE TRANSCEIVER IDENTIFICATION NUMBER CORRESPONDING TO THE PORTABLE TRANSCEIVER
620
ACK ?
YES
NO
622
EXCEED RESEND COUNT ?
NO
YES
628
PORTABLE SUBSCRIBER UNIT RESPONSE MESSAGE ICON IS CHANGED TO A RESPONSE ACCEPTED STATUS
624
PORTABLE SUBSCRIBER UNIT MOVES THE RESPONSE MESSAGE TO THE TOP OF PREVIEW SCREEN WITH FAILURE STATUS INDICATED
626
PORTABLE SUBSCRIBER UNIT ALERTS USER TO FAILED RESPONSE MESSAGE

FIG. 7