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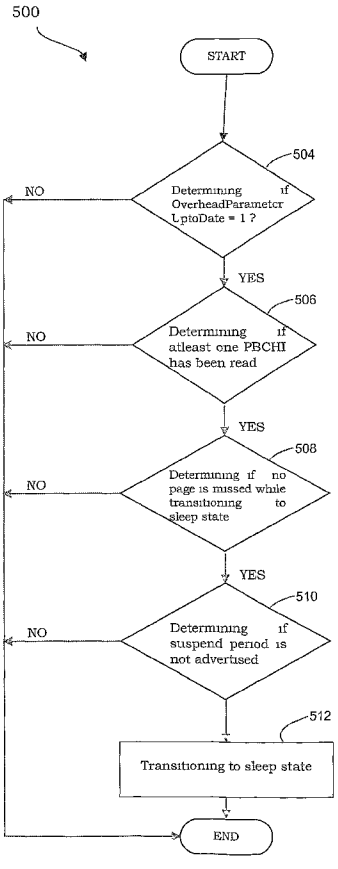
(54) Title: A METHOD AND APPARATUS FOR TRANSITIONING FROM MONITOR STATE IN WIRELESS COMMUNICATION SYSTEMS



(57) Abstract: A method and apparatus is provided, comprising determining if a ForwardTrafficChannelMAC.PageReceived indication is generated and transitioning to an access state based upon the ForwardTrafficChannelMAC.PageReceived indication. A method and apparatus is further provided, comprising determining if a ControlChannelMAC.PageReceived indication is generated and transitioning to an access state based upon the ControlChannelMAC.PageReceived indication. A method and apparatus is further provided, comprising determining if a PageUATI message is received and transitioning to an access state. A method and apparatus is further provided, comprising determining if an OpenConnection Command is queued and transitioning to an access state.

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A METHOD AND APPARATUS FOR TRANSITIONING FROM MONITOR STATE IN WIRELESS COMMUNICATION SYSTEMS

CLAIM OF PRIORITY UNDER 35 U.S.C. §119

[0001] The present Application for Patent claims priority to Provisional Application Ser. No. 60/731,126, entitled "METHOD AND APPARATUS FOR PROVIDING MOBILE BROADBAND WIRELESS LOWER MAC", filed October 27, 2005, assigned to the assignee hereof and expressly incorporated herein by reference.

BACKGROUND

Field

[0002] The present disclosure relates generally to wireless communication and more particularly to method and apparatus for transitioning from Monitor state by an access terminal.

Background

[0003] Wireless communication systems have become a prevalent means by which a majority of people worldwide have come to communicate. Wireless communication devices have become smaller and more powerful in order to meet consumer needs and to improve portability and convenience. The increase in processing power in mobile devices such as cellular telephones has lead to an increase in demands on wireless network transmission systems. Such systems typically are not as easily updated as the cellular devices that communicate there over. As mobile device capabilities expand, it can be difficult to maintain an older wireless network system in a manner that facilitates fully exploiting new and improved wireless device capabilities.

[0004] Wireless communication systems generally utilize different approaches to generate transmission resources in the form of channels. These systems may be code division multiplexing (CDM) systems, frequency division multiplexing (FDM) systems, and time division multiplexing (TDM) systems. One commonly utilized variant of FDM is orthogonal frequency division multiplexing (OFDM) that effectively partitions the overall system bandwidth into multiple orthogonal subcarriers. These subcarriers

may also be referred to as tones, bins, and frequency channels. Each subcarrier can be modulated with data. With time division based techniques, a each subcarrier can comprise a portion of sequential time slices or time slots. Each user may be provided with a one or more time slot and subcarrier combinations for transmitting and receiving information in a defined burst period or frame. The hopping schemes may generally be a symbol rate hopping scheme or a block hopping scheme.

[0005] Code division based techniques typically transmit data over a number of frequencies available at any time in a range. In general, data is digitized and spread over available bandwidth, wherein multiple users can be overlaid on the channel and respective users can be assigned a unique sequence code. Users can transmit in the same wide-band chunk of spectrum, wherein each user's signal is spread over the entire bandwidth by its respective unique spreading code. This technique can provide for sharing, wherein one or more users can concurrently transmit and receive. Such sharing can be achieved through spread spectrum digital modulation, wherein a user's stream of bits is encoded and spread across a very wide channel in a pseudo-random fashion. The receiver is designed to recognize the associated unique sequence code and undo the randomization in order to collect the bits for a particular user in a coherent manner.

[0006] A typical wireless communication network *(e.g.*, employing frequency, time, and/or code division techniques) includes one or more base stations that provide a coverage area and one or more mobile *(e.g.*, wireless) terminals that can transmit and receive data within the coverage area. A typical base station can simultaneously transmit multiple data streams for broadcast, multicast, and/or unicast services, wherein a data stream is a stream of data that can be of independent reception interest to a mobile terminal. A mobile terminal within the coverage area of that base station can be interested in receiving one, more than one or all the data streams transmitted from the base station. Likewise, a mobile terminal can transmit data to the base station or another mobile terminal. In these systems the bandwidth and other system resources are assigned utilizing a scheduler.

[0007] The signals, signal formats, signal exchanges, methods, processes, and techniques disclosed herein provide several advantages over known approaches. These include, for example, reduced signaling overhead, improved system throughput, increased signaling flexibility, reduced information processing, reduced transmission

bandwidth, reduced bit processing, increased robustness, improved efficiency, and reduced transmission power

SUMMARY

[0008] The following presents a simplified summary of one or more aspects in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated aspects, and is intended to neither identify key or critical elements of all aspects nor delineate the scope of any or all aspects. Its sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

[0009] According to yet another embodiment, a method is provided for transitioning from Monitor state by an access terminal, the method comprising determining if a ForwardTrafficChannelMAC.PageReceived indication is generated and transitioning to an access state based upon the ForwardTrafficChannelMAC.PageReceived indication.

[0010] According to yet another embodiment, a computer-readable medium is described having a first set of instructions for determining if a ForwardTrafficChannelMAC.PageReceived indication is generating and a second set of instructions for transitioning to an access state based upon the ForwardTrafficChannelMAC.PageReceived indication.

[0011] According to yet another embodiment, an apparatus operable in a wireless communication system is described which includes means for determining if a ForwardTrafficChannelMAC.PageReceived indication is generated and means for transitioning to an access state based upon the ForwardTrafficChannelMACPageReceived indication.

[0012] According to yet another embodiment, a method is provided for transitioning from Monitor state by an access terminal, the method comprising determining if a ControlChannelMAC.PageReceived indication is generated and transitioning to an access state based upon the ControlChannelMAC.PageReceived indication.

[0013] According to yet another embodiment, a computer-readable medium is described having a first set of instructions for determining if a ControlChannelMAC.PageReceived indication is generated and a second set of

instructions for transitioning to an access state based upon the ControlChannelMAC.PageReceived indication.

[0014] According to yet another embodiment, an apparatus operable in a wireless communication system is described which includes means for determining if a ControlChannelMAC.PageReceived indication is generated and means for transitioning to an access state based upon the ControlChannelMAC.PageReceived indication.

[0015] According to yet another embodiment, a method is provided for transitioning from Monitor state by an access terminal, the method comprising determining if a PageUATI message includes an UATI field that matches an UATI public data field of an Address management Protocol and transitioning to an access state when the PageUATI message includes the UATI field that matches the UATI public data field.

[0016] According to yet another embodiment, a computer-readable medium is described having a first set of instructions for determining if a PageUATI message includes an UATI field that matches an UATI public data field of an Address management Protocol and a second set of instructions for transitioning to an access state when the PageUATI message includes the UATI field that matches the UATI public data field.

[0017] According to yet another embodiment, an apparatus operable in a wireless communication system is described which includes means for determining if a PageUATI message includes an UATI field that matches an UATI public data field of an Address management Protocol and means for transitioning to an access state when the PageUATI message includes the UATI field that matches the UATI public data field.

[0018] According to yet another embodiment, a method is provided for transitioning from Monitor state by an access terminal, the method comprising determining if an OpenConnection Command is queued and transitioning to an access state if the OpenConnection Command is queued.

[0019] According to yet another embodiment, a computer-readable medium is described having a first set of instructions for determining if an OpenConnection Command is queued and a second set of instructions for transitioning to an access state if the OpenConnection Command is queued.

[0020] According to yet another embodiment, an apparatus operable in a wireless communication system is described which includes means for determining if an

OpenConnection Command is queued and means for transitioning to an access state if the OpenConnection Command is queued.

[0021] According to an embodiment, a method is provided for transitioning from Monitor state by an access terminal, the method comprising determining if an OverheadPararneterUptoDate value is '1', determining if at least one transmission of pBCHl has been read in a visit to the Monitor state, determining if no page is missed in a current superframe while transitioning to sleep state, determining if a current suspend period is not advertised and transitioning to sleep state upon determining if the OverheadParameterUptoDate is value is '1', if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised.

[0022] According to another embodiment, a computer-readable medium is described having a first set of instructions for determining if an OverheadParameterUptoDate value is '1', a second set of instructions for determining if at least one transmission of pBCHl has been read in a visit to the Monitor state, a third set of instructions for determining if no page is missed in a current superframe while transitioning to sleep state, a fourth set of instructions for determining if a current suspend period is not advertised and a fifth set of instructions for transitioning to sleep state upon determining if the OverheadParameterUptoDate is value is '1', if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised.

[0023] According to yet another embodiment, an apparatus operable in a wireless communication system is described which includes means for determining if an OverheadParameterUptoDate value is '1', means for determining if at least one transmission of pBCHl has been read in a visit to the Monitor state, means for determining if no page is missed in a current superframe while transitioning to sleep state, means for determining if a current suspend period is not advertised and means for transitioning to sleep state upon determining if the OverheadParameterUptoDate is value is '*V*, if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised.

[0024] To the accomplishment of the foregoing and related ends, the one or more aspects comprise the features hereinafter fully described and particularly pointed out in

the claims. The following description and the annexed drawings set forth in detail certain illustrative aspects of the one or more aspects. These aspects are indicative, however, of but a few of the various ways in which the principles of various aspects may be employed and the described aspects are intended to include all such aspects and their equivalents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] Fig. 1 illustrates aspects of a multiple access wireless communication system.

[0026] Fig. 2 illustrates aspects of a transmitter and receiver in a multiple access wireless communication system.

[0027] Figs. 3A and 3B illustrate aspects of superframe structures for a multiple access wireless communication system.

[0028] Fig. 4A illustrates a flow diagram of a process by an access terminal.

[0029] Fig. 4B illustrates one or more processors configured for transitioning to an access state from Monitor state by the access terminal.

[0030] Fig. 5A illustrates a flow diagram of a process by the access terminal.

[0031] Fig. 5B illustrates one or more processors configured for transitioning to a sleep state from Monitor state by the terminal.

DETAILED DESCRIPTION

[0032] Various aspects are now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout, hi the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more aspects. It may be evident, however, that such aspect(s) may be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing one or more aspects.

[0033] Referring to Fig. 1, a multiple access wireless communication system according to one aspect is illustrated. A multiple access wireless communication system 100 includes multiple cells, e.g. cells 102, 104, and 106. Iri the aspect of Fig. 1, each cell 102, 104, and 106 may include an access point 150 that includes multiple sectors. The multiple sectors are formed by groups of antennas each responsible for communication with access terminals in a portion of the cell. In cell 102, antenna

groups 112, 114, and 116 each correspond to a different sector. In cell 104, antenna groups 118, 120, and 122 each correspond to a different sector. In cell 106, antenna groups 124, 126, and 128 each correspond to a different sector.

[0034] Each cell includes several access terminals which are in communication with one or more sectors of each access point. For example, access terminals 130 and 132 are in communication base 142, access terminals 134 and 136 are in communication with access point 144, and access terminals 138 and 140 are in communication with access point 146.

[0035] Controller 130 is coupled to each of the cells 102, 104, and 106. Controller 130 may contain one or more connections to multiple networks, e.g. the Internet, other packet based networks, or circuit switched voice networks that provide information to, and from, the access terminals in communication with the cells of the multiple access wireless communication system 100. The controller 130 includes, or is coupled with, a scheduler that schedules transmission from and to access terminals. In other aspects, the scheduler may reside in each individual cell, each sector of a cell, or a combination thereof.

[0036] As used herein, an access point may be a fixed station used for communicating with the terminals and may also be referred to as, and include some or all the functionality of, a base station, a Node B, or some other terminology. An access terminal may also be referred to as, and include some or all the functionality of, a user equipment (UE), a wireless communication device, terminal, a mobile station or some other terminology.

[0037] It should be noted that while Fig. 1, depicts physical sectors, i.e. having different antenna groups for different sectors, other approaches may be utilized. For example, utilizing multiple fixed "beams" that each cover different areas of the cell in frequency space may be utilized in lieu of, or in combination with physical sectors. Such an approach is depicted and disclosed in co-pending US Patent Application Serial No. 11/260,895, entitled "Adaptive Sectorization in Cellular System."

[0038] Referring to Fig.2, a block diagram of an aspect of a transmitter system 210 and a receiver system 250 in a MIMO system 200 is illustrated. At transmitter system 210, traffic data for a number of data streams is provided from a data source 212 to transmit (TX) data processor 214. In an aspect, each data stream is transmitted over a respective transmit antenna. TX data processor 214 formats, codes, and interleaves the

traffic data for each data stream based on a particular coding scheme selected for that data stream to provide coded data.

[0039] The coded data for each data stream may be multiplexed with pilot data using OFDM, or other orthogonalization or non-orthogonalization techniques. The pilot data is typically a known data pattern that is processed in a known manner and may be used at the receiver system to estimate the channel response. The multiplexed pilot and coded data for each data stream is then modulated (i.e., symbol mapped) based on one or more particular modulation schemes (e.g., BPSK, QSPK, M-PSK, or M-QAM) selected for that data stream to provide modulation symbols. The data rate, coding, and modulation for each data stream may be determined by instructions performed on provided by processor 230.

[0040] The modulation symbols for all data streams are then provided to a TX processor 220, which may further process the modulation symbols (e.g., for OFDM). TX processor 220 then provides N_T modulation symbol streams to N_T transmitters (TMTR) 222a through 222t. Each transmitter 222 receives and processes a respective symbol stream to provide one or more analog signals, and further conditions (e.g., amplifies, filters, and upconverts) the analog signals to provide a modulated signal suitable for transmission over the MBVIO channel. N_T modulated signals from transmitters 222a through 222t are then transmitted from N_T antennas 224a through 224t, respectively.

[0041] At receiver system 250, the transmitted modulated signals are received by N_R antennas 252a through 252r and the received signal from each antenna 252 is provided to a respective receiver (RCVR) 254. Each receiver 254 conditions (e.g., filters, amplifies, and downconverts) a respective received signal, digitizes the conditioned signal to provide samples, and further processes the samples to provide a corresponding "received" symbol stream.

[0042] An RX data processor 260 then receives and processes the N_R received symbol streams from N_R receivers 254 based on a particular receiver processing technique to provide N_T "detected" symbol streams. The processing by RX data processor 260 is described in further detail below. Each detected symbol stream includes symbols that are estimates of the modulation symbols transmitted for the corresponding data stream. RX data processor 260 then demodulates, deinterleaves, and decodes each detected symbol stream to recover the traffic data for the data stream. The

processing by RX data processor 218 is complementary to that performed by TX processor 220 and TX data processor 214 at transmitter system 210.

[0043] RX data processor 260 may be limited in the number of subcarriers that it may simultaneously demodulate, e.g. 512 subcarriers or 5 MHz, and such a receiver should be scheduled on a single carrier. This limitation may be a function of its FFT range, e.g. sample rates at which the processor 260 may operate, the memory available for FFT, or other functions available for demodulation. Further, the greater the number of subcarriers utilized, the greater the expense of the access terminal.

[0044] The channel response estimate generated by RX processor 260 may be used to perform space, space/time processing at the receiver, adjust power levels, change modulation rates or schemes, or other actions. RX processor 260 may further estimate the signal-to-noise-and-interference ratios (SNRs) of the detected symbol streams, and possibly other channel characteristics, and provides these quantities to a processor 270. RX data processor 260 or processor 270 may further derive an estimate of the "operating" SNR for the system. Processor 270 then provides channel state information (CSI), which may comprise various types of information regarding the communication link and/or the received data stream. For example, the CSI may comprise only the operating SNR. In other aspects, the CSI may comprise a channel quality indicator (CQI), which may be a numerical value indicative of one or more channel conditions. The CSI is then processed by a TX data processor 278, modulated by a modulator 280, conditioned by transmitters 254a through 254r, and transmitted back to transmitter system 210.

[0045] At transmitter system 210, the modulated signals from receiver system 250 are received by antennas 224, conditioned by receivers 222, demodulated by a demodulator 240, and processed by a RX data processor 242 to recover the CSI reported by the receiver system. The reported CSI is then provided to processor 230 and used to (1) determine the data rates and coding and modulation schemes to be used for the data streams and (2) generate various controls for TX data processor 214 and TX processor 220. Alternatively, the CSI may be utilized by processor 270 to determine modulation schemes and/or coding rates for transmission, along with other information. This may then be provided to the transmitter which uses this information, which may be quantized, to provide later transmissions to the receiver.

[0046] Processors 230 and 270 direct the operation at the transmitter and receiver systems, respectively. Memories 232 and 272 provide storage for program codes and data used by processors 230 and 270, respectively.

[0047] At the receiver, various processing techniques may be used to process the N_R received signals to detect the N_T transmitted symbol streams. These receiver processing techniques may be grouped into two primary categories (i) spatial and space-time receiver processing techniques (which are also referred to as equalization techniques); and (ii) "successive nulling/equalization and interference cancellation" receiver processing technique (which is also referred to as "successive interference cancellation" or "successive cancellation" receiver processing technique).

[0048] While Fig. 2 discusses a MIMO system, the same system may be applied to a multi-input single-output system where multiple transmit antennas, e.g. those on a base station, transmit one or more symbol streams to a single antenna device, e.g. a mobile station. Also, a single output to single input antenna system may be utilized in the same manner as described with respect to Fig. 2.

[0049] The transmission techniques described herein may be implemented by various means. For example, these techniques may be implemented in hardware, firmware, software, or a combination thereof. For a hardware implementation, the processing units at a transmitter may be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, electronic devices, other electronic units designed to perform the functions described herein, or a combination thereof. The processing units at a receiver may also be implemented within one or more ASICs, DSPs, processors, and so on.

[0050] For a software implementation, the transmission techniques may be implemented with modules (e.g., procedures, functions, and so on) that perform the functions described herein. The software codes may be stored in a memory (e.g., memory 230, 272x or 272y in FIG. 2) and executed by a processor (e.g., processor 232, 27Ox or 27Oy). The memory may be implemented within the processor or external to the processor.

[0051] It should be noted that the concept of channels herein refers to information or transmission types that may be transmitted by the access point or access terminal. It

does not require or utilize fixed or predetermined blocks of subcarriers, time periods, or other resources dedicated to such transmissions.

[0052] Referring to Figs. 3A and 3B, aspects of superframe structures for a multiple access wireless communication system are illustrated. Fig. 3A illustrates aspects of superframe structures for a frequency division duplexed (FDD) multiple access wireless communication system, while Fig. 3B illustrates aspects of superframe structures for a time division duplexed (TDD) multiple access wireless communication system. The superframe preamble may be transmitted separately for each carrier or may span all of the carriers of the sector.

[0053] In both Figs. 3A and 3B, the forward link transmission is divided into units of superframes. A superframe may consist of a superframe preamble followed by a series of frames. In an FDD system, the reverse link and the forward link transmission may occupy different frequency bandwidths so that transmissions on the links do not, or for the most part do not, overlap on any frequency subcarriers. In a TDD system, N forward link frames and M reverse link frames define the number of sequential forward link and reverse link frames that may be continuously transmitted prior to allowing transmission of the opposite type of frame. It should be noted that the number of N and M may be vary within a given superframe or between superframes.

[0054] In both FDD and TDD systems each superframe may comprise a superframe preamble. In certain aspects, the superframe preamble includes a pilot channel that includes pilots that may be used for channel estimation by access terminals, a broadcast channel that includes configuration information that the access terminal may utilize to demodulate the information contained in the forward link frame. Further acquisition information such as timing and other information sufficient for an access terminal to communicate on one of the carriers and basic power control or offset information may also be included in the superframe preamble. In other cases, only some of the above and/or other information may be included in this superframe preamble.

[0055] As shown in Figs. 3A and 3B, the superframe preamble is followed by a sequence of frames. Each frame may consist of a same or a different number of OFDM symbols, which may constitute a number of subcarriers that may simultaneously utilized for transmission over some defined period. Further, each frame may operate according to a symbol rate hopping mode, where one or more non-contiguous OFDM symbols are assigned to a user on a forward link or reverse link, or a block hopping mode, where

users hop within a block of OFDM symbols. The actual blocks or OFDM symbols may or may not hop between frames.

[0056] The access terminal enters Monitor state in order to receive a Page, QuickPage or other messages from the access network. Using a communication link and based upon predetermined timing, system conditions, or other decision criteria, the access terminal receives the Page, QuickPage or other messages from the access network. The communication link may be implemented using communication protocols/standards such as World Interoperability for Microwave Access (WiMAX), infrared protocols such as Infrared Data Association (IrDA), short-range wireless protocols/technologies, Bluetooth® technology, ZigBee® protocol, ultra wide band (UWB) protocol, home radio frequency (HomeRF), shared wireless access protocol (SWAP), wideband technology such as a wireless Ethernet compatibility alliance (WECA), wireless fidelity alliance (Wi-Fi Alliance), 802.1 1 network technology, public switched telephone network technology, public heterogeneous communications network technology such as the Internet, private wireless communications network, land mobile radio network, code division multiple access (CDMA), wideband code division multiple access (WCDMA), universal mobile telecommunications system (UMTS), advanced mobile phone service (AMPS), time division multiple access (TDMA), frequency division multiple access (FDMA), orthogonal frequency division multiple (OFDM), orthogonal frequency division multiple access (OFDMA), orthogonal frequency division multiple FLASH (OFDM-FLASH), global system for mobile communications (GSM), single carrier (IX) radio transmission technology (RTT), evolution data only (EV-DO) technology, general packet radio service (GPRS), enhanced data GSM environment (EDGE), high speed downlink data packet access (HSPDA), analog and digital satellite systems, and any other technologies/protocols that may be used in at least one of a wireless communications network and a data communications network.

[0057] Fig. 4A illustrates a flow diagram of process 400, according to an embodiment. In an embodiment, at 404, it is determined whether a ForwardTrafficChannelMAC.PageReceived indication is received at the access terminal. At 412, the access terminal transitions to access state if the ForwardTrafficCharmelMAC.PageReceived indication is received. In another embodiment, at 406, it is determined whether a ControlChannelMAC.PageReceived indication is received at the access terminal. At 412, the access terminal transitions to the access state if the ControlChannelMAC.PageReceived indication is received. In yet

another embodiment, at 408, it is determined whether a PageUATI message is received where an Upper96UATI field matches the upper *96* bits of UATI public data field of an Address management Protocol. At 412, the access terminal transitions to the access state if the PageUATI message is received. In yet another embodiment, at 410, it is determined whether an OpenConnection Command is queued at the access terminal. At 412, the access terminal transitions to the access state if the OpenConnection Command is queued at the access terminal. The processes 404, 406, 408 and 410 may be occurring independent of each other or may be a joint decision.

[0058] Fig. 4B illustrates a processor 450 for transitioning to an access state from Monitor state by an access terminal. The processors referred to may be electronic devices and may comprise one or more processors configured for transitioning to access state according to the embodiment. In an embodiment, a processor 454 is configured for determining whether a ForwardTrafficChannelMAC.PageReceived indication is received at the access terminal. A processor 462 is further configured for transitioning the access terminal transitions to access state if the ForwardTrafficChannelMAC.PageReceived indication is received. In another embodiment, a processor 456 is configured for determining whether a ControlChannelMAC.PageReceived indication is received at the access terminal. A processor 462 is further configured for transitioning the access terminal to the access state if the ControlChannelMACPageReceived indication is received. In yet another embodiment, a processor 458 is configured for determining whether a PageUATI message is received where an Upper96UATI field matches the upper 96 bits of UATI public data field of an Address management Protocol. A processor 462 is further configured for transitioning the access terminal to the access state if the PageUATI message is received. In yet another embodiment, a processor 460 is configured for determining whether an OpenConnection Command is queued at the access terminal. A processor 462 is further configured for transitioning the access terminal transitions to the access state if the OpenConnection Command is queued at the access terminal. The functionality of the discrete processors 454 to 462 depicted in the figure maybe combined into a single processor 464. A memory 466 is also coupled to the processor 464.

[0059] In an embodiment, an apparatus is described which includes means for determining whether a ForwardTrafficChannelMACPageReceived indication is received at the access terminal. A means is further provided for transitioning the access

terminal transitions to access state if the ForwardTrafficChannelMAC.PageReceived indication is received. In another embodiment, a means is provided for determining whether a ControlChannelMAC.PageReceived indication is received at the access terminal. A means is further provided for transitioning the access terminal to the access state if the ControlChannelMAC.PageReceived indication is received. In yet another embodiment, a means is provided for determining whether a PageUATI message is received where an Upper96UATI field matches the upper 96 bits of UATI public data field of an Address management Protocol. A means is further provided for transitioning the access terminal to the access state if the PageUATI message is received. In yet another embodiment, a means is provided for determining whether an OpenConnection Command is queued at the access terminal. A means is further provided for transitioning the access terminal transitions to the access state if the OpenConnection Command is queued at the access terminal. The means described herein may comprise one or more processors.

[0060] Fig.5A illustrates a flow diagram of process 500, according to an embodiment. At 504, it is determined whether an OverheadParameterUptoDate is value is '1'. At 506, it is determined whether at least one transmission of pBCHl has been read in a visit to the Monitor state. Further at 508, it is determined whether no page is missed in a current superframe while transitioning to sleep state and at 510, it is determined whether a current suspend period is not advertised. At 512, the access terminal transitions to a sleep state upon determining if the OverheadParameterUptoDate is value is '1', if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised. The access terminal transitions to the sleep state only if all of the conditions described in processes 504 to 510 are met.

[0061] Fig. 5B illustrates a processor 550 for transitioning to a sleep state from Monitor state by an access terminal. The processors referred to may be electronic devices and may comprise one or more processors configured for transitioning to access state according to the embodiment. A processor 554 is configured for determining whether an OverheadParameterUptoDate is value is T . A processor 556 is configured for determining whether at least one transmission of pBCHl has been read in a visit to the Monitor state. A processor 558 is further configured for determining whether no page is missed in a current superframe while transitioning to sleep state and a processor

560 is configured for determining whether a current suspend period is not advertised. A processor 562 is configured for transitioning the access terminal to a sleep state upon determining if the OverheadPararneterUptoDate is value is T , if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised. The functionality of the discrete processors 554 to 562 depicted in the figure may be combined into a single processor 564. A memory 566 is also coupled to the processor 564.

[0062] In an embodiment, an apparatus is described which comprises means for determining whether an OverheadParameterUptoDate is value is '1', means for determining whether at least one transmission of pBCHl has been read in a visit to the Monitor state, means for determining whether no page is missed in a current superframe while transitioning to sleep state and a means for determining whether a current suspend period is not advertised. A means is further provided for transitioning the access terminal to a sleep state upon determining if the OverheadParameterUptoDate is value is ' 1', if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised. The means described herein may comprise one or more processors.

[0063] Furthermore, embodiments may be implemented by hardware, software, firmware, middleware, microcode, or any combination thereof. When implemented in software, firmware, middleware or microcode, the program code or code segments to perform the necessary tasks may be stored in a machine readable medium such as a separate storage(s) not shown. A processor may perform the necessary tasks. A code segment may represent a procedure, a function, a subprogram, a program, a routine, a subroutine, a module, a software package, a class, or any combination of instructions, data structures, or program statements. A code segment may be coupled to another code segment or a hardware circuit by passing and/or receiving information, data, arguments, parameters, or memory contents. Information, arguments, parameters, data, etc. may be passed, forwarded, or transmitted via any suitable means including memory sharing, message passing, token passing, network transmission, etc.

[0064] Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the description is not intended to be limited to the aspects shown herein

but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

CLAIMS

We claim:

1. A method for transitioning from a Monitor State by an access terminal in a wireless communication system, characterized in that:

determining if a ForwardTrafficChannelMAC.PageReceived indication is generated; and

transitioning to an access state based upon the ForwardTrafficChannelMAC .PageReceived indication.

2. A computer-readable medium including instructions stored thereon, characterized in that:

a first set of instructions for determining if a ForwardTrafficChannelMAC.PageReceived indication is generating; and

a second set of instructions for transitioning to an access state based upon the ForwardTrafficChannelMAC .PageReceived indication.

3. An apparatus operable in a wireless communication system, characterized in that:

means for determining if a ForwardTrafficChannelMAC.PageReceived indication is generated; and

means for transitioning to an access state based upon the ForwardTrafficChannelMAC .PageReceived indication.

4. A method for transitioning from a Monitor State by an access terminal in a wireless communication system, characterized in that:

determining if a ControlChannelMAC.PageReceived indication is generated; and

transitioning to an access state based upon the ControlChannelMAC .PageReceived indication.

5. A computer-readable medium including instructions stored thereon, characterized in that:

a first set of instructions for determining if a ControlChannelMAC.PageReceived indication is generated; and

a second set of instructions for transitioning to an access state based upon the ControlChannelMAC.PageReceived indication.

6. An apparatus operable in a wireless communication system, characterized in that:

means for determining if a ControlChannelMAC.PageReceived indication is generated; and

means for transitioning to an access state based upon the ControlChannelMAC.PageReceived indication.

7. A method for transitioning from a Monitor State by an access terminal in a wireless communication system, characterized in that:

determining if a PageUATI message includes an UATI field that matches an UATI public data field of an Address management Protocol; and

transitioning to an access state when the PageUATI message includes the UATI field that matches the UATI public data field.

8. A computer-readable medium including instructions stored thereon, characterized in that:

a first set of instructions for determining if a PageUATI message includes an UATI field that matches an UATI public data field of an Address management Protocol; and

a second set of instructions for transitioning to an access state when the PageUATI message includes the UATI field that matches the UATI public data field.

9. An apparatus operable in a wireless communication system, characterized in that:

means for determining if a PageUATI message includes an UATI field that matches an UATI public data field of an Address management Protocol; and

means for transitioning to an access state when the PageUATI message includes the UATI field that matches the UATI public data field.

10. A method for transitioning from a Monitor State by an access terminal in a wireless communication system, characterized in that:

determining if an OpenConnection Command is queued; and

transitioning to an access state if the OpenConnection Command is queued.

11. A computer-readable medium including instructions stored thereon, characterized in that:

a first set of instructions for determining if an OpenConnection Command is queued; and

a second set of instructions for transitioning to an access state if the OpenConnection Command is queued.

12. An apparatus operable in a wireless communication system, characterized in that:

means for determining if an OpenConnection Command is queued; and

means for transitioning to an access state if the OpenConnection Command is queued.

13. A method for transitioning from Monitor State by an access terminal in a wireless communication system, characterized in that:

determining if an OverheadParameterUptoDate value is T ;

determining if at least one transmission of pBCHl has been read in a visit to the Monitor state;

determining if no page is missed in a current superframe while transitioning to sleep state;

determining if a current suspend period is not advertised; and

transitioning to sleep state upon determining if the OverheadParameterUptoDate is value is '1', if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised.

14. A computer-readable medium including instructions stored thereon, characterized in that:

a first set of instructions for determining if an OverheadParameterUptoDate value is '1';

a second set of instructions for determining if at least one transmission of pBCHl has been read in a visit to the Monitor state;

a third set of instructions for determining if no page is missed in a current superframe while transitioning to sleep state;

a fourth set of instructions for determining if a current suspend period is not advertised; and

a fifth set of instructions for transitioning to sleep state upon determining if the OverheadParameterUptoDate is value is '1', if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised.

15. An apparatus operable in a wireless communication system, characterized in that:

means for determining if an OverheadParameterUptoDate value is '1';

means for determining if at least one transmission of pBCHl has been read in a visit to the Monitor state;

means for determining if no page is missed in a current superframe while transitioning to sleep state;

means for determining if a current suspend period is not advertised; and

means for transitioning to sleep state upon determining if the OverheadParameterUptoDate is value is T , if at least one transmission of pBCHl has been read in the visit to the Monitor state, if no page is missed in the current superframe while transitioning to the sleep state and if the current suspend period is not advertised.

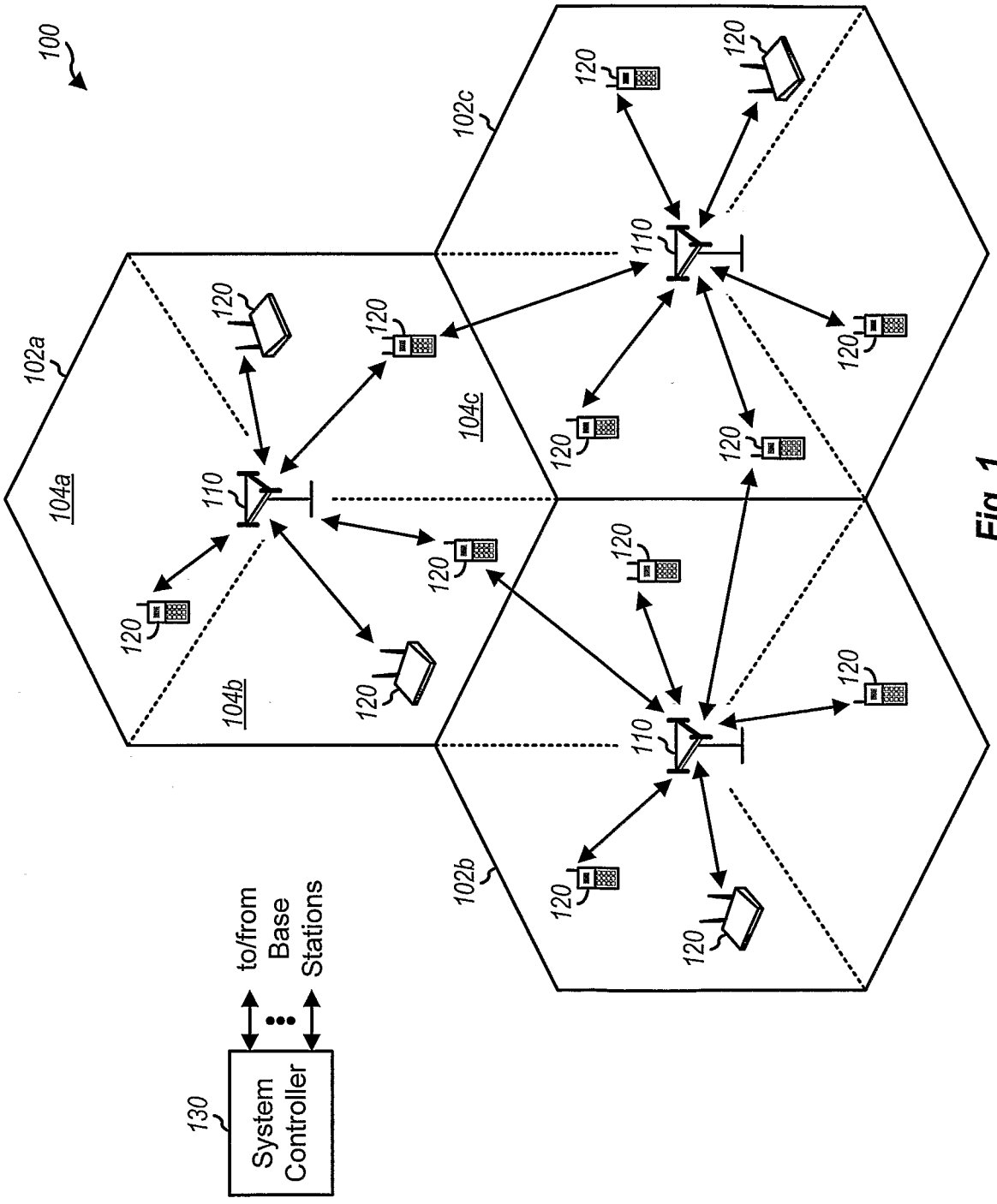
100
102a
102b
102c
104a
104b
104c
110
120
130
System Controller
to/from Base Stations

Fig. 1

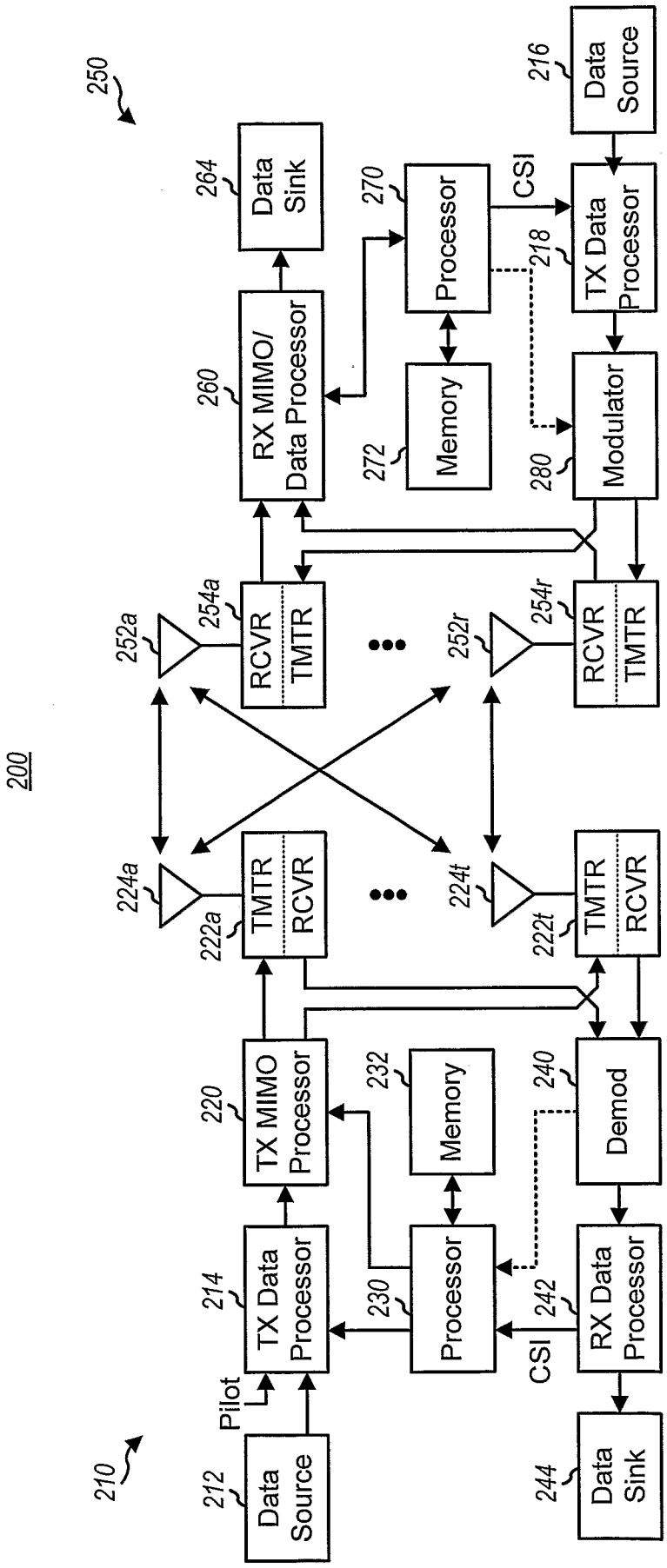
200
210
212
Data Source
Pilot
214
TX Data Processor
220
TX MIMO Processor
222a
TMTR
RCVR
224a
252a
254a
RCVR
TMTR
250
260
RX MIMO/ Data Processor
264
Data Sink
270
Processor
272
Memory
218
CSI
216
Data Source
TX Data Processor
280
Modulator
254r
252r
224t
222t
232
Memory
230
Processor
240
Demod
242
CSI
RX Data Processor
244
Data Sink

Fig 2

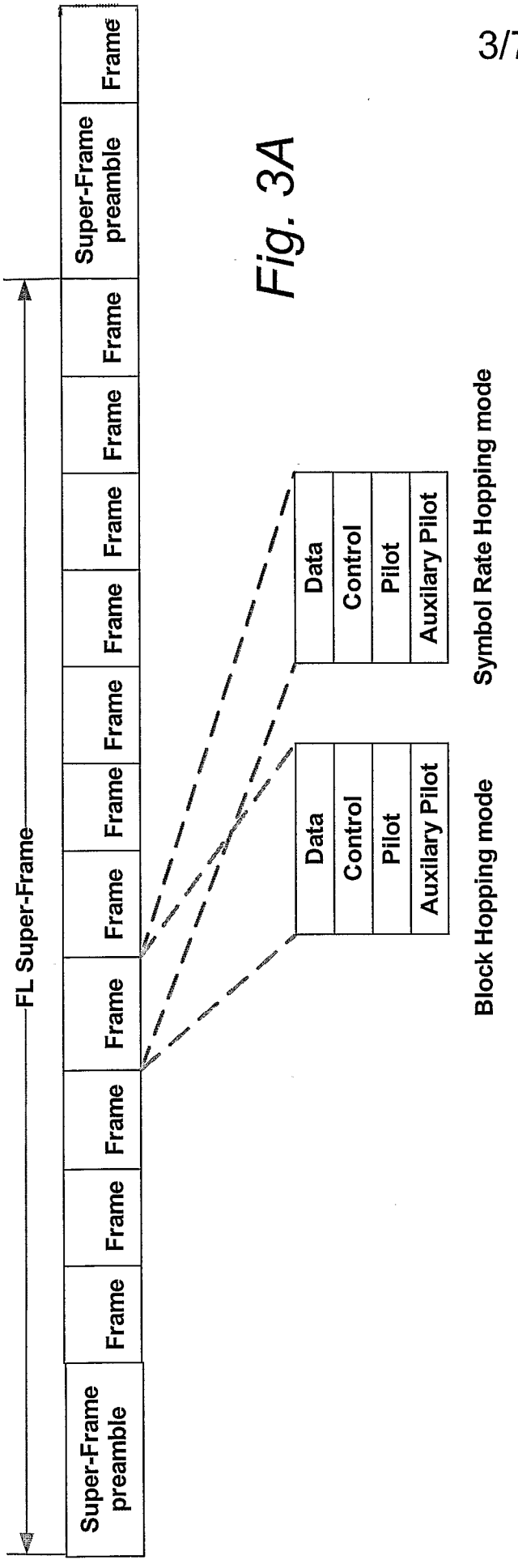
FL Super-Frame
Super-Frame preamble
Frame
Data
Control
Pilot
Auxilary Pilot
Block Hopping mode
Symbol Rate Hopping mode

Fig. 3A

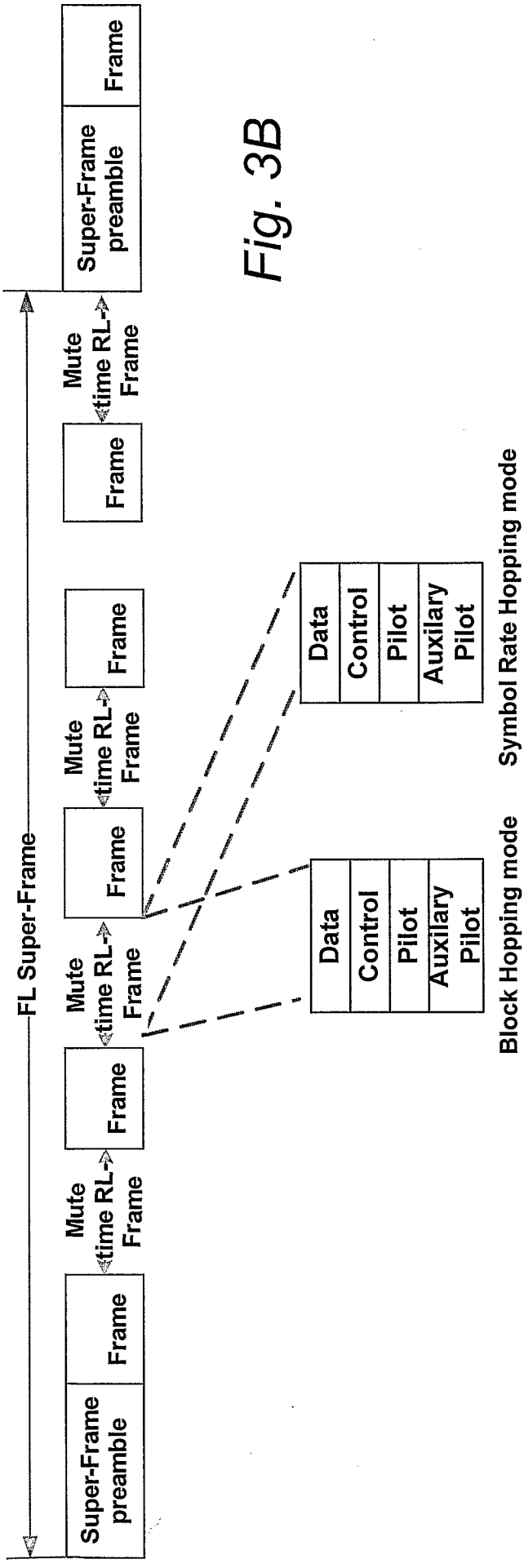
FL Super-Frame
Super-Frame preamble
Frame
Mute time RL-Frame
Data
Control
Pilot
Auxilary Pilot
Block Hopping mode
Symbol Rate Hopping mode

Fig. 3B

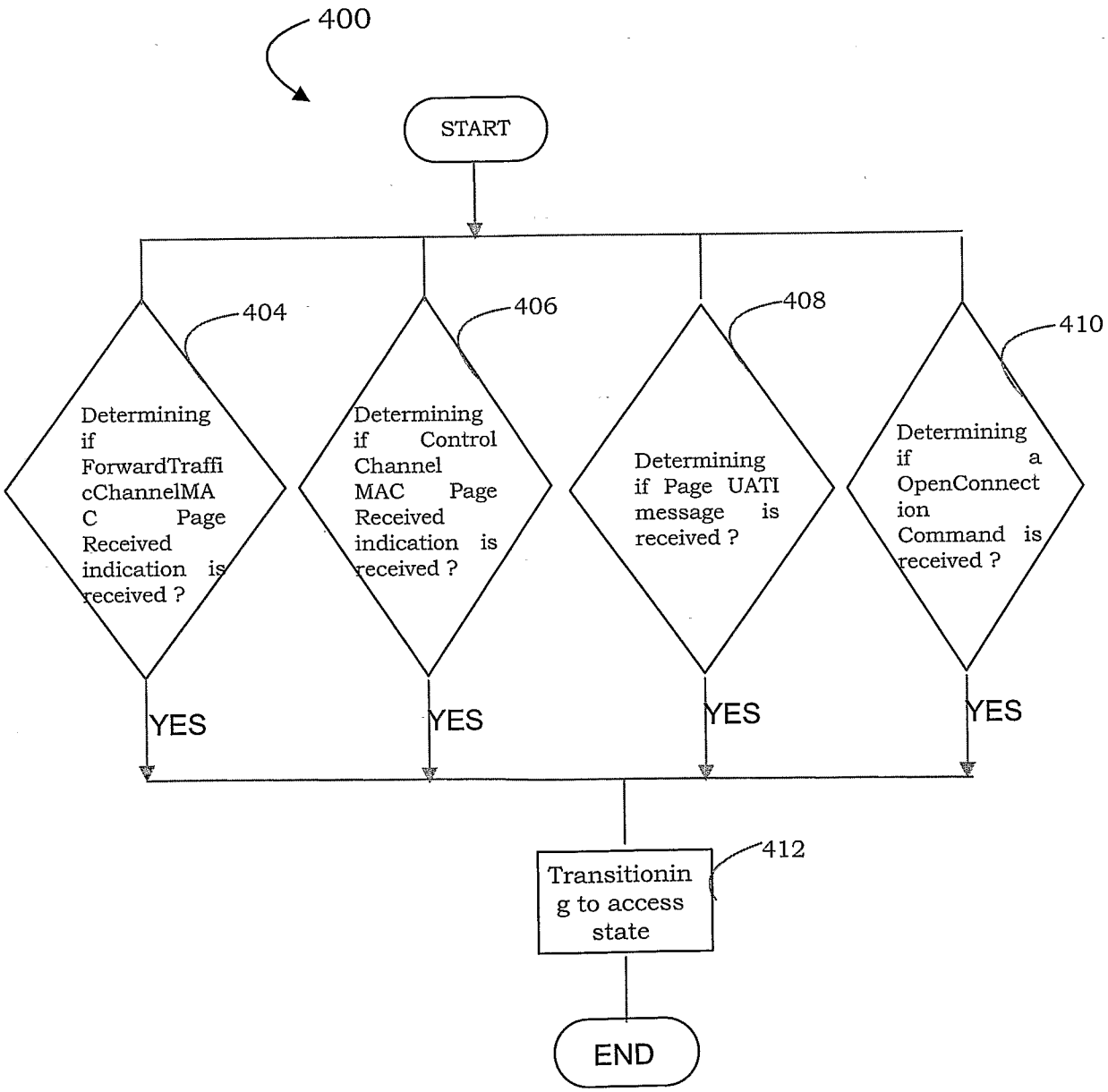
400
START
404
Determining if ForwardTraffiCChannelMAC Page Received indication is received ?
406
Determining if Control Channel MAC Page Received indication is received ?
408
Determining if Page UATI message is received ?
410
Determining if a OpenConnection Command is received ?
YES
YES
YES
YES
412
Transitioning to access state
END

FIGURE 4A

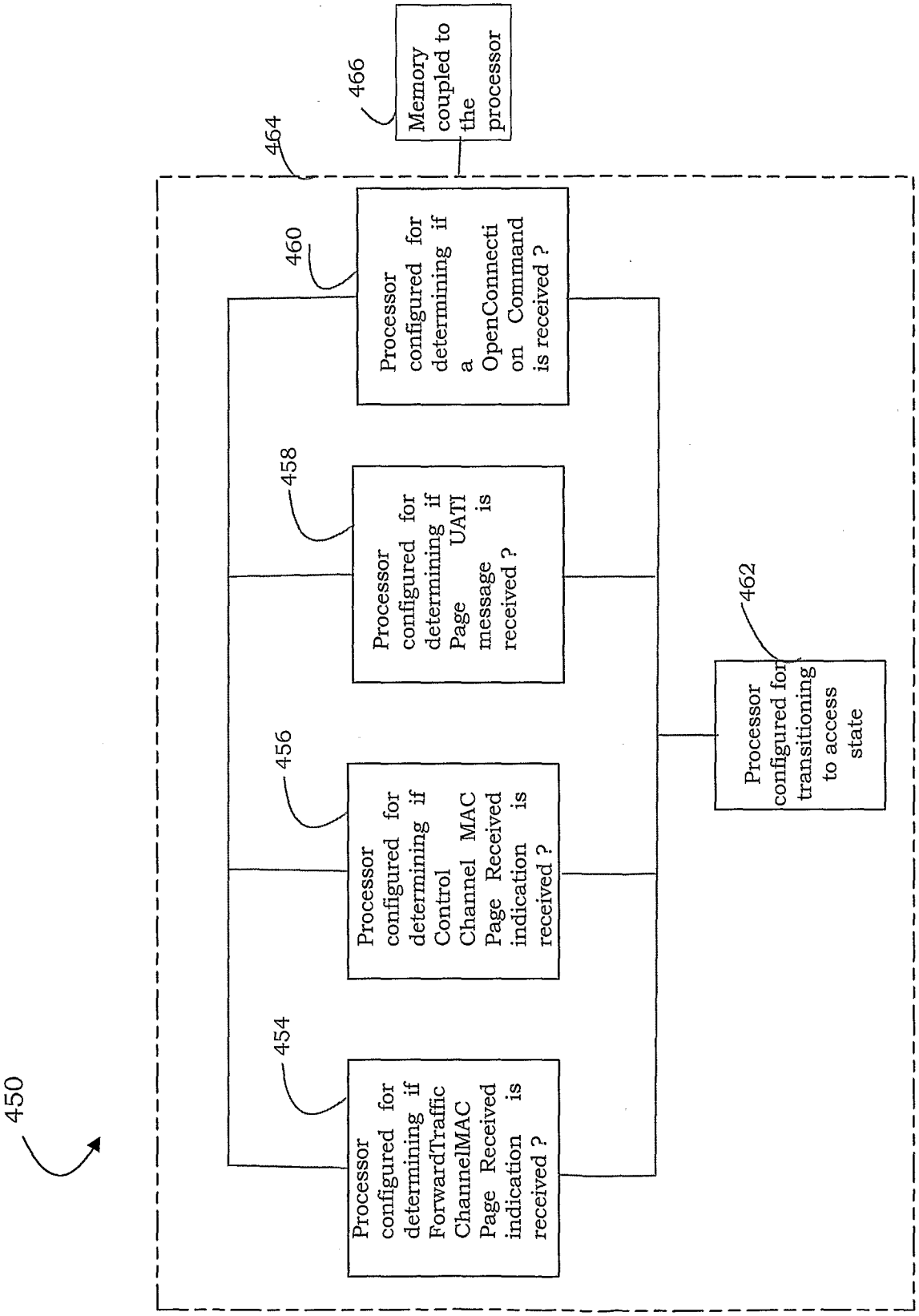
450
464
466
Memory coupled to the processor
460
Processor configured for determining if a OpenConnection Command is received ?
458
Processor configured for determining if Page UATI message is received ?
456
Processor configured for determining if Control Channel MAC Page Received indication is received ?
454
Processor configured for determining if ForwardTraffic ChannelMAC Page Received indication is received ?
462
Processor configured for transitioning to access state

FIGURE 4B

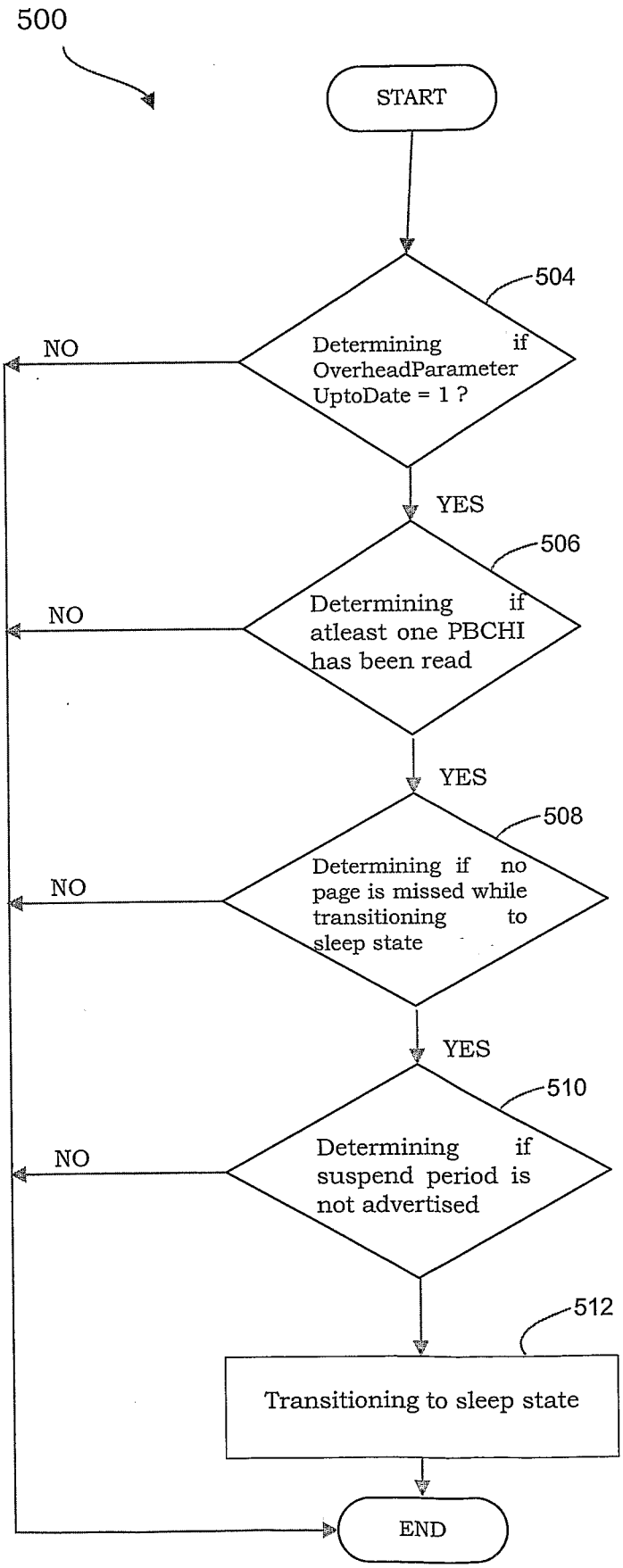
500
START
504
Determining if OverheadParameter UptoDate = 1 ?
NO
YES
506
Determining if atleast one PBCHI has been read
NO
YES
508
Determining if no page is missed while transitioning to sleep state
NO
YES
510
Determining if suspend period is not advertised
NO
512
Transitioning to sleep state
END

FIGURE 5A

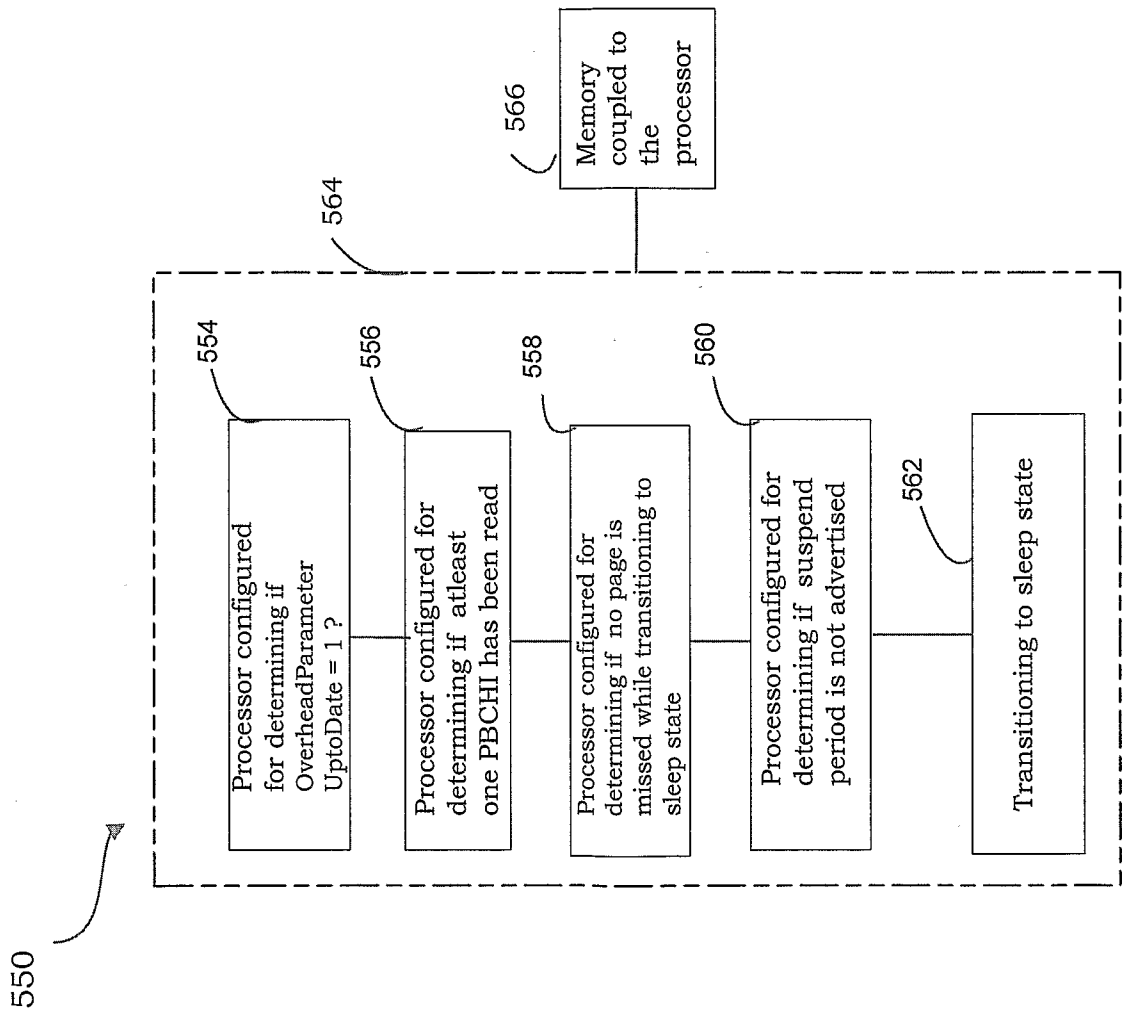
550
564
566
Memory coupled to the processor
554
Processor configured for determining if OverheadParameter UptoDate = 1 ?
556
Processor configured for determining if atleast one PBCHI has been read
558
Processor configured for determining if no page is missed while transitioning to sleep state
560
Processor configured for determining if suspend period is not advertised
562
Transitioning to sleep state

FIGURE 5B