MULTIPLE USER BASE STATIONS AND METHODS FOR THEIR OPERATION

Field of the Invention

This invention relates to communications systems and more particularly to radio personal communications systems for use within wide area cellular networks.

Background of the Invention

Radio communications systems are increasingly being used for wireless mobile communications. An example of a radio communications system is a wide area cellular phone network. Cellular radio communications systems are wide area communications networks which utilize a frequency (channel) reuse pattern. The design and operation of an analog cellular phone system is described in an article entitled *Advanced Mobile Phone Service* by Blecher, IEEE Transactions on Vehicular Technology, Vol. VT29, No. 2, May, 1980, pp. 238-244. The analog mobile cellular system is also referred to as the "AMPS" system.

Recently, digital cellular phone systems have also been proposed and implemented using a Time-Division Multiple Access (TDMA) architecture. Standards have also been set by the Electronics Industries Association (EIA) and the Telecommunications Industries Association (TIA) for an American Digital Cellular (ADC) architecture which is a dual mode analog and digital system following EIA/TIA document IS-54B. Telephones which implement the IS-54B dual mode architecture are presently being marketed by the assignee of the present invention. Different standards have been promulgated for digital cellular phone

systems in Europe. The European digital cellular system, also referred to as GSM, also uses a TDMA architecture.

Proposals have recently been made to expand the cellular phone network into a radio personal communications system. The radio personal communications system provides mobile radio voice, digital, video and/or multimedia communications using radio personal communications terminals. Thus, any form of information may be sent and received. Radio personal communications terminals include a radio telephone, such as a cellular telephone, and may include other components for voice, digital, video and/or multimedia communications.

A radio personal communications system includes at least one telephone base station also referred to herein as a base station. A base station is a low power transceiver which communicates with a radio personal communications terminal such as a cellular terminal over a limited local region, such as tens of meters, and is also electrically connected to the conventional public wire network. The base station allows the owner of a radio personal communications terminal to directly access the wire telephone network without passing through the cellular phone network, whose access rates are typically more costly. When located outside the range of the base station, the cellular terminal automatically communicates with the cellular phone network at the prevailing access rates.

Summary of the Invention

The present invention is a telephone base station which allows the wire telephone network to be accessed by multiple cellular terminals within the local region of the base station. The present invention stems from the realization that it is desirable to allow multiple users to access the wire

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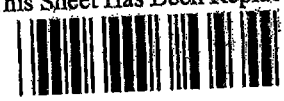

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telephone network via a base station. These users are generally not public users. Rather, they belong to a specified group. For example, each member of a family may have a cellular terminal which can access the wire telephone network via the base station when the cellular terminal is within the local region of the base station. Similarly, each member of a business may have a cellular terminal which can access the wire telephone network via the base station when the cellular terminal is within the local region in the cell. Accordingly, the need to access the cellular network at the prevailing access rates is reduced.

A telephone base station according to the present invention connects a wire telephone network to a plurality of cellular terminals within a local region in a cell of a wide area cellular network which uses a plurality of channels within a cellular network spectrum. The telephone base station includes a portable housing so that it can be purchased by a consumer and easily installed at the home, office or other location. Wire telephone network connecting means extends within the portable housing. Preferably, the wire telephone network connecting means is a single line wire telephone network connecting means and is implemented via a standard single line telephone jack. The radio transceiver in the portable housing communicates with the plurality of cellular terminals within the local region using a single channel selected from the cellular network spectrum. Since a single connection to the wire telephone network is provided, the radio transceiver communicates with a plurality of cellular terminals serially, such that the radio transceiver only communicates with a single one of the cellular terminals at any time.

Since the telephone base station should only operate with a plurality of predefined users, the telephone base station includes authenticating means,

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which is responsive to entry of a cellular terminal into the local region, for identifying the cellular terminal as one of the plurality of cellular terminals. Moreover, since only a single cellular terminal can communicate with the wire telephone network via the telephone base station at any given time, the base station includes access preventing means for preventing communication between the base station and remaining cellular terminals in the local region during communication with a given cellular terminal. The access preventing means may also operate to prevent access to the base station by remaining terminals in the local region during authentication of a given terminal. Accordingly, only a single cellular terminal can place a call with the wire network via the base station at a given time. While the placed call is in progress, the remaining cellular terminals to the base station is also prevented. If calls are placed during this time, remaining terminals may be forced to place these calls via the cellular network at the prevailing access rates. Alternatively, a busy signal may be transmitted so that the caller places the call again at a later time.

When a telephone call is placed to one of the cellular terminals via the wire telephone network, the cellular terminal in the local region for which the call is intended is identified. In particular, an inbound call is accepted from the wire telephone network via the wire telephone network connecting means. A request is made via the wire telephone network, for identification of a cellular terminal to which the inbound call is directed. Identification of the cellular terminal is accepted via the wire telephone network. The base station transceiver then communicates with the identified cellular terminal.

In a preferred embodiment of the invention, a stored audible message is transmitted by the base

station to the wire network via the wire telephone network connector, to request identification of the intended recipient of the inbound call. The message is preferably digitally stored in the base station and may state, for example, "To speak with John Doe, press 1; to speak with Jane Doe, press 2; and to speak with Jim Doe, press 3". The telephone base station preferably accepts DTMF tones from the wire telephone line in response to this message to identify the cellular terminal, and then routes the inbound call to the identified cellular terminal.

According to methods of the present invention, a portable telephone base station is operated with multiple users by locating the portable telephone base station in a cell of a wide area cellular network which uses a plurality of channels within a cellular network spectrum. The portable telephone base station is connected to the wire telephone network. The radio transceiver of the portable telephone base station is controlled to communicate with a predetermined plurality of cellular terminals within the local region using a channel selected from the cellular network spectrum, such that the predetermined plurality of cellular terminals within the local region access the wire telephone network via the portable base station. Preferably, the radio transceiver is controlled to serially communicate with the predetermined plurality of cellular terminals, such that only a single one of the cellular terminals within the local region accesses the wire telephone network via the portable base station at any time.

Upon entry of a cellular terminal into the local region, it is authenticated to identify the cellular terminal as one of the predetermined plurality of cellular terminals. After successful authentication, the cellular terminal is attached to the telephone base station, such that it can accept

calls from and initiate calls to the telephone base station. Also, during communication with a cellular terminal in the local region, access to the base station by remaining cellular terminals within the local region is prevented. Upon receipt of an inbound call to the base station from the wire telephone network, the cellular terminal to which the inbound call is directed is identified. Identification takes place by requesting identification via the wire telephone network and accepting an identification from the wire telephone network. Identification is preferably requested by transmitting a stored audible message to the wire telephone network. Identification is accepted by decoding DTMF tones or voice messages which are received from the wire telephone network.

Accordingly, multiple members of a predefined group may use the portable base station to access the wire telephone network when in the local region of the base station, and thereby avoid paying the higher access rates of the wide area cellular network.

Brief Description of the Drawings

Figure 1 schematically illustrates a radio personal communications system including a base station and a plurality of cellular terminals, with radio communications between the terminal, the base station and a wide area cellular network.

Figure 2 illustrates a front perspective view of an embodiment of a base station of the present invention, with a terminal shown in hidden lines.

Figure 3 is a schematic block diagram of a base station according to the present invention.

Figure 4 is a schematic block diagram of a base station transceiver according to the present invention.

Figure 5 is a schematic block diagram of a cellular terminal according to the present invention.

Figure 6 is a flowchart illustrating operations of a multiple user base station according to the present invention.

Detailed Description of the Invention

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Referring now to Figure 1, a conceptual diagram of a radio personal communications system according to the present invention is shown. Such a system operates within a cellular communications network which allocates portions of a plurality of frequencies (channels) within a cellular spectrum to separate geographic cells. Thus, the system provides a wide area wireless communications network having the capacity to provide high quality wireless communications to a large number of users with a limited number of frequencies allocated to the wide area cellular network. As shown in Figure 1, a wide area cellular network includes at least one radio network cell station **102**, such as a cellular telephone cell station, for transmitting and receiving messages in a network cell range indicated by **104**, via cell antenna **106**. The range **104** of radio network cell station **102** is typically represented graphically as illustrated in Figure 1. Radio network cell station **102** also interfaces with the wire network **108**. It will be understood by those having skill in the art that a wide area cellular network typically includes many

radio network cell stations **102** to cover a large area. In such a system each radio network cell station **102** covers a cell (range) **104** within wide area cellular network and may interface with a central station (not shown) by wireless (radio) communications. The central station may provide the connection to wire network **108** for all of the network cell stations **102** that make up wide area cellular network.

Still referring to Figure 1, a telephone base station **110** is located within the cell (range) **104** of a network cell station **102** of wide area cellular network. Base station **110** includes a low power transceiver for transmitting and receiving via base station antenna **112**, over a limited local region **114**, typically on the order of tens of meters. Thus, a base station may be used for transmission and receipt of radio personal communications in a home or office. Base station **110** also is electrically connected to the wire telephone network **108**. Wire telephone network **108**, is also referred to as the Public Switched Telephone Network (PSTN). PSTN **108** is the regular "wire line" telephone system supplied by, for example, the regional Bell Operating Companies, and may use copper wire, optical fiber or other stationary transmission channels. Base station **110** may be wired directly to PSTN **108** or connect through a PABX (not shown).

Still referring to Figure 1, a plurality of cellular terminals **120a-120c** are shown for radio communications with both base station **110** and radio network cell station **102** via antennas **122a-122c**. Cellular terminals **120a-120c** include a radio telephone such as a cellular phone. Cellular terminals **120a-120c** may also include, for example, a full computer keyboard and display, a scanner, and full graphics and multimedia capabilities to provide a radio personal communications terminal.

Base station 110 is configured to communicate with a predetermined set of cellular terminals 120a-120c, for example belonging to members of a family or business. As illustrated in Figure 1, when a cellular terminal 120a is within the local region 114 of the base station 110, a radio link 124 therebetween is established so that the cellular terminal 120a is attached to the base station 110. As also shown in Figure 1, when a terminal 120c is outside the local region 114 of the base station 110, but within the cell 104, a new radio link 126a is automatically established with the network cell station 102 to attach the terminal 120c to the wide area cellular network. Thus, when a user is relatively close to the base station 110 (i.e. within the home or office), wireless communications take place with the base station so that wide area cellular network, with its higher billing rate structure, is bypassed. When the user is relatively far from the base station 110, communications take place with the cellular network.

The base station 110 preferably provides a single line connection to wire network 108. Thus, only one cellular terminal 120 can communicate with base station 110 at a time. Accordingly, if a call is first placed by cellular terminal 122a, via base station 110, or a call is relayed from wire telephone network 108 to cellular terminal 122a via base station 110, then cellular terminal 120b prevented from communicating with wire telephone network 108 via base station 110, even though terminal 126b is within the local region 114 of base station 110. As described below, base station 110 includes access preventing means for preventing access to the base station during communication with a cellular terminal in the local region, by remaining cellular terminals within the local region. The access preventing means may cause a busy signal to be received, so that the user of

terminal **120b** places or receives the call later. Alternatively, terminal **120b** may communicate with cell station **102** at higher access rates, as illustrated in Figure 1 by radio link **126b**.

It will be understood by those having skill in the art that a complete radio personal communications system may include many base stations **110**, terminals **120** and radio network cell stations **102**. It will also be understood by those having skill in the art that conventional cellular communications and handoff protocols may be used between the base station **110** and cellular terminals **120a-120c**, and need not be described further herein.

In the radio personal communications system described in Figure 1, it is important to avoid co-channel interference between base station **110** and the radio network cell station **102**. Accordingly, the operator of cellular network, which has typically been assigned the use of a specific plurality of cellular channels (frequencies) within a frequency spectrum of a designated geographic region by a regulatory authority, is allowed to assign cellular channels and optionally power levels, of base station **110**. The wide area cellular network operator (provider) can assign a channel and optionally power level to base station **110** to minimize same channel interference and to maximize revenue from the assigned frequency spectrum, as described in Application Serial No. 08/148,828 cited above.

An embodiment of a base station and cellular terminal according to the present invention is illustrated in Figure 2. Base station **110** includes housing **130** which is adapted to cooperatively mate with cellular terminal **120** and provide an electrical interface between base station **110** and cellular terminal **120** using electrical connector **132** or other electrical connecter means. Base station **110** is

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connected to a power source (power outlet) by power line connector **134** or other power connection means and to a wire telephone network by a wire telephone network connector **136** extending from base station **110** to within housing **130** or other means for electrically connecting base station **110** to a wire telephone network.

Preferably, a single wire telephone network line connector **136** is provided. As shown in Figure 2, housing **130** is preferably portable to allow the user to move it and reinstall it in different locations. Base station **110** as illustrated in Figure 2 may further include battery charger connector **138** or other charger interface means which connects battery powered cellular terminal **120** to a battery charger (not shown in Figure 2) when cellular terminal **120** is inserted or parked in housing **130** as illustrated by hidden lines in Figure 2. Sensor **140** detects when cellular terminal **120** is parked in housing **130** and the battery charger is activated to charge the battery of battery powered cellular terminal **120**. It will be understood by those having skill in the art that a separate sensor **140** need not be used to detect when terminal **120** is parked in housing **130**.

Base station **110** as illustrated in Figure 2 also includes display **142** or other user indicating means. Alternatively, cellular terminal **120** may include an indicating means which may be used to display signals from base station **110** transmitted over electrical connector **132** when cellular terminal **120** is parked in housing **130**. Base station **110** may also include keyboard **144** or other user input means. Alternatively, as with display **142**, cellular terminal **120** may include an input means which may be used to provide inputs to base station **110** when cellular terminal **120** is parked in housing **130**.

A block diagram of an embodiment of a base station **110** of the present invention is illustrated in Figure 3. Power supply **150** is connected to power line

connector **134** and provides the power supply voltages to the circuitry of base station **110**. Power supply **150** further includes power detection means **151** for detecting when the connection of power line connector **134** to the power source has been lost and for providing a sense signal to control processor **154** indicating that power has been lost.

Ringing current and exchange battery voltage detector **152** is electrically connected to wire telephone connector **136** and includes means for detecting an incoming call on wire telephone connector **136** which is connected to wire telephone network **108**. Detector **152** further detects if the electrical connection of wire telephone network **108** to connector **136** has been lost. Detector **152** supplies signals to control processor **154** when an incoming call "ring" is detected and when the connection to wire telephone network **108** is lost. An indication that the wire telephone network (line) connection has been lost may then be sent to display **142** under the control of control processor **154**.

Control processor **154**, in cooperation with ringing current and exchange battery voltage detector **152** provide activation means for initiating communications between wire telephone network **108** and cellular terminal **120** through base station **110** when cellular terminal **120** is within region **114**. For incoming calls from wire telephone network (line) **108**, detector **152** detects the incoming call and sends an activation signal to control processor **154** which in turn controls subsequent communications operations of base station **110**. For calls initiated from cellular terminal **120**, control processor **154** detects the communication from cellular terminal **120** received by transceiver circuit **164** or other radio transceiving means connected to antenna **112** at a selected frequency within the spectrum of wide area cellular network.

Control processor **154** sends a control signal to detector circuit **152** to generate OFF-HOOK and other signals such as pulse dialling that may be necessary to interface with a loop-disconnect line interface such as is typically used by wire telephone network **108**. Control processor **154** also controls base station **110** for multiple cellular terminal operation as described in connection with Figure 6.

Splitter circuit **156** effects a split of the two-wire, bidirectional telephone audio signal into a four-wire system of separate send and receive signals. Received signals from the wire telephone network **108** are converted from analog to digital by analog to digital converter (A to D) **158** while transmit signals to wire telephone network **108** are converted from digital to analog by digital to analog converter (D to A) **160**. This allows all of the subsequent audio signal processing to be carried out digitally using digital signal processors. Echo canceler **162** attenuates echoes of the signal sent through connector **136** to PSTN wire network **108** to inhibit corrupting of the signal received from the PSTN. Echo canceler circuit **162** further prevents echoes being transmitted to cellular terminal **120** by transceiver circuit **164** or other radio transceiving means connected to antenna **112**.

On incoming calls over wire telephone network (line) connector **136**, transceiver circuit **164** responds to the ring detect from detector **152** under the control of processor **154** to communicate with cellular terminal **120** using a selected frequency within the frequency spectrum of the wide area cellular network. Storage circuit **155** or other storage means is electrically connected to control processor **154** to provide a storage capacity for program and data information such as a frequency indicating signal representing the selected frequency. Storage circuit **155** may include

conventional readable and writable memory such as RAM or EEPROM.

After echo cancellation, modem **166** processes received digitized audio signals to extract any digital control messages that might be received along with the audio signal from the wire telephone network (line). Such digital control messages may, for example be programming information for base station **110** transmitted by the operator of wide area cellular network. Extracted digital control messages are passed to control processor **154**. Modem **166** may perform data/speech discrimination. A digital signal processor such as Texas Instruments type TMS320C56 may be used for echo canceler **162** and modem **166**.

Received digitized speech is passed to transceiver **164** for transmission. The digitized speech may first be compressed by compression circuit, not shown, to a lower bit rate using a conventional speech decoding algorithm such as CELP or VSELP. In an analog transmission embodiment of base station **110** of the present invention a conversion circuit, not shown, reconverts the discriminated speech to an analog signal for modulating transceiver **164** which in this embodiment is an analog transceiver.

Radio signals from cellular terminal **120** to base station **110** received by antenna **112** are detected and converted to digital speech signals by transceiver **164**. The digital speech signals are then passed to echo canceler circuit **162** and modem circuit **166** for transmission on wire telephone network (line) connector **136** to wire network **108**. Alternatively, the received signals may be digitized to complex number form, using for example the LOGPOLAR technique described in U.S. Patent No. 5,048,049. The complex number stream is then passed to modem **166** for numerical demodulation and conversion to analog speech for sending on the wire telephone line.

The present invention may also be used for data transmission from cellular terminal **120** when cellular terminal **120** either incorporates a personal computer system or by plugging cellular terminal **120** into a personal computer to connect the computer to modem circuit **166** without the use of a direct wire telephone line cable connection to the computer. When handling data transmissions, modem circuit **166** and transceiver **164** translate the data stream between the over-the-air protocols used and normal wire telephone line data transmission protocols. Transceiver **164** may also detect when the received signal has reverted to voice and, responsive to control processor **154**, effect a reversion of modem circuit **166** and echo canceler circuit **162** to the processing of voice signals.

Transceiver **164** may be selected to generate and receive signals conforming to any standard, for example, AMPS, ETACS, NMT450, NMT900, GSM, DCS1800 or IS54. In addition, transceiver **164** may generate or receive signals conforming to air-interface standard for communications with satellite systems, such as INMARSAT-M, INMARSAT-P, IRIDIUM, ODYSSEY, GLOBALSTAR, ELLIPSAT or M-SAT. All such standards may be utilized with the present invention to provide communications from cellular terminal **120** through normal PSTN wire lines **108** and avoiding using the wide area system.

Figure 4 illustrates a schematic block diagram of a radio transceiver **164** of Figure 3. As shown, transceiver **164** includes circuitry for both the reception and transmission of the radio frequency signals. Signals received by the antenna **112** are directed to the receive circuits by the duplexer **201**. The duplexer is a filter with two separate bandpass responses: one for passing signals in the receive band and another for passing signals in the transmit band. Duplexer **201** allows simultaneous transmission and reception of signals by using different receive and

transmit frequencies. For example, in the ADC architecture, the receive and transmit frequencies are separated by 45 MHz.

After passing through the duplexer **201**, received signals are amplified by a low noise radio frequency (RF) amplifier **202**. This amplifier provides just enough gain to overcome the expected losses in the front end circuitry. After amplification, unwanted components of the signal are filtered out by the receive filter **203**. After filtering, the signal is mixed down to a first intermediate frequency (IF) by mixing it in mixer **204** with a second signal generated by the channel synthesizer **215** and filtered by Local Oscillator (LO) filter **214**. The first IF signal is then amplified by amplifier **205** and unwanted mixing products are removed by IF filter **206**. After filtering, the first IF is mixed in mixer **207** to yet another lower frequency or second IF signal, using a signal provided by local oscillator synthesizer **216**. The second IF signal is then filtered by two filters **208** and **210**, and amplified by multistage amplifiers **209** and **211** to obtain an IF signal **212** and a radio signal strength indication (RSSI) signal **213**. Thereafter, it undergoes a process of detection, for example, as described in U.S. Patent 5,048,059 to Dent, the disclosure of which is incorporated herein by reference.

In order to transmit, a datastream **219** is generated by modem **166** (Figure 3). In ADC architecture, the datastream is organized as bursts for time division multiplexing with other users. Reference oscillator **218** generates a precise frequency which is used as a stable reference for the RF circuits. The output of oscillator **218** is passed through a multiplier **221** where it experiences a sixfold increase in frequency. This frequency is then passed into a quadrature network **222** which produces two signals of

equal amplitude which have a quadrature phase relationship, i.e. they are offset by 90°. These quadrature signals, along with the datastream **219**, are combined in the modulator **223** to create a modulated signal, as described in an article entitled *I and Q Modulators for Cellular Communications Systems*, D. E. Norton et al., Microwave Journal, Vol. 34, No. 10, October 1991, pp. 63-79. The modulated signal is passed to a mixer **224** which translates the signal to radio frequency. The exact radio frequency is determined by the local oscillator signal provided by the channel synthesizer **215**. The radio frequency signal is passed through a variable gain controlled amplifier **225**. The gain of this amplifier, which is controlled by means of a voltage on transmit power control line **220**, determines the eventual output power, since the linear power amplifier **227** has fixed gain. Filtering is performed by transmit filter **226**.

Referring now to Figure 5, the design of terminal **120** is similar to that of base station **110** (Figure 3) except that a ringing current and exchange battery voltage detector **152** are not present. As illustrated in Figure 5, cellular terminal **120** includes transceiver **250** or other means for communicating with wide area cellular network when cellular terminal **120** is not within the base region (range) **114** of base station **110** and for communicating with transceiver **164** of base station **110** when cellular terminal **120** is within base region **114**. Transceiver **250** is connected to antenna **122**. Cellular terminal **120** further includes its own control processor **254** and storage means **255** similar to those described with respect to base station **110** and transmit circuit **251** and receive circuit **253** for receive and transmit signal processing respectively.

As further shown in Figure 5, when terminal **120** is a cellular phone, it includes a keypad **257**, a

display **259**, a speaker **261**, and a microphone **263**. In order to provide a computer communications terminal for receipt and transmission of audio, video and data and/or multimedia signals, keypad **257** may be a full scale personal computer keyboard and display **259** may be a large graphics display. A scanner **265** may also be provided as may other devices **267** such as disk drives and modems. The design of terminal **120** is well known to those having skill in the art and need not be described further herein.

Referring now to Figure 6, operations for controlling multiple user base station **110** will now be described. It will be understood that the means and steps provided by these operations may be implemented by a stored program in storage circuit **155** which executes on control processor **154** (Figure 3). However, alternatively, the means and steps provided by the operations of Figure 6 may be implemented by special purpose hardware or combinations of a control processor and special purpose hardware. The operations of Figure 6 generally include attaching **602**, outbound call connecting **604** and inbound call connecting **608**. Each of these operations will now be described.

Attaching **602** is used to place a new terminal **120** which enters local region **114** or which is powered on in local region **114** in standby mode. Attaching includes operations for registration, verification and exchange of ciphering information with the base station **110**. As already described, the multiple user base station communicates with a predefined group of users, such as members of a family or office workers. Accordingly, it must be insured that the terminal **120** is a member of that group. According to the invention, each time a terminal requests to be attached to the base station, an authentication process is started. Authentication, verification and ciphering information is generally individual for each terminal. In

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addition, each terminal has its own identification code. Since the base station **110** preferably operates using cellular frequencies and protocols, authentication procedures which are conventionally used with a cellular terminal and radio network station **102** may be used by base station **108**. Alternatively, special authentication procedures may be used such as those described in copending application Serial No. 08/205,705, entitled *Secure Radio Personal Communication System and Method*, by Paul W. Dent and the present inventor Jaap Haartsen and assigned to the assignee of the present invention, the disclosure of which is hereby incorporated herein by reference.

Still referring to Figure 6, details of attaching **602** will now be described. As shown at Block **612**, a test is made as to whether an unregistered terminal **120** is present in the local region **114**. If YES, a temporary connection between the unregistered terminal and the base station is made, while access by all other terminals in the local region to the base station is prevented, at Block **614**. During attaching, base station **110** may transmit a busy signal to all other locked terminals so that they will not request a connection to the base station during the attaching process. This busy signal can either result in an audible busy tone in the attached terminals or can be used as an indication that calls can only be made and accepted through the wide area cellular network via cell station **102**.

Authentication is performed at Block **616** using cellular telephone techniques or other authentication techniques. After authentication is completed and the new terminal is attached to base station **110** or rejected, the busy status is removed at Block **618** so that access to base station **110** by other terminals is permitted. New terminals can enter the local region and attach to base station **110**, and

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previously attached terminals in the local region can set up a connection. It will also be understood by those having skill in the art that it may be possible to perform authentication in an interleaved manner with an ongoing telephone call or with other authentications. If this is the case, access preventing need not be performed at Block **614**.

Still referring to Figure 6, outbound call connecting **604** will now be described. In general, when an attached terminal such as terminal **120a** within the local region **114** originates a call, the terminal's identification code is used to identify the terminal which is calling. A connection **124** is made to the base station **110** and the remaining terminals in the local region **114** such as terminal **120b** are prevented from accessing the base station **110**.

In particular, referring to Block **622**, when an attached terminal in the local region **114** places a call, a test is made at Block **624** as to whether the base station **110** is already active. If the base station is already active, the call may be placed with the cellular network at Block **630** as illustrated in Figure 1. Alternatively, if it is desired to avoid placing the call with the cellular network, a busy signal may be transmitted to the terminal which has placed the call so that it cannot place the call with the wide area cellular network and must try to place the call at a later time.

Referring again to Block **624**, if the base station is not active, then at Block **626** access to base station **110** by all of the other attached terminals is prevented. Since the base station includes a single line to the wire telephone network, only a single call may be placed with the wire telephone network at any time. As described before, the terminals for which access is prevented may receive busy signals if calls are attempted to be placed, or may place calls with the

wide area cellular network. At Block 628, the call is placed with the wire cellular network via the base station.

Still referring to Figure 6, inbound call connecting 608 will now be described. In general, since the base station has only a single wire telephone network line and a single wire telephone network phone number, a caller who calls the base station is in effect placing a call to all of the cellular terminals 122 rather than a single desired cellular terminal. In one embodiment, a ringing tone command can be transmitted to all the terminals connected to the base station. However, and preferably, individual terminals can be accessed by distinguishing between their identification codes.

As shown at Block 640, upon receipt of an inbound call from the wire network 108 at base station 110, a request is returned by base station 110 to identify the cellular terminal to which the call is intended. As shown at Block 642, identification requesting includes retrieval of an identification message at Block 644 and transmission of the identification message to the wire network 108 at Block 646. For example, the base station may include a stored message which states: "For John Doe, press 1; for Jane Doe, press 2; and for Jim Doe, press 3" or the like. It will be understood that the identification message can also request identification of all terminals, for example: "Press 0 to call any family member". The identification message may be digitized and stored in storage circuit 155, retrieved from storage circuit 155 and transmitted by base station 108 to wire telephone network via wire telephone network connector 108.

In response, at Block 648, a terminal identification is accepted from the wire network. The terminal identification may be DTMF tones corresponding

to the telephone key which is pressed. Alternatively, base station 112 may include voice recognition circuitry which recognizes a voice message such as a spoken name or number. Other identification techniques may be used. At Block 650, the identified terminal is connected. On reception of the terminal identification, base station 110 may include in its paging message the identification code which was received. Only the user whose identification matches that of the paging message will respond to the page. Call setup then proceeds as described above. At Block 652, access to the base station by the other terminals is prevented as was already described.

Accordingly, multiple members of a group may use a portable base station for wireless communications while avoiding the wide area cellular network when possible.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

THAT WHICH IS CLAIMED:

1. A telephone base station which connects a wire telephone network to a plurality of cellular terminals within a local region in a cell of a wide area cellular network which uses a plurality of channels within a cellular network spectrum, said telephone base station comprising:

a portable housing;

wire telephone network connecting means extending within said portable housing; and

radio transceiving means in said portable housing, said radio transceiving means communicating with said plurality of cellular terminals within said local region using a channel selected from said cellular network spectrum.

2. A telephone base station according to Claim 1 wherein said radio transceiving means communicates with said plurality of cellular terminals serially, such that said radio transceiving means only communicates with a single one of said cellular terminals at a time.

3. A telephone base station according to Claim 1 further comprising:

authenticating means, responsive to entry of a cellular terminal into said local region, for identifying said cellular terminal as one of said plurality of cellular terminals.

4. A telephone base station according to Claim 3 further comprising access preventing means, responsive to said authenticating means, for preventing access between said base station and remaining cellular terminals in said local region during operation of said authenticating means.

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5. A telephone base station according to Claim 1 further comprising:

access preventing means, for preventing access to said base station during communication with a cellular terminal in said local region, by remaining cellular terminals within said local region.

6. A telephone base station according to Claim 5 wherein said access preventing means further comprises means for preventing access to said wide area cellular network by remaining cellular terminals within said local region.

7. A telephone base station according to Claim 1 further comprising:

terminal identifying means, responsive to receipt of an inbound call to said base station from said wire telephone network connecting means, for identifying a cellular terminal to which the inbound call is directed.

8. A telephone base station according to Claim 1 wherein said terminal identifying means comprises:

inbound call accepting means, for accepting an inbound call to said base station from said wire telephone network connecting means;

terminal identification requesting means, responsive to said inbound call accepting means, for requesting via said wire telephone network connecting means, identification of a cellular terminal to which the inbound call is directed;

terminal identification accepting means, responsive to said terminal identification requesting means, for accepting identification of a cellular terminal via said wire telephone network connecting means; and

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call placing means, for controlling said transceiving means to communicate with the identified cellular terminal.

9. A telephone base station according to Claim 8 wherein said terminal identification requesting means comprises means for transmitting a stored audible message requesting identification via said wire telephone network connecting means.

10. A telephone base station according to Claim 9 wherein said terminal identification accepting means comprises means for decoding DTMF tones received from said wire telephone line connecting means to identify a cellular terminal.

11. A telephone base station according to Claim 9 wherein said terminal identification accepting means comprises means for decoding voice messages received from said wire telephone line connecting means to identify a cellular terminal.

12. A telephone base station according to Claim 1 in combination with a wire telephone network and a wide area cellular network.

13. A telephone base station which connects a wire telephone network to a plurality of cellular terminals within a local region in a cell of a wide area cellular network which uses a plurality of channels within a cellular network spectrum, said telephone base station comprising:

a portable housing;

wire telephone network connecting means extending within said portable housing;

radio transceiving means in said portable housing, said radio transceiving means communicating

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with said plurality of cellular terminals within said local region; and

access preventing means, responsive to placement of a telephone call by one of said cellular terminals and responsive to receipt of a telephone call by one of said cellular terminals via said base station from said wire telephone network connecting means, for preventing remaining ones of said cellular terminals in said local region from accessing said wire telephone network connecting means, such that only a single cellular terminal communicates with said wire telephone network via said base station at any time.

14. A telephone base station according to Claim 13 wherein said access preventing means further comprises means for preventing access to said wide area cellular network by the remaining cellular terminals within said local region.

15. A telephone base station according to Claim 14 further comprising:

a terminal identifying means, responsive to receipt of an inbound call to said base station from said wire telephone network connecting means, for identifying a cellular terminal to which the inbound call is directed.

16. A telephone base station according to Claim 15 wherein said terminal identifying means comprises:

inbound call accepting means, for accepting an inbound call to said base station from said wire telephone network connecting means;

terminal identification requesting means, responsive to said inbound call accepting means, for requesting via said wire telephone network connecting

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means, identification of a cellular terminal to which the inbound call is directed;

terminal identification accepting means, responsive to said terminal identification requesting means, for accepting identification of a cellular terminal via said wire telephone network connecting means; and

call placing means, for controlling said transceiving means to communicate with the identified cellular terminal.

17. A telephone base station according to Claim 16 wherein said terminal identification requesting means comprises means for transmitting a stored audible message requesting identification via said wire telephone network connecting means.

18. A telephone base station according to Claim 17 wherein said terminal identification accepting means comprises means for decoding DTMF tones received over said wire telephone line connecting means to identify a cellular terminal.

19. A telephone base station according to Claim 17 wherein said terminal identification accepting means comprises means for decoding voice messages received from said wire telephone line connecting means to identify a cellular terminal.

20. A telephone base station according to Claim 13 in combination with a wire telephone network and a wide area cellular network.

21. A method of operating a portable telephone base station which includes a cellular radio transceiver which transmits and receives within a local region, said method comprising the steps of:

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locating said portable telephone base station in a cell of a wide area cellular network which uses a plurality of channels within a cellular network spectrum;

connecting said portable telephone base station to a wire telephone network; and

controlling said radio transceiver to communicate with a predetermined plurality of cellular terminals within said local region, using a channel selected from said cellular network spectrum, such that said predetermined plurality of cellular terminals within said local region access said wire telephone network via said portable base station.

22. A method according to Claim 21 wherein said controlling step comprises the step of controlling said radio transceiver to serially communicate with said predetermined plurality of cellular terminals, such that only a single one of said predetermined plurality of cellular terminals within said local region accesses said wire telephone network via said portable base station at any time.

23. A method according to Claim 21 further comprising the step of:

authenticating a cellular terminal upon entry into said local region, to identify said cellular terminal as one of said predetermined plurality of cellular terminals.

24. A method according to Claim 21 wherein the following step is performed during said authenticating step:

preventing communication between said base station and remaining cellular terminals in said local region.

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25. A method according to Claim 21 wherein said controlling step further comprises the step of:

preventing access to said base station during communication with a cellular terminal in said local region, by remaining cellular terminals within said local region.

26. A method according to Claim 21 wherein the following step is performed in response to receipt of an inbound call to said base station from said wire telephone network:

identifying a cellular terminal from said predetermined plurality of cellular terminals, to which said inbound call is directed.

27. A method according to Claim 26 wherein said identifying step comprises the steps of:

requesting via said wire telephone network, identification of said cellular terminal to which said inbound call is directed;

accepting identification of said cellular terminal from said wire telephone network; and

controlling said transceiver to communicate with the identified cellular terminal.

28. A method according to Claim 27 wherein said requesting step comprises the step of:

transmitting a stored audible message to said wire telephone network which requests identification of said cellular terminal to which said inbound call is directed.

29. A method according to Claim 28 wherein said accepting step comprises the step of:

decoding DTMF tones received from said wire telephone network to identify said cellular terminal to which said inbound call is directed.

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30. A method according to Claim 28 wherein said accepting step comprises the step of:

decoding voice messages received from said wire telephone network to identify said cellular terminal to which said inbound cell is directed.

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FIG. 1

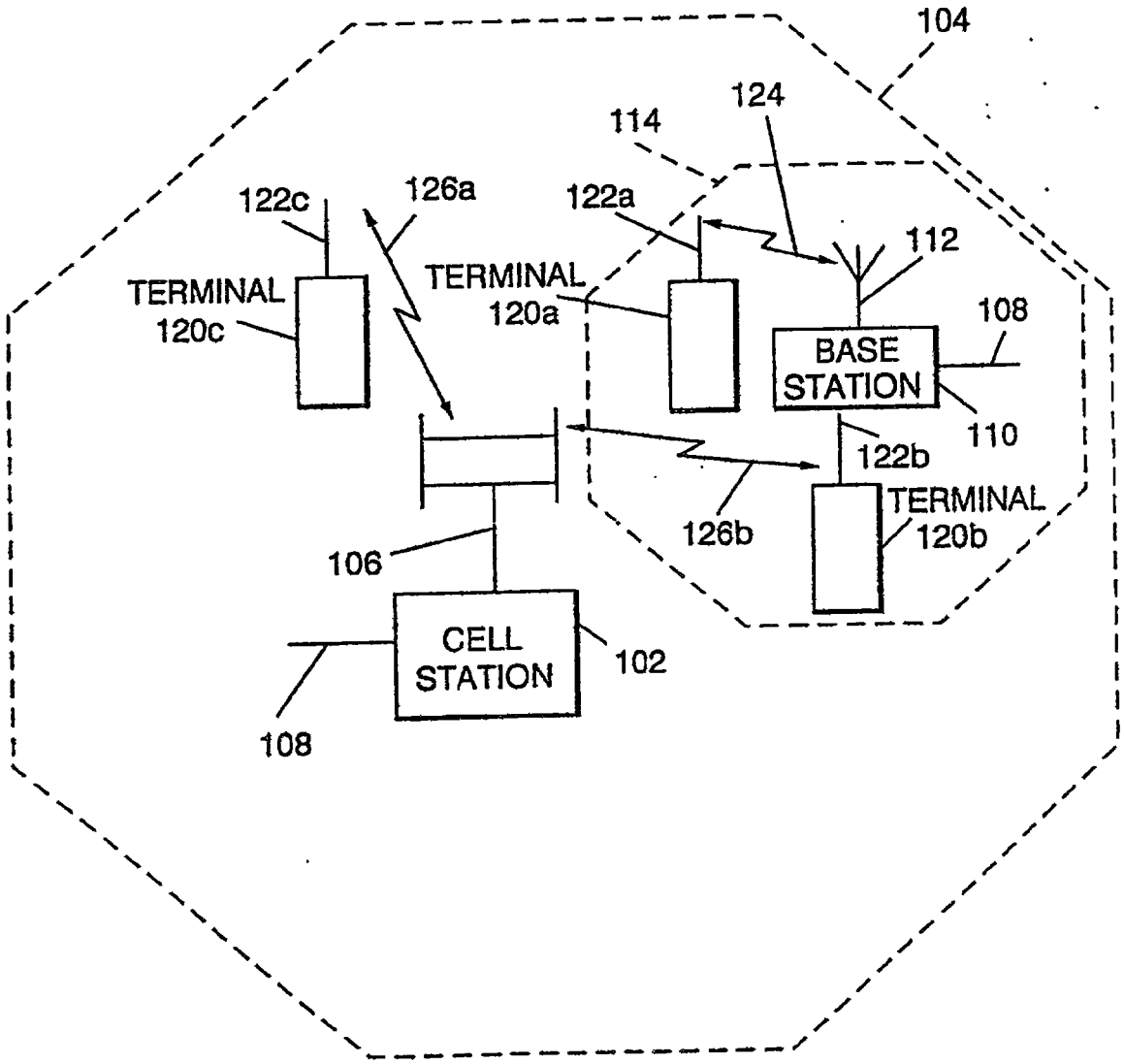
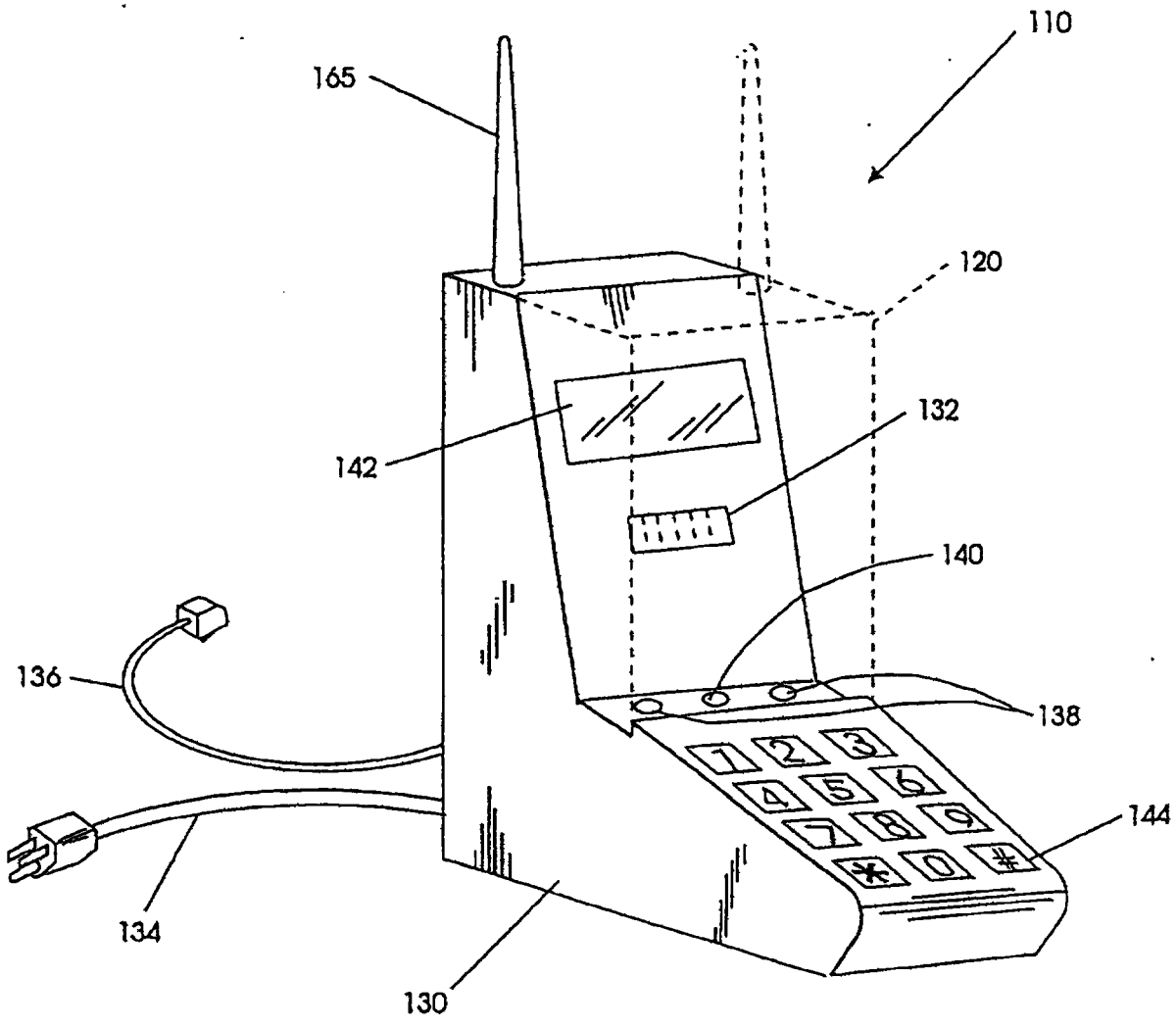

104
124
114
122c
126a
122a
112
TERMINAL
120c
TERMINAL
120a
108
BASE
STATION
110
122b
TERMINAL
120b
126b
106
CELL
STATION
102
108

FIG. 2



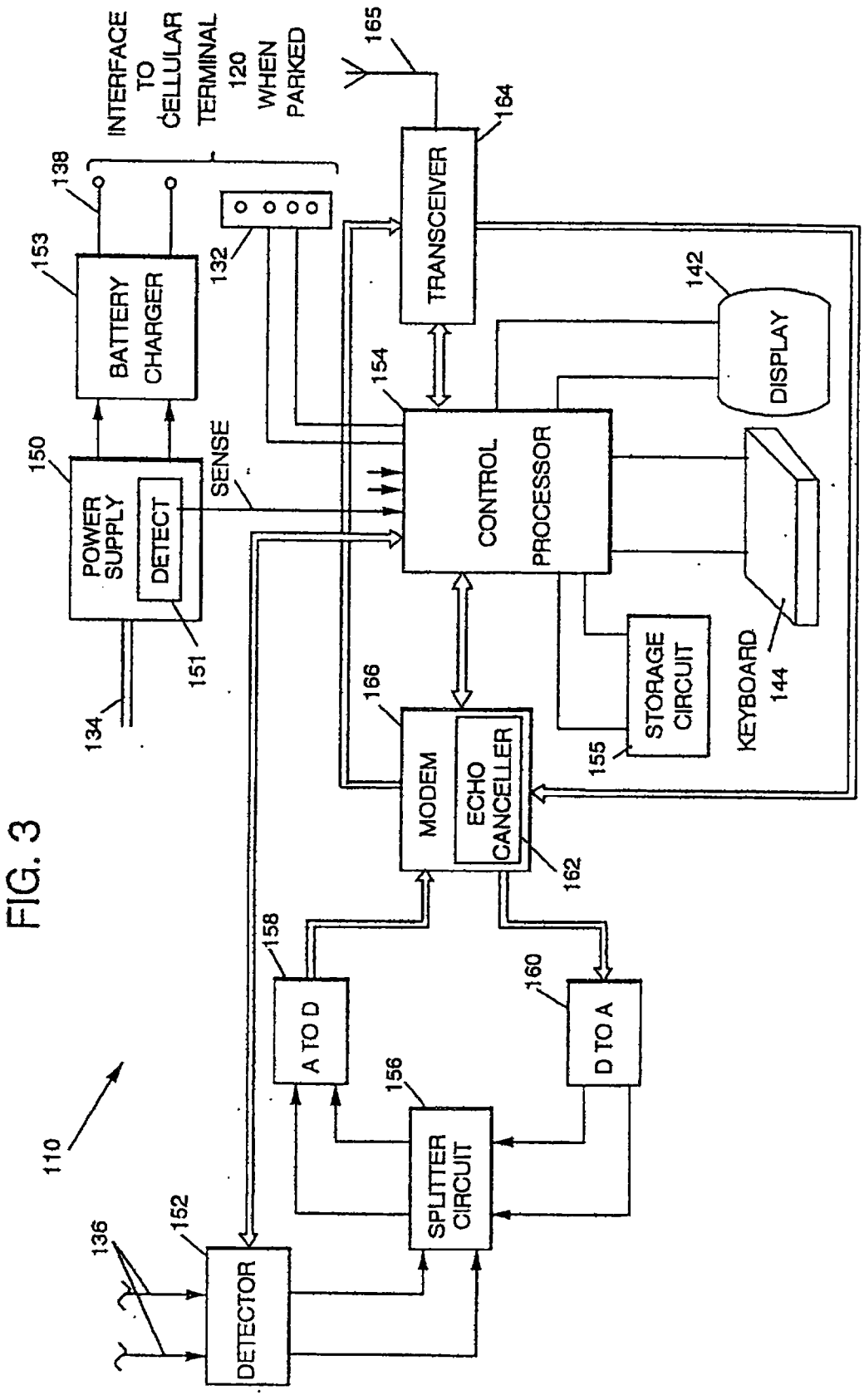

INTERFACE TO CELLULAR TERMINAL 120 WHEN PARKED
165
164
TRANSCEIVER
138
153
BATTERY CHARGER
132
142
DISPLAY
154
150
POWER SUPPLY
DETECT
SENSE
CONTROL PROCESSOR
151
134
166
MODEM
ECHO CANCELLER
162
STORAGE CIRCUIT
155
KEYBOARD 144
158
A TO D
160
D TO A
156
SPLITTER CIRCUIT
110
152
136
DETECTOR

FIG. 3

FIG. 4

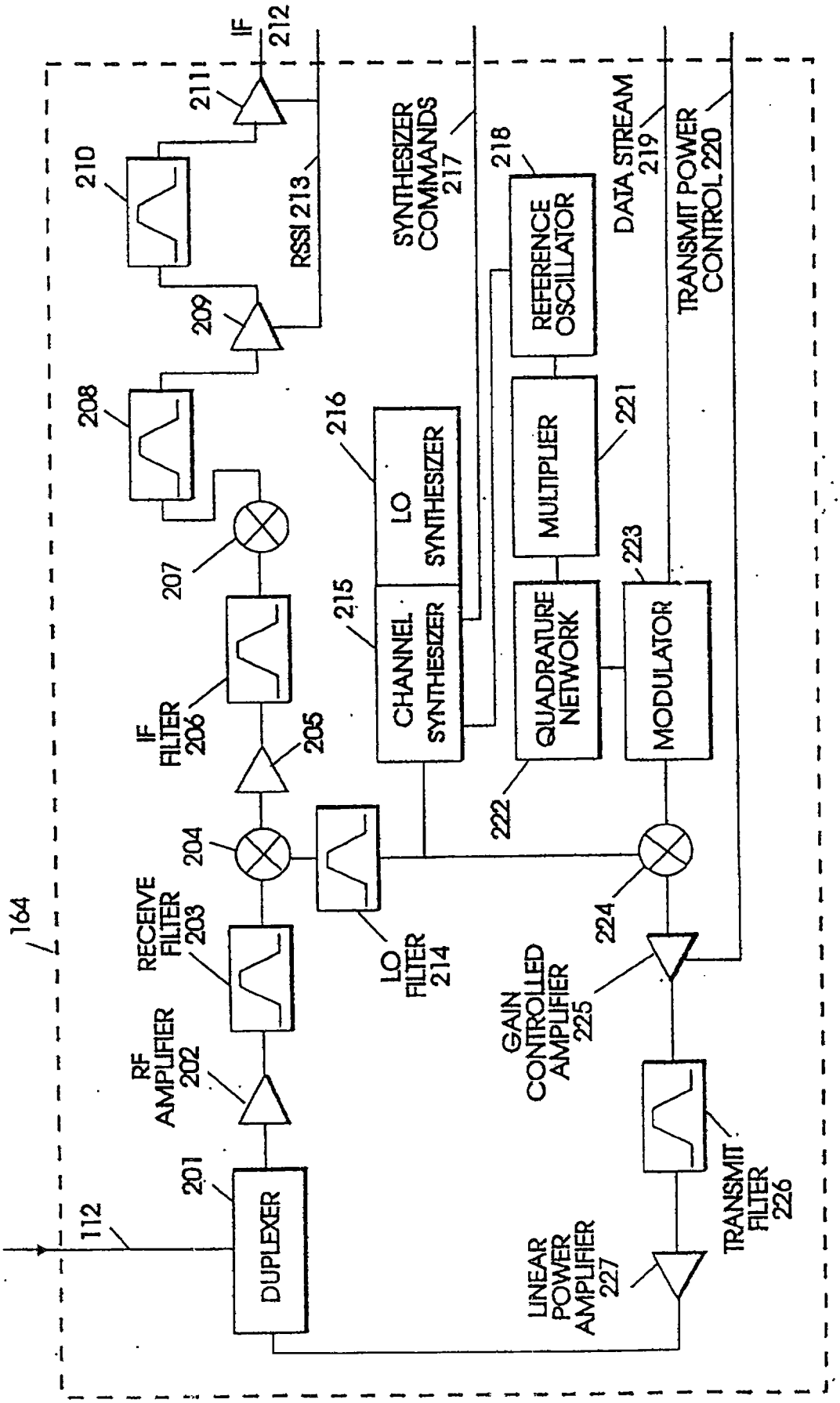

164
112
DUPLEXER
201
RF AMPLIFIER 202
RECEIVE FILTER 203
204
205
IF FILTER 206
207
208
209
210
211
IF
212
RSSI 213
LO FILTER 214
CHANNEL SYNTHESIZER
215
LO SYNTHESIZER
216
SYNTHESIZER COMMANDS 217
REFERENCE OSCILLATOR
218
DATA STREAM 219
TRANSMIT POWER CONTROL 220
MULTIPLIER
221
QUADRATURE NETWORK
222
MODULATOR
223
224
GAIN CONTROLLED AMPLIFIER 225
TRANSMIT FILTER 226
LINEAR POWER AMPLIFIER 227

FIG. 5

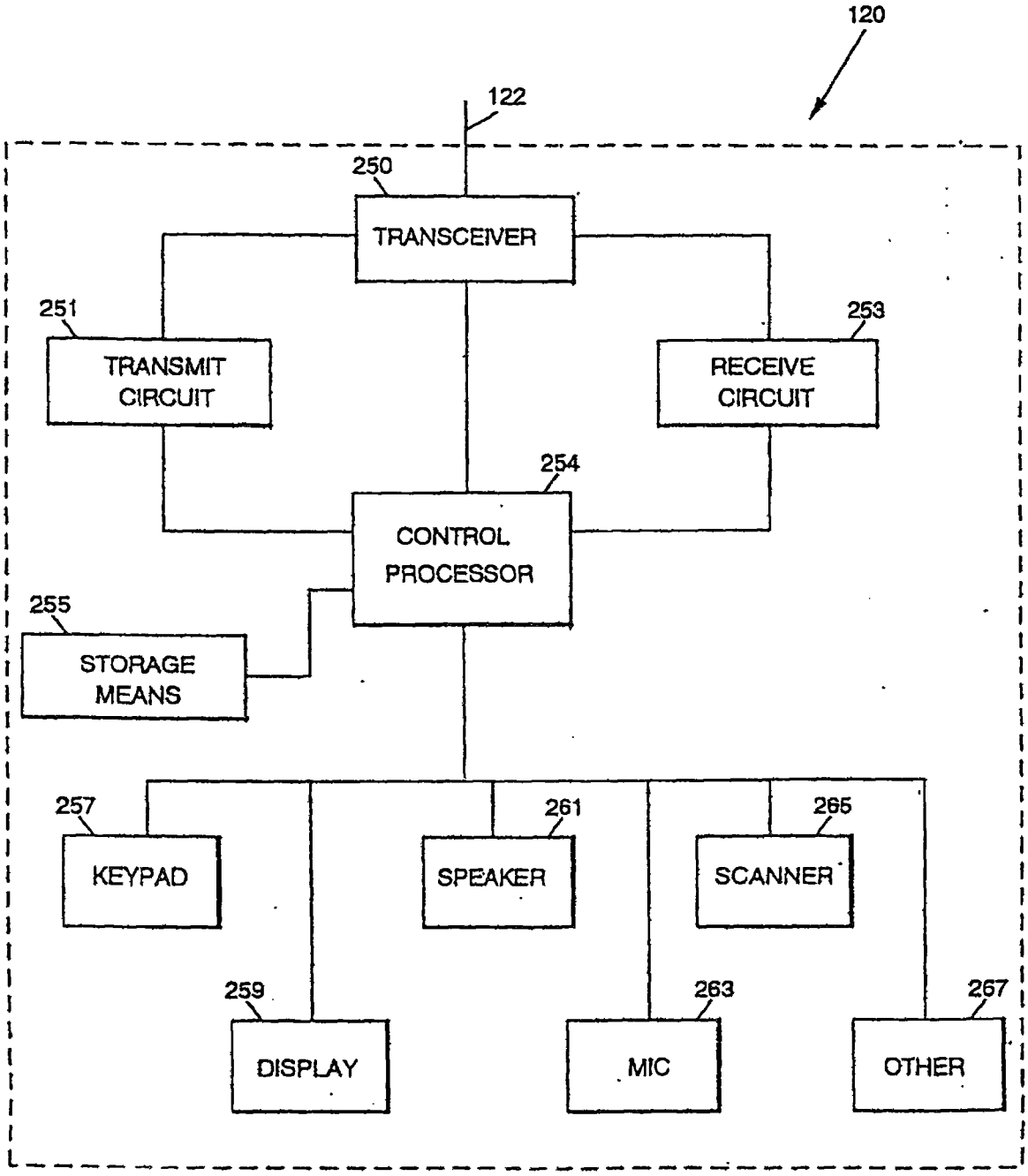
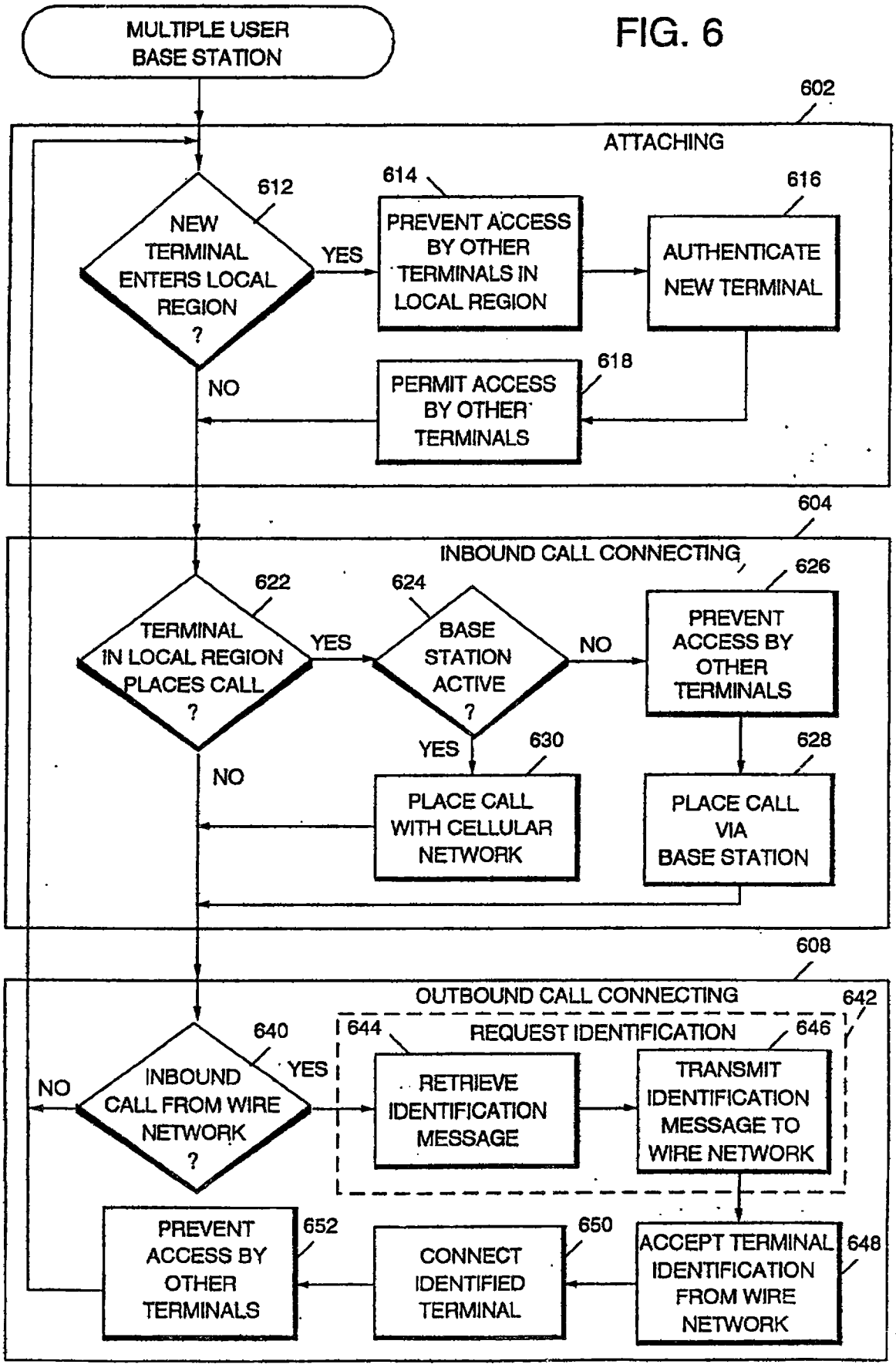

120
122
250
TRANSCEIVER
251
TRANSMIT CIRCUIT
253
RECEIVE CIRCUIT
254
CONTROL PROCESSOR
255
STORAGE MEANS
257
KEYPAD
261
SPEAKER
265
SCANNER
259
DISPLAY
263
MIC
267
OTHER

FIG. 6


MULTIPLE USER BASE STATION
602
ATTACHING
612
NEW TERMINAL ENTERS LOCAL REGION ?
YES
614
PREVENT ACCESS BY OTHER TERMINALS IN LOCAL REGION
616
AUTHENTICATE NEW TERMINAL
NO
618
PERMIT ACCESS BY OTHER TERMINALS
604
INBOUND CALL CONNECTING
622
TERMINAL IN LOCAL REGION PLACES CALL ?
YES
624
BASE STATION ACTIVE ?
NO
626
PREVENT ACCESS BY OTHER TERMINALS
NO
YES
630
PLACE CALL WITH CELLULAR NETWORK
628
PLACE CALL VIA BASE STATION
608
OUTBOUND CALL CONNECTING
642
640
INBOUND CALL FROM WIRE NETWORK ?
NO
YES
644
REQUEST IDENTIFICATION
RETRIEVE IDENTIFICATION MESSAGE
646
TRANSMIT IDENTIFICATION MESSAGE TO WIRE NETWORK
652
PREVENT ACCESS BY OTHER TERMINALS
650
CONNECT IDENTIFIED TERMINAL
ACCEPT TERMINAL IDENTIFICATION FROM WIRE NETWORK
648

systems in Europe. The European digital cellular system, also referred to as GSM, also uses a TDMA architecture.

Proposals have recently been made to expand the cellular phone network into a radio personal communications system. The radio personal communications system provides mobile radio voice, digital, video and/or multimedia communications using radio personal communications terminals. Thus, any form of information may be sent and received. Radio personal communications terminals include a radio telephone, such as a cellular telephone, and may include other components for voice, digital, video and/or multimedia communications.

A radio personal communications system includes at least one telephone base station also referred to herein as a base station. A base station is a low power transceiver which communicates with a radio personal communications terminal such as a cellular terminal over a limited local region, such as tens of meters, and is also electrically connected to the conventional public wire network. The base station allows the owner of a radio personal communications terminal to directly access the wire telephone network without passing through the cellular phone network, whose access rates are typically more costly. When located outside the range of the base station, the cellular terminal automatically communicates with the cellular phone network at the prevailing access rates.

International Publication No. WO95/12957 (United States Patent No. 5,428,668) discloses a radio communication system with transceiver frequency and optionally power level allocated to a radio personal communication system including a base station connected to a wire telephone network and a cellular terminal operating within a region of a wide area cellular

network to minimize interference between communications over the wide area cellular network and communications between the base station and the cellular terminal. The same cellular terminal may then be used to communicate over the lower cost wire network when within range of the base station and otherwise over the wide area cellular network.

International Publication No. WO94/03993 discloses a wireless PBX system using frequency scanner for channel identification. This reference, unlike the present reference, is directed to a wireless private branch exchange communication network providing for identifying network communication resources.

International Publication No. WO93/16534 discloses frequency sharing and multiple radio telephone systems. A portable radio telephone operates with a cordless base station over a local coverage area. Both the radio telephone and the base station scan available channels to generate priority lists which are combined to form a master priority list. The system then assigns the clearest available channel from the master priority list for use in the cordless telephone system.

Summary of the Invention

The present invention is a telephone base station which allows the wire telephone network to be accessed by multiple cellular terminals within the local region of the base station. The present invention stems from the realization that it is desirable to allow multiple users to access the wire

telephone network via a base station. These users are generally not public users. Rather, they belong to a specified group. For example, each member of a family may have a cellular terminal which can access the wire telephone network via the base station when the cellular terminal is within the local region of the base station. Similarly, each member of a business may have a cellular terminal which can access the wire telephone network via the base station when the cellular terminal is within the local region in the cell. Accordingly, the need to access the cellular network at the prevailing access rates is reduced.

A telephone base station according to the present invention connects a wire telephone network to a plurality of cellular terminals within a local region in a cell of a wide area cellular network which uses a plurality of channels within a cellular network spectrum. The telephone base station includes a portable housing so that it can be purchased by a consumer and easily installed at the home, office or other location. Wire telephone network connecting means extends within the portable housing. Preferably, the wire telephone network connecting means is a single line wire telephone network connecting means and is implemented via a standard single line telephone jack. The radio transceiver in the portable housing communicates with the plurality of cellular terminals within the local region using a single channel selected from the cellular network spectrum. Access preventing means responsive to placement of a telephone call by one of the cellular terminals and also responsive to receipt of a telephone call by one of the cellular terminals via the base station from the wire telephone network, prevents remaining ones of the cellular terminals in the local region from accessing the wire telephone network so that only a singular cellular

terminal communicates with the wire telephone network via the base station at any time.

Since the telephone base station should only operate with a plurality of predefined users, the telephone base station includes authenticating means,

terminal **120b** places or receives the call later. Alternatively, terminal **120b** may communicate with cell station **102** at higher access rates, as illustrated in Figure 1 by radio link **126b**.

It will be understood by those having skill in the art that a complete radio personal communications system may include many base stations **110**, terminals **120** and radio network cell stations **102**. It will also be understood by those having skill in the art that conventional cellular communications and handoff protocols may be used between the base station **110** and cellular terminals **120a-120c**, and need not be described further herein.

In the radio personal communications system described in Figure 1, it is important to avoid co-channel interference between base station **110** and the radio network cell station **102**. Accordingly, the operator of cellular network, which has typically been assigned the use of a specific plurality of cellular channels (frequencies) within a frequency spectrum of a designated geographic region by a regulatory authority, is allowed to assign cellular channels and optionally power levels, of base station **110**. The wide area cellular network operator (provider) can assign a channel and optionally power level to base station **110** to minimize same channel interference and to maximize revenue from the assigned frequency spectrum, as described in United States Patent No. 5,428,668 (International Number WO95/12957).

An embodiment of a base station and cellular terminal according to the present invention is illustrated in Figure 2. Base station **110** includes housing **130** which is adapted to cooperatively mate with cellular terminal **120** and provide an electrical interface between base station **110** and cellular

terminal 120 using electrical connector 132 or other electrical connecter means. Base station 110 is

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addition, each terminal has its own identification code. Since the base station 110 preferably operates using cellular frequencies and protocols, authentication procedures which are conventionally used with a cellular terminal and radio network station 102 may be used by base station 108. Alternatively, special authentication procedures may be used such as those described in International Publication Number WO95/24106, entitled *Secure Radio Personal Communications System and Method*, by Paul W. Dent and the present inventor Jaap Haartsen and assigned to the assignee of the present invention, the disclosure of which is hereby incorporated herein by reference.

Still referring to Figure 6, details of attaching 602 will now be described. As shown at Block 612, a test is made as to whether an unregistered terminal 120 is present in the local region 114. If YES, a temporary connection between the unregistered terminal and the base station is made, while access by all other terminals in the local region to the base station is prevented, at Block 614. During attaching, base station 110 may transmit a busy signal to all other locked terminals so that they will not request a connection to the base station during the attaching process. This busy signal can either result in an audible busy tone in the attached terminals or can be used as an indication that calls can only be made and accepted through the wide area cellular network via cell station 102.

Authentication is performed at Block 616 using cellular telephone techniques or other authentication techniques. After authentication is completed and the new terminal is attached to base station 110 or rejected, the busy status is removed at Block 618 so that access to base station 110 by other terminals is

permitted. New terminals can enter the local region and attach to base station 110, and

THAT WHICH IS CLAIMED:

1. A telephone base station (110) including a portable housing (130) and a wire telephone connecting means (136) extending within said portable housing (130), said telephone base station (110) connecting a wire telephone network (108) to a plurality of cellular terminals (120) within a local region (114) in a cell (104) of a wide area cellular network which uses a plurality of channels within a cellular network spectrum said cellular terminals (120) being operable to communicate over said wide area cellular network, said telephone base station (110) comprising:

radio transceiving means (164) in said portable housing (130), said radio transceiving means (164) communicating with said plurality of cellular terminals (120) within said local region (114); and

access preventing means, responsive to placement of a telephone call by one of said cellular terminals (120) and responsive to receipt of a telephone call by one of said cellular terminals (120) via said base station (110) from said wire telephone network connecting means (136), for preventing remaining ones of said cellular terminals (120) in said local region (114) from accessing said wire telephone network connecting means (136), such that only a single cellular terminal communicates with said wire telephone network (108) via said base station (110) at any time.

2. A telephone base station (110) according to Claim 13 wherein said radio transceiving means (164) communicates with said plurality of cellular terminals (120) within said local region (114) using a channel selected from said cellular network spectrum.

3. A telephone base station (110) according to Claim 1 wherein said access preventing means further

comprises means for preventing access to said wide area cellular network by the remaining cellular terminals (120) within said local region (114).

4. A telephone base station (110) according to Claim 3 further comprising:

a terminal identifying means, responsive to receipt of an inbound call to said base station (110) from said wire telephone network connecting means (136), for identifying a cellular terminal (120) to which the inbound call is directed.

5. A telephone base station (110) according to Claim 4 wherein said terminal identifying means comprises:

inbound call accepting means, for accepting an inbound call to said base station (110) from said wire telephone network connecting means (136);

terminal identification requesting means, responsive to said inbound call accepting means, for requesting via said wire telephone network connecting means (136), identification of a cellular terminal (120) to which the inbound call is directed;

terminal identification accepting means, responsive to said terminal identification requesting means, for accepting identification of a cellular terminal (120) via said wire telephone network connecting means (136); and

call placing means, for controlling said transceiving means (164) to communicate with the identified cellular terminal (120).

6. A telephone base station (110) according to Claim 5 wherein said terminal identification requesting means comprises means for transmitting a stored audible

message requesting identification via said wire telephone network connecting means (136).

7. A telephone base station (110) according to Claim 6 wherein said terminal identification accepting means comprises means for decoding DTMF tones received over said wire telephone line connecting means (136) to identify a cellular terminal (120).

8. A telephone base station (110) according to Claim 6 wherein said terminal identification accepting means comprises means for decoding voice messages received from said wire telephone line connecting means (136) to identify a cellular terminal (120).

9. A telephone base station (110) according to Claim 1 in combination with a wire telephone network (108) and a wide area cellular network.

10. A method of operating a portable telephone base station (110) which includes a cellular radio transceiver (164) which transmits and receives within a local region (114), said method comprising the steps of:

locating said portable telephone base station (110) in a cell (104) of a wide area cellular network which uses a plurality of channels within a cellular network spectrum;

connecting said portable telephone base station (110) to a wire telephone network (108); and

controlling said radio transceiver (164) to communicate with a predetermined plurality of cellular terminals (120) within said local region (114), using a channel selected from said cellular network spectrum, such that only a single one of said predetermined plurality of cellular terminals (120) within said local

region (114) accesses said wire telephone network (108) via said portable base station (110) at any time.

11. A method according to Claim 10 wherein said controlling step comprises the step of controlling said radio transceiver (164) to serially communicate with said predetermined plurality of cellular terminals (120) within said local region (114).

12. A method according to Claim 10 further comprising the step of:

authenticating a cellular terminal (120) upon entry into said local region (114), to identify said cellular terminal (120) as one of said predetermined plurality of cellular terminals (120).

13. A method according to Claim 10 wherein the following step is performed during said authenticating step:

preventing communication between said base station (110) and remaining cellular terminals (120) in said local region (114).

14. A method according to Claim 10 wherein said controlling step further comprises the step of:

preventing access to said base station (110) during communication with a cellular terminal (120) in said local region, by remaining cellular terminals (120) within said local region (114).

15. A method according to Claim 10 wherein the following step is performed in response to receipt of an inbound call to said base station (110) from said wire telephone network (108):

identifying a cellular terminal (120) from said predetermined plurality of cellular terminals (120), to which said inbound call is directed.

16. A method according to Claim 15 wherein said identifying step comprises the steps of:

requesting via said wire telephone network (108), identification of said cellular terminal (120) to which said inbound call is directed;

accepting identification of said cellular terminal (120) from said wire telephone network (108); and

controlling said transceiver (164) to communicate with the identified cellular terminal (120).

17. A method according to Claim 16 wherein said requesting step comprises the step of:

transmitting a stored audible message to said wire telephone network (108) which requests identification of said cellular terminal (120) to which said inbound call is directed.

18. A method according to Claim 17 wherein said accepting step comprises the step of:

decoding DTMF tones received from said wire telephone network (108) to identify said cellular terminal (120) to which said inbound call is directed.

19. A method according to Claim 17 wherein said accepting step comprises the step of:

decoding voice messages received from said wire telephone network (108) to identify said cellular terminal (120) to which said inbound cell is directed.

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(74) Agents: BIGEL, Mitchell, S. et al.; Bell, Seltzer, Park & Gibson, P.O. Drawer 34009, Charlotte, NC 28234 (US).

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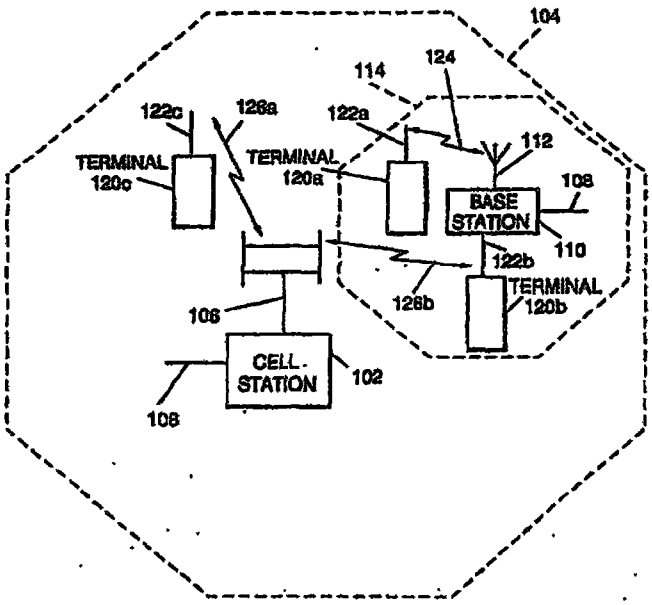
With international search report.

(54) Title: MULTIPLE USER BASE STATIONS AND METHODS FOR THEIR OPERATION



(57) Abstract

A telephone base station allows a wire telephone network to be accessed by multiple cellular terminals within the local region of the base station. The users are generally members of a specified group such as a family or business. The base station is connected to the wire telephone network by a single line so that the radio transceiver of the base station communicates with the multiple cellular terminals serially. Each of the cellular terminals is authenticated upon entry of the local area. During communication with a given terminal, the remaining terminals in the local area are prevented from accessing the base station. Upon receipt of an incoming call, a message is transmitted to the caller to identify the desired cellular terminal. The base station then communicates with the identified cellular terminal and prevents access by the remaining terminals.