Title: MULTI-BASE STATION CORDLESS TELEPHONE

Abstract: The present invention is a system of at least one cordless telephone, a home base station and at least one non-home base station. A roaming cordless telephone out of range of its home base station will use a non-home base station to direct digital mode signals to its home base station. The home base station will convert the digital mode signals to analog signals and communicate them with the telephone network. Only a single direct line connection is needed for the home base station, as the digital mode signals and the analog signals communications do not interfere with each other. The user may potentially avoid long distance charges by using the non-home base station as a conduit while using the home base station as the telephone network site for long distance charge accrual. Further, the necessity for using a cellular telephone with the consequent charges is avoided.
MULTI-BASE STATION CORDLESS TELEPHONE

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BACKGROUND OF THE INVENTION

The present invention relates to cordless telephones operating from base stations which are connected to conventional telephone systems. More particularly, the present invention relates to the field of cordless telephones that may operate with an effective connection to a conventional telephone system when the cordless telephone is out of range of its base station.

There is an ongoing need for a communication system in which out of range operation for a cordless telephone can be achieved to thus eliminate the necessity for employing a cellular telephone (with the consequent cost) or the use of the telephone connection of another party.

SUMMARY OF THE INVENTION

The present invention is a cordless telephone that can place, receive or continue processing of telephone calls, whether or not the cordless telephone is in range of its home base station. When out of range of its home base station, the cordless telephone of the subject invention transmits or receives digital mode signals with a non-home base station. Those transmitted or received digital mode signals are routed in one of several possible methods between the cordless telephone and its home base station, wirelessly or by wired connection.

The home base station receives the transmitted digital mode signals from a non-home base station, translates them to analog or other digital (i.e. such as ISDN) or data signals and transmits them to a home telephone line. The home base station may also receive analog or other digital (i.e., such as ISDN) or data signals from the telephone line, translate them to digital mode signals and transmit them to the non-home base station for retransmission to the cordless telephone.

A non-home base station can wirelessly route digital mode signals to the home base station, or vice versa. The wireless routing can be direct or indirect.

Direct wireless routing has a non-home base station in wireless range of a home base station. The digital mode signals are directly exchanged between those two base stations. This means that the cordless phone is out of range of its home
base station but in range of the non-home base station.

Indirect wireless routing uses additional, intervening non-home base stations. A first non-home base station is out of range of the home base station but in range of a second non-home base station. The second station is either in range of the home base station or in range of a third non-home station. If in range of the home base station, the second station acts as a wireless link from the first non-home base station to the home base station. Other intervening non-home base stations can act as additional wireless links to span the distance between the first non-home base station and the home base station.

As long as one or more non-home base stations have overlapping wireless communication ranges between the cordless phone and the home base station, the user can move freely out of range of the home base station without service interruption. More importantly, the user can conceivably avoid cellular or telephone network charges for wireless communication from the cordless phone to the home base station. The invention wireless routing can be made without devoting new wireless bandwidth to its operation. Most locations in the world have cordless phone bandwidth already segregated for that purpose apart from cellular or other uses.

For effective wireless routing, the user can strategically locate his own non-home base stations within wireless range of each other over a desired area. Or the user can depend on non-home base stations located in and operating as parts of the base stations of other invention cordless phones. A new user gets their own uniquely addressed cordless phone and home base station and installs the home base station at a desired location. That new base station has means for acting as a non-home base station for another cordless phone uniquely addressed to a different home base station. Each new home base station installation at the desired location of a new user becomes an extension of the effective wireless operating range of the invention system.

Such call processing of the invention cordless telephone through a non-home base station does not substantially affect call processing of a second telephone that can use the non-home base station as the second telephone's home base station.

Digital mode, as used herein, describes a digital transmission and reception technology signal, i.e., TDMA, E-TDMA, narrow band CDMA, and broadband CDMA, spread spectrum, or other appropriate mode that may be transmitted on a channel. In an optional mode, the cordless telephone may employ a direct wire connection.
with a non-home base station for processing. The subject system allows the
cordless telephone user to roam away from his home base station to the range of
another base station and transmit and receive in digital mode to the other base
station without interfering with the local analog operation of the other base station.
This aspect of non-interference or line sharing is entirely novel to the art.

For the out of range or roaming cordless telephone, digital mode signals are
exchanged by a roaming cordless telephone at a signal-separable frequency than
that of the one or more cordless telephone handsets for the other base station so the
signals do not interfere with each other. In one of several methods of routing
transmission from a roaming cordless telephone, a received signal from the out of
range cordless telephone is received by the other base station and transmitted from
the other base station to the home base station for translation to analog or other
appropriate signals (such as for data communications).

The digital mode signals sent by the other base station are of course
transmitted on the same conventional telephone network connection (land line,
wireless or other means, referred to hereafter just as "land line") used by the other
station for its own analog or other communications with a telephone network. The
concurrent operation of the subject system and the normal operation of the other
base station takes place so that the integrity of the normal operation of the other
base station is at least substantially maintained. Although complete absence of
interference by line sharing would be preferable, the owner of the other base station
may well accept a reduced performance of normal operation if in exchange for being
part of the invention system and to share in its benefits.

In further explanation of the subject system, digital mode transmissions (and
received signals as well) enter the land lines of the other base station from the other
base station for handling in one of several modes of routing to the home base
station. The digital mode transmissions may be received by the telephone network
with unique identifier(s) indicating that the signals or packets must be directed to the
home base station.

In an alternate embodiment, the other base station and its associated
television account may be equipped with broad band communications technology,
such as for DSL communications, permitting co-transmission of the digital mode
signals with the normal operation of the other base station telephone line, although
using some of the bandwidth of the telephone account for the other base station. In
another alternate embodiment, the digital mode signals may be transmitted directly to the home base station without requiring processing by the telephone network. In one or more of these transmission (and/or receiving) methods for digital mode signals from the other base station to the home base station, the digital mode signals are delivered to the home base station.

The home base station incorporates apparatus for receiving these transmissions in a manner such that it does not substantially impair the normal land line operation. The normal land line operation may include exchange of signals in analog or other digital (i.e., such as ISDN and the like) and data signals. Analog signals are needed for phone speaker and microphone operation. The home base station, upon receiving a digital mode signal from the roaming cordless telephone (for example, the first number of a desired telephone number that the user wants to call) moves the home base station to an off-hook state and transmits the transformed digital mode signal (now in analog or other digital (i.e, such as ISDN) form) to the telephone network for appropriate processing. Each subsequent number received from the roaming cordless telephone causes the telephone network to respond as if the cordless telephone were within its home base station range. When a dial up attempt is completed, the roaming cordless telephone receives communications signals in the reverse order, i.e., the home base station receives an analog signal from a telephone network source, the analog signal is translated to a digital mode signal, the digital mode signal is transmitted to the other base station, the other base station transmits the non-analog signal to the roaming cordless telephone, and the roaming cordless telephone transforms the non-analog signal to an analog signal that may result in an audible or data output usable by the roaming cordless telephone holder.

These simple concepts eliminate the need for an out of range base station with a land line committed only to reception and transmission of signals from the roaming cordless handset. The prior art contains many examples of cordless telephones that switch to a cellular network when out of range of home base station. The present invention system is not one of that category.

The present invention may incorporate a feature for timing out in a standby mode for a period of time if the roaming cordless telephone moves out of range of any receptive base station, so that the user traveling in a car or other transport may not lose communication contact with the connected telephone number during a call.
The out of range base station can be a telephone with similar capabilities as that of
the home base station, providing inducement for many user's in a locality (corporate
building or campus, small community or other relatively compact geographical area)
to install the subject cordless telephone so that they may have the benefit of out of
range operation without the need to pay for a cellular network call.

It is well known that cellular network calls are many times more expensive
than those from a single land line telephone. The subject system having at least one
cordless telephone and two or more base stations permits the user to place and
receive calls from out of range locations where the only charges that will accrue to
the user will be those that would have accrued had the user been within range of the
home base station.

The frequencies for a roaming cordless telephone and that set aside for the
local cordless telephone preferably operate within the broad ranges set aside for the
spread spectrum technology of the 900 MHz and 2.4 GHz cordless telephones. It is
well known from the cellular telephone art and the cellular – cordless telephone art
that one of several frequencies may be programmably selected by the invention
cordless telephone so that its communication frequency does not interfere with the
communications of a local base station as opposed to the home base station of the
roaming cordless telephone. It is also well known in the cellular telephone art and
the cellular – cordless telephone art that base station range sensing expedients and
range to range "hand-off" expedients presently exist for relatively simple
incorporation into the subject system so a roaming cordless telephone can move out
of range of one of the other base stations and automatically transfer all
communication exchanges with a nearby or adjacent-range base station. Optionally,
the user can be given a visual or audible signal that the roaming cordless telephone
is moving out of and/or into range of another base station. Such signal will alert the
user that their call may be terminated if another base station range is not at least
nearby.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a block diagram of a cordless telephone C1 within operating range
of its home base station CB1, showing other base stations and cordless telephones
according to the invention connected by land lines to a telephone network.

Figure 2 is a block diagram of a cordless telephone C1 outside of operating
range of its home base station CB1, showing other base stations and cordless
telephones connected by land lines to a telephone network.

Figure 3 is a flow chart of functions for the subject cordless telephone system.

Figure 4 is a diagram of two cordless telephones and their respective base stations showing wireless connection of one cordless telephone to a non-home base station in accordance with the present invention.

Figure 5 is a diagram of a prior art system for a dual function handset to have a first means for wireless connection to a cellular system and a second means for wireless connection directly to a cordless phone home base station when the handset is within its range.

Figure 6 is a diagram of the invention system of an out of range cordless handset transceiving wireless signals with its home base station by leaftrogs on non-home base stations to establish intervening connection(s).

DETAILED DESCRIPTION OF THE INVENTION

The subject system incorporates at least one cordless telephone and two or more base stations. The functions of an exemplary cordless telephone and the base stations are now discussed in more detail.

A cordless telephone in accordance with preferred embodiments of the present invention will have a transmit/receive circuit (with antenna(s)) operationally connected with programmable circuitry to select a transmit/receive frequency according the objects of the invention. The programmable circuitry may include a central processing unit connected to one or more forms of memory for directing and controlling the cordless telephone functions as required herein. As controlled by the programmable circuitry, a modem circuit can demodulate received radio signals into a continuous signal stream, which will be able to be decoded by the coder/decoder (CODEC) into an audio signal which is controllably amplified by an interface controller and output through a telephone speaker. Likewise, a reverse path is followed through the cordless telephone as the telephone microphone detects user speech. A keypad and a display provide conventional user input and output. Or more simply, as shown in cordless telephones C1 and C100 of Figure 4, respective input/output circuitry 201 and 204 includes wireless transmission and reception apparatus in connection with logic 205 and 208 as well as analog user interface 209 and 212.

Each cordless telephone is identified to a base station by a unique identifier.
As in Figure 4, the base stations CB1 and CB100 respectively include input/output coupling circuitry 202 or 203 for connection by direct land line with the public telephone network or other telephone network. Base stations CB1 and CB100 also respectively incorporate logic 206 and 207 and analog user interfaces 210 and 211.

The ability to switch between invention base stations may be accomplished with known range sensing and hand-off technology which use an over-air protocol as with a mobile telephone system, such as a Personal Communication System (PCS) with hand-held telephones in a cellular communication system or any cellular or mobile telephone system. The protocol defines a method in which user stations, such as cellular or mobile telephone handsets, communicate with one or more base stations to place and receive telephone calls. The protocol provides air-channel agility between base stations and user stations. Each base station may simultaneously maintain communication with as many user stations as there are air channels in its polling loop. The ability of a user station to communicate on any unoccupied air channel makes the protocol air-channel agile. Each base station continually transmits on each one of its air channels in a predetermined sequence.

The ability and technology of a single circuit to conduct multiple simultaneous conversations through identical and closely coupled media without substantial interference are well known in the art. The present invention uses such technology for transmission, along the same land lines, the digital mode signals of the roaming cordless telephone and the analog signals from the cordless or other telephone of the local base station.

Figure 1 shows a set of base stations C1 to C100 according to the invention connected by land line L1. Those base stations are connected without an intervening first switching telephone network TN1. Similarly, a set of the subject base stations C101 to C200 are connected by land line Ln. Those base stations are connected without an intervening first switching telephone network TNn. The set of telephone networks TN1 to TNn represent a worldwide communication telephone network in which base stations according to the invention are capable of land line connection thereto for analog or other communication with any other effectively connected user of the worldwide communication telephone network. Figure 1 shows only invention base stations in the worldwide communication telephone network.

The subject base stations each have unique station identifiers matching those programmed into programmable circuitry in the cordless telephones associated with
them as in Figure 1, i.e., cordless telephone C1 transmits in an analog or data mode directly with base station CB1 when it is within its range. For a typical cordless telephone operating at 900 MHz or 2.4 GHz, that range may be anywhere from a 10-20 feet to hundreds of feet. It is within skill in the art with this disclosure to provide greater operating range of one or more of the subject base stations as desired and/or as permitted by regulation. No other base station will receive analog or data communication from cordless telephone C1 other than base station CB1, for example.

Figure 2 shows cordless telephone C1 out of range of its home base station, base station CB1, but within range of a non-home base station, base station CB100. Non-home base station CB100 optionally has uniquely addressed to it a cordless telephone C100. A non-home base station CB100 routing digital mode signals wirelessly on path 215 doesn’t need a telephone network connection path 216 for the invention system to work. Path 216 may exist in that circumstance so that station CB100 can act as a base station for cordless phone C100. A line is shown connecting cordless telephone C1 with base station CB100, which has a different station identifier than that of telephone C1. Base station CB100 cannot accept analog or data signals communicated by telephone C1. The base station incorporates standard cordless telephone circuitry with an additional transmit/receive circuit operatively connected with programmable circuitry which is turn is operatively connected with the land line connection of the base station to accomplish the objects of the invention.

The transmit/receive circuitry and programmable circuitry are adapted to permit transmit/receive functions of the subject system for more than one roaming cordless telephone. Where more than one cordless telephone is within range of a non-home base station, the programmable circuitry of the roaming cordless telephones and the non-home base station will operate to transmit / receive at separate frequencies for the roaming cordless telephones and operate on the digital mode signals of the multiple roaming cordless telephones as if they were different subscriber lines.

Non-home base stations (as to telephone C1) in the positions of base stations CB2 to CB100 may be capable of the transmit/receive functions for digital mode signals of the roaming cordless telephone to the home base station directly without intervening routing through the telephone network, as a portion of public telephone
network TN1. More specifically, for a set of entirely local direct connection base stations as in base stations CB1 to CB100 (or the separate set of base stations CB101 to CB200), the several cordless telephones identified to their home base stations may roam from the range of their home base stations to the ranges of the local set of non-home base stations and be operatively connected with the home base station without intervening routing to the local telephone network.

The invention is now discussed with reference to the flow chart of Figure 3. Step 151 shows a first cordless telephone in a standby mode, thereafter performing step 152 of sensing for the range of a base station. If a base station is not sensed, the standby mode is maintained for a desired period of time. If a base station is sensed, step 153 is performed with communication established between the first cordless telephone and the base station to determine if the base station is the home base station of the first cordless telephone.

If a home base station is sensed in step 153, the first cordless telephone is thereafter in a state to place, receive or continue a call as in step 154. If a call is not placed, received or continued, the first cordless telephone is placed in a standby mode for a period of time. If a call is placed, received or continued, the first cordless telephone processes the call directly through its home base station as in step 155. If the first cordless telephone moves out of range of its home base station, it is returned to the state of step 152 to sense for a base station, otherwise the call processing is completed as in Step 157 and the first cordless telephone is returned to a standby mode in Step 151.

If at step 153 the first cordless telephone did not sense the home base station, it detects the non-home base station and its address in step 158. The first cordless telephone is moved to a state to place, receive or continue calls in step 159. If a call is not placed, received or continued, the first cordless telephone is placed in the standby mode of step 151. If a call is placed, received or continued, the first cordless telephone will transmit and receive digital signals as in step 160 to a non-home base station. This routing between the non-home and home base stations can be wireless or by wired connection. Digital mode signals are routed directly or indirectly to the home base station uniquely addressed to the roaming cordless telephone. The routing may use one or more intervening non-home base stations to connect the cordless phone with the home base station.

As a graphic example of the forms of routing, Figure 4 shows wireless routing
along path 215 between a non-home base station at CB100 and a home base station at CB1. Figure 4 also shows wired routing along path 216 between the non-home base station at CB100 and a home base station at CB1, with an optional routing through network TN1 and path 219.

In a wireless routing operation as shown in Figure 4, non-home base station CB100 has means for sensing if it is in wireless range of another base station and determining whether that other base station is the home base station of phone C1 or if it is in wireless range of a non-home base station as to phone C1. Routing along path 215 is wirelessly established if non-home base station CB100 senses home base station CB1 for phone C1. If non-home base station CB100 senses only one or more non-home base stations, non-home base station CB100 directs a control signal to those other non-home base stations to sense as it has just done for wireless range to home base station CB1 or to yet another non-home base station. Thus, an intervening non-home base station has means for receiving such a control signal, acting upon it to sense wireless range to other base stations and routing digital mode signals as an intervening link when the connection is ultimately made between non-home base station CB100 and CB1.

If the first cordless telephone moves out of range of the non-home base station with which it exchanges digital signals, as in step 161, the telephone is returned to the base station sensing step 152 for appropriate connection with a home base station or non-home base station. If in step 161 the first cordless telephone remains within the range of the non-home base station, the call processing is completed as in step 162, and thereafter the first cordless telephone is returned to the standby state.

It is important that the present invention not be perceived as being especially limited to the routing process of digital signals between a home base station and a non-home base station exchanging digital signals with a cordless telephone addressed to that home base station. Such digital signals may be routed directly by wire or wireless connection, through a local telephone network, through a public telephone network, through one or more of a sequence or network of non-home base stations, or other such configuration.
Figure 5 is a diagram of a prior art system for putting a cellular phone in the same handset case as a cordless phone. This combination phone doesn’t change the way each phone connected with the telephone network (Telnet) before the two devices were put in the same case. The cellular phone (GSM type) connects to a cellular tower antenna that wirelessly connects to the telephone network. The cordless phone (DECT base station type) wirelessly connects directly with its base station.

Figure 6 is a diagram of the invention system. Out of range of its home base station, the cordless handset sends its signals leapfrogging across non-home base stations to find their way to the home base station. The home base station is connected to the telephone network to complete a call with the “leapfrogged” signals from the cordless handset. Alternately, when the home base station gets a call from the telephone network and the handset is out of station range, the home base station sends its signals for the handset leapfrogging across non-home base stations to find their way to the cordless handset. The cordless handset can transceive after establishing that connection with the home base station.

The invention system lets the user wander as far from their home base station as they wish without incurring telephone network usage or charges. However, the invention system requires overlapping ranges of non-home base stations between the cordless handset and the home base station. As a user moves out of range of a non-home base station that directly receives the cordless handset signals, another non-home base station with an overlapping range will take on that task of direct reception.

Referring again to Figure 6, the home base station and non-home base station are now further explained. Home base stations may be DECT cells as described in US Patent 6226527. In US Patent 6226527, a cordless phone is described as having more than one home base station. The cordless phone can wirelessly connect with transceivers in any DECT cell where that phone is "assigned". In the prior art, DECT cells have not had the ability to leapfrog signals from one DECT cell to another without the help of the telephone network. In the present invention, a DECT cell can be a home base station as the connection to a telephone network, but non-home base stations transceive signals between the DECT cell and a cordless phone that is "assigned" to that DECT cell. As described above, the digital mode signals from the handset “leapfrogged” to the DECT cell are
converted at the DECT cell to appropriate signals for transmission to the telephone network. The invention may take advantage of existing DECT cells where the cordless phone is "assigned" a right to connect with the telephone network.

In addition, DECT cells, and their functional equivalents, can act as non-home base stations. Acting as non-home base stations, DECT cells, and their functional equivalents, may be able to send and receive signals as a non-home base stations at a much greater range than a standard single transceiver non-home base station. A DECT cell could operate as a broad range non-home base station even without permitting the invention cordless phone access to the telephone network of that DECT cell. The non-assigned DECT cell could simply act as a leapfrog to a DECT cell where the invention cordless phone is in fact assigned.

The invention as shown in Figure 6 also includes incorporation of a cellular phone into the invention cordless phone handset, similar to that of US Patent 6226527. Cellular phone means can cooperate with the invention cordless phone in the same handset. When the invention cordless phone is outside of range of the home base station or a non-home base station, the cellular call capability could be activated through the cellular phone means in the same handset. The invention cordless phone reduces the need for cellular phone calls. In one form, an invention cordless phone in a handset with a cellular phone would switch from cordless phone operation to cellular phone operation on transmission of a digital mode signal that was not shown in the handset as received by the home base station after a short period of time. In another form, the invention cordless phone in a handset with a cellular phone would, during a cellular call, alert the handset user that the user had entered the range of a non-home base station that could connect with the home base station. A user could choose to end the cellular call and re-start the call from the home base station.

The invention as shown in Figure 6 also includes using a modified non-home base station and the cellular system as a pseudo-home base station. The handset for the invention cordless phone in this form does not require a cellular phone installation. One or more non-home base stations have means for initiating cellular system calls by converting digital mode signals from the cordless phone to cellular system digital signals and transmitting the cellular system digital signals to a cellular system reception antenna. This cellular system connection detects the call being placed (or received) as if the carrier of the uniquely addressed handset was the one
establishing the call, not the non-home base station. When the invention cordless phone is out of range of non-home base stations that will leapfrog the phone’s signals to the home base station, the modified non-home base station in range of a cellular system receives the digital mode signals from the handset. The modified non-home base station converts the digital mode signals to cellular system digital signals and establishes a call through the cellular system. The user of the invention cordless phone handset can move out of range of the non-home base station that established the cellular call and not lose the connection. A second non-home base station can leapfrog the digital mode signals from the handset to the first non-home base station with the cellular system connection. This form allows a construction of the handset without cellular phone components, although cellular calls can still be made from the handset of the invention cordless phone.

The above options will sometimes present the skilled artisan with considerable and wide ranges from which to choose appropriate apparatus and method modifications for the above examples. However, the objects of the present invention will still be obtained by that skilled artisan applying such options in an appropriate manner.
WE CLAIM:

1. A system for completing a cordless phone call through a cordless subscriber's home base station via a non-home base station including at least one cordless telephone uniquely addressed to a home base station comprising:

   (a) at least one non-home base station;

   (b) the home base station having telephone line connection to a telephone network by direct connection and a unique address;

   (c) the cordless telephone having means for analog signal input, converting analog signal input to digital mode signals, and wirelessly transmitting those digital mode signals with said unique address to a non-home base station when the cordless telephone is out of range of its home base station;

   (d) each non-home base station having means for routing digital mode signals from a cordless telephone uniquely addressed to a home base station, wherein said means for routing comprises means for wirelessly receiving said digital mode signals, means for correlating the transmitted unique address to the home base station, and a means for:

      (i) wirelessly routing said digital mode signals to said home base station based on said unique address if a given non-home base station receiving said digital mode signals is within range of said home base station, and,

      (ii) if said given non-home base station is not within range of said home base station, wirelessly routing said digital mode signals to at least one additional non-home base station, thereby eventually routing the digital mode signals to said home base station based on said unique address; and

   (e) said home base station having means for wirelessly receiving the routed digital mode signals, means for identifying the unique address of the cordless phone, and a means for completing said call through the direct line connection by using the digital mode signals received from said non-home base station.

2. The system of claim 1 wherein at least one of the non-home base stations is also a home base station uniquely addressed for a second cordless telephone.
3. The system of claim 1 wherein at least one non-home base station is capable of communication with another telephone line in the public telephone network.

4. The system of claim 3 wherein at least one non-home base station is capable of communication with another telephone line in the public telephone network at the same time as the transmission of digital mode signals to a home base station from a cordless telephone.

5. The system of claim 1 wherein each home base station has means for converting received digital mode signals to analog or digital or data signals.

6. The system of claim 5 wherein each home base station has means for transmitting to another telephone line in the public telephone network the analog signals converted from digital mode signals.

7. The system of claim 6 wherein each home base station has means for receiving analog, digital or data signals from a live telephone line to the public telephone network, converting those analog, digital or data signals to digital mode signals and transmitting them to a non-home base station having means for sending the digital mode signals wirelessly to a cordless telephone uniquely addressed to the home base station.

8. The system of claim 7 wherein each cordless telephone has means for wirelessly receiving digital mode signals sent from a non-home base station such that only digital mode signals from a cordless telephone's home base station are further processed.

9. The system of claim 7 wherein each cordless telephone has means for wirelessly receiving digital mode signals sent from a non-home base station and transforming those signals to analog signals such that a user of the cordless telephone may receive communication thereby.

10. The system of claim 7 wherein at least one non-home base station has means
for transmitting to and receiving from digital mode signals from more than one
cordless telephone out of range of their respective home base stations and
respectively receiving from and transmitting to the direct line those digital mode
signals such that each set of digital mode signals from each out of range cordless
telephone is effectively exchanged with its home base station without interference
with the other digital mode signals transmitted on the same direct line.

11. A system for completing a cordless phone call through a cordless subscriber's
home base station via a non-home base station including at least one cordless
telephone uniquely addressed to a home base station comprising:
(a) the cordless telephone having a unique address;
(b) the home base station having telephone line connection to a telephone
network by direct connection and means for input from the telephone
network, converting input from the telephone network to digital mode
signals, and wirelessly transmitting those digital mode signals with said
unique address to a non-home base station when the cordless telephone
is out of range of its home base station;
(c) at least one non-home base station, each having means for routing digital
mode signals from the home base station uniquely addressed to its
cordless telephone, wherein said means for routing comprises means for
wirelessly receiving said digital mode signals, means for correlating the
transmitted unique address to the cordless telephone, and a means for
selectively:
(i) wirelessly routing said digital mode signals to said cordless telephone
based on said unique address if a given non-home base station
receiving said digital mode signals is within range of said home
base station, and,
(ii) if said given non-home base station is not within range of said home
base station, wirelessly routing said digital mode signals to at least
one additional non-home base station, thereby eventually routing
the digital mode signals to said cordless telephone based on said
unique address; and
(d) the cordless telephone further having means for wirelessly receiving the
routed digital mode signals, means for identifying the unique address of
the home base station, and a means for completing said call through the
direct line connection by using the digital mode signals received from said
non-home base station.

12. A system for completing a cordless phone call through a cordless subscriber's
home base station via a non-home base station including at least one cordless
telephone uniquely addressed to a home base station comprising:

(a) at least one non-home base station;

(b) the home base station having telephone line connection to a telephone
    network by direct connection and a unique home address;

(c) the cordless telephone having a unique handset address, means for
    analog signal input, converting analog signal input to digital mode signals,
    and wirelessly transmitting those digital mode signals with said unique
    home address to a non-home base station when the cordless telephone is
    out of range of its home base station;

(d) the home base station further having means for input from the telephone
    network, converting input from the telephone network to digital mode
    signals, and wirelessly transmitting those digital mode signals with said
    unique handset address to a non-home base station when the cordless
    telephone is out of range of its home base station;

(e) each non-home base station having means for routing digital mode signals
    from said cordless telephone to its home base station and means for
    routing digital mode signals from said home base station to its cordless
    phone, wherein said means for routing comprises means forwirelessly
    receiving said digital mode signals, means for correlating the transmitted
    unique home address to the home base station, means for correlating the
    transmitted unique handset address to the cordless telephone and a
    means for selectively:

(i) wirelessly routing said digital mode signals to said home base station
    based on said unique address if a given non-home base station
    receiving said digital mode signals is within range of said home base
    station, and, if said given non-home base station is not within range of
    said home base station, wirelessly routing said digital mode signals to
    at least one additional non-home base station, thereby eventually
routing the digital mode signals to said home base station based on said unique home address; and

(ii) wirelessly routing said digital mode signals to said cordless telephone based on said unique handset address if a given non-home base station receiving said digital mode signals is within range of said cordless telephone, and, if said given non-home base station is not within range of said cordless telephone, wirelessly routing said digital mode signals to at least one additional non-home base station, thereby eventually routing the digital mode signals to said cordless telephone based on said unique handset address; and

(f) said home base station and cordless telephone having means for wirelessly receiving the routed digital mode signals, means for identifying the received unique address, and a means for completing said call through the direct line connection by using the digital mode signals received from said non-home base station. 2. The system of claim 1 wherein at least one of the non-home base stations is also a home base station uniquely addressed for a second cordless telephone.

13. A system for completing a cordless phone call through a cordless subscriber’s home base station via a non-home base station including at least one cordless telephone uniquely addressed to a home base station comprising:

(a) at least one non-home base station;

(b) the home base station is a cordless phone network with multiple and direct telephone line connections to a telephone network so that more than one cordless phone in range of the cordless phone network can establish connection to the telephone network by direct connection, where the home base station has a unique address;

(c) the cordless telephone having means for analog signal input, converting analog signal input to digital mode signals, and wirelessly transmitting those digital mode signals with said unique address to a non-home base station when the cordless telephone is out of range of its home base station;

(d) each non-home base station having means for routing digital mode signals from a cordless telephone uniquely addressed to a home base station,
wherein said means for routing comprises means for wirelessly receiving
said digital mode signals, means for correlating the transmitted unique
address to the home base station, and a means for:
(i) wirelessly routing said digital mode signals to said home base station
   based on said unique address if a given non-home base station
   receiving said digital mode signals is within range of said home
   base station, and,
(ii) if said given non-home base station is not within range of said home
    base station, wirelessly routing said digital mode signals to at least
    one additional non-home base station, thereby eventually routing
    the digital mode signals to said home base station based on said
    unique address; and
(e) said home base station having means for wirelessly receiving the routed
digital mode signals, means for identifying the unique address of the
cordless phone, and a means for completing said call through the direct
line connection by using the digital mode signals received from said non-
home base station.

14. The system of claim 13 wherein at least one of the non-home base stations is
also a home base station uniquely addressed for a second cordless telephone.

15. The system of claim 13 wherein at least one non-home base station is capable
of communication with another telephone line in the public telephone network.

16. The system of claim 15 wherein at least one non-home base station is capable
of communication with another telephone line in the public telephone network at the
same time as the transmission of digital mode signals to a home base station from a
cordless telephone.

17. The system of claim 13 wherein each home base station has means for
converting received digital mode signals to analog or digital or data signals.

18. The system of claim 13 wherein each home base station has means for
transmitting to another telephone line in the public telephone network the analog
4 signals converted from digital mode signals.

19. The system of claim 18 wherein each home base station has means for
2 receiving analog, digital or data signals from a live telephone line to the public
3 telephone network, converting those analog, digital or data signals to digital mode
4 signals and transmitting them to a non-home base station having means for sending
5 the digital mode signals wirelessly to a cordless telephone uniquely addressed to the
6 home base station.

20. A system for completing a cordless phone call through a cordless subscriber's
1 home base station via a non-home base station including at least one cordless
2 telephone uniquely addressed to a home base station comprising:
3 (a) at least one non-home base station;
4 (b) the home base station having telephone line connection to a telephone
5 network by direct connection and a unique address;
6 (c) the cordless telephone having means for analog signal input, converting
7 analog signal input to digital mode signals, and wirelessly transmitting
8 those digital mode signals with said unique address to a non-home base
9 station when the cordless telephone is out of range of its home base
10 station;
11 (d) each non-home base station having means for routing digital mode signals
12 from a cordless telephone uniquely addressed to a home base station,
13 wherein said means for routing comprises means for wirelessly receiving
14 said digital mode signals, means for correlating the transmitted unique
15 address to the home base station, and a means for:
16 (i) wirelessly routing said digital mode signals to said home base station
17 based on said unique address if a given non-home base station
18 receiving said digital mode signals is within range of said home
19 base station, and,
20 (ii) if said given non-home base station is not within range of said home
21 base station, wirelessly routing said digital mode signals to at least
22 one additional non-home base station, thereby eventually routing
23 the digital mode signals to said home base station based on said
24 unique address;
(e) said home base station having means for wirelessly receiving the routed digital mode signals, means for identifying the unique address of the cordless phone, and a means for completing said call through the direct line connection by using the digital mode signals received from said non-home base station; and

(f) the cordless telephone constructed in a handset with a cellular telephone adapted to connect with a cellular system when the cordless phone is out of range of one or more non-home base stations that can establish a connection between the cordless phone and the home base station.
FIGURE 5
PRIOR ART

FIGURE 6