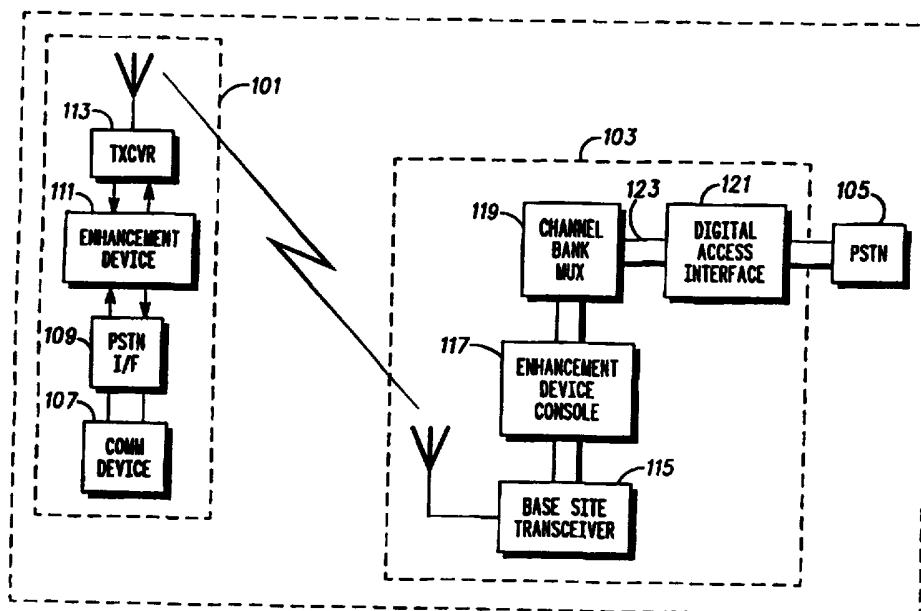




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(54) Title: SIGNALLING METHOD IN A FIXED WIRELESS COMMUNICATIONS SYSTEM



(57) Abstract

A fixed wireless communication system (100) is a hybrid of a fixed wire-line telephone system and a conventional cellular radio system. In particular, this fixed wireless telephone system (100) provides real time signalling of standard telephony signals (off hook, on hook, flash hook, metering pulse and call release) using standard wire-line telephony equipment.

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SIGNALLING METHOD IN A FIXED WIRELESS COMMUNICATIONS SYSTEM

Field of the Invention

5 Generally, the present invention relates to communication systems and more particularly to a communication system including a radio communication system and a wire line communication system acting as a fixed wireless communication system.

10 **Background of the Invention**

Generally, a fixed wireless telephone service is used as an alternative to wire line telephone service in rural or urban settings, particularly in developing countries. One way of providing a fixed wireless
15 telephone service is to use a conventional cellular telephone system and couple it with a wire line telephone system to provide wireless service to fixed terminals throughout a geographic area.

There are obvious differences between a conventional cellular
20 telephone system and a conventional wire line telephone system. For example, in a wire line telephone system, a flash hook signal is detected immediately at an active switch of the wireline communication system in real time. In a conventional cellular system, a real time flash hook signal is not available. As an
25 alternative some cellular systems require the user to input a special key sequence that is interpreted over a control channel to the remote base site. After a certain amount of delay, the key sequence is interpreted at the remote base site and the flash hook signal is recognised. Similar delays occur for on hook or off hook, causing
30 improper billing to a user. Thus, a conventional cellular system does not allow for real time transmission of conventional telephony signals using standard telephony equipment.

In order to provide a fixed wireless telephone service, it is desirable
35 to emulate the service of a fixed wire line telephone service.

Specifically, it would be advantageous to provide real time telephony signals that can be generated using traditional wire line communication equipment. Such traditional wire line communication equipment including: standard telephones, modems, and facsimile machines.

Summary of the Invention

A first aspect of the present invention provides a method of signalling in a communication system including a radio communication system and a wireline communication system, the method comprising the steps of: generating a standard telephony signal at a first communication device; detecting the standard telephony signal; transmitting a digital code corresponding to the standard telephony signal over a traffic channel of the radio communication system; receiving the digital code; and transmitting, responsive to receiving the digital code, a standard telephony signal corresponding to the received digital code on a traffic channel of the wireline communication system.

A second aspect of the present invention provides a method of signalling in a communication system including a radio communication system and a wireline communication system, the method comprising the steps of: generating a standard telephony signal in the wireline communication system; detecting the standard telephony signal; transmitting a digital code corresponding to the standard telephony signal over a traffic channel of the radio communication system; receiving the digital code; and transmitting, responsive to the step of receiving the digital code, a standard telephony signal corresponding to the received digital code to a first communication unit.

Brief Description of the Drawings

FIG. 1 is an illustration of a fixed wireless telephone service incorporating a conventional cellular telephone system and a conventional wire line telephone system in accordance with the present invention.

5

FIG. 2 is a detailed illustration in block diagram form of a base site inter-connection in accordance with the present invention.

10

FIG. 3 is an illustration in block diagram form of an enhancement device console in accordance with the present invention.

FIG. 4 - FIG. 12 are illustrations of signalling diagrams in accordance with the present invention.

15

Detailed Description of a Preferred Embodiment

The preferred embodiment includes a description of a fixed wireless system that is a hybrid of a fixed wire-line telephone system and a conventional cellular radio system. It is intended as an alternative to wire line telephone system in rural or urban settings, particularly in developing countries. A fixed wireless telephone system saves the tremendous cost of providing the infrastructure required for a wire line telephone system and allows rapid installation of the service. In particular, this fixed wireless telephone system provides real time signalling of standard telephony signals (off hook, on hook, flash hook, metering pulse and call release) using standard wire line telephony equipment.

FIG. 1 is an illustration of a fixed wireless communication system 100 including a fixed wireless terminal 101, a fixed wireless base station 103 and a conventional wire line switch 105. The fixed wireless terminal (FWT) 101 includes a traditional wire line communication device 107 such as a modem, a telephone or a fax machine or any combination thereof. The fixed wireless terminal 101

additionally includes a PSTN interface 109, an enhancement device 111 and a cellular radio telephone transceiver 113.

5 The communication device 107 is any traditional wire line communication device such as a telephone, a fax machine or a modem. The communication device 107 is coupled to the PSTN interface via a traditional two-wire connection as is known in wire line communication systems. The PSTN interface 109 provides a traditional interface to a communication device such that the end
10 user is not aware of any difference between a fixed wireless communication system and a fixed wire line communication system. Additionally, the PSTN interface detects traditional telephony signals created by the communication device 107, such as an off hook signal, an on hook signal and a flash hook signal. The PSTN
15 interface 109 transmits the analogue audio between the communication device 107 and the enhancement device 111. Additionally, the PSTN interface 109 transmits the detected standard communication device signals (on hook, off hook, flash hook) to the enhancement device 111 and communicates any
20 standard wire line signals such as an incoming call signal, a metering pulse or an end of call signal from the enhancement device to the communication device 107.

25 The enhancement device 111 digitises the audio received from the PSTN interface 109 and transmits it to a standard cellular radio telephone system transceiver 113. Likewise, the audio received from the transceiver 113 is converted to analogue audio signals. Likewise, the enhancement device 111 converts the digital audio received from the transceiver 113 to analogue audio and is output to the PSTN
30 interface 109. Additionally, the enhancement device 111 provides the necessary enhancement for operating the traditional cellular transceiver 113 in a fixed wireless telephone environment. Specifically, in response to receiving an original off hook signal from the PSTN interface 109, the enhancement device requests a
35 communication channel on the conventional cellular radio

communication system by transmitting a pre-determined digital sequence to the transceiver 113. In the preferred embodiment this predetermined digital sequence is a "ghost" telephone number. The specific details of this request are described below. Additionally, the
5 enhancement device 111 codes and decodes traditional wire line signals, such as on hook, off hook, flash hook, metering pulse and end of communication signals, as detailed below.

The transceiver 113 is a standard cellular radio telephone system
10 transceiver. In a preferred embodiment, the transceiver is developed to meet the TACS analogue cellular radio telephone system. However, it is envisioned that any other traditional cellular radio telephone communication system could be substituted therefor including analogue and digital cellular systems. The transceiver 113
15 transmits and receives radio frequency "RF" signals to and from a base site transceiver 115 located in the fixed wireless base station 103. The base site transceiver 115 is comparable with the radio transceiver 113 of the fixed wireless terminal 101. The base site transceiver 115 sends and receives digital audio signals to and from
20 an enhancement device console 117. The enhancement device console 117 contains a plurality of enhancement devices earlier described in relation to the fixed wireless terminal 101. Again, the enhancement devices 111 contained in the enhancement device console 117 digitise analogue audio signals transmitted there to pass
25 those digital audio signals on to the base site transceiver 115. Likewise, the enhancement devices 111 contained within the enhancement device console 117 transform received digital audio signals into audio signals for use in the traditional wire line telephone system. Additionally, the enhancement devices contained
30 within the enhancement device console 117 code and decode the signals transmitted between enhancement device 111 of the fixed wireless terminal and enhancement devices in the enhancement device console 117.

The channel bank multiplexer (MUX) 119 is coupled to a digital access interface (DAI) 121 via an E1 trunk 123. The digital access interface 121 may be remotely located from the base site transceiver 115. In the preferred embodiment, the enhancement device console 117 and the channel bank MUX 119 are coupled using a microwave link. The channel bank MUX 119 converts audio received from the digital access interface 121 into four-way audio which is then transmitted to the enhancement device console 117. Likewise, four-way audio received from the enhancement device console 117 is converted by the channel bank MUX 119 into one trunk and output to the digital access interface 121.

The digital access interface 121 provides a standard trunk level interface such as R2 or SAT, or a proprietary interface to the local central office switch. Thus, the DAI 121 interfaces between the E1 trunk 123 and the public switching telephone network 105. Additionally, the DAI 121 requests audio links on the wire line communication system and links the audio link on the wire line communication system with a communication channel on the conventional cellular radio telephone system, thus providing a link between the communication device 107 and the PSTN 105.

FIG. 2 is a detailed illustration in block diagram form of a portion of the fixed wireless base station 103. Specifically, FIG. 2 includes the base site transceiver 115, the enhancement device console 117, the channel bank MUX 119, the E1 interface 123 and the interconnections between these devices. The base site transceiver 115 includes a transceiver 201 for each of the radio communication channels to a fixed wireless communication device such as FWT 101 of FIG. 1. It should be noted that the number of transceivers necessary will vary depending upon the cellular system utilised in this communication system 100. Specifically, if a time division multiple access system is used, then each transceiver could service multiple fixed wireless telephony devices, thus, reducing the number of required transceivers. Each transceiver 201 of the base site

transceiver 115 is coupled to the enhancement device console 117 via a four-wire connection 203. Each of the transceivers 201 are coupled to an enhancement device 111 contained within the enhancement device console 117. In the preferred embodiment, up to 30
5 transceivers and 30 corresponding enhancement devices may be utilised. Each of the enhancement device 111 transmits a four-wire analogue audio signal to and from the channel bank MUX 119 via lines 205. Additionally, the enhancement devices 111 code and decode the real time signalling bits which are used to transmit the
10 traditional wire line signals such as on hook, off hook, flash hook, metering pulses and call termination via the real time signalling connections 207.

FIG. 3 is a detailed illustration in block diagram form of a
15 enhancement device 111 of the present invention. The enhancement device includes a DSP 301, a first codec 303, a second codec 305, external memory 307, an interface connector 309, a first set of filters 311 related to the first codec 303 and a second set of filters 313 related to the second codec 305. In the preferred embodiment, the
20 DSP 301 is a 16 bit fixed point DSP operating at 80 megahertz (Mhz). For outgoing audio, the DSP 301 receives a string of binary numbers representing an analogue audio signal. It converts this string to a digital stream that represents the actual data or voice received from the communication device 107 or from the PSTN 105. It then
25 encodes the voice or data using the first code 303 or the second codec 305, filters the signals using the appropriate set of filters and transmits the encoded data/voice to the interface connector 309. For incoming audio, the DSP 301 performs decodes the data/voice digital signals, converting them back to an analogue audio signal, reversing
30 the outgoing audio process previously described. Thus, the enhancement device 111 acts as a digital transmitter and a digital receiver for transmission on the analogue cellular network. Additionally, the enhancement device 111, encodes and decodes the traditional telephony signals (on hook, off hook, flash hook, metering
35 pulses, call disconnect) on to and off of the audio signals received by

and transmitted from the enhancement device 111 on the VCO/MP line and MP line of FIG. 3, acting as the signalling in line and the signalling out line, as described below.

- 5 Once a communication link is established between the communication device 107 and the PSTN 105 of FIG. 1, real time signalling of standard telephony signals is available to the user of the communication device 107 as well as the communication system 100. The signalling is referred to as real time because the signals
10 are transmitted using the traffic channels of the radio communication system and the wireline communication system.

The real time signals from the FWT 101 to the PSTN 105 are generated by the enhancement device 111. The path nodes until the
15 DAI 121 merely reflect these signal, and they are detected and acted upon at the DAI 121. Conversely, the real-time signals from the PSTN 105 to the FWT 101 are generated by the DAI 121, reflected along the path and detected only at the enhancement device 111. The real time signalling path is described below.

- 20 The path between the PSTN 105 and the DAI 121 is an interface that is defined by the wireline communication system and is not affected by the real time signalling implementation. The real time signals between the DAI 121 and the MUX 119 will be transmitted
25 using the bi-directional channel associated signalling. Specifically, the signalling path will use the signalling time-slot number 16 of the E1 trunk related to the call. The above signals will be transmitted or received on bit N of the 4 signalling time slot bits that correspond to the audio channel of the call in the multi-frame packet. The value
30 1 of this bit will correspond to 'no current', and the value 0 will correspond to 'current'. The metering pulses and the end of call signals received from the PSTN 105 will be transmitted from the MUX 119 to the enhancement device console 117 on a signalling-in line 207 of FIG. 2. The on hook, off hook, and flash hook signals
35 received enhancement device console 117 will be transmitted to the

- MUX 119 on a signalling-out line 207 of FIG. 2. The signals transmitted between the enhancement device console 117 and the enhancement device 111 will be transmitted on the traffic channel of the conventional cellular radio system using either a bit-robbing method or an alternate bandwidth modem, as described below. Once the signals are received by the enhancement device, the signals will be decoded and sent out on the signalling out line of FIG. 3.
- 10 Metering pulses are sent through the real-time signalling path to a FWT 101 for billing purposes. The most common use of metering pulses is with payphones. Typically, standard cellular phone systems, such as AMPS and NAMPS, do not provide a signalling protocol for metering pulses to be sent to their phones. Other
- 15 systems, TACS, have special commands for metering pulses, however, because of delays in the protocol, the metering pulses do not represent an exact replica of the wireline metering pulse and may cause charging inaccuracies. However, since fixed wireless telephony may be used with pay phones, it is desirable to provide metering
- 20 pulses from the PSTN 105 to the FWT 101. When the PSTN 105 sends metering pulses, the DAI 121 transfers them, one by one, to the FWT 101 on the real time signalling path, and the PSTN interface 109 generates the 12KHz metering pulse accordingly.
- 25 A communication can be released by the radio subscriber (whether the subscriber is a calling or a called party), or by the PSTN 105. The PSTN 105 can release the call either by sending busy tone to the subscriber - if the call was already in conversation mode, or by stopping the ringing before the subscriber answers.
- 30 If the communication device 107 goes on hook by the user, the FWT 101 sends an on hook signal to the DAI 121 on the real time signalling path. After transmitting the on hook signal on the real time signalling path, and after waiting for the delay specified below,
- 35 the FWT 101 signals the transceiver 113 to send the a TACS

- protocol Mob Release message. This order of the FWT's actions is important, because once the transceiver 113 receives the release signal, the audio channel is closed and the enhancement devices 111 have no more means of communication. The PSTN interface 109
- 5 must wait for 240 msec between transmitting the real-time on hook signal to the enhancement device 111 and transmitting a Mob Release signal to the transceiver 113, to allow the real-time signal to pass from the FWT 101 to the enhancement device console 117 then to the MUX 119. The DAI 121 initiates disconnection of the speech
- 10 path, and release towards the local exchange. During the release process, the DEPI interface is held in release condition by the DAI 121. At the end of the release process, the DEPI interface is allowed to become idle.
- 15 If the call is released by the PSTN 105, the DAI 121 detects busy tone on the DEPI interface from the PSTN 105. After 5 seconds, the DAI 121 releases the signalling connection and the allocated time-slot. The DAI 121 sends the Release Signal to the FWT 101 both through the real-time signalling path. The FWT 101 sends a busy
- 20 tone to the communication device 107 for 20 seconds or until the subscriber goes on hook. If the communication device remains off hook, the FWT 101 generates a howler tone for 5 minutes.
- If the call is released at the end of ringing, then the signal for end of
- 25 ringing is the same one used for the release from PSTN 105, which is described in the previous item. This case is handled in the same way as the previous one by the DAI 121.
- The real-time signals will be modulated at the enhancement devices
- 30 by their duration and transitions, since they will be transmitted using a single bit. The real-time signalling lines will be sampled by the enhancement devices once every 30 msec.

The following paragraphs describe in detail the signals sent on the real-time signalling path, from the FWT 101 to the PSTN 105 in audio calls.

- 5 • Subscriber off hook - on the FWT 101 side, the level at the signalling_in pin is pushed down by the PSTN interface, once it detects that the subscriber went off hook. This is the same signal as the VCO (Voice Channel Open), since the voice channel to the fixed wireless base 103 is opened by the transceiver 113 only
10 when the subscriber goes off hook.
- 15 • Flash Hook - a short Active-HI pulse, with duration of 150+/-30 msec. This pulse is generated by the PSTN interface 109. Note that the FWT's enhancement device 111 should, at the same time, transmit this signal to the DAI 121 and measure the length of this
20 signal, in order to differentiate between it and the on hook signal. Therefore, if the signalling_in level goes HI for up to 180 msec (150 + 30), the enhancement device 111 should not indicate flash hook but should take 2 more samples. If these samples are HI
25 too, then this is the On Hook signal - see the next item.
- 30 • Subscriber on hook - the level at the VCO pin is pulled up for longer than 240 msec (180 msec which is the length of the flash hook + 60 msec for 2 additional samples, by which this signal will differ from the flash hook). This level is pulled up by the PSTN
35 interface 109, once it detects that the communication unit 107 is on hook, and before it signals the on hook to the transceiver. When the enhancement device 111 detects that the signalling_in level has been HI for at least 240 msec, indicates that the communication device is on-hook.

FIG. 4 is an illustration of these previously described signals at the signalling-in line of the enhancement device 111 of FIG. 3. These signals are modulates by the FWT's enhancement device 111 on
35 audio frames using the 'bit-robbing' method as described below, so

that they are reflected on the Base-Side end as they were seen at the FWT's enhancement device 111. At the Base-Site the appropriate enhancement device in the enhancement device console 117 demodulates these signals from the audio frames, inverts the signals and sends them to the MUX 119 through an opto-coupler.

From the appropriate enhancement device in the enhancement device console 117, the PSTN-bound signals will be transmitted on the signalling_out pin, which is connected through the opto-coupler to the MUX 119 as illustrated in FIG. 5.

The following paragraphs describe in detail the signals sent on the real-time signalling path, from the PSTN 105 to the FWT 101.

- metering pulse - a short pulse, with duration of 150+/-30 msec. This pulse is transmitted from the MUX 119 through the opto-coupler, following the signal sent from the PSTN 105 through the DAI 121. On the Base-Site end, this pulse is active-LO when it is received on the signalling_in pin of the Base-Site enhancement device as illustrated in FIG. 6. The enhancement device reverts this signal, so that when it is transmitted from the FWT's enhancement device 111 to the FWT's PSTN controller 109, it is Active-HI.
- Release from PSTN - the level at the Base-Site enhancement device's signalling_in pin is pushed down for at least 240 msec as illustrated in FIG. 6 (180 msec which is the length of the meter pulse + 60 msec for 2 additional samples, by which this signal will differ from the meter pulse). This level is pushed down by the MUX 119 through the opto-coupler, following the Release from PSTN signal generated by the DAI 121. However, this signal is reverted in the Base-Site's enhancement device, so that on the FWT side the level is pulled up on the FWT enhancement device's signalling_out pin.

- Call start - This signal will be sent from the DAI 121 (through the MUX 119) to the Base-Site's enhancement device when the call starts. Upon receiving this signal from the DAI 121, the MUX 119 will pull up the level on the signalling_in line of the Base-Site enhancement device, as illustrated in FIG. 6.

On the FWT's enhancement device 111, the FWT-bound signals will be transmitted from the signalling_out pin as illustrated in FIG. 7.

The difference in the metering pulse transmission between audio and modem/fax calls is in their modulation by the enhancement devices. In audio calls these pulses will be modulated by "bit robbing" on the audio frame, while in modem/fax calls they will be modulated using an out of band modem. The reason for this difference is that the "bit robbing" method or by allocating additional overhead bits for signalling, is applicable for audio only, and the out of band modulation is not as reliable as the "bit robbing" method, since the modem/fax data frequency might occasionally overlap this modem's frequency. Therefore, in modem/fax calls, this transmission method will be used only for the metering pulses, and the release from PSTN signal will be transmitted through the TACS protocol message only.

The metering pulses must be transmitted through the real-time signalling path because the TACS messages path causes delays, which are problematic for metering pulses. For the release from PSTN signal these delays are less critical, hence they will be transmitted through the TACS protocol signalling path.

When transmitting fax and/or data over a conventional cellular system, it is advantageous to compress the data prior to any radio frequency transmission to avoid any "clipping" of the data and corresponding loss of data at the receiving end. Consequentially, in the preferred embodiment an automatic discriminator detects the presence of fax and/or data present on the incoming audio line prior

to RF transmission. In response to the detection a data compressor is automatically switched in and out of the audio path to enable automatic compression of the fax or data signals. This feature tremendously increases the accuracy of the fax and/or data signals received at the receiving end of the conventional cellular system.

FIG. 8 and FIG. 9 illustrate the signalling pulses in data/fax communications from the PSTN 105 to the FWT 101. In particular FIG. 8 illustrates the signalling_in pin at the base site's enhancement device and FIG. 9 illustrates the signalling_out pin at the FWT's enhancement device 111.

FIG. 10 - FIG. 12 illustrate the real-time signalling as it is carried on the air between the enhancement devices. Note that not all the signals that appear in the previous schemes exist here, because some of them (that signify call end or start) cannot be transmitted between the enhancement devices communication channel does not exist at the time of their transmission. These signals are generated at both ends (Base-Site and FWT) by the default levels (HI or LO) defined above, that the lines will have when there is no call. In particular FIG. 10 illustrates the signals from the FWT's enhancement device to the FWT's enhancement device in audio calls. FIG. 11 illustrates the signals from the base site's enhancement device to the FWT's enhancement device in audio calls. FIG. 12 illustrates the signals from the base site's enhancement device to the FWT's enhancement device during facsimile or data calls.

The bit-robbing method assigns a predetermined bit or bits of a frame to indicate the standard telephony signalling. For example, there are 32 bits per frame sent over the air between two enhancement devices. Bit 3 of every other frame is used to indicate the state of the standard telephony signals. This bit robbing technique is good to use when transmitting voice on the traffic channel between the FWT 101 and the fixed wireless base site 103. However, when transmitting fax and data information it is

inadvisable to use the bit robbing method since this will corrupt the data being transmitted.

Alternatively, an out of band modem or an alternative band modem
5 may be used to transmit the standard telephony signals on the
traffic channel between the FWT 101 and the fixed wireless base site
103. In the preferred embodiment, the 3 dB bandwidth or the
normal bandwidth for a traffic channel is passband filtered between
300 and 3000 Hz (hertz). The alternative bandwidth used to
10 transmit the standard telephony signals is 3030 to 3090 Hz.
Although, the alternative bandwidth is beyond the 3dB rolloff of the
pass band filter, it is of sufficient quality to transmit the low data
rate required to transmit the standard telephony signals.

CLAIMS

1. A method of signalling in a communication system including a radio communication system and a wireline communication system, the method comprising the steps of:
- 5 generating a standard telephony signal at a first communication device;
- detecting the standard telephony signal;
- transmitting a digital code corresponding to the standard
- 10 telephony signal over a traffic channel of the radio communication system by modulating a signal using a modem in an alternate bandwidth different from a normal bandwidth for the traffic channel;
- receiving the digital code; and
- 15 transmitting, responsive to receiving the digital code, a standard telephony signal corresponding to the received digital code on a traffic channel of the wireline communication system.
- 20 2. A method of signalling in a communication system including a radio communication system and a wireline communication system, the method comprising the steps of:
- generating a standard telephony signal in the wireline communication system;
- 25 detecting the standard telephony signal;
- transmitting a digital code corresponding to the standard telephony signal over a traffic channel of the radio communication system by modulating a signal using a modem in an alternate bandwidth different from a normal bandwidth
- 30 for the traffic channel;
- receiving the digital code; and
- transmitting, responsive to the step of receiving the digital code, a standard telephony signal corresponding to the received digital code to a first communication unit.

3. A method of signalling in accordance with claims 1 or 2 wherein said alternate bandwidth is 3030 - 3090 Hz (hertz).
- 5 4. A method of signalling in accordance with claims 1 or 2 wherein said normal bandwidth for the radio communication channel is 300 - 3000 Hz (hertz).
- 10 5. A method of signalling in accordance with any of the preceding claims wherein the standard telephony signals may be an on-hook signal, an off-hook signal or a flash-hook signal.
- 15 6. A method of signalling in accordance with any of the preceding claims wherein the standard telephony signal may be a metering pulse signal.
- 20 7. A method of signalling in accordance with any of the preceding claims wherein the radio communication system is a cellular radio communication system.
- 25 8. A method of signalling in accordance with claim 7 wherein the cellular radio communication system is an analogue cellular radio communication system.
- 30 9. A method of signalling in accordance with claim 8 wherein the analogue cellular radio communication system includes a digital transmitter and a digital receiver.
- 35 10. A method of signalling in a communication system including a radio communication system and a wireline communication system, the method comprising the steps of:
 - generating a standard telephony signal at a first communication device;
 - detecting the standard telephony signal;
 - transmitting a digital code corresponding to the standard telephony signal over a traffic channel of the radio

communication system by using a single bit of a traffic channel time slot to indicate a desired status of the wireline communication system to be "current" or no current";
receiving the digital code; and

5 transmitting, responsive to receiving the digital code, a standard telephony signal corresponding to the received digital code on a traffic channel of the wireline communication system by creating the desired status of the wireline communication system.

10

11. A method of signalling in a communication system including a radio communication system and a wireline communication system, the method comprising the steps of:

generating a standard telephony signal in the wireline
15 communication system;
detecting the standard telephony signal;
transmitting a digital code corresponding to the standard telephony signal over a traffic channel of the radio communication system by using a single bit of a traffic
20 channel time slot to indicate a status of the wireline communication system to be "current" or no current";
receiving the digital code; and
transmitting, responsive to the step of receiving the digital code, a standard telephony signal corresponding to the
25 received digital code to a first communication unit by re-creating the status of the wireline communication system.

12. A method of signalling in accordance with any of the preceding claims wherein the standard telephony signals may
30 be an on-hook signal, an off-hook signal or a flash-hook signal.

13. A method of signalling in accordance with any of the preceding claims wherein the standard telephony signal may be a metering pulse signal.

35

14. A method of signalling in accordance with any of the preceding claims wherein the radio communication system is a cellular radio communication system.
- 5 15. A method of signalling in accordance with claim 14 wherein the cellular radio communication system is an analogue cellular radio communication system.
- 10 16. A method of signalling in accordance with claim 15 wherein the analogue cellular radio communication system includes a digital transmitter and a digital receiver.
- 15 17. An apparatus for improving the quality of fax and data transmissions in a communication system including a conventional cellular communication system, the apparatus comprising:
- 20 a detector displaced in an audio path of the communication system for detecting the presence of fax or data signals on the audio path; and
- a data compressor, responsive to said detector, for compressing the audio path when fax or data signals are present on the audio path.

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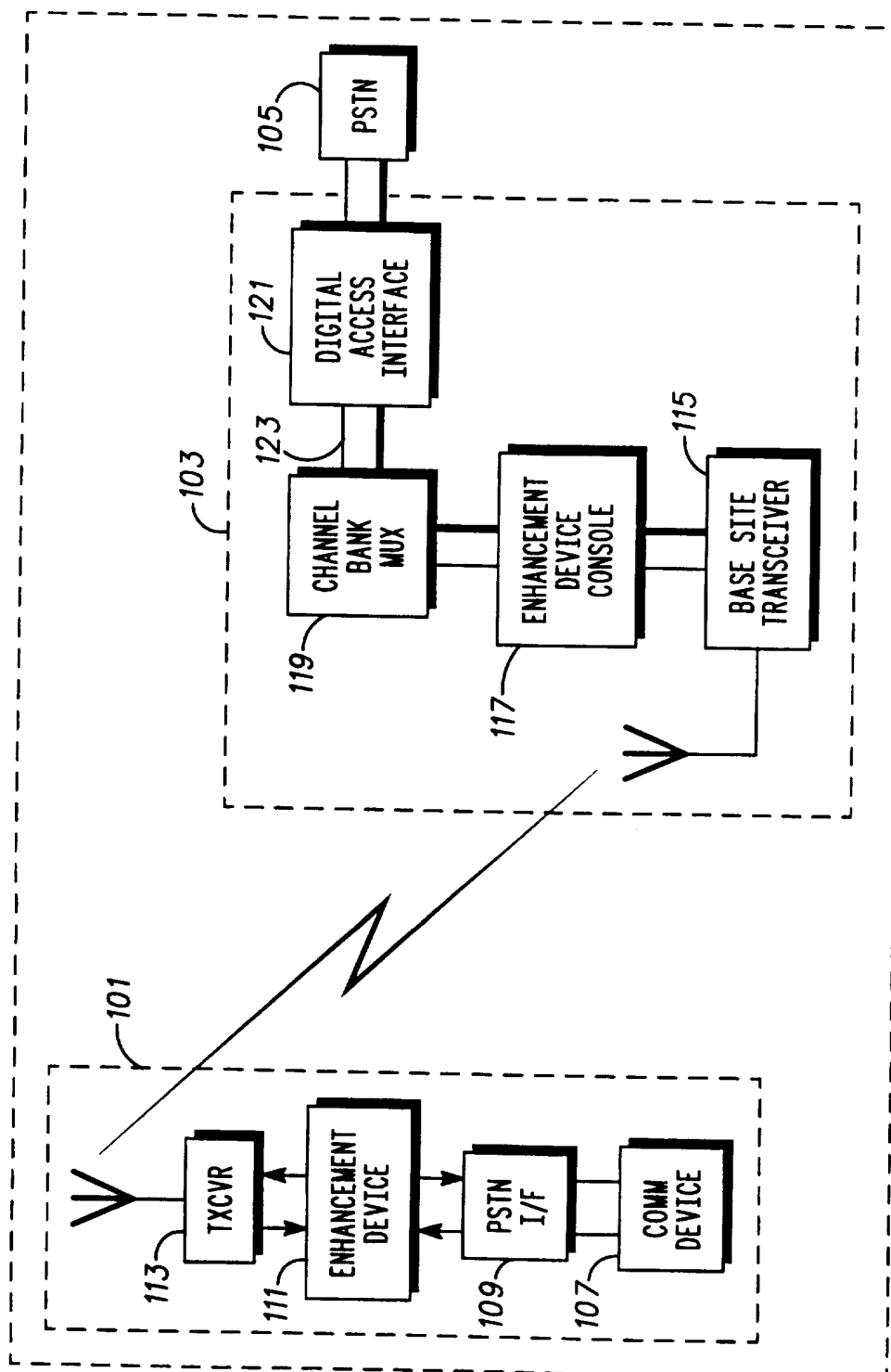
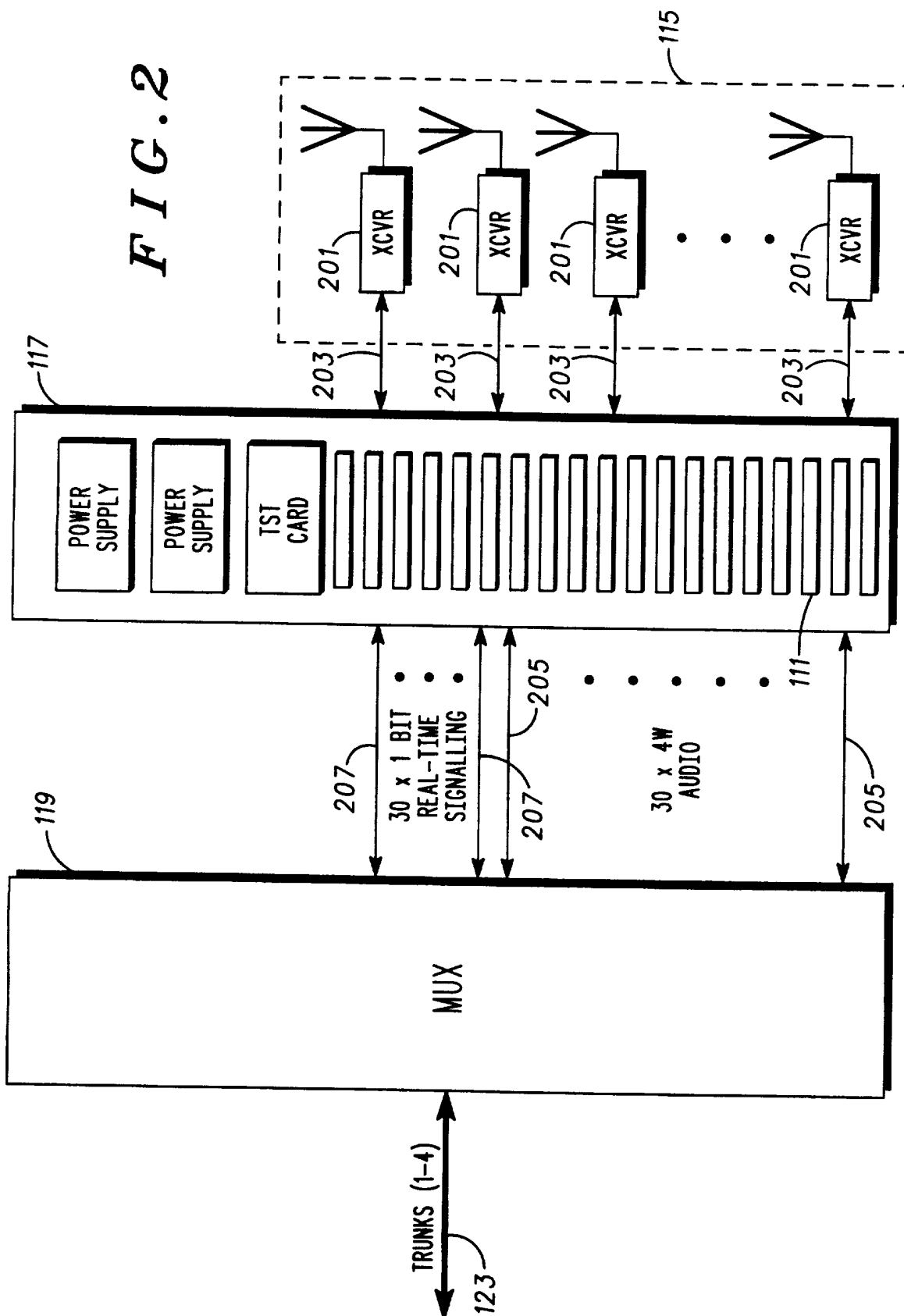
100

FIG. 1

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FIG. 2



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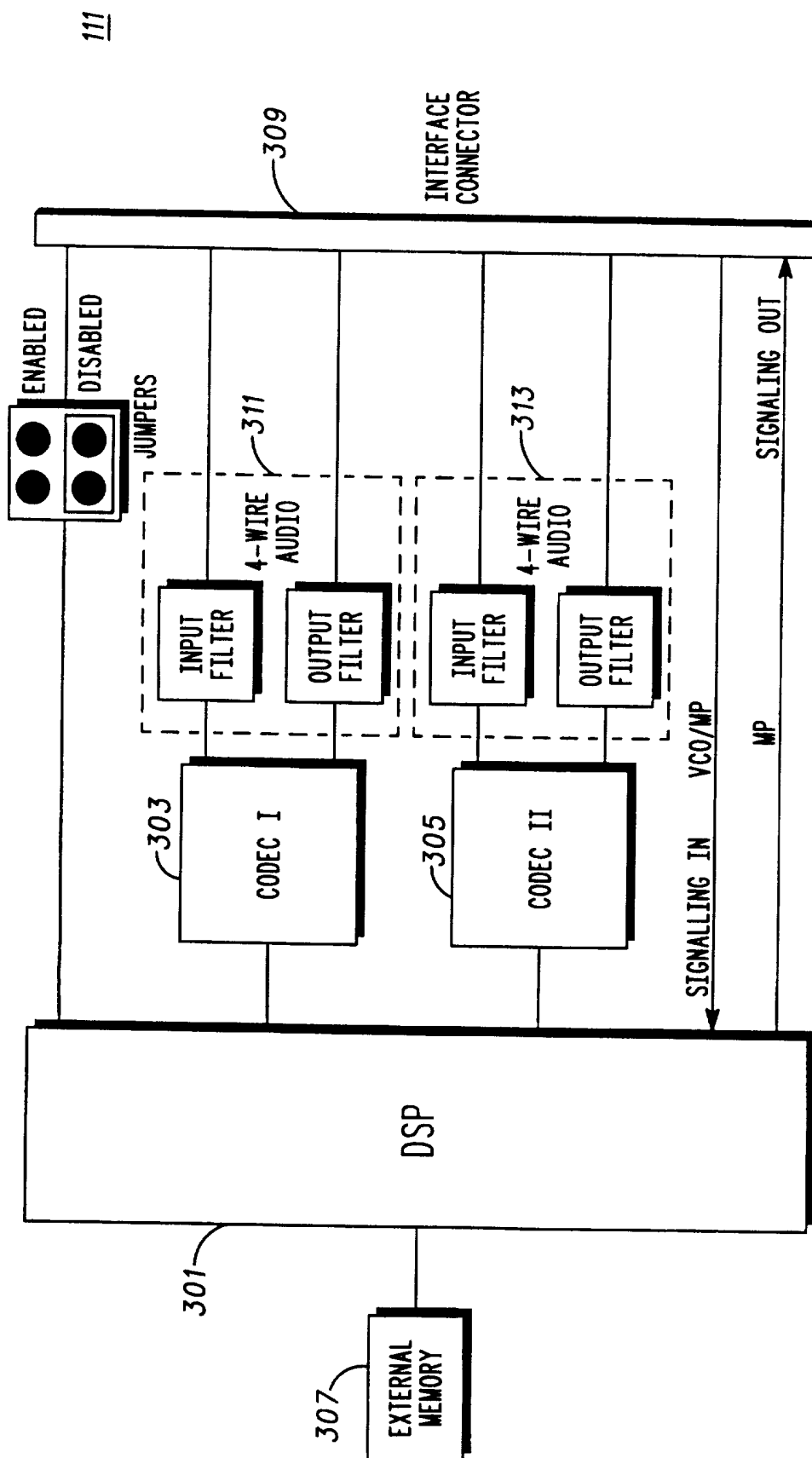
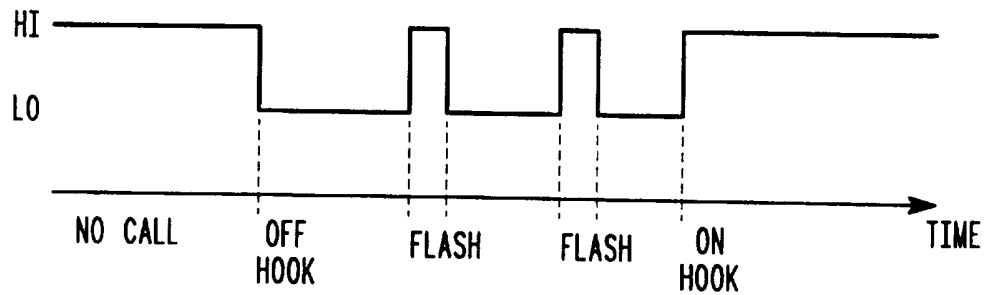
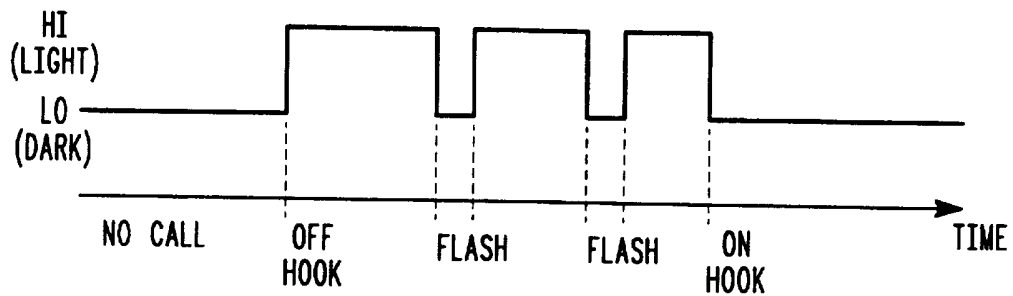
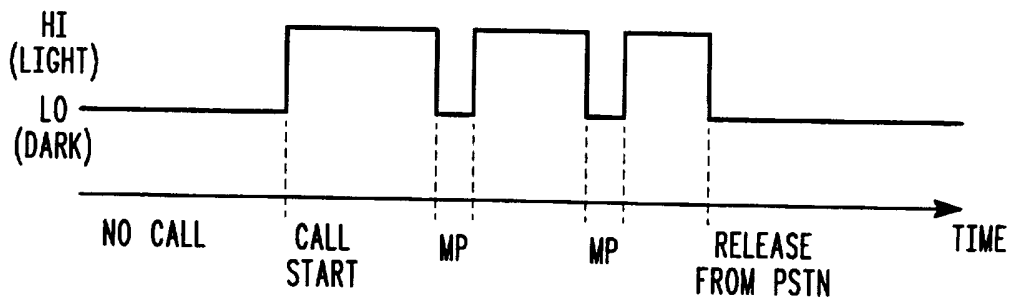
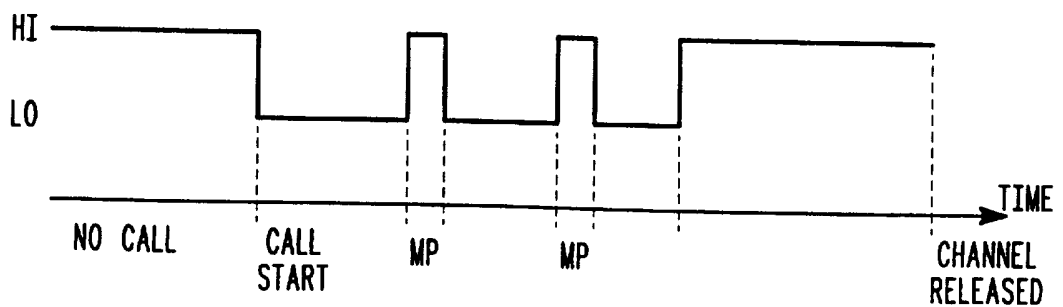
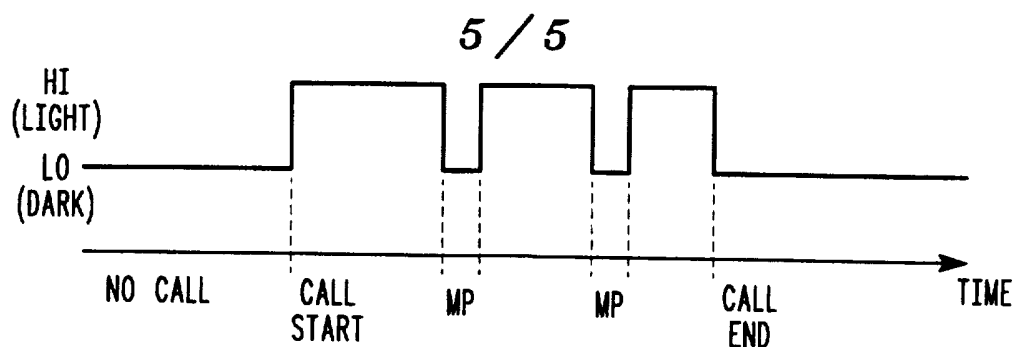
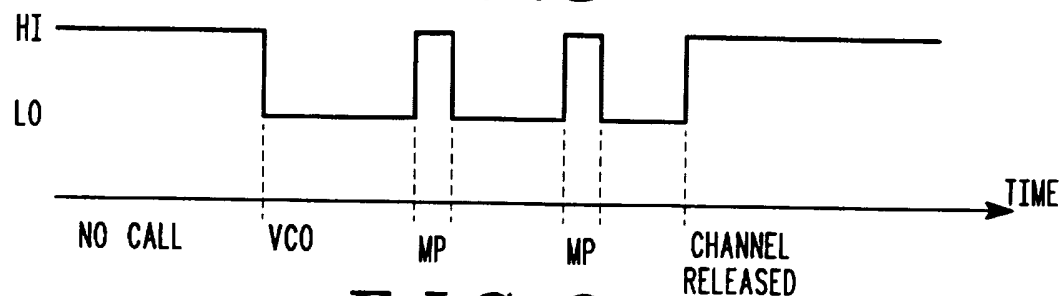
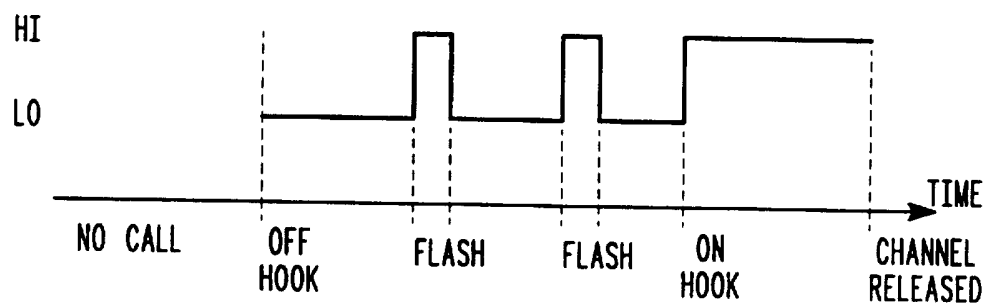
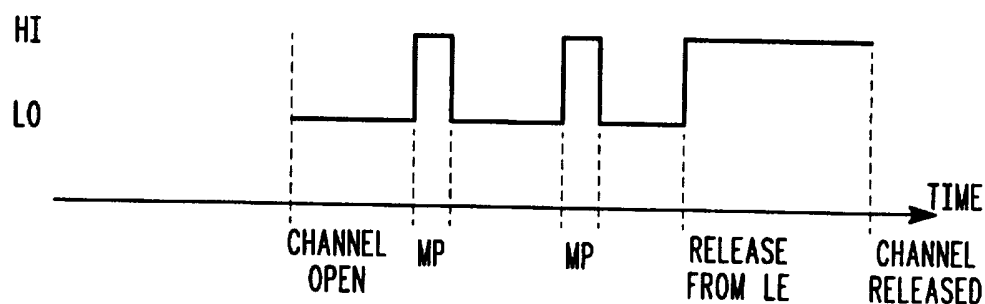
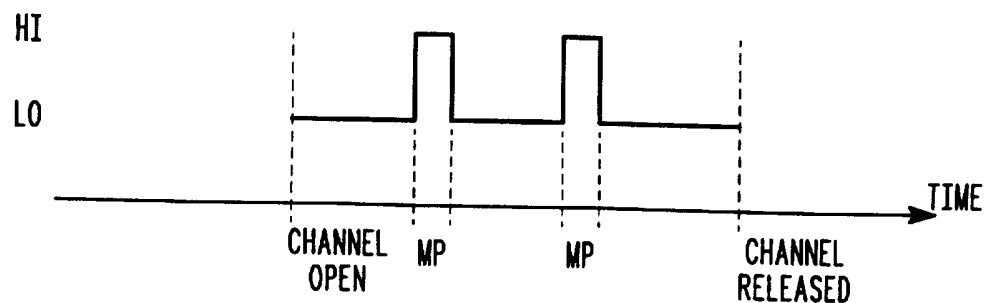


FIG. 3

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*FIG. 4**FIG. 5**FIG. 6**FIG. 7*

**FIG. 8****FIG. 9****FIG. 10****FIG. 11****FIG. 12**