[0001] # PROCEDURES FOR OPERATING IN LONG TERM EVOLUTION IDLE MODE

[0002] ## FIELD OF INVENTION

[0003] This application is related to wireless communications.

[0004] ## BACKGROUND

[0005] In the Third Generation Partnership (3GPP) long term evolution (LTE), measurements take the wireless transmit/receive unit (WTRU) mobility state into account. For example, whether a WTRU is moving with low or zero speed has a different effect on the measurements than a WTRU moving with high speed on a rural area or a highway due to the Doppler Effect in the radio transmission and reception. Therefore in LTE, different scaling factors for measurements apply to the WTRU in different mobility states to balance or normalize the Doppler Effects on different mobility speeds. How to maintain the WTRU mobility states between Idle mode and Connected mode is not specified.

[0006] In LTE, the WTRU has three mobility states: low mobility, medium mobility, and high mobility. In Idle mode, when the WTRU does not have a call, it counts the number of reselections. In Connected mode, when the WTRU has a call, it counts the number of handovers. The WTRU counts the number of reselections or the number of handovers and determines whether it is not moving (also called stationary), it is moving slow (also called normal mobility), or it is moving fast (also called high mobility). Reselections and handovers are treated differently because the time needed to reselect is different from the time needed to perform a handover. The mobility states cannot be carried over from Idle mode to Connected mode for most purposes. A mechanism of adapting the mobility state when the WTRU transitions from Idle mode to Connected mode is needed. Also, the mobility state between modes should not be lost, meaning if the WTRU is moving fast while in Idle mode, and then transitions to Connected mode, the WTRU should not have to restart the mobility state determination. For example,

if the WTRU is moving fast (i.e., in the high mobility state) it has an impact on how the WTRU performs reselections and handovers.

[0007] When the WTRU attempts to reselect to another cell, it needs to make sure that the target cell satisfies the minimum signal level, signal strength, and condition. The WTRU compares this data with some parameters that are transmitted by the network. That comparison is embodied in an equation called the S criteria. The S criteria effectively says how strong or weak the target cell is. If the S criteria, which is the difference between the signal strength and the threshold signaled by the network, is below zero, then the WTRU does not have to consider the target cell. If the S criteria is above zero, then the WTRU may proceed to camp on the target cell. The S criteria means that the signal strength of the target cell has to absolutely meet at least a minimum threshold, below which the network thinks that the target cell is not worth camping on. The LTE WTRU cell selection and reselection basic rules have the WTRU check the serving cell or another cell's signal strength using the S criteria. In LTE, one component in the S criteria, i.e., the Pcompensation parameter, remains undefined and needs to be specified.

[0008] LTE includes the concept of priority in cell reselection, which means that there are certain frequencies, for example, UMTS or GSM, that are given a priority. The WTRU has to follow the priority, so, for example, frequency "a" may be given priority one, frequency "b" may be given priority two, or vise versa. The WTRU has to make sure that it first tries to camp on frequency "a," and if it cannot find the cell of frequency "a," then it goes to frequency "b." Currently, in the standards, there is no clear indication how long these priorities are valid. The WTRU may be signaled a priority using system information or dedicated RRC messages. But when the WTRU considers the priorities to no longer be valid or expired is not described.

[0009] In UMTS systems, there is a parameter called Pcompensation, which compensates for the pathloss when a WTRU performs cell reselection. There is no clear indication in LTE to date of how the Pcompensation parameter

is going to be designed. This disclosure proposes some definitions of Pcompensation.

[0010] SUMMARY

[0011] Various procedures for operating a WTRU in LTE Idle mode are described. The procedures include: methods for applying cell reselection priorities in the WTRU, methods for converting a mobility state of the WTRU between operating modes, a method for assigning a mobility state to the WTRU, and a method for determining whether the WTRU may access a closed subscriber group cell. Also described are methods and an apparatus on the operations of the LTE mobility state transition mechanism between LTE WTRU Idle mode and Connected mode, a definition of the Pcompensation parameter for LTE, inter-frequency and inter-RAT cell reselection priority validity definitions, and coverage extension principles for closed subscriber group (CSG) cells.

[0012] BRIEF DESCRIPTION OF THE DRAWINGS

[0013] A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings, wherein:

[0014] Figure 1 shows an example wireless communication system including a plurality of wireless transmit/receive units (WTRUs) and an evolved Node B (eNB);

[0015] Figure 2 is an example functional block diagram of one WTRU and the eNB of Figure 1;

[0016] Figure 3 is a flowchart of a method for updating cell reselection priority information;

[0017] Figure 4 is a flowchart of a method for updating cell reselection priority information in connection with a timer;

[0018] Figure 5 is a flowchart of a method for converting the WTRU's mobility state when the WTRU changes RRC modes; and

[0019] Figure 6 is a flowchart of a method for assigning the WTRU's mobility state by the network when the WTRU changes RRC modes.

[0020] DETAILED DESCRIPTION

[0021] When referred to hereafter, the term "wireless transmit/receive unit (WTRU)" includes, but is not limited to, a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the term "base station" includes, but is not limited to, a Node B, an evolved Node B (eNB), a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0022] Figure 1 shows an example wireless communication system 100 including a plurality of WTRUs 110 and an eNB 120. As shown in Figure 1, the WTRUs 110 are in communication with the eNB 120. It should be noted that, although an example configuration of WTRUs 110 and an eNB 120 is depicted in Figure 1, any combination of wireless and wired devices may be included in the wireless communication system 100.

[0023] Figure 2 is an example functional block diagram 200 of one WTRU 110 and the eNB 120 of the wireless communication system 100 of Figure 1. As shown in Figure 2, the WTRU 110 is in communication with the eNB 120.

[0024] In addition to the components that may be found in a typical WTRU, the WTRU 110 includes a processor 112, a receiver 114, a transmitter 116, and an antenna 118. The receiver 114 and the transmitter 116 are in communication with the processor 112. The antenna 118 is in communication with both the receiver 114 and the transmitter 116 to facilitate the transmission and reception of wireless data. The processor 112 is configured to determine the LTE mobility state of the WTRU, determine cell reselection criteria, determine cell reselection priority validity, and determine a CSG cell coverage extension.

[0025] In addition to the components that may be found in a typical eNB, the eNB 120 includes a processor 122, a receiver 124, a transmitter 126, and an

antenna 128. The receiver 124 and the transmitter 126 are in communication with the processor 122. The antenna 128 is in communication with both the receiver 124 and the transmitter 126 to facilitate the transmission and reception of wireless data. The processor 122 is configured to determine the LTE mobility state of the WTRU, determine cell reselection criteria, determine cell reselection priority validity, and determine a CSG cell coverage extension.

[0026] Validity lifetime for LTE reselection priorities

[0027] The WTRU may use one or more of the following conditions to maintain its reselection priorities. In all the conditions listed below, the WTRU's already present priorities may be overwritten when new priorities are signaled by the network.

[0028] (1) WTRU power-on/WTRU power-off. In this case, once the WTRU receives the cell reselection priorities, they are retained until the WTRU is turned off or until the cell reselection priorities are overwritten by the network.

[0029] (2) Next system information (SI) update. The WTRU may maintain its cell reselection priorities until the next SI update. When the SI changes, the WTRU re-reads the SI and updates the cell reselection priorities. There might be certain conditions when the WTRU does not update the cell reselection priorities based on the new SI. For example, if the WTRU already has dedicated cell reselection priorities, then it might not override the cell reselection priorities provided by the SI.

[0030] In general, the cell reselection priority information provided by the SI is broadcast, so all WTRUs receive the same cell reselection priority information. Dedicated cell reselection priorities are sent to a given WTRU. So if a WTRU has dedicated cell reselection priorities, in the next SI update when the SI changes, the WTRU might not override the dedicated cell reselection priorities with the cell reselection priorities from the SI.

[0031] Figure 3 is a flowchart of a method 300 for updating cell reselection priority information. The method begins with the WTRU applying existing cell reselection priorities (step 302). A determination is made whether the WTRU

received dedicated cell reselection priorities (step 304). If the WTRU has received dedicated cell reselection priorities, then the WTRU applies the dedicated cell reselection priorities, overwriting the existing cell reselection priorities (step 306).

[0032] The WTRU may also receive timer information with the dedicated cell reselection priorities, to indicate the length of time that the dedicated cell reselection priorities are valid. If the WTRU does not receive timer information for the dedicated cell reselection priorities (step 308), then the method terminates (step 310). If the WTRU receives timer information for the dedicated cell reselection priorities (step 308), the timer is started (step 312). When the timer expires (step 314), this means that the dedicated cell reselection priorities are no longer valid.

[0033] If the WTRU has not received any dedicated cell reselection priorities (step 304) or if the timer has expired (step 314), then the WTRU waits to receive a SI update (step 316). After receiving the SI update, the WTRU overwrites the existing cell reselection priorities with information contained in the SI update (step 318) and the method terminates (step 310).

[0034] (3) Timer information. Along with the cell reselection priorities signaled to the WTRU, an optional parameter called validity time is defined, which tells the WTRU how long it may retain the cell reselection priorities. When the timer expires, the cell reselection priority information is discarded. In one embodiment, the timer only applies to dedicated cell reselection priorities received by the WTRU. In another embodiment, the timer is started when the WTRU enters the Connected mode.

[0035] When the timer expires, the WTRU re-reads the SI or requests the network to provide new cell reselection priorities. Alternatively, once the timer expires, the WTRU waits for the next available SI reading opportunity to update its cell reselection priorities. While the validity timer is running, the WTRU's cell reselection priorities may be overwritten if the WTRU receives dedicated cell reselection priorities.

[0036] Figure 4 is a flowchart of a method 400 for updating cell reselection priority information in connection with a timer. The method begins with the WTRU receiving cell reselection priorities (step 402). The WTRU also receives timer information (step 404) and starts a timer based on this information (step 406). A determination is made whether the timer has expired (step 408). If the timer has expired, then the WTRU has one of three options: the WTRU re-reads the SI immediately (step 410), the WTRU waits for the next regular opportunity to read the SI (step 412), or the WTRU requests new cell reselection priority information from the network (step 414). After the WTRU has received the new cell reselection priority information, it applies the new cell reselection priority information (step 416) and the method terminates (step 418).

[0037] If the timer has not expired (step 408), a determination is made whether the WTRU has received dedicated cell reselection priorities (step 420). If the timer has not expired, the WTRU waits until the timer has expired (step 408) or the WTRU receives dedicated cell reselection priorities (step 420). If the WTRU has received dedicated cell reselection priorities (step 420), then it applies the new cell reselection priority information (step 422) and resets the timer (step 424).

[0038] (4) Scope of cell reselection priorities. The scope of the cell reselection priorities may be defined as a simple variable with a few enumerated values. For example, the enumerated values may include: (a) only valid within a public land mobile network (PLMN) or (b) valid across many PLMNs. As another example, the enumerated values may include: (a) only valid within a Tracking Area, (b) valid across many Tracking Areas, (c) only valid within one LTE frequency layer, or (d) valid within several LTE frequency layer(s) (multicast-broadcast single frequency network (MBSFN) or not). The definition of the scope of the cell reselection priorities includes information for the WTRU to know when to read the new cell reselection priorities.

[0039] (5) RRC message forcing the WTRU to read the system information blocks (SIBs). The WTRU may be forced to read the SIBs to obtain new cell reselection priority information by using RRC messages. Existing RRC messages

may also be used to force the WTRU to update its cell reselection priority information. For example, when the WTRU goes into Idle mode, the RRC connection release or reject message may include a simple enumerated information element (IE) which may force the WTRU to read the SIBs.

[0040] In one embodiment, if the WTRU is in Idle mode and the SI changes, the network may send a new RRC message, like a paging message, to the WTRU to force the WTRU to read the SIBs to obtain the new SI. One reason that the SI may change is if the cell reselection priorities change; however, the SI may change for any reason.

[0041] Mobility state handling between Idle mode and Connected mode

[0042] There are three mobility states defined in LTE: the normal state, the medium state, and the high state. In the current 3GPP LTE specification (TS 36.304), the LTE WTRU mobility state in Idle mode is determined based on a number of cell reselections experienced during a time period T_{CRmax} and a comparison to the threshold values N_{CR_H} and N_{CR_M}. In Connected mode, a number of handovers is used as a criteria for mobility.

[0043] Given the above conditions, to retain or maintain the mobility state between the Idle mode and the Connected mode, a relationship between the mobility states and their quantifying/qualifying parameters is proposed. For example, X number of cell reselections in Idle mode may map to Y number of handovers in Connected mode or vice versa. Mapping the number of cell reselections to the number of handovers or the number of handovers to the number of cell reselections may reflect the geographical cell size.

[0044] Convert the mobility state directly between the LTE WTRU modes

[0045] Several rules for defining a direct mapping for the WTRU mobility state between Idle mode and Connected mode are proposed.

[0046] (1) Symmetric same state direct mapping. In general, state A in Idle mode maps to state A in Connected mode. For example, the Idle mode normal state maps to the Connected mode normal state, the Idle mode medium state

maps to the Connected mode medium state, and the Idle mode high state maps to the Connected mode high state. This approach might be useful because when the WTRU changes modes (Idle to Connected or Connected to Idle), the WTRU's moving speed remains the same.

[0047] (2) Asymmetric state direct mapping. In general, state A in Idle mode maps to state B in Connected mode or vice versa. For example, the Idle mode normal state maps to the Connected mode medium state, the Idle mode medium state and high state both map to the Connected mode high state. The latter mapping assumes that the measurement requirement is stricter in the Connected mode, thus converting a low mobility state in the Idle mode to a higher mobility state in the Connected mode. If the measurement requirement is stricter in the Idle mode, a higher mobility state in the Connected mode may be mapped to a lower mobility state in the Idle mode, e.g., the Connected mode normal state maps to the Idle mode medium state, the Connected mode medium state and high state both map to the Idle mode high state, etc.

[0048] (3) Reset the mobility state. Alternatively, the WTRU may reset its mobility state to the stationary or normal mobility state when it changes modes, irrespective of the WTRU's mobility state in the previous mode.

[0049] Figure 5 is a flowchart of a method 500 for converting the WTRU's mobility state when the WTRU changes RRC modes. The method 500 begins with the WTRU operating in a mobility state in an RRC mode (step 502). For example, the WTRU may be operating in the low mobility state while in Idle mode. The WTRU changes RRC modes, for example from Idle mode to Connected mode (step 504). The WTRU's mobility state may be mapped between the two RRC modes (step 506) or the mobility state may be reset upon changing RRC modes (step 508). The new mobility state is applied to the current RRC mode (step 510) and the method terminates (step 512).

[0050] Inherit the mobility state and adjust the state during WTRU mode change

[0051] This method proposes that when the WTRU changes RRC operating modes (i.e., between Idle mode and Connected mode), the mobility state is handled as follows.

[0052] (1) Inherit the mobility state initially when the RRC mode changes.

[0053] (2) Adjust the mobility state in the next short period with the inherited parameter values in the old mode (e.g., Idle mode) to parameter values in the new mode (e.g., Connected mode) according to the following conversions. The "short period" is a predefined period of time in which the WTRU needs to finish converting the parameter values between RRC modes. The short period may be known to the WTRU or may be signaled to the WTRU by the network.

[0054] (a) Define system-configurable conversion factors (one for all parameters or one for each parameter) to convert the mobility state parameters from one RRC mode to the other for: the state thresholds (i.e., N_{CR_H} or N_{CR_M} to the comparable handover (HO) thresholds), the time periods, and the current cell reselection (CR) or HO count. As an example, employing the conversion factors $FAC_{CR_HO_H}$ and $FAC_{CR_HO_M}$ to scale the N_{CR_H} and the N_{CR_M} thresholds (the variables for HO may be N_{HO_H} and N_{HO_M}) with respect to CR and HO, such that

$$N_{CR_H} = FAC_{CR_HO_H} \times N_{HO_H} \quad \text{Equation (1)}$$

$$N_{CR_M} = FAC_{CR_HO_M} \times N_{HO_M} \quad \text{Equation (2)}$$

[0055] The factor $FAC_{T_CR_HO}$ may be used to convert $T_{MaxHyst}$ between CR and HO.

$$T_{MaxHyst\text{-}CR} = FAC_{T_CR_HO} \times T_{MaxHyst\text{-}HO} \quad \text{Equation (3)}$$

[0056] (b) Alternatively, maintain the state thresholds and the time period, but convert the counts between the CR and HO. Therefore, a conversion factor ($FAC_{CR_HO_COUNT}$) is needed when the WTRU's RRC mode changes (from Idle mode to Connected mode or vise versa). For example, the counts before the state change are $Count_{HO}$ and $Count_{CR}$, respectively. When the state changes, the scale factor $FAC_{CR_HO_COUNT}$ is applied to convert the values.

$$Count_{HO} = Count_{HO} \times FAC_{CR_HO_COUNT} \quad \text{Equation (4)}$$

$$Count_{CR} = Count_{CR} \times FAC_{CR_HO_COUNT} \quad \text{Equation (5)}$$

[0057] The resulting new scaled counts may be used to compare to the unchanged threshold values in the new state. For example, the scaled $Count_{CR}$ is compared with the unscaled N_{CR_H} threshold.

[0058] Network-based mobility state assignments

[0059] Based on the detected or reported WTRU mobility state, the network may assign a mobility state for the WTRU when the RRC mode changes. The assigned mobility state may be temporary and may be adjusted later using new parameters.

[0060] (1) The WTRU reports its mobility state by sending a RRC message. The WTRU retains its current mobility state for a predetermined period of time or the WTRU adjusts its mobility state during this period using one of the methods described above. One of the existing RRC messages (for example, RRC-Connection-Req or RRC-Re-Establishment-Req) may be used or other new or existing RRC messages may be defined or modified for this purpose. The WTRU reports its mobility state when it changes RRC modes.

[0061] (2) The network then assigns or informs the WTRU of its mobility state by another RRC message (for example, RRC-Connection-Setup, Re-Establishment-Resp, HO-Command, RRC-Connection-Release, or any other defined or modified RRC message).

[0062] (3) A RRC message may be defined so that when the WTRU has established a connection with the network, it sends a mobility state request message with the mobility state calculated from the Idle mode. The network sends back a mobility state confirm message with the mobility state it thinks the WTRU should have. During this period, the WTRU may not have to perform any mobility calculations.

[0063] Figure 6 is a flowchart of a method 600 for assigning the WTRU's mobility state by the network when the WTRU changes RRC modes. The method 600 begins with the WTRU operating in a mobility state in an RRC mode (step 602). For example, the WTRU may be operating in the low mobility state while in

Idle mode. The WTRU changes RRC modes, for example from Idle mode to Connected mode (step 604).

[0064] The WTRU reports its current mobility state to the network (step 606). Optionally, the WTRU may request that the network assign it a new mobility state (step 608). The WTRU receives a new mobility state (step 610), either upon the network's initiation or in response to a request from the WTRU. The new mobility state is applied to the current RRC mode (step 612) and the method terminates (step 614).

[0065] S criteria Pcompensation

[0066] The cell selection criterion S is fulfilled when:

$$Srxlev > 0 \qquad \text{Equation (6)}$$

where

$$Srxlev = Q_{rxlevmeas} - (Q_{rxlevmin} - Q_{rxlevminoffset}) - Pcompensation \qquad \text{Equation (7)}$$

[0067] where Srxlev is the cell selection received signal level value in dB, $Q_{rxlevmeas}$ is the measured cell received signal level value (RSRP), $Q_{rxlevmin}$ is the minimum required received signal level in the cell (in dBm), and $Q_{rxlevminoffset}$ is only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a visited PLMN.

[0068] In UMTS, the Pcompensation parameter (which may be defined as, for example, max(UE_TXPWR_MAX_RACH − P_MAX, 0)) is used to take the uplink interference into account for the cell measurement. In UMTS, each WTRU's uplink power is another WTRU's interference. When the maximum allowed uplink transmit power (UE_TXPWR_MAX_RACH) is high, it implies that the uplink interference is also high. Therefore, it presents as an unfavorable factor to the S criteria in terms of cell selection or cell reselection (i.e., $Q_{rxlevmeas}$ needs to be stronger to fulfill the S criteria).

[0069] In LTE, the intra-cell interference between sub-carriers is supposedly none or very low. Thus, the interference between WTRUs in terms of uplink RACH is assumed (in this case) to be small to negligible. The following options are proposed.

[0070] (1) Remove the Pcompensation term from the equation such that

$$Srxlev = Q_{rxlevmeas} - (Q_{rxlevmin} - Q_{rxlevminoffset}) \quad \text{Equation (8)}$$

[0071] The value of $Q_{rxlevminoffset}$ should already compensate for the value of Pcompensation, meaning that $Q_{rxlevminoffset}$ may be defined so that Pcompensation is not needed.

[0072] (2) Allow the Pcompensation term in Equation (7) to affect the Srxlev in both ways, i.e., require $Q_{rxlevmeas}$ to be stronger or weaker to fulfill the S criteria. Set Pcompensation = (UE_TXPWR_MAX_RACH – P_MAX). Consequently, if the system published UE_TXPWR_MAX_RACH is greater than the WTRU's P_MAX, Pcompensation is positive, requiring $Q_{rxlevmeas}$ to be higher to meet the condition Srxlev > 0. If UE_TXPWR_MAX_RACH is smaller than the WTRU's P_MAX, Pcompensation is negative, requiring $Q_{rxlevmeas}$ to be lower to meet the condition Srxlev > 0 (as opposed to in UMTS, where Pcompensation = max(UE_TXPWR_MAX_RACH – P_MAX, 0)). This means that when UE_TXPWR_MAX_RACH is smaller than the WTRU's P_MAX, Pcompensation is 0, thereby not contributing to the equation.

[0073] (3) Another option for Pcompensation is to tie the uplink compensation with the pathloss (the distance from the eNB, i.e., the pathloss = CELL_TX_POWER – $Q_{rxlevmeas}$) that the WTRU measures in the LTE cell. So the greater the value of the pathloss, the stronger or weaker is the compensation to the S criteria. For the Srxlev formula in Equation (7), Pcompensation = compensate (pathloss, network or system defined comp-value-table), where compensate may be any function returning the compensation value based on the current WTRU pathloss and the network defined compensation vectors.

[0074] Two examples on the pathloss to compensation value mapping are as follows.

[0075] (a) The Pcompensation value results from a function of the pathloss value.

$$Pcompensation = (a \times pathloss) + b \quad \text{Equation (9)}$$

[0076] where a is a scaling factor and b is an offset. Both a and b may be any positive or negative numbers, fractions, or 0. It is noted that this may be linear (i.e., a and b are consistently one value throughout) or discrete, applying to ranges of measured pathloss. For example, for pathloss measurements between 30 and 40dBs, a is 2/3 and b is 4, while for pathloss measurements between 40 and 50dBs, a is 3/4 and b is 5, and so on.

[0077] The pathloss value is based on the current measurement (i.e., together with the $Q_{rxlevmeas}$, say the n^{th}) or the previous measurement (say the $n-1^{th}$) to smooth out the possible jittering. The values of a and b may be signaled to the WTRU through RRC signaling, SIB signaling, may be predefined in the specification, or the WTRU may be preconfigured with the values.

[0078] (b) The Pcompensation value is obtained from a standards-defined or network-published (via SI) mapping table, such as:

Pathloss in dB	Pcompensation in dB
30	3
31	3.1
32	3.2
…	…
150	9

Other values or tables may also be used.

[0079] Coverage extension subscription

[0080] Closed subscriber group (CSG) coverage extension means that if a CSG cell may be used to extend the coverage of the macro cell, then the CSG cell may be put in a particular place to provide service in areas where the macro cell is not able to provide service. A network operator may deploy CSG cells for

coverage extension purposes. Some users may subscribe to this service and others may not.

[0081] The WTRU may have a configurable parameter (e.g., one bit) that represents the subscription status of the user/WTRU to these services. At least one of non-access stratum (NAS), RRC, or Open Mobile Alliance (OMA) Device Management signaling may be used by the network to configure this parameter. This parameter may be stored in the WTRU in non-volatile memory, in an application on the Universal Integrated Circuit Card (UICC) (e.g., Universal Subscriber Identity Module (USIM) or LTE equivalent), or in some other place within the WTRU (e.g., Read-Only Memory).

[0082] The WTRU may use the coverage extension parameter to determine whether it has access to a coverage extension CSG cell (this may also be referred to as a hybrid cell). A WTRU that detects (in Idle mode or in Connected mode) a coverage extension CSG cell may determine that it has access to that CSG cell if the coverage extension parameter within the WTRU indicates a valid subscription (e.g., by the bit being set) to coverage extension services. The WTRU may detect that a cell is a coverage extension CSG cell using at least one of the following.

[0083] (1) The one bit CSG indicator on the system information (e.g., SIB1) being set to true.

[0084] (2) A Physical Cell ID corresponding to a CSG cell.

[0085] (3) An indicator on the broadcast channel (e.g., one bit) on the system information (e.g., SIB1) indicating that the cell is for coverage extension (e.g., a one bit indicator or a public/private CSG cell indicator). The coverage extension indicator may be an optional bit, may only be present only if the CSG indicator is set to "True," or may be mandatory.

[0086] (4) A Physical Cell ID corresponding to a coverage extension CSG cell.

[0087] A WTRU with a valid coverage extension CSG cell would not have to verify the presence of the CSG ID of the coverage extension CSG cell in its white list to confirm accessibility and would be able to select/reselect/handover to such

a coverage extension CSG cell without verifying the CSG ID on its white list. A WTRU with a valid coverage extension subscription may automatically add the CSG IDs of accessible coverage extension CSG cells to its white list.

[0088] A WTRU without a valid coverage extension subscription (indicated by a certain value of the configurable parameter, e.g., the bit not being set) would not be able to access a coverage extension CSG cell. Such a WTRU may, however, have access to this cell if the CSG ID of the coverage extension CSG cell was programmed in its white list.

[0089] Embodiments

[0090] 1. A method for applying cell reselection priorities in a wireless transmit/receive unit includes receiving and applying cell reselection priorities, receiving timer information relating to the cell reselection priorities, starting a timer based on the received timer information, and on a condition that the timer expires, obtaining new cell reselection priorities and applying the new cell reselection priorities.

[0091] 2. The method according to embodiment 1, wherein the obtaining includes re-reading system information immediately to obtain the new cell reselection priorities.

[0092] 3. The method according to embodiment 1, wherein the obtaining includes re-reading system information at a next regular opportunity to obtain the new cell reselection priorities.

[0093] 4. The method according to embodiment 1, wherein the obtaining includes requesting the new cell reselection priorities.

[0094] 5. The method according to one of embodiments 1–4, wherein on a condition that the timer has not expired, the method further including determining whether new cell reselection priorities have been received and on a condition that new cell reselection priorities have been received, applying the new cell reselection priorities and resetting the timer based on the received timer information.

[0095] 6. A method for applying cell reselection priorities in a wireless transmit/receive unit includes receiving and applying cell reselection priorities, receiving information on a scope of the cell reselection priorities, and reading new cell reselection priorities at a time indicated by the scope information.

[0096] 7. The method according to embodiment 6, wherein the scope information includes a variable with an enumerated value.

[0097] 8. The method according to embodiment 7, wherein the enumerated value is one of: valid within one public land mobile network, valid across multiple public land mobile networks, valid within one tracking area, valid across multiple tracking areas, valid within one frequency layer, or valid within multiple frequency layers.

[0098] 9. A method for converting a mobility state of a wireless transmit/receive unit (WTRU) between operating modes includes determining a mobility state of the WTRU in a first operating mode, mapping the mobility state in the first operating mode to a second mobility state in a second operating mode, transitioning the WTRU from the first operating mode to the second operating mode, and applying the second mobility state to the second operating mode.

[0099] 10. The method according to embodiment 9, wherein the mapping includes mapping the mobility state in the first operating mode to the same mobility state in the second operating mode.

[0100] 11. The method according to embodiment 9, wherein the mapping includes mapping the mobility state in the first operating mode to a different mobility state in the second operating mode.

[0101] 12. A method for converting a mobility state of a wireless transmit/receive unit (WTRU) between operating modes includes transitioning the WTRU from a first operating mode to a second operating mode and resetting the mobility state to a stationary state or a normal mobility state in response to the WTRU transitioning to the second operating mode.

[0102] 13. A method for assigning a mobility state to a wireless transmit/receive unit (WTRU) includes transitioning the WTRU from a first operating mode to a second operating mode, reporting a mobility state in the

second operating mode to a network, receiving a new mobility state from the network, and applying the new mobility state to the second operating mode.

[0103] 14. The method according to embodiment 13, wherein the reporting includes sending a radio resource control (RRC) message and the receiving includes receiving a RRC message.

[0104] 15. The method according to embodiments 13 or 14, further including requesting the new mobility state.

[0105] 16. The method according to embodiment 15, wherein the requesting is performed at the same time as the reporting.

[0106] 17. The method according to embodiment 15, wherein the requesting is performed after the reporting.

[0107] 18. A method for determining whether a wireless transmit/receive unit (WTRU) may access a closed subscriber group (CSG) cell including receiving a CSG subscription status, storing the CSG subscription status, detecting a CSG cell, and examining the stored CSG subscriber status to determine whether the WTRU may access the detected CSG cell.

[0108] 19. The method according to embodiment 18, wherein the detecting includes detecting whether the CSG cell is a coverage extension CSG cell.

[0109] 20. The method according to embodiments 18 or 19, wherein the detecting includes examining an indicator in system information.

[0110] 21. The method according to embodiments 18 or 19, wherein the detecting includes examining a physical cell identity of the detected CSG cell.

[0111] 22. The method according to one of embodiments 18–21, wherein on a condition that the WTRU may access the detected CSG cell, the method further includes adding an identity of the detected CSG cell to a white list of accessible cells stored at the WTRU and accessing the detected CSG cell.

[0112] 23. The method according to one of embodiments 18–21, wherein on a condition that the WTRU cannot access the detected CSG cell, the method further includes determining whether an identity of the detected CSG cell is in a

white list of accessible cells stored at the WTRU and accessing the detected CSG cell on a condition that the identity of the detected CSG cell is in the white list.

[0113] 24. A wireless transmit/receive unit configured to perform the method of one of embodiments 1–23.

[0114] Although features and elements are described above in particular combinations, each feature or element may be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware incorporated in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0115] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[0116] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet

browser, and/or any wireless local area network (WLAN) or Ultra Wide Band (UWB) module.

* * *

CLAIMS

1. A method for performing cell reselection in a long term evolution (LTE) wireless transmit/receive unit, comprising:

receiving cell reselection priorities;

receiving timer information that indicates a length of time for which the cell reselection priorities are valid;

starting a timer based on the received timer information; and

performing cell reselection using the cell reselection priorities on a condition that the timer has not expired.

2. The method according to claim 1, further comprising:

reading system information to obtain new cell reselection priorities on a condition that the timer has expired.

3. The method according to claim 1, further comprising:

reading system information at a next regular opportunity to obtain new cell reselection priorities on a condition that the timer has expired.

4. The method according to claim 1, further comprising:

requesting new cell reselection priorities on a condition that the timer has expired.

5. The method according to claim 1, the method further comprising:

on a condition that the timer has not expired:

determining whether new cell reselection priorities have been received;

performing cell reselection using the new cell reselection priorities; and

resetting the timer based on the received timer information.

6. A long term evolution (LTE) wireless transmit/receive unit (WTRU) configured to perform cell reselection, comprising:

a receiver configured to:

receive cell reselection priorities; and

receive timer information that indicates a length of time for which the cell reselection priorities are valid; and

a processor configured to:

start a timer based on the received timer information; and

perform cell reselection using the cell reselection priorities on a condition that the timer has not expired.

7. The WTRU according to claim 6, wherein the processor is further configured to read system information to obtain new cell reselection priorities on a condition that the timer has expired.

8. The WTRU according to claim 6, wherein the processor is further configured to read system information at a next regular opportunity to obtain new cell reselection priorities on a condition that the timer has expired.

9. The WTRU according to claim 6, wherein the processor is further configured to request new cell reselection priorities on a condition that the timer has expired.

10. The WTRU according to claim 6, wherein the processor is further configured to:

on a condition that the timer has not expired:

determine whether new cell reselection priorities have been received;

perform cell reselection using the new cell reselection priorities; and

reset the timer based on the received timer information.