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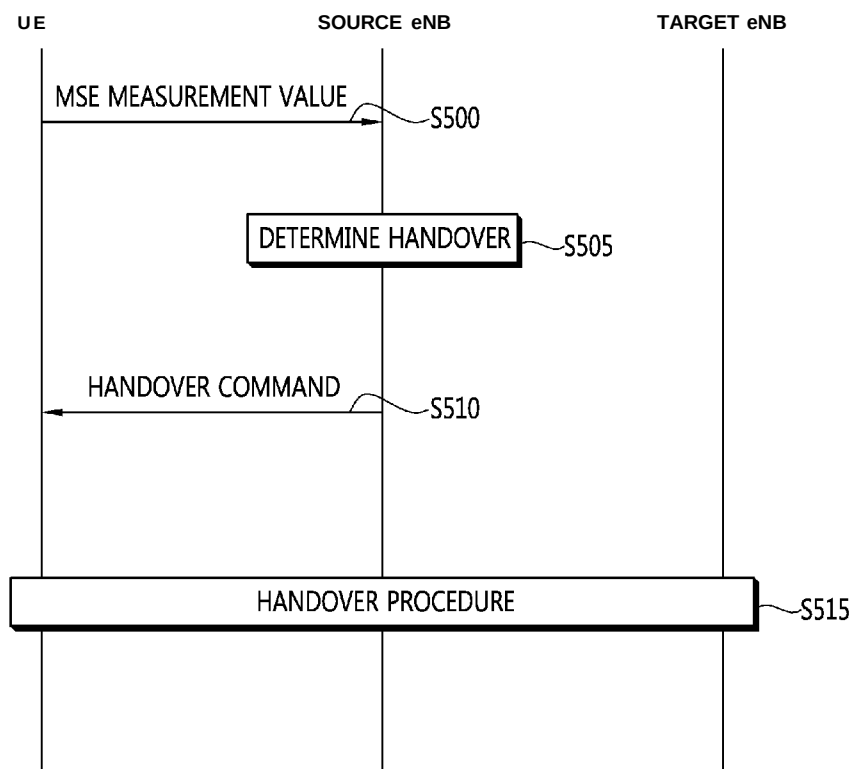
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[Continued on nextpage]

(54) **Title:** METHOD AND APPARATUS FOR SELECTIVE HANDOVER IN WIRELESS COMMUNICATION SYSTEM



(57) **Abstract:** There are provided a method and apparatus for performing a selective handover in a wireless communication system. This method includes, by an eNB, receiving a Mobility State Estimation (MSE) measurement value of User Equipment (UE) from the UE, determining whether or not to perform a handover based on the MSE measurement value, and sending a handover command message to the UE based on the determined result. The MSE measurement value comprises information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.



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Description

Title of Invention: METHOD AND APPARATUS FOR SELECTIVE HANDOVER IN WIRELESS COMMUNICATION SYSTEM

Technical Field

- [1] The present invention relates to a wireless communication system, and more particularly, to a method and apparatus for performing a handover selectively.

Background Art

- [2] 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE), that is, the improvement of a Universal Mobile Telecommunications System (UMTS), uses an Orthogonal Frequency Division Multiple Access (OFDMA) multiplexing method in downlink and uses Single Carrier-Frequency Division Multiple Access (SC-FDMA) multiplexing method in uplink. It adopts Multiple Input Multiple Output (MIMO) having a maximum of 4 antennas. Recently, 3GPP LTE-Advanced (LTE-A), that is, the evolution of 3GPP LTE, is being discussed.
- [3] Lots of special communication needs are generated in a specific area, such as a hotspot within a cell, and the reception sensitivity of an electric wave can be reduced in a specific area, such as a cell edge or a coverage hole. With the development of wireless communication technology, small cells, for example, a pico cell, a femto cell, a Remote Radio Head (RRH), a relay, and a repeater, are also installed within a macro cell for the purpose of enabling communication in areas, such as a hotspot, a cell edge, and a coverage hole. This network is called a Heterogeneous Network (HetNet). In an HetNet environment, a macro cell is a large cell having a large coverage as compared with a femto cell and a pico cell, and a femto cell and a pico cell are small cells having small coverages.
- [4] UE that has accessed an HetNet can perform communication with a specific cell according to a channel environment or a mobility state and may also perform a cell change. For example, UE can break connection with a macro cell due to a deteriorated channel state in the state in which the UE has accessed the macro cell and access another macro cell or pico cell. Or, for example, while UE is moving in the state in which the UE has accessed a macro cell, the UE can break connection with the macro cell and access another macro cell or pico cell.
- [5] The number of times that UE has changed cells in estimating the mobility state of the UE can be used as a parameter. In a conventional homogeneous network (HomoNet), the number of cell changes is selected only based on cells (e.g., macro cells) having the same form.

[6] When a UE which receives wireless service from macro cell moves as a high speed to a pico cell area which is hotspot, the UE has a high possibility to get away from the pico cell area soon after the handover from macro cell to pico cell. Also, because, in hotspot, macro cell as well as pico cell can service, it is more efficient for the UE not to handover to pico cell. However, when a UE which receives wireless service from macro cell moves as a high speed to a pico cell area which is coverage hole, it is more efficient for the UE to handover to pico cell even though the UE stays very shortly in the pico cell area, because if the UE does not handover to pico cell, wireless services can be impossible.

[7] So, a method and apparatus for performing handover selectively based on the UE mobility in HetNet are needed.

Disclosure of Invention

Technical Problem

[8] An object of the present invention is to provide a method and apparatus for performing a handover selectively based on the mobility state of a terminal.

[9] Another object of the present invention is to provide a method and apparatus for performing a handover selectively based on the type of Home eNodeB (hereinafter referred to as an 'HeNB').

[10] Yet another object of the present invention is to provide a method and apparatus for transmitting a terminal mobility state measurement value using a proximity indication message.

[11] Yet another further object of the present invention is to provide a method and apparatus for transmitting a terminal mobility state measurement value using a Radio Resource Control (RRC) connection procedure.

[12] Yet another further object of the present invention is to provide a method and apparatus for transmitting the Mobility State Estimation (MSE) measurement value of a terminal using a measurement report message.

Solution to Problem

[13] As an aspect, a method of a eNodeB (eNB) performing a selective handover in a wireless communication system comprises receiving a Mobility State Estimation (MSE) measurement value of User Equipment (UE) from the UE, determining whether or not to perform a handover based on the MSE measurement value and information on a type of a target eNB and sending a handover command message to the UE based on the determined result. The MSE measurement value may comprise information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.

[14] As another aspect, a method of User Equipment (UE) performing a selective

handover in a wireless communication system comprises receiving proximity indication configuration information for configuring a proximity indication operation, indicating that the UE enters or leaves a cell having a Closed Subscriber Group (CSG) ID in a CSG white list of the UE, through a Radio Resource Control (RRC) connection reconfiguration message, sending a proximity indication message, comprising a Mobility State Estimation (MSE) measurement value of the UE, to a Home eNodeB (eNB) based on the proximity indication configuration information and receiving a handover command message comprising information on whether or not to perform a handover. The proximity indication configuration information may comprise information on whether the MSE measurement value has to be included in the proximity indication message or not, the MSE measurement value comprises information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.

[15] As yet another aspect, a eNodeB (eNB) for performing a selective handover in a wireless communication system comprises a reception unit configured to receive a Mobility State Estimation (MSE) measurement value of User Equipment (UE) from the UE, a determination unit configured to determine whether or not to perform a handover based on the MSE measurement value and a transmission unit configured to send a handover command message to the UE based on a result of the determination of the determination unit. The MSE measurement value may comprise information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.

[16] As yet another aspect, User Equipment (UE) for performing a selective handover in a wireless communication system comprises a reception unit configured to receive proximity indication configuration information for configuring a proximity indication operation, indicating that the UE enters or leaves a cell having a Closed Subscriber Group (CSG) ID in a CSG white list of the UE, through a Radio Resource Control (RRC) connection reconfiguration message and a transmission unit configured to send a proximity indication message, comprising a Mobility State Estimation (MSE) measurement value of the UE, to a Home eNodeB (eNB) based on the proximity indication configuration information. The the reception unit may receive a handover command message comprising information on whether or not to perform a handover, the proximity indication configuration information may comprise information on whether the MSE measurement value has to be included in the proximity indication message or not, and the MSE measurement value may comprise information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.

Advantageous Effects of Invention

[17] In accordance with the present invention, when handover is performed from a source eNB to a target eNB, the handover can be performed selectively based on information of the type of cell of a target eNB and an installation object.

[18] In accordance with the present invention, the unnecessary handover of a terminal can be minimized.

[19] In accordance with the present invention, more efficient service can be provided by using a terminal and a system efficiently.

Brief Description of Drawings

[20] FIG. 1 is a diagram schematically illustrating the concept of a heterogeneous network, including a macro cell, a femto cell, and a pico cell.

[21] FIG. 2 shows a distribution of cells having a variety of coverage in a heterogeneous network.

[22] FIG. 3 is a diagram illustrating the Mobility State Estimation of User Equipment in a heterogeneous network according to the present invention.

[23] FIG. 4 is a flowchart illustrating a process in which UE performs a handover from a macro eNB to a CSG cell using a proximity indication to which the present invention is applied.

[24] FIG. 5 is an example of a flowchart illustrating a method in which UE performs a handover selectively based on the MSE measurement value of UE in accordance with the present invention.

[25] FIG. 6 is a flowchart illustrating another example for a selective handover according to the present invention.

[26] FIG. 7 is a flowchart illustrating yet another example for a selective handover according to the present invention.

[27] FIG. 8 is a flowchart illustrating still yet another example for a selective handover according to the present invention.

[28] FIG. 9 is a flowchart illustrating still yet another example of a selective handover procedure according to the present invention.

[29] FIG. 10 is a flowchart illustrating the operation of UE for performing a handover selectively in accordance with the present invention.

[30] FIG. 11 is a flowchart illustrating the operation of a source eNB for performing a handover selectively in accordance with the present invention.

[31] FIG. 12 is a block diagram of an eNB and UE which perform a handover in accordance with an embodiment of the present invention.

Mode for the Invention

[32] Hereinafter, in this specification, the contents of the present invention will be described in detail in connection with some exemplary embodiments, with reference to

the accompanying drawings. It is to be noted that in assigning reference numerals to elements in the drawings, the same reference numerals denote the same elements throughout the drawings even in cases where the elements are shown in different drawings. Furthermore, in describing the embodiments of the present invention, a detailed description of the known functions and constitutions will be omitted if it is deemed to make the gist of the present invention unnecessarily vague.

[33] Furthermore, in describing the elements of this specification, terms, such as the first, the second, A, B, (a), and (b), may be used. However, although the terms are used only to distinguish one element from the other element, the essence, order, or sequence of the elements is not limited by the terms. When it is said that one element is 'connected', 'combined', or 'coupled' with the other element, the one element may be directly connected or coupled with the other element, but it should also be understood that a third element may be 'connected', 'combined', or 'coupled' between the two elements.

[34] Furthermore, in this specification, a wireless communication network is described as a target, and tasks performed in the wireless communication network may be performed in a process in which a system (e.g., an HeNB or an eNB) managing the wireless communication network controls the wireless communication network and sends data or may be performed by a terminal that accesses the wireless communication network.

[35] It is difficult to satisfy an increasing need for data services by simply dividing a cell into a macro cell and a micro cell. In order to overcome this difficulty, data service may be provided to indoor and outdoor small-sized areas using pico cells, femto cells, and relays. Although the use of small cells is not specially limited, a pico cell can be chiefly used in a communication shadow area not covered exclusively by a macro cell or an area that requires a lot of data service, that is, a so-called hotspot. In general, a femto cell can be used in an indoor office or a home. Furthermore, a wireless relay can supplement the coverage of a macro cell. When heterogeneous networks are configured, not only can a shadow area in data service be obviated, but also the data transfer speed can be increased.

[36] FIG. 1 is a diagram schematically illustrating the concept of a heterogeneous network, including a macro cell, a femto cell, and a pico cell. A heterogeneous network including a macro cell, a femto cell, and a pico cell is illustrated, for convenience of description, but the heterogeneous network may be configured to include other types of cells. A description of a femto cell may be applied to a pico cell, and a description of a pico cell may be applied to a femto cell. A femto cell is a low-power wireless access point and is an ultra-small size eNB for mobile communication which is used in indoors, such as homes and offices. A femto cell may access a mobile communication core network using the DSL or cable broadband of a home or an office.

- [37] Referring to FIG. 1, a macro eNB 110, a femto eNB 120, and a pico eNB 130 are operated in the heterogeneous network. Each of the macro eNB 110, the femto eNB 120, and the pico eNB 130 has a unique cell coverage.
- [38] Hereinafter, a cell provided by the macro eNB 110 is called a macro cell 111, a cell provided by the femto eNB 120 is called a femto cell 121, and a cell provided by the pico eNB 130 is called a pico cell 131.
- [39] The femto eNB 120 is a low-power wireless access point and an ultra-small size eNB for mobile communication that is used indoors, such as in homes and offices. The femto eNB 120 may access a mobile communication core network using the DSL or cable broadband of a home or an office. The femto eNB 120 is connected to a mobile communication network over a wired network, such as an Internet network. A terminal within the femto cell may access the mobile communication network or the Internet network through the femto eNB 120.
- [40] In FIG. 1, the heterogeneous network including the macro cell, the femto cell, and the pico cell is illustrated, for convenience of description, but the heterogeneous network may be configured to include a relay or other types of cells.
- [41] FIG. 2 shows a distribution of cells having a variety of coverage in a heterogeneous network.
- [42] Referring to FIG. 2, macro cells and small cells are distributed in horizontal and vertical planes (e.g., meters), and the degree of the distribution may be represented by the number of macro cells and small cells. One hexagon indicates a macro cell, and three hexagons (i.e., macro cells) are collectively called a site. A plurality of small cells is crowded within each macro cell. The small cell may be placed at the boundary of a plurality of macro cells. Regarding the size of each cell, the diameter of one site may be about 600 m, the diameter of the macro cell may be about 300 m, and the diameter of the small cell is about 20-30 m.
- [43] FIG. 3 is a diagram illustrating the Mobility State Estimation (MSE) of User Equipment (hereinafter referred to as 'UE') in a heterogeneous network according to the present invention. The mobility state of UE may include at least one of the moving path of the UE and the estimation speed of the UE. That is, a criterion for the mobility state of UE may be the moving path of the UE or the estimation speed of the UE or both.
- [44] Referring to FIG. 3, a macro cell1 and a macro cell2 neighbor each other, and a small cell1 and a small cell2 are located within the macro cell1. UE A and UE B move from the macro cell1 to the macro cell2 at the same (or similar) speed. Here, the UE A moves to the macro cell2 via the small cell1 and the small cell2, and the UE B moves to the macro cell2 without passing through any small cell.
- [45] When the UE A moves to the small cell1, the UE A breaks a connection with the

macro celll and may perform a cell change into the small celll. Here, the UE A may be in idle mode or Radio Resource Control (RRC) connected mode. Idle mode is a state in which UE does not exchange data with an eNB, and RRC connected mode is a state in which UE exchanges data with a eNB.

- [46] As an example of a cell change, when the UE A is in idle mode, the UE A may perform cell reselection for the small celll. As another example of a cell change, when the UE A is in RRC connected mode, the UE A may perform a handover to the small celll. The term 'cell change' may mean that UE in idle mode performs reselection or UE in RRC connected mode performs a handover.
- [47] The UE A attempts a cell change into the small celll whether the UE A is in any mode. When the UE A performs a cell change, the number of cell changes N_A of the UE A is increased by 1. For example, in order to increase the number of cell changes effectively, it is a precondition that UE stays in a cell for k seconds or more. Here, k may be 1.
- [48] Meanwhile, when the UE A moves and again performs a cell change from the small celll to the macro celll, the number of cell changes N_A is increased to 2. Likewise, when the UE A moves and again performs a cell change from the macro celll to the small cell2, the number of cell changes N_A is increased to 3. When the UE A again performs a cell change from the small cell2 to the macro celll, the number of cell changes N_A is increased to 4. Next, when the UE A moves from the macro celll to the macro cell2, a cell change is performed, and thus the number of cell changes N_A is increased to 5. Meanwhile, the UE B moves from the macro celll to the macro cell2 without passing through any small cell, thus performing a cell change. Here, the number of cell changes N_B of the UE B is increased to 1.
- [49] The estimation speed of UE is calculated based on the number of times per hour (i.e., the number of cell changes) that the UE has performed a cell change. Here, the estimation speed of UE may be classified into two or more levels depending on whether the estimation speed is higher or lower than a specific reference value. For example, the estimation speed of UE may be classified into two levels: high and low. As another example, the estimation speed of UE may be classified into three levels: high, medium, and low. As yet another example, the estimation speed of UE may be classified into three levels: high, medium, and normal.
- [50] For example, medium is an estimation speed when the number of cell changes N exceeds a medium reference value Th_M but does not exceed a high reference value Th_H (i.e., $Th_M < N < Th_H$) for a specific reference time. High is an estimation speed when the number of cell changes N exceeds the high reference value Th_H (i.e., $N > Th_H$) for a specific reference time. Low is an estimation speed when the number of cell changes N does not exceed the medium reference value Th_M (i.e., $N \leq Th_M$) for a specific reference

time or when the number of cell changes N is determined not to be medium or high for a specific reference duration of time. If the estimation speed of UE calculated based on the number of cell changes of the UE is matched with an actual speed, low may be defined as about 0-30 km/h (0-8.3 m/s), medium may be defined as about 30-60 km/h (8.3-16.6 m/s), and high may be defined as about 60-120 km/h (16.6-33.2 m/s).

- [51] The reason why an error occurs between the actual speed of UE and the estimation speed of the UE is that cell changes not related to the mobility state of the UE are not taken into consideration in a process of calculating the estimation speed. Accordingly, in order to improve the reliability of the estimation speed of UE calculated based on the number of cell changes, a cell change not related to the mobility state of UE must be taken into consideration. In the present invention disclosed hereinafter, it is a pre-condition that the estimation speed of UE has three levels. The present invention may be properly changed and used even when the estimation speed has a different number of levels.
- [52] UE may deduce a new cell change parameter that enables a cell change to be performed more successfully by scaling cell change parameters (e.g., Q_{hyst} , $T_{\text{reselection}}$, and a Time To Trigger (TTT)) based on a Mobility State Estimation (MSE) value. The cell change parameter is a parameter, that is, a basis for estimating the mobility state of UE. UE determines whether the estimation speed of the UE is high, medium, or low based on the cell change parameter. The cell change parameter received from an eNB is a value defined in a corresponding system and may be transmitted by the eNB of a macro cell or the eNB of a pico cell. Furthermore, the cell change parameter is control information that is used to reduce a cell change failure when UE performs a cell change from a current cell to another cell.
- [53] The cell change parameter may be differently defined depending on mode (i.e., idle mode or RRC connected mode) of UE.
- [54] First, if UE is in idle mode, the cell change parameter may include Q_{hyst} , $T_{\text{reselection}}$, a scaling factor, a medium reference value Th_M and a high reference value Th_H , an estimation time taken to estimate the speed of the UE, or a low determination time.
- [55] Q_{hyst} is a value that controls the good and bad of a relative wireless state with a new cell while the value is added to or subtracted from a value indicative of the good or bad of the wireless state of a current cell. $T_{\text{reselection}}$ is the time that a new cell must maintain a better wireless state than a current cell so that UE in idle mode may reselect the new cell.
- [56] The scaling factor is a value that is multiplied so that $T_{\text{reselection}}$ may be scaled or a value that is added so that Q_{hyst} may be scaled, depending on the estimation speed of UE. The scaling factor may have a different value depending on the level of the speed of UE. In order to perform cell reselection rapidly, UE scales the values $T_{\text{reselection}}$ and Q

$_{hyst}$ so that the values are reduced when the estimation speed of the UE in idle mode is high and scales the values $T_{reselection}$ and Q_{hyst} so that they are increased when the estimation speed of the UE in idle mode is low.

[57] For example, the scaling factor of Q_{hyst} that scales Q_{hyst} may be -6 dB, -4 dB, -2 dB, or 0 dB. The scaling factor of each Q_{hyst} may be set to correspond to any one of the estimation speeds, that is, high, medium, and low. The following table is an example of the scaling factors of Q_{hyst} corresponding to the estimation speeds.

[58] Table 1

[Table 1]

estimation speed	scaling factor of Q_{hyst}
high	-6 dB
medium	-4 dB or -2 dB
low	0 dB

[59] In Table 1, Q_{hyst} is scaled by adding a scaling factor to Q_{hyst} as in Equation 1 below.

[60] [Equation 1]

[61]
$$new\ Q_{hyst} = old\ Q_{hyst} + scaling\ factor$$

[62] Referring to Equation 1, when a scaling factor is added to an old Q_{hyst} , a new Q_{hyst} into which an estimation speed has been incorporated is obtained.

[63] For another example, the scaling factor of $T_{reselection}$ that scales $T_{reselection}$ may be 0.25, 0.5, 0.75, or 1. The scaling factor of each $T_{reselection}$ may be set to correspond to any one of the final estimation speeds, that is, high, medium, and low. The following table shows an example of the scaling factors of $T_{reselection}$ corresponding to the final estimation speeds.

[64] Table 2

[Table 2]

estimation speed	scaling factor of $T_{reselection}$
high	0.25
medium	0.5 or 0.75
low	1

[65] In Table 2, $T_{reselection}$ is scaled by multiplying $T_{reselection}$ by a scaling factor as in Equation below.

[66] [Equation 2]

[67]
$$new\ T_{reselection} = old\ T_{reselection} \times scaling\ factor$$

- [68] Referring to Equation 2, a new $T_{\text{reselection}}$ into which the final estimation speed has been incorporated is obtained by multiplying an old $T_{\text{reselection}}$ by a scaling factor.
- [69] Meanwhile, each of the medium reference value and the high reference value included in the cell change parameter may be an integer value between 1 and M (wherein 'M=16'). For example, assuming that the medium reference value is 5 and the high reference value is 10, the estimation speed is low if the number of cell changes is 1-5, the estimation speed is medium if the number of cell changes is 6-10, and the estimation speed is high if the number of cell changes is 11-16.
- [70] An estimation time taken to estimate the speed of UE may have a value, such as 30 seconds, 60 seconds, 180 seconds, or 240 seconds. UE accumulatively increases the number of cell changes until an estimation time expires. UE may use a timer that operates until the estimation time expires (hereinafter referred to as an 'estimation timer').
- [71] A low determination time is a specific time value at which the speed of UE is determined to be low when the estimation speed of the UE is determined not to be medium or high for a specific time. The low determination time may have a value, such as 30 seconds, 60 seconds, 180 seconds, or 240 seconds.
- [72] Second, if UE is in RRC connected mode, the cell change parameter may include a TTT, a scaling factor, a medium reference value Th_M and a high reference value Th_H , an estimation time taken to estimate the speed of UE, or a low determination time.
- [73] The TTT is a parameter used to enable UE to initiate a handover preparation stage, such as the start of a measurement report, when the wireless state of a new cell remains intact for the TTT after the wireless state becomes higher than that of a current cell by a specific reference value or higher.
- [74] The scaling factor is a value that is multiplied so that a TTT may be scaled depending on the estimation speed of UE. The scaling factor may have a different value depending on the level of the speed of UE. In order to perform a handover rapidly, UE scales a TTT so that the TTT is reduced when the estimation speed of the UE in RRC connected mode is high and scales a TTT so that the TTT is increased when the estimation speed of the UE is low.
- [75] For example, the scaling factor that scales the TTT may be 0.25, 0.5, 0.75, or 1. Each scaling factor may be set to correspond to any one of the estimation speeds: high, medium, and low. The following table shows an example of the scaling factors of a TTT corresponding to the estimation speeds.
- [76] Table 3

[Table 3]

estimation speed	scaling factor of TTT
high	0.25
medium	0.5 or 0.75
low	1

- [77] In Table 3, it is assumed that when the estimation speed is high, the scaling factor of a TTT is 0.25, but this is only illustrative. The scaling factor corresponding to each estimation speed may be changed in various ways.
- [78] Here, the TTT is scaled by multiplying the TTT by the scaling factor as in Equation below.
- [79] [Equation 3]
- [80] ***new trigger time = old trigger time $\times$ scaling factor***
- [81] Referring to Equation 3, a new TTT in which an estimation speed has been incorporated is obtained by multiplying an old TTT by a scaling factor.
- [82] The UE that has received a cell change parameter performs a cell change based on the cell change parameter. Here, UE in idle mode detects cell selection (or cell reselection), and UE in RRC connected mode detects a handover.
- [83] When the UE performs a cell change, the UE may apply a scaling factor to the cell change parameter depending on the mobility state of the UE estimated for an old estimation time. That is, UE in idle mode scales values Q_{hyst} and $T_{reselection}$ as in Equation 1 and Equation 2 by using the scaling factors of Table 1 and Table 2. UE in RRC connected mode may scale a TTT as in Equation 3 by using the scaling factors of Table 3.
- [84] Meanwhile, UE may select a scaling factor corresponding to an updated moving speed estimation result. For example, UE in idle mode may select the scaling factors of Q_{hyst} and $T_{reselection}$ based on Table 1 and Table 2. For another example, UE in RRC connected mode may select the scaling factor of a TTT based on Table 3.
- [85] Meanwhile, UE may scale a cell change parameter using a selected scaling factor. When the cell change parameter is scaled, a new cell change parameter is deduced. UE in idle mode calculates new values Q_{hyst} and $T_{reselection}$ by scaling values Q_{hyst} and $T_{reselection}$ based on Equation 1 and Equation 2. As another example, UE in RRC connected mode calculates a new TTT by scaling a TTT based on Equation 3.
- [86] FIG. 4 is a flowchart illustrating a process in which UE performs a handover from a macro eNB to a CSG cell using a proximity indication to which the present invention is applied. A source eNB refers to the macro eNB, and a target eNB refers to the eNB of the CSG cell.

- [87] The UE determines when the CSG cells to which access has been permitted will be searched for and in what frequency (i.e., an intra frequency or inter frequency) depending on an implementation technique of the UE. This technology is called a UE Autonomous Search Function (ASF).
- [88] The UE may search for the CSG cells based on the ASF technology. When entering or leaving the CSG cells to which access is permitted (i.e., CSG cells having a CSG ID in the CSG white list of the UE), the UE may transmit information related to an eNB through a proximity indication message.
- [89] Referring to FIG. 4, the source eNB configures the UE for the purpose of control related to a proximity indication at step S400. For example, the source eNB may configure the UE by sending an RRC connection reconfiguration message, and the RRC connection reconfiguration message may include information on the recognition of a CSG cell.
- [90] The source eNB sends the RRC connection reconfiguration message, including proximity indication configuration information, to the UE. In the proximity indication configuration information, whether or not the UE makes a proximity indication report to the source eNB regarding cells having a CSG ID in the CSG white list of the UE is configured. That is, the proximity indication configuration information commands the UE to send (or not to send) the proximity indication message.
- [91] If it is determined that the UE approaches a cell having a CSG ID in the CSG white list of the UE, the UE sends a proximity indication message indicative of 'entering' (or leaving) to the source eNB at step S405.
- [92] If a measurement configuration regarding related frequency and RAT is not present, the source eNB performs a measurement configuration at step S410 and sends an RRC connection reconfiguration message, including information on the measurement configuration, to the UE.
- [93] The UE may perform measurement in the reported RAT and frequency based on the measurement configuration information. Furthermore, a network may use a proximity indication in order to minimize a request for handover preparation information from a CSG cell or a hybrid cell by not requesting information on a cell which has a CSG ID in the CSG white list of UE, but is not located in the geographical area of the UE.
- [94] The measurement configuration information includes at least one of a measurement object, a reporting configuration, a measurement identity (ID), a quantity configuration, and a measurement gap.
- [95] The measurement object refers to a carrier frequency, that is, the object to be measured, the list frequencies and frequency offsets of cells, and cell-specific offset values.
- [96] The reporting configuration refers to information on whether a periodic report or an

event-triggered report will be performed or not and a report measurement result (e.g., Reference Signal Received Power (RSRP) or Reference Signal Received Quality (RSRQ)). The event-triggered report, that is, the triggering of an event to be reported includes an A1 event (i.e., when a measurement result of a serving cell is greater than a specific threshold), an A2 event (i.e., when a measurement result of a serving cell is smaller than a specific threshold), an A3 event (i.e., when a measurement result of a neighbor cell is greater than a measurement result of a serving cell by a specific offset), an A4 event (i.e., when a measurement result of a neighbor cell is greater than a specific threshold), and an A5 event (i.e., when a measurement result of a serving cell is smaller than a measurement result of a neighbor cell by a specific offset). In the case of inter-RAT mobility, there are a B1 event (i.e., when a measurement result of a neighbor cell is greater than a specific threshold) or a B2 event (i.e., when a measurement result of a serving cell is smaller than a measurement result of a neighbor cell by a specific threshold).

- [97] The measurement ID may be the ID of a measurement object and a reporting configuration.
- [98] The quantity configuration may be filtering that will be applied to the measurement.
- [99] The measurement gap is a gap between uplink and downlink which is used to stop the transmission of uplink and downlink in the case of inter-frequency measurement.
- [100] After the step S410, the UE performs measurement according to a measurement method configured by the source eNB and sends a measurement report message, including a result of the measurement including a Physical Cell ID (PCI), to the source eNB at step S415. For example, the UE may send a measurement report when the A3 event is triggered.
- [101] The measurement report message may include an RSRP or RSRQ value, a PCI, a Cell Global ID (CGI), etc. In addition, a lot of pieces of information may be reported through the measurement report message.
- [102] The source eNB configures the UE in order to obtain System Information (SI) and in order for the UE to report a particular PCI at step S420.
- [103] The UE obtains SI (e.g., a CGI, a Tracking Area ID (TAI), and a CSG ID) from a target eNB using an autonomous gap at step S425. For example, the UE may suspend reception from and transmission to the source eNB within a limit determined by a rule in order to request related SI from the target eNB.
- [104] The UE sends a measurement report, including the received SI (e.g., a CGI (or E-CGI), a TAI, a CSG ID, and a member/non-member indication), to the source eNB at step S430.
- [105] The source eNB sends a handover request message, including a target E-CGI and CSG ID, to an MME at step S435. If a target cell is a hybrid cell, cell access mode of

the target cell is included in the handover request message.

- [106] The MME performs UE access control on a CSG based on a CSG ID included in the received handover request message and stores CSG subscription data regarding the UE at step S440. If the access control process fails, the MME terminates the handover process by sending a handover preparation failure message. If cell access mode is present in the handover request message, the MME determines the CSG membership status of the UE so that the UE is handled into a hybrid cell and includes the determined CSG membership status in the handover request message.
- [107] The MME sends the handover request message including the target CSG ID, received from the UE, to the target eNB via an eNB gateway (GW) at step S445. If the target eNB is a hybrid cell, the CSG membership status is included in the handover request message.
- [108] The target eNB checks whether the CSG ID received through the handover request message is identical with a CSG ID broadcasted to the target cell. If, as a result of the check, the CSG ID received through the handover request message is identical with a CSG ID broadcasted to the target cell, the target eNB allocates proper resources at step S450. If the CSG membership status indicates that the UE is a member, the priority task of the UE is applied.
- [109] The target eNB may approve or disapprove the handover of the UE by taking the status of resources available for the target eNB into consideration.
- [110] The target eNB sends a handover request acknowledgement message to the MME via the eNB GW at step S455. The handover request acknowledgement message includes information on whether the target eNB approves the handover or not.
- [111] The MME sends a handover command message to the source eNB at step S460.
- [112] The source eNB sends a handover command message (i.e., an RRC connection re-configuration message including mobility control information) to the UE at step S465.
- [113] If a cell having a CSG ID included in the CSG white list of the UE is not located nearby after the UE sends the entering proximity indication, the UE sends a leaving proximity indication to the source eNB. In response to the leaving proximity indication, the source eNB configures the UE so that the UE stops measurement for the reported RAT and frequency.
- [114] If the UE has already reached the target eNB, the UE may not have to send the proximity indication.
- [115] In response to the handover command, the UE terminates the connection with the cell of the source eNB to which the UE is now connected and then initiates a handover procedure for accessing the cell of a new eNB at step S470.
- [116] Here, a selective handover method and apparatus according to the present invention are described below.

- [117] FIG. 5 is an example of a flowchart illustrating a method in which UE performs a handover selectively based on the MSE measurement value of UE in accordance with the present invention.
- [118] Referring to FIG. 5, the UE sends its MSE measurement value to a source eNB at step S500. The MSE measurement value may be transmitted through a proximity indication message or a measurement report message. In some embodiments, the MSE measurement value may be transmitted through a new message, such as RRC signaling.
- [119] The source eNB determines whether or not to perform a handover based on the MSE measurement value of the UE at step S505.
- [120] In determining whether or not to perform the handover, information on the type of target eNB (or information on the type of cell of the target eNB) may also be used along with the MSE measurement value.
- [121] The information on the type of target eNB may be any one of the type of a 'pico cell for a coverage hole' and the type of a 'pico cell for a hot spot'.
- [122] The 'pico cell for a coverage hole' is a pico cell which transmits and receive data to and from UE instead of a macro cell and is used when UE is unable to transmit and receive data through a macro cell. The term 'coverage hole' is an area within the coverage of a macro cell, but is an area where sufficient radio service cannot be received due to a weak radio signal.
- [123] The 'pico cell for a hot spot' is a pico cell which transmits and receives data to and from UE along with a macro cell. The pico cell for a hot spot is a pico cell where UE may transmit and receive data through a macro cell, but which is installed in an area where a load that may be accommodated by a macro cell is exceeded because there are so many pieces of UE that require radio service in the corresponding area. The pico cell for a hot spot is used to transmit and receive data having a referenced capacity or higher that may be provided by a macro cell by installing the pico cell in this area. Here, the UE may transmit and receive data through the pico cell instead of the macro cell. Furthermore, the 'hot spot' refers to an area where a floating population or a settled population is significantly large or an area where required traffic is very high. A hot spot area may occur irrespective of the electro-magnetic field of a macro cell. The pico cell for a hot spot may be divided into an 'intra-frequency pico cell' and an 'inter-frequency pico cell'.
- [124] The 'intra-frequency pico cell' is a pico cell that uses the same frequency as a macro cell. When the same frequency resources are reused in areas spatially separated from each other, the same radio resources as those of a macro cell may be secured within the coverage of a pico cell. Most pico cells for hot spots correspond to the intra-frequency pico cells.

- [125] Furthermore, the 'inter-frequency pico cell' is a pico cell that uses a different frequency from that of a macro cell. If the signal of a macro cell is strong in a hot spot area, separated frequency resources may be used between a pico cell and the macro cell in order to prevent the deterioration of performance due to interference between the pico cell and the macro cell and to secure the coverage of the pico cell. Accordingly, the inter-frequency pico cell may be usefully used when a hot spot located close to the center of a macro cell is supported.
- [126] UE performs measurement in order to check whether or not there is a neighbor cell. UE may perform measurement for neighbor cells located in an intra-frequency while performing transmission and reception along with a serving cell because the neighbor cells send signals using the same frequency as that of a current serving cell. In contrast, since neighbor cells located in an inter-frequency transmit and receive signals using different frequencies, UE temporarily stops the transmission and reception of signals to and from a serving cell, retunes an RF chain, and receives a signal for a frequency where neighbor cells are possibly checked to be located. Here, the 'RF chain' refers to a part in which an antenna, a filter and a power amplifier are added. Accordingly, measurement for neighbor cells located in an inter-frequency is relatively time-limited.
- [127] If the estimation speed of UE is high, the intensity of the signal of each cell according to a change of the time is greatly changed. In this case, the handover of the UE to an inter-frequency is relatively more difficult than the handover of the UE to an intra-frequency. For this reason, when determining whether or not to perform the handover based on the estimation speed of UE, whether the frequency of a pico cell for a hot spot is an intra-frequency or an inter-frequency may be taken into consideration.
- [128] Meanwhile, the information on the type of target eNB may be information directly provided by a pico cell or information determined based on information (e.g., a measurement report) received by a pico cell from UE.
- [129] For example, the information on the type of target eNB may be directly provided by a pico cell. That is, the pico cell may have information on its own type. The information on the type of target eNB may be provided to a neighbor cell or an eNB. The neighbor cell or the eNB may check information on the type of target eNB based on the information and thus may know an object of the neighbor pico cell.
- [130] The information on the type of target eNB may be transmitted to a neighbor cell or an eNB through an X2 interface. For example, when sending a handover request acknowledgement message to a source eNB in response to a handover request, a target eNB may include the information on the type of target eNB in the handover request acknowledgement message.
- [131] Meanwhile, whether a target eNB is located in the area of a pico cell for a coverage hole or the area of a pico cell for a hot spot may be determined based on the mea-

surement report of UE. For example, when the A3 event, that is, a criterion for determining a handover, is generated, a pico cell may be determined to be for a coverage hole if a measurement result (e.g., RSRP or RSRQ) of a serving cell is a specific threshold or lower and the pico cell may be determined to be for a hot spot if a measurement result (e.g., RSRP or RSRQ) of a serving cell is higher than a specific threshold.

- [132] Examples of a method of determining whether or not to perform a handover procedure based on an MSE measurement value or information on the type of target eNB include the following embodiments 1 to 4.
- [133] In an example (embodiment 1) in which whether or not to perform a handover procedure is determined, a source eNB may determine whether or not to perform the handover based on only the MSE measurement value of UE.
- [134] That is, when the estimation speed of UE is high, a source eNB determines not to perform a handover. When the estimation speed of UE is not high (e.g., medium or low), a source eNB may determine to perform a handover.
- [135] In another example (embodiment 2) in which whether or not to perform a handover procedure is determined, a source eNB may determine whether or not to perform a handover based on only information on the type of target eNB.
- [136] That is, when a target eNB is located in a pico cell for a coverage hole, a source eNB may determine to perform a handover. When a target eNB is located in a pico cell for a hot spot, a source eNB may determine not to perform a handover.
- [137] In yet another example (embodiment 3) in which whether or not to perform a handover procedure is determined, a source eNB may determine whether or not to perform a handover by taking both the MSE measurement value of UE and information on the type of target eNB into consideration.
- [138] That is, when the estimation speed of the UE is high, the source eNB determines to perform the handover if the target eNB is located in a pico cell for a coverage hole and determines not to perform the handover if the target eNB is located in a pico cell for a hot spot. In contrast, when the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of the information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).
- [139] In still yet another example (embodiment 4) in which whether or not to perform a handover procedure is determined, a source eNB may determine whether or not to perform a handover by taking not only the MSE measurement value of UE, but also frequency information from information on the type of target eNB into consideration.
- [140] That is, when the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB determines to perform the handover irrespective of the frequency of the pico cell (e.g., an intra-frequency or an inter-

frequency). In contrast, when the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB determines to perform the handover procedure if the pico cell uses the same frequency as a macro cell, that is, a serving cell, but determines not to perform the handover procedure if the pico cell uses a different frequency from a macro cell. Meanwhile, when the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of the information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).

- [141] If the source eNB determines to perform the handover procedure at step S505, the source eNB sends a handover command, instructing the UE to perform the handover to a target eNB, to the UE at step S510. The handover command may be transmitted through a handover command message.
- [142] If the source eNB determines not to perform the handover procedure at step S505, the source eNB may inform the UE that the source eNB has determined not to perform the handover procedure by sending a no handover command message to the UE (not shown). In some embodiments, no handover command information may be included in the handover command message.
- [143] In response to the handover command, the UE terminates the connection with the source eNB and initiates a handover procedure for accessing the cell of the target eNB at step S515. Concretely, in order to access the target eNB, the UE performs an access operation related to a layer 1 and a layer 2. The access operation related to the layer 1 and the layer 2 may include a random access operation. When the UE completes the access to the target eNB, the UE may transmit and receive packet data.
- [144] Meanwhile, if the source eNB determines to not perform the handover procedure at step S505, the source eNB may indicate that it does not perform the handover procedure by sending a specific message to the UE (not shown). The specific message may be a handover command message.
- [145] FIG. 6 is a flowchart illustrating another example for a selective handover according to the present invention. This example corresponds to a case where the MSE measurement value of UE is included in a proximity indication message and the proximity indication message is transmitted.
- [146] Referring to FIG. 6, a source eNB configures a proximity indication operation for UE by performing RRC connection reconfiguration at step S600. The RRC connection reconfiguration may be performed through an RRC connection reconfiguration message.
- [147] The RRC connection reconfiguration message includes proximity indication configuration information for configuring the proximity indication operation. Here, information on whether or not an MSE measurement value must be included in a proximity indication message transmitted from the UE to the source eNB may be

included in the proximity indication configuration information. The MSE measurement value may be a value measured by the UE.

[148] For example, the proximity indication configuration information may include information on the type of cell, and the type of cell may be at least one of a 'CSG cell', a 'pico cell', a 'pico cell for a coverage hole', 'a pico cell for a hot spot', and 'all cells'. For example, if the type of cell is a pico cell for a coverage hole, when UE enters or leaves the area of the pico cell for a coverage hole, the proximity indication configuration information is configured so that the MSE measurement value is included in the proximity indication message. In some embodiments, if the type of cell corresponds to all cells, when UE enters or leaves the areas of all types of cells, the proximity indication configuration information is configured so that the MSE measurement value is included in the proximity indication message.

[149] The proximity indication configuration information may further include MSE configuration event information along with the information on the type of cell, and the MSE configuration event information may have an 'entering' or 'leaving' value. For example, if the type of cell is a 'pico cell for a coverage hole' and MSE configuration event information has an 'entering' value, when UE enters the area of the pico cell for a coverage hole, the proximity indication configuration information is configured so that the MSE measurement value is included in the proximity indication message. In some embodiments, if the type of cell is a 'pico cell for a hot spot' and MSE configuration event information has a 'leaving' value, when UE leaves the area of the pico cell for a hot spot, the proximity indication configuration information is configured so that the MSE measurement value is included in the proximity indication message.

[150] After the step S600, the UE performs the proximity indication operation by sending the proximity indication message to the source eNB based on the proximity indication configuration information at step S605. The proximity indication message may indicate that 'the UE enters the pico cell' or 'the UE leaves the pico cell'. The proximity indication message may further include the MSE measurement value of the UE. The MSE measurement value may be any one of high, medium, and low. In some embodiments, the UE may make a determination for itself irrespective of the proximity indication configuration information, include the MSE measurement value in the proximity indication message, and send the proximity indication message.

[151] After the step S605, the source eNB determines whether or not to perform a handover based on the received MSE measurement value at step S610. If, as a result of the determination at step S610, to not perform the handover is determined to be appropriate, subsequent procedures (i.e., steps subsequent to the step S615) are not performed.

[152] In determining whether or not to perform the handover, the source eNB may use in-

formation on the type of target eNB (or information on the type of cell of the target eNB) in addition to the MSE measurement value. Here, the source eNB may use the information on the type of target eNB when it already has the information on the type of target eNB or when it may determine whether or not to perform the handover based on the proximity indication message received from the UE.

[153] In this case, the embodiments 1 to 4 described with reference to FIG. 5 may be applied to the above case.

[154] For example, the source eNB may determine whether or not to perform the handover based on only the MSE measurement value of the UE. If, as a result of the determination, the estimation speed of the UE is high, the source eNB may determine to not perform the handover. If, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB may determine to perform the handover.

[155] For another example, the source eNB may determine whether or not to perform the handover based on only the information on the type of target eNB. If, as a result of the determination, the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the target eNB is located in a pico cell for a hot spot, the source eNB may determine not to perform the handover.

[156] For yet another example, the source eNB may determine whether or not to perform the handover by taking both the MSE measurement value of the UE and the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover. In contrast, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).

[157] For yet another example, the source eNB may determine whether or not to perform the handover by taking not only the MSE measurement value of the UE, but also frequency information of the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover irrespective of the frequency of the pico cell (e.g., both an intra-frequency and an inter-frequency). In contrast, if, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot

spot, the source eNB may determine to perform the handover procedure when the pico cell uses the same frequency as a macro cell, that is, a serving cell, but determines to not perform the handover procedure when the pico cell uses a different frequency from a macro cell, that is, a serving cell. Meanwhile, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of the information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).

[158] After the step S610, the source eNB configures measurement to be performed by the UE by sending an RRC connection reconfiguration message to the UE at step S615. Next, the UE reports a result of the measurement using a measurement report message at step S620.

[159] The source eNB determines whether or not to perform a handover based on the measurement report message at step S625. If, as a result of the determination at step S625, it is determined to not perform the handover appropriately based on the measurement report message, even though to perform the handover has been determined to be appropriate at step S610, subsequent procedures (i.e., steps subsequent to step S625) are not performed.

[160] In this case, the embodiments 1 to 4 described with reference to FIG. 5 may be applied to the above case. If whether or not to perform the handover is not determined at step S610, the source eNB may determine whether or not to perform the handover by taking the measurement result of the measurement report message into consideration. In some embodiments, a determination at step S610 may be changed based on the measurement result. That is, when the A3 event, that is, a criterion for determining a handover, is generated, if a measurement result (e.g., RSRP or RSRQ) of a serving cell is a specific threshold or less, a pico cell is determined to be used for a coverage hole. If a measurement result of a serving cell is higher than a specific threshold, a pico cell may be determined to be used for a hot spot. Information on the type of pico cell obtained as described above may be applied in order to determine whether or not to perform a handover in the embodiments 1 to 4 described with reference to FIG. 5.

[161] If, as a result of the determination at step S625, the handover is determined to be performed, the source eNB requests the handover from the target eNB by sending a handover request message to the target eNB at step S630.

[162] If the source eNB or the UE is unable to know information on the type of target eNB, the source eNB may request both information on the type of cell of the target eNB (e.g., a macro cell, a pico cell, or a CSG cell) and an installation object (e.g., a coverage hole or a hot spot) through the handover request message.

[163] The target eNB determines whether or not to approve the handover based on the

handover request message at step S635. Although the source eNB has determined to perform the handover, the handover may be performed only when the target eNB approves the handover.

- [164] The target eNB sends a handover request acknowledgement message (or a handover response message), including handover approval information on whether the target eNB has approved the handover or not, to the source eNB at step S640. The handover request acknowledgement message may include information on the type of target eNB. In particular, if the source eNB or the UE has requested information on the type of cell of the target eNB and an installation object through the handover request message because it did not know information on the type of target eNB, the target eNB may send the information on the type of cell of the target eNB and the installation object through the handover request acknowledgement message.
- [165] The source eNB may determine whether or not to perform the handover based on the handover request acknowledgement message at step S645. If, as a result of the determination at step S645, to not perform the handover is determined to be appropriate based on the handover approval information, even though to perform the handover has been determined to be appropriate at step S610 or S625, a subsequent procedure (i.e., a step S650) is not performed.
- [166] If, as a result of the determination at step S645, the handover is finally determined to be performed, the source eNB commands the UE to perform the handover by sending a handover command message to the UE at step S650.
- [167] In response to the handover command message, the UE initiates a procedure for performing the handover from the source eNB to the target eNB at step S655.
- [168] If, as a result of the determination at step S610, S625, or S645, the handover is determined to not be performed, subsequent procedures are not performed and the source eNB may inform the UE that it has determined to not perform the handover procedure through the handover command message (not shown).
- [169] FIG. 7 is a flowchart illustrating yet another example for a selective handover according to the present invention. This example corresponds to a case where the MSE measurement value of UE is included in a measurement report message and the measurement report message is transmitted.
- [170] Referring to FIG. 7, a source eNB configures measurement that will be performed by UE by sending an RRC connection reconfiguration message to the UE at step S700. The RRC connection reconfiguration message includes measurement configuration information for configuring the measurement that will be performed by the UE. Here, information on whether an MSE measurement value must be included in a measurement report message transmitted from the UE to the source eNB may be included in the measurement configuration information. The MSE measurement value may be a value

measured by the UE.

[171] For example, the measurement configuration information may include information on the type of cell, and the type of cell may be at least one of a 'CSG cell', a 'pico cell', a 'pico cell for a coverage hole', 'a pico cell for a hot spot', and 'all cells'. For example, if the type of cell is a pico cell for a coverage hole, when UE enters or leaves the area of the pico cell for a coverage hole, the measurement configuration information is configured so that the MSE measurement value is included in the measurement report message. In some embodiments, if the type of cell corresponds to all cells, when UE enters or leaves the areas of all types of cells, the measurement configuration information is configured so that the MSE measurement value is included in the measurement report message.

[172] The measurement configuration information may further include MSE configuration event information along with the information on the type of cell, and the MSE configuration event information may have an entering or leaving value. For example, if the type of cell is a pico cell for a coverage hole and an MSE configuration event is 'entering', when the UE enters the area of the pico cell for a coverage hole, the measurement configuration information is configured so that the MSE measurement value is included in the measurement report message. In some embodiments, if the type of cell is a pico cell for a hot spot and an MSE configuration event is 'leaving', when the UE leaves the area of the pico cell for a hot spot, the measurement configuration information is configured so that the MSE measurement value is included in the measurement report message.

[173] After the step S700, the UE reports a result of the measurement performed based on the measurement configuration information to the source eNB using a measurement report message at step S705.

[174] The measurement report message includes the MSE measurement value of the UE. The MSE measurement value may be high, medium, or low. As another example, the UE may make a determination for itself irrespective of the measurement configuration information, include the MSE measurement value in the measurement report message, and then send the measurement report message.

[175] After the step S705, the source eNB determines whether or not to perform a handover based on the received MSE measurement value at step S710. If, as a result of the determination at step S710, to not perform the handover is determined to be appropriate, subsequent procedures (i.e., steps subsequent to the step S710) are not performed. In determining whether or not to perform the handover, information on the type of target eNB (or information on the type of cell of the target eNB) may be used in addition to the MSE measurement value. Here, the source eNB may use the information on the type of target eNB when it already has the information on the type of

target eNB or when it may determine whether or not to perform the handover based on the measurement report message received from the UE.

[176] In this case, the embodiments 1 to 4 described with reference to FIG. 5 may be applied to the above case.

[177] For example, the source eNB may determine whether or not to perform the handover based on only the MSE measurement value of the UE. If, as a result of the determination, the estimation speed of the UE is high, the source eNB may determine to not perform the handover. If, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB may determine to perform the handover.

[178] As another example, the source eNB may determine whether or not to perform the handover based on only the information on the type of target eNB. If, as a result of the determination, the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover.

[179] As yet another example, the source eNB may determine whether or not to perform the handover by taking both the MSE measurement value of the UE and the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover. In contrast, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).

[180] As yet another example, the source eNB may determine whether or not to perform the handover by taking not only the MSE measurement value of the UE, but also frequency information of the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover irrespective of the frequency of the pico cell (e.g., both an intra-frequency and an inter-frequency). In contrast, if, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to perform the handover procedure when the pico cell uses the same frequency as a macro cell, that is, a serving cell, but determines to not perform the handover procedure when the pico cell uses a different frequency from

a macro cell, that is, a serving cell. Meanwhile, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of the information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).

[181] If, as a result of the determination at step S710, the handover is determined to be performed, the source eNB requests the handover from the target eNB by sending a handover request message to the target eNB at step S715.

[182] If the source eNB or the UE is unable to know information on the type of target eNB, the source eNB may request both information on the type of cell of the target eNB (e.g., a macro cell, a pico cell, and a CSG cell) and an installation object (e.g., a coverage hole or a hot spot) through the handover request message.

[183] The target eNB determines whether or not to approve the handover based on the handover request message at step S720. Although the source eNB has determined to perform the handover, the handover may be performed only when the target eNB approves the handover.

[184] The target eNB sends a handover request acknowledgement message (or a handover response message), including handover approval information on whether the target eNB has approved the handover or not, to the source eNB at step S725. The handover request acknowledgement message may include information on the type of target eNB. In particular, if the source eNB or the UE has requested information on the type of cell of the target eNB and information on an installation object through the handover request message because it did not know information on the type of target eNB, the target eNB may send the information on the type of cell of the target eNB and the information on the installation object through the handover request acknowledgement message.

[185] The source eNB may determine whether or not to perform the handover based on the handover approval information (or the handover request acknowledgement message) at step S730. If, as a result of the determination at step S730, to not perform the handover is determined to be appropriate based on the handover approval information even though to perform the handover has been determined to be appropriate at step S710, subsequent procedures (i.e., steps subsequent to the step S735) are not performed.

[186] If, as a result of the determination at step S730, the handover is finally determined to be performed, the source eNB commands the UE to perform the handover by sending a handover command message to the UE at step S735. In response to the handover command message, the UE initiates a procedure for performing the handover from the source eNB to the target eNB at step S740.

[187] If, as a result of the determination at step S710 or S730, the handover is determined not to be performed, subsequent procedures are not performed, and the source eNB

may inform the UE that it has determined to not perform the handover procedure through the handover command message (not shown).

[188] Meanwhile, a proximity indication operation is not essential because an MSE measurement value is transmitted through a measurement report message. In this case, there is an advantage in that information on whether UE accesses a pico cell or not may be obtained through the proximity indication operation. Accordingly, prior to the transmission of the measurement report message, a source eNB may configure the proximity indication operation for the UE by performing RRC connection reconfiguration, and the proximity indication message may be transmitted to the source eNB based on the RRC connection reconfiguration message (not shown).

[189] FIG. 8 is a flowchart illustrating still yet another example for a selective handover according to the present invention. In this example, the MSE measurement value of UE is transmitted through an additional MSE report message.

[190] Referring to FIG. 8, UE reports to a source eNB that it has entered the cell area of a target eNB through an MSE report message at step S800. Here, an MSE measurement value is also reported through an MSE report message, that is, an additional message. The MSE measurement value may be a value measured by the UE and may be high, medium, or low. The UE may make a determination for itself and send the MSE report message or may send the MSE report message under the direction of the source eNB.

[191] After the step S800, the source eNB determines whether or not to perform a handover based on the received MSE measurement value at step S805. If, as a result of the determination at step S805, to not perform the handover is determined to be appropriate, subsequent procedures (i.e., steps subsequent to the step S810) are not performed.

[192] In determining whether or not to perform the handover, the source eNB may use information on the type of target eNB (or information on the type of cell of the target eNB) in addition to the MSE measurement value. Here, the source eNB may use the information on the type of target eNB when it already has the information on the type of target eNB.

[193] In this case, the embodiments 1 to 4 described with reference to FIG. 5 may be applied in the above case.

[194] For example, the source eNB may determine whether or not to perform the handover based on only the MSE measurement value of the UE. If, as a result of the determination, the estimation speed of the UE is high, the source eNB may determine to not perform the handover. If, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB may determine to perform the handover.

[195] As another example, the source eNB may determine whether or not to perform the

handover based on only the information on the type of target eNB. If, as a result of the determination, the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover.

- [196] As yet another example, the source eNB may determine whether or not to perform the handover by taking both the MSE measurement value of the UE and the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover. In contrast, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).
- [197] As yet another example, the source eNB may determine whether or not to perform the handover by taking not only the MSE measurement value of the UE, but also frequency information of the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover irrespective of the frequency of the pico cell (e.g., both an intra-frequency and an inter-frequency). In contrast, if, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to perform the handover procedure when the pico cell uses the same frequency as a macro cell, that is, a serving cell, but determines to not perform the handover procedure when the pico cell uses a different frequency from a macro cell, that is, a serving cell. Meanwhile, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of the information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).
- [198] After the step S805, the source eNB configures the measurement that will be performed by the UE by sending an RRC connection reconfiguration message to the UE at step S810. The RRC connection reconfiguration message includes measurement configuration information for configuring the measurement that will be performed by the UE.
- [199] The UE reports a result of the measurement performed based on the measurement configuration information to the source eNB using a measurement report message at

step S815.

- [200] The source eNB determines whether or not to perform a handover based on the received measurement report message and MSE measurement value at step S820. If, as a result of the determination at step S820, to not perform the handover is determined to be appropriate based on the measurement report message even though to perform the handover has been determined to be appropriate at step S805, subsequent procedures (i.e., steps subsequent to step S825) are not performed.
- [201] For example, the embodiments 1 to 4 described with reference to FIG. 5 may be applied to the above case. If, as a result of the determination at step S805, the handover is determined not to be performed, the source eNB may determine whether or not to perform the handover by taking the measurement report message into consideration.
- [202] If, as a result of the determination at step S820, the handover is determined to be performed, the source eNB requests the handover from the target eNB by sending a handover request message to the target eNB at step S825.
- [203] If the source eNB or the UE is unable to know information on the type of target eNB, the source eNB may request both information on the type of cell of the target eNB (e.g., a macro cell, a pico cell, and a CSG cell) and an installation object (e.g., a coverage hole or a hot spot) through the handover request message.
- [204] The target eNB determines whether or not to approve the handover based on the handover request message at step S830. Although the source eNB has determined to perform the handover, the handover may be performed only when the target eNB approves the handover.
- [205] The target eNB sends a handover request acknowledgement message (or a handover response message), including handover approval information on whether the target eNB has approved the handover or not, to the source eNB at step S835. The handover request acknowledgement message may include information on the type of target eNB. In particular, if the source eNB or the UE has requested information on the type of cell of the target eNB and information on an installation object through the handover request message because it did not know information on the type of target eNB, the target eNB may send the information on the type of cell of the target eNB and the information on the installation object through the handover request acknowledgement message.
- [206] The source eNB may determine whether or not to perform the handover based on the handover approval information and the information on the type of target eNB at step S840. If, as a result of the determination at step S840, to not perform the handover is determined to be appropriate based on the handover approval information even though to perform the handover has been determined to be appropriate at step S805 or S820, a subsequent procedure (i.e., a step S845) is not performed.

- [207] For example, the embodiments 1 to 4 described with reference to FIG. 5 may be applied to the above case.
- [208] If, as a result of the determination at step S840, the handover is finally determined to be performed, the source eNB commands the UE to perform the handover by sending a handover command message to the UE at step S845. In response to the handover command message, the UE initiates a procedure for performing the handover from the source eNB to the target eNB at step S850.
- [209] If, as a result of the determination at step 805, S820, or S840, the handover is determined to not be performed, subsequent procedures are not performed, and the source eNB may inform the UE that it has determined to not perform the handover procedure through the handover command message (not shown).
- [210] Meanwhile, a proximity indication operation is not essential because an MSE measurement value is transmitted through a measurement report message. In this case, there is an advantage in that information on whether UE accesses a pico cell or not may be obtained through the proximity indication operation. Accordingly, prior to the transmission of the measurement report message, a source eNB may configure the proximity indication operation for the UE by performing RRC connection reconfiguration, and the proximity indication message may be transmitted to the source eNB based on the RRC connection reconfiguration message (not shown).
- [211] FIG. 9 is a flowchart illustrating still yet another example of a selective handover procedure according to the present invention.
- [212] Referring to FIG. 9, when a source eNB requests an MSE measurement value from UE at step S900, the UE sends a message (e.g., a proximity indication message, a measurement report message, or an MSE report message), including the MSE measurement value, to the source eNB at step S905.
- [213] After the step S905, the source eNB determines whether or not to perform a handover based on the received MSE measurement value at step S910. In determining whether or not to perform the handover, information on the type of target eNB (or information on the type of cell of the target eNB) may also be used in addition to the MSE measurement value. Here, the information on the type of target eNB (or the information on the type of cell of the target eNB) may be used when the source eNB already has the information on the type of target eNB or a determination may be made based on the message received from the UE. The embodiments 1 to 4 described with reference to FIG. 5 may be applied to this case.
- [214] If, as a result of the determination at step S910, the handover is determined not to be performed, the source eNB informs the UE that it has determined to not perform the handover procedure by sending a no handover command to the UE. In some embodiments, information on the no handover command may be included in a handover

command message (or an RRC connection reconfiguration message).

[215] FIG. 10 is a flowchart illustrating the operation of UE for performing a handover selectively in accordance with the present invention.

[216] Referring to FIG. 10, the UE sends an MSE measurement value to a source eNB while transmitting and receiving data to and from the source eNB at step S1000. The MSE measurement value may be transmitted through a proximity indication message or a measurement report message. In some embodiments, the MSE measurement value may be transmitted through a new message, such as RRC signaling or a MSE report message.

[217] The UE receives a handover command, instructing to perform a handover to a target eNB, from the source eNB at step S1005. The handover command may be transmitted through a handover command message.

[218] The handover command could have been determined by the source eNB based on the MSE measurement value of the UE. In determining whether or not to perform the handover, information on the type of target eNB (or information on the type of cell of the target eNB) may be used in addition to the MSE measurement value of the UE.

[219] In response to the handover command, the UE terminates the connection with the cell of the source eNB and initiates a handover procedure for accessing the cell of the target eNB at step S1010. Concretely, in order to access the target eNB, the UE performs an access operation related to a layer 1 and a layer 2. The access operation related to the layer 1 and the layer 2 may include an operation such as random access. When the access to the target eNB is completed, the UE is able to transmit and receive packet data.

[220] FIG. 11 is a flowchart illustrating the operation of a source eNB for performing a handover selectively in accordance with the present invention.

[221] Referring to FIG. 11, the source eNB receives an MSE measurement value from UE at step SI100. The MSE measurement value may be transmitted through a proximity indication message or a measurement report message. In some embodiments, the MSE measurement value may be transmitted through a new message, such as RRC signaling or a MSE report message.

[222] The source eNB determines whether or not to perform a handover based on the MSE measurement value of the UE at step SI105. In determining whether or not to perform the handover, information on the type of target eNB (or information on the type of cell of the target eNB) may be used in addition to the MSE measurement value of the UE. The information on the type of target eNB may be directly provided by a pico cell or may be determined by a pico cell based on information (e.g., a measurement report) received from the UE. For example, the embodiments 1 to 4 of FIG. 5 may be applied to a method for determining whether or not to perform the handover procedure based

on the MSE measurement value or the information on the type of target eNB.

- [223] For example, the source eNB may determine whether or not to perform the handover based on only the MSE measurement value of the UE. If, as a result of the determination, the estimation speed of the UE is high, the source eNB may determine not to perform the handover. If, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB may determine to perform the handover.
- [224] For another example, the source eNB may determine whether or not to perform the handover based on only the information on the type of target eNB. If, as a result of the determination, the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover.
- [225] As yet another example, the source eNB may determine whether or not to perform the handover by taking both the MSE measurement value of the UE and the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to not perform the handover. In contrast, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).
- [226] For yet another example, the source eNB may determine whether or not to perform the handover by taking not only the MSE measurement value of the UE, but also frequency information of the information on the type of target eNB into consideration. If, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the source eNB may determine to perform the handover irrespective of the frequency of the pico cell (e.g., both an intra-frequency and an inter-frequency). In contrast, if, as a result of the determination, the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the source eNB may determine to perform the handover procedure when the pico cell uses the same frequency as a macro cell, that is, a serving cell, but determines to not perform the handover procedure when the pico cell uses a different frequency from a macro cell, that is, a serving cell. Meanwhile, if, as a result of the determination, the estimation speed of the UE is not high (e.g., medium or low), the source eNB determines to perform the handover irrespective of the information on the type of target

eNB (e.g., both for a coverage hole and for a hot spot).

[227] The source eNB sends a handover command, instructing the UE to perform the handover to the target eNB, to the UE at step SI 110. The handover command may be transmitted through a handover command message.

[228] In response to the handover command, the UE terminates the connection with the cell of the source eNB and initiates a handover procedure for accessing the cell of the target eNB at step SI 115.

[229] FIG. 12 is a block diagram of an eNB 1250 and UE 1200 which perform a handover in accordance with an embodiment of the present invention. The eNB 1250 may be a source eNB.

[230] Referring to FIG. 12, the UE 1200 includes a reception unit 1210 and a transmission unit 1220.

[231] The reception unit 1210 receives an RRC connection reconfiguration message from the eNB 1250. The RRC connection reconfiguration message may include proximity indication configuration information for configuring a proximity indication operation. The proximity indication configuration information may include information on whether or not an MSE measurement value must be included in a proximity indication message transmitted from the UE to the source eNB. Furthermore, the RRC connection reconfiguration message includes measurement configuration information for configuring the measurement that will be performed by the UE. Here, the information on whether or not the MSE measurement value must be included in a measurement report message transmitted from UE to a source eNB may be included in the measurement configuration information. The proximity indication configuration information or the measurement configuration information includes information on the type of cell, and the type of cell may be at least one of a CSG cell, a pico cell, a pico cell for a coverage hole, a pico cell for a hot spot, and all cells. The proximity indication configuration information or the measurement configuration information may further include information on an MSE configuration event along with the information on the type of cell, and the information on the MSE configuration event may have an entering or leaving value.

[232] The reception unit 1210 receives a handover command from the eNB 1250. The handover command may be transmitted through a handover command message. If it is determined not to perform a handover, the reception unit 1210 receives a no handover command message. The no handover command message indicates that a handover procedure has been determined to not be performed. The no handover command message may be included in the handover command message.

[233] The transmission unit 1220 transmits an MSE measurement value to the source eNB 1250. The MSE measurement value may be transmitted through a proximity indication

message or a measurement report message. In some embodiments, the MSE measurement value may be transmitted through an MSE report message, that is, a new message, such as RRC signaling.

[234] The eNB 1250 includes a reception unit 1260, a determination unit 1270, and a transmission unit 1280.

[235] The eNB 1250 may be a source eNB in a handover.

[236] The reception unit 1260 receives an MSE measurement value from the UE 1200. The MSE measurement value may be received through a proximity indication message or a measurement report message. In some embodiments, the MSE measurement value may be received through a new message, such as RRC signaling.

[237] The determination unit 1270 determines whether or not to perform a handover based on the MSE measurement value. In determining whether or not to perform the handover, information on the type of target eNB (or information on the type of cell of the target eNB) may be used in addition to the MSE measurement value of the UE. The type of target eNB includes the type of pico cell for a coverage hole and the type of pico cell for a hot spot. Meanwhile, the information on the type of target eNB may be directly provided by a pico cell or may be determined by a pico cell based on information (e.g., a measurement report) received from the UE.

[238] The determination unit 1270 determines whether or not to perform the handover based on only the MSE measurement value of the UE. If the estimation speed of the UE is high, the determination unit 1270 may determine to not perform the handover. If the estimation speed of the UE is not high (e.g., medium or low), the determination unit 1270 may determine to perform the handover.

[239] Furthermore, the determination unit 1270 may determine whether or not to perform the handover based on only the information on the type of target eNB. If the target eNB is located in a pico cell for a coverage hole, the determination unit 1270 may determine to perform the handover. If the target eNB is located in a pico cell for a hot spot, the determination unit 1270 may determine to not perform the handover.

[240] Furthermore, the determination unit 1270 may determine whether or not to perform the handover by taking both the MSE measurement value of the UE and the information on the type of target eNB into consideration. If the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the determination unit 1270 may determine to perform the handover. If the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the determination unit 1270 may determine to not perform the handover. In contrast, if the estimation speed of the UE is not high (e.g., medium or low), the determination unit 1270 determines to perform the handover irrespective of information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).

- [241] Furthermore, the determination unit 1270 may determine whether or not to perform the handover by taking not only the MSE measurement value of the UE, but also frequency information of the information on the type of target eNB into consideration. If the estimation speed of the UE is high and the target eNB is located in a pico cell for a coverage hole, the determination unit 1270 may determine to perform the handover irrespective of the frequency of the pico cell (e.g., both an intra-frequency and an inter-frequency). In contrast, if the estimation speed of the UE is high and the target eNB is located in a pico cell for a hot spot, the determination unit 1270 may determine to perform the handover procedure when the pico cell uses the same frequency as a macro cell, that is, a serving cell, but determines to not perform the handover procedure when the pico cell uses a different frequency from a macro cell, that is, a serving cell. Meanwhile, if the estimation speed of the UE is not high (e.g., medium or low), the determination unit 1270 determines to perform the handover irrespective of the information on the type of target eNB (e.g., both for a coverage hole and for a hot spot).
- [242] The transmission unit 1280 sends a handover command to the UE 1200. If it is determined to perform the handover procedure, the transmission unit 1280 sends a handover command, instructing the UE to perform the handover to the target eNB, to the UE. The handover command may be transmitted through a handover command message. If it is determined to not perform the handover procedure, the transmission unit 1280 informs the UE that the handover procedure has been determined to not be performed. This information may also be transmitted through the handover command message.
- [243] The transmission unit 1280 sends an RRC connection reconfiguration message to the UE. The RRC connection reconfiguration message may include proximity indication configuration information for configuring a proximity indication operation. The proximity indication configuration information may include information on whether an MSE measurement value must be included in a proximity indication message or not. The RRC connection reconfiguration message further includes measurement configuration information for configuring the measurement to be performed by the UE. Here, information on whether the MSE measurement value must be included in a measurement report message or not may be included in the measurement configuration information. The proximity indication configuration information or the measurement configuration information includes information on the type of cell, and the type of cell may be at least one of a CSG cell, a pico cell, a pico cell for a coverage hole, a pico cell for a hot spot, or all cells. The proximity indication configuration information or the measurement configuration information may further include information on an MSE configuration event along with the information on the type of cell, and the information on the MSE configuration event may have an entering or leaving value.

[244] In the above exemplary system, although the methods have been described based on the flowcharts in the form of a series of steps or blocks, the present invention is not limited to the sequence of the steps, and some of the steps may be performed in a different order from that of other steps or may be performed simultaneous to other steps. Furthermore, those skilled in the art will understand that the steps shown in the flowchart are not exclusive and the steps may include additional steps or that one or more steps in the flowchart may be deleted without affecting the scope of the present invention.

[245] The above embodiments include various aspects of examples. Although all possible combinations for representing the various aspects may not be described, those skilled in the art will appreciate that other combinations are possible. Accordingly, the present invention should be construed as including all other replacements, modifications, and changes which fall within the scope of the claims.

Claims

- [Claim 1] A method of a eNodeB (eNB) performing a selective handover in a wireless communication system, the method comprising:
receiving a Mobility State Estimation (MSE) measurement value of User Equipment (UE) from the UE;
determining whether or not to perform a handover based on the MSE measurement value and information on a type of a target eNB; and
sending a handover command message to the UE based on the determined result,
wherein the MSE measurement value comprises information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.
- [Claim 2] The method of claim 1, further comprising receiving information on a type of cell of the target eNB to which the UE will perform the handover,
wherein the type of cell of the target eNB is a cell for a coverage hole or a cell for a hot spot.
- [Claim 3] The method of claim 2, further comprising receiving information on a type of cell of the target eNB from the target eNB, before determining whether or not to perform the handover.
- [Claim 4] The method of claim 2, further comprising determining the type of cell of the target eNB based on a result of measurement performed by the UE, before determining whether or not to perform the handover,
wherein the type of cell of the target eNB is determined to be the cell for the coverage hole if the result of the measurement is a specific threshold or lower, and
the type of cell of the target eNB is determined to be the cell for the hot spot if the result of the measurement is higher than the specific threshold.
- [Claim 5] The method of claim 2, wherein in the determining of whether or not to perform the handover based on the MSE measurement value, the handover is determined to not be performed if the estimation speed of the UE is high and the handover is determined to be performed if the estimation speed of the UE is medium or low.
- [Claim 6] The method of claim 2, wherein:
in the determining of whether or not to perform the handover based on the MSE measurement value, whether or not to perform the handover is

determined by taking the information on the type of cell of the target eNB into consideration,

if the estimation speed of the UE is high, the handover is determined to be performed if the type of cell of the target eNB is the cell for the coverage hole and the handover is determined to not be performed if the type of cell of the target eNB is the cell for the hot spot, and
if the estimation speed of the UE is medium or low, the handover is determined to be performed.

[Claim 7]

The method of claim 2, wherein:

in the determining of whether or not to perform the handover based on the MSE measurement value, whether or not to perform the handover is determined by taking the information on the type of cell of the target eNB into consideration,

if the estimation speed of the UE is high, the handover is determined to be performed if the type of cell of the target eNB is the cell for the coverage hole and the cell of the target eNB uses an identical frequency with that of the cell of the eNB, and the handover is determined to not be performed if the type of cell of the target eNB is the cell for the hot spot and the cell of the target eNB uses a different frequency from that of the cell of the eNB, and

if the estimation speed of the UE is medium or low, the handover is determined to be performed.

[Claim 8]

The method of claim 1, further comprising sending proximity indication configuration information for configuring a proximity indication operation, indicating that the UE enters or leaves a cell having a Closed Subscriber Group (CSG) ID in a CSG white list of the UE, through a Radio Resource Control (RRC) connection reconfiguration message,

wherein the proximity indication configuration information comprises information on whether or not the MSE measurement value of the UE has to be included in a proximity indication message transmitted from the UE to the eNB, and

the MSE measurement value is received from the UE through the proximity indication message.

[Claim 9]

The method of claim 1, further comprising sending measurement configuration information for configuring the measurement performed by the UE through an RRC connection reconfiguration message, wherein the measurement configuration information comprises in-

formation on whether or not the MSE measurement value of the UE has to be included in a measurement report message transmitted from the UE to the eNB, and

the MSE measurement value is received from the UE through the measurement report message.

[Claim 10] The method of claim 1, wherein the MSE measurement value is received through an MSE report message.

[Claim 11] The method of claim 1, further comprising:
sending a handover request message, requesting the handover, to the target eNB; and
receiving a handover request acknowledgement message comprising information on whether the target eNB has approved the handover or not, wherein whether or not to perform the handover is determined based on the handover request acknowledgement message.

[Claim 12] The method of claim 11, wherein:
the handover request message comprises information requesting the information on a type of cell of the target eNB, and
the handover request acknowledgement message further comprises the information on the type of cell of the target eNB.

[Claim 13] The method of claim 1, wherein if the eNB determines not to perform the handover, the handover command message comprises information indicating that the handover is not performed.

[Claim 14] A method of User Equipment (UE) performing a selective handover in a wireless communication system, the method comprising:
receiving proximity indication configuration information for configuring a proximity indication operation, indicating that the UE enters or leaves a cell having a Closed Subscriber Group (CSG) ID in a CSG white list of the UE, through a Radio Resource Control (RRC) connection reconfiguration message;
sending a proximity indication message, comprising a Mobility State Estimation (MSE) measurement value of the UE, to a eNodeB (eNB) based on the proximity indication configuration information; and
receiving a handover command message comprising information on whether or not to perform a handover,
wherein the proximity indication configuration information comprises information on whether the MSE measurement value has to be included in the proximity indication message or not, the MSE measurement value comprises information on an estimation speed of the UE, and the

estimation speed of the UE is high, medium, or low.

[Claim 15]

The method of claim 14, wherein:

the proximity indication configuration information further comprises a parameter for a type of cell,

the type of cell is a CSG cell, a pico cell, a pico cell for a coverage hole, a pico cell for a hot spot, or all cells, and

if the UE enters or leaves a cell indicated by the parameter for the type of cell, the MSE measurement value is included in the proximity indication message.

[Claim 16]

The method of claim 15, wherein:

the proximity indication configuration information further comprises a parameter for an MSE configuration event,

the MSE configuration event is entering or leaving, and

when an event indicated by the MSE configuration event is generated for a cell indicated by the parameter for the type of cell, the MSE measurement value is included in the proximity indication message.

[Claim 17]

A eNodeB (eNB) for performing a selective handover in a wireless communication system, the eNB comprising:

a reception unit configured to receive a Mobility State Estimation (MSE) measurement value of User Equipment (UE) from the UE;

a determination unit configured to determine whether or not to perform a handover based on the MSE measurement value; and

a transmission unit configured to send a handover command message to the UE based on a result of the determination of the determination unit, wherein the MSE measurement value comprises information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.

[Claim 18]

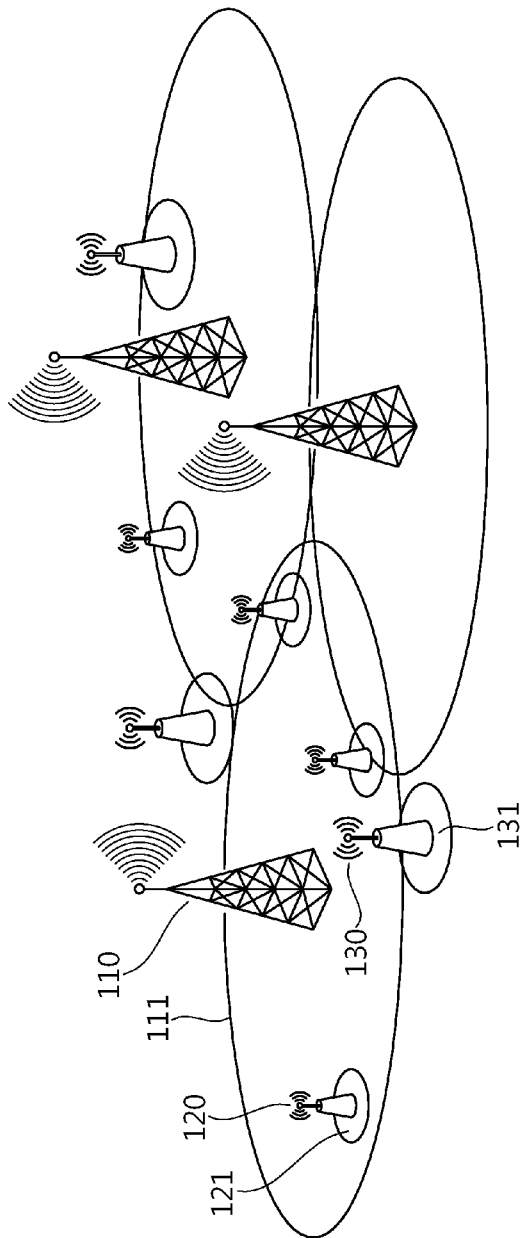
User Equipment (UE) for performing a selective handover in a wireless communication system, the UE comprising:

a reception unit configured to receive proximity indication configuration information for configuring a proximity indication operation, indicating that the UE enters or leaves a cell having a Closed Subscriber Group (CSG) ID in a CSG white list of the UE, through a Radio Resource Control (RRC) connection reconfiguration message; and

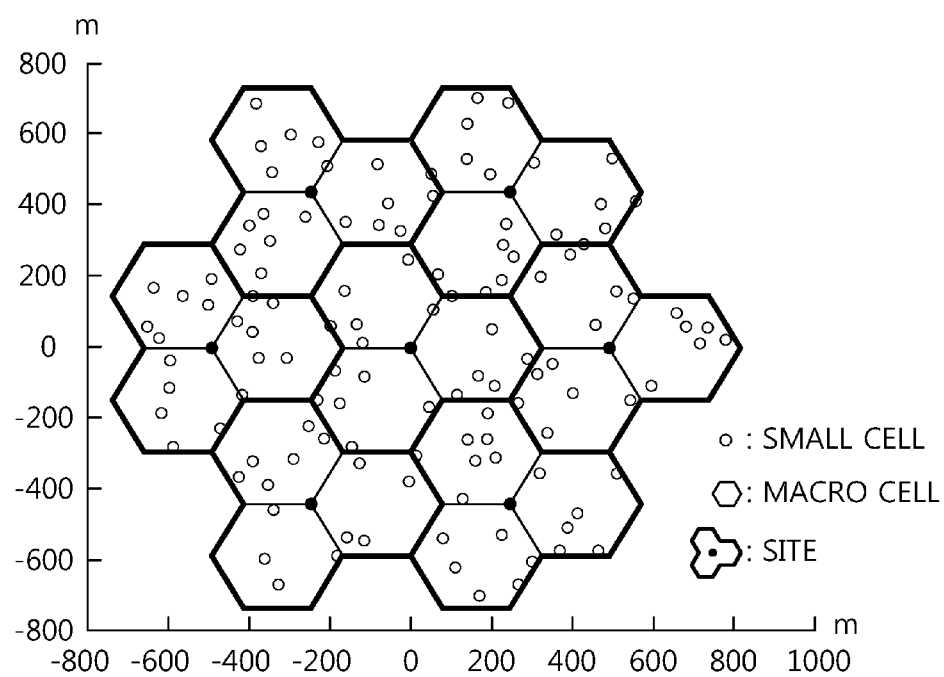
a transmission unit configured to send a proximity indication message, comprising a Mobility State Estimation (MSE) measurement value of the UE, to a eNodeB (eNB) based on the proximity indication con-

figuration information,
wherein the reception unit receives a handover command message comprising information on whether or not to perform a handover, the proximity indication configuration information comprises information on whether the MSE measurement value has to be included in the proximity indication message or not, and the MSE measurement value comprises information on an estimation speed of the UE, and the estimation speed of the UE is high, medium, or low.

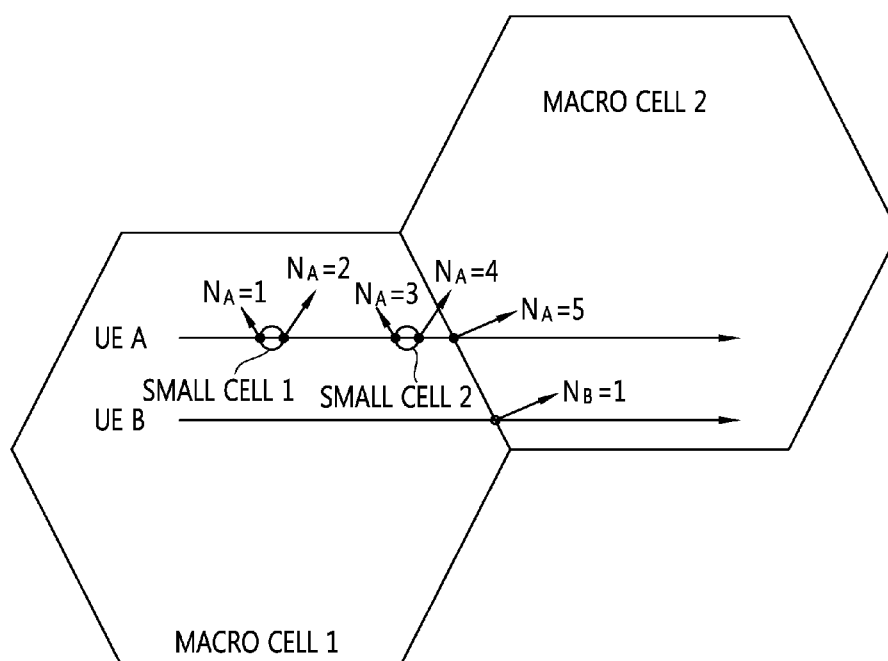
[Fig. 1]



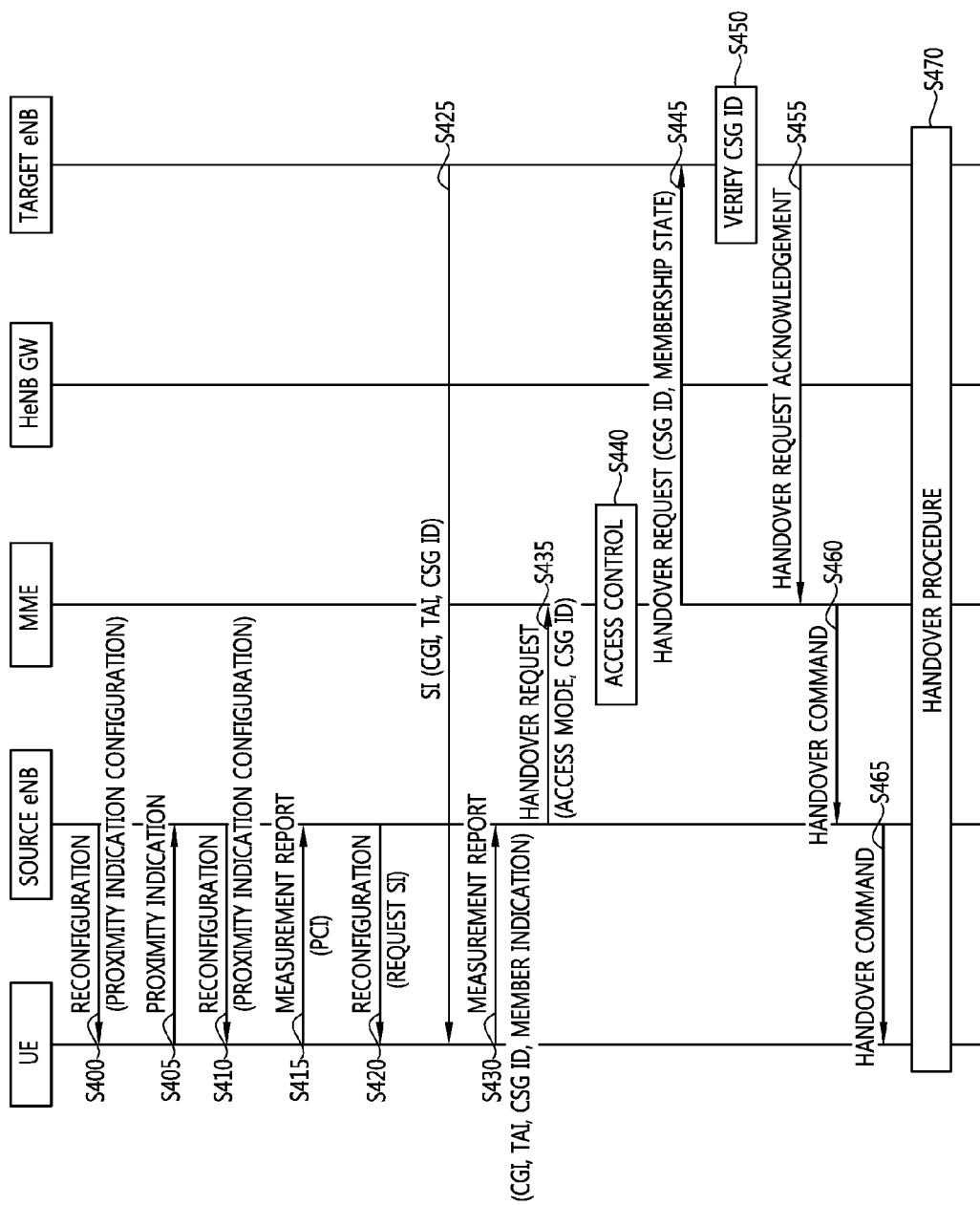
[Fig. 2]



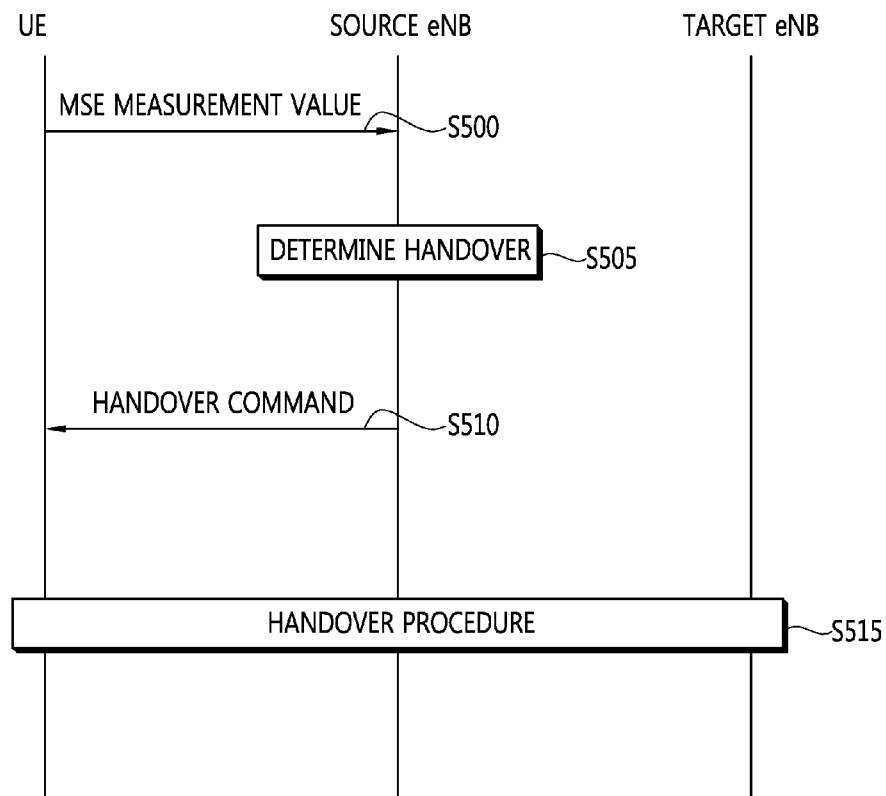
[Fig. 3]



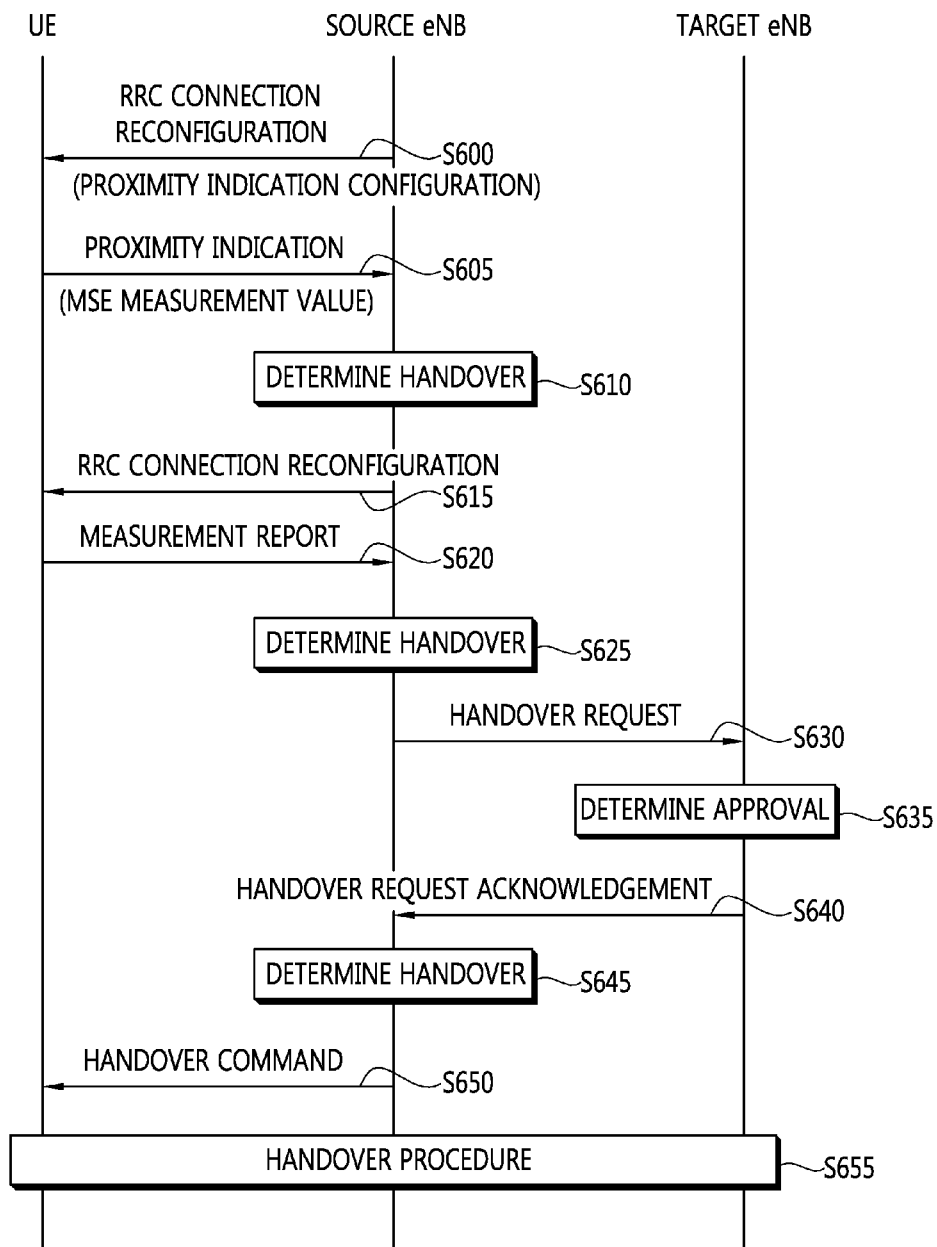
[Fig. 4]



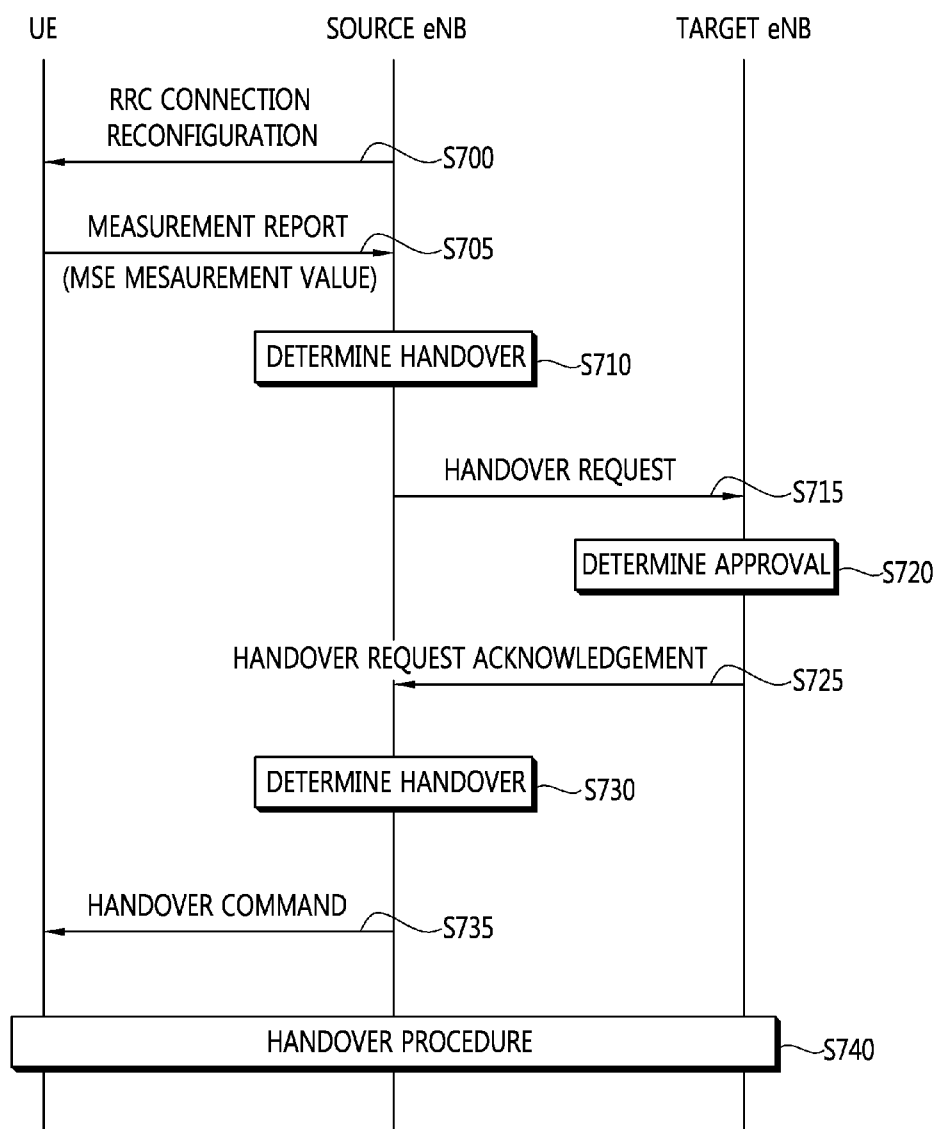
[Fig. 5]



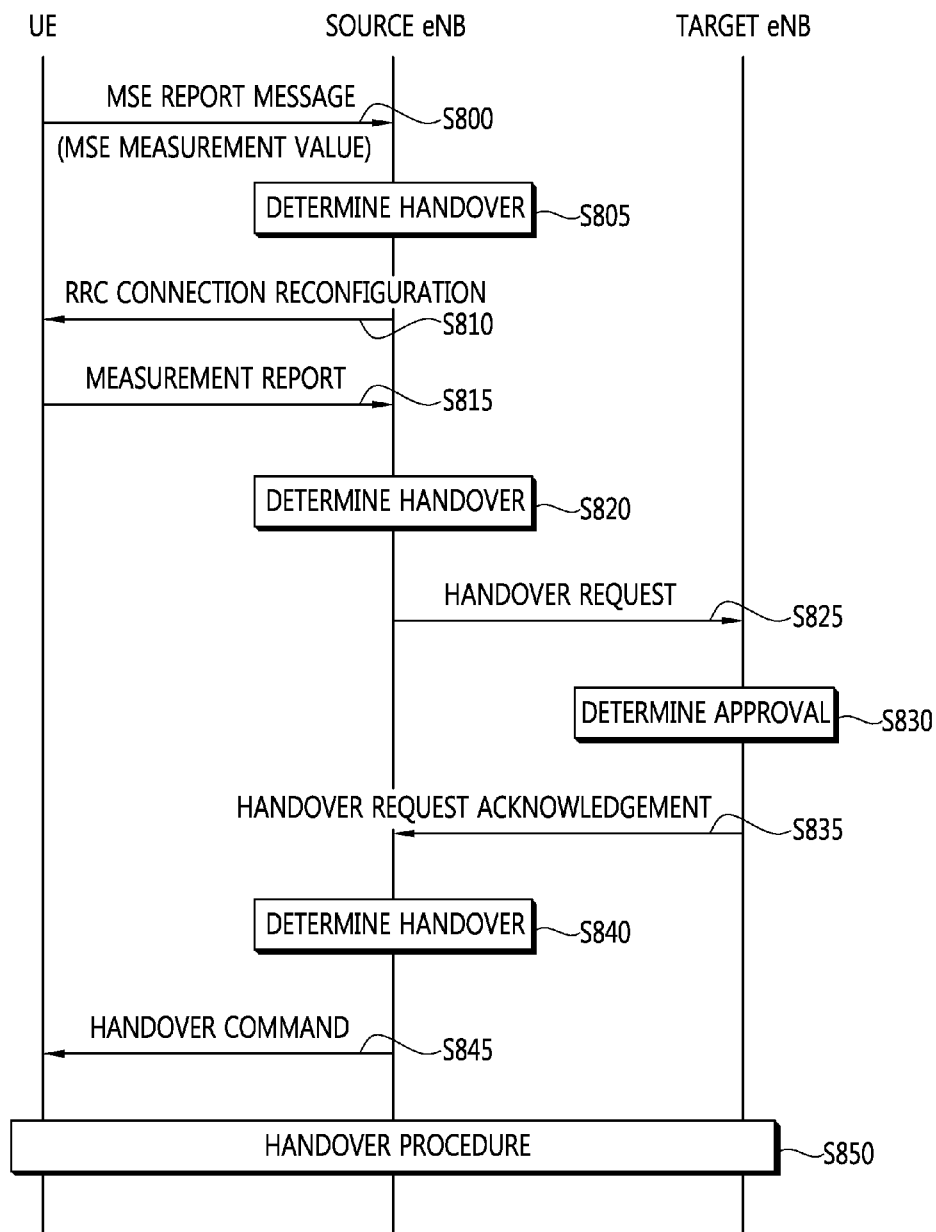
[Fig. 6]



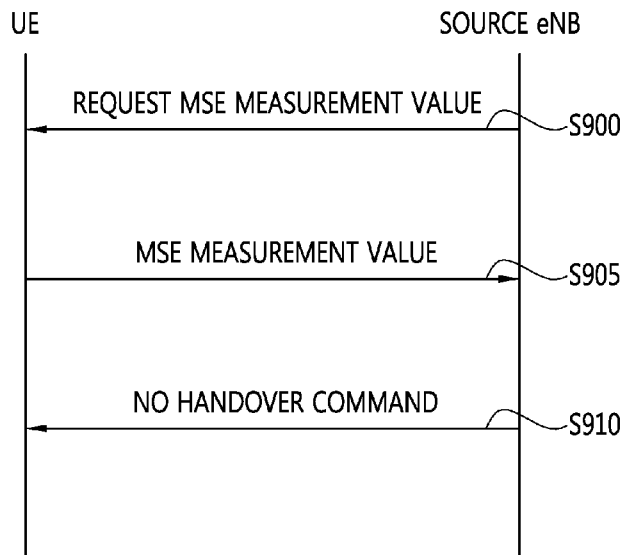
[Fig. 7]



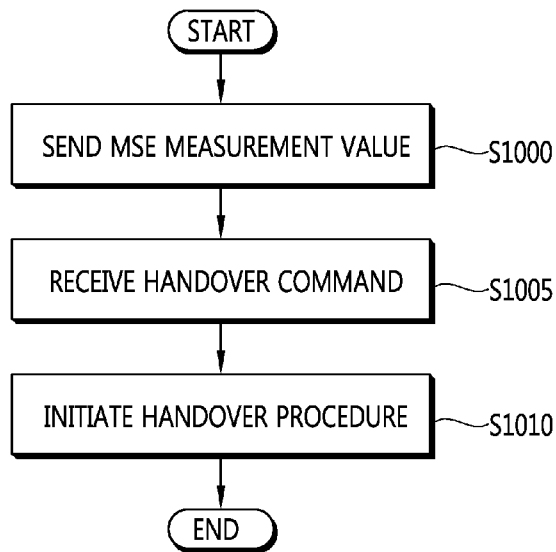
[Fig. 8]



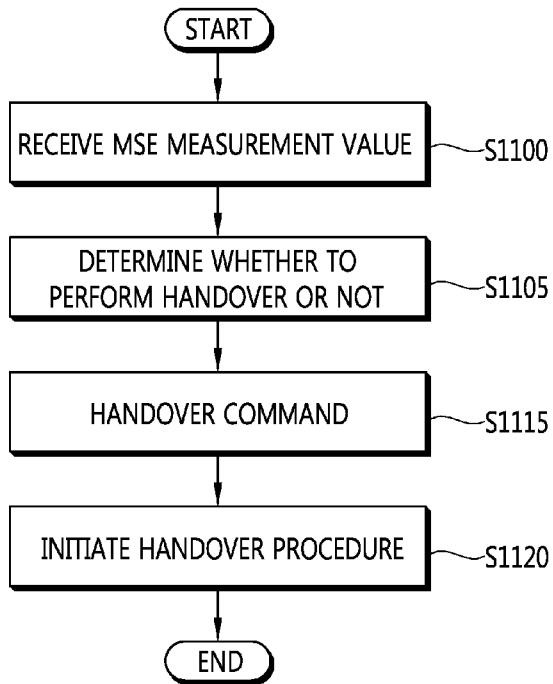
[Fig. 9]



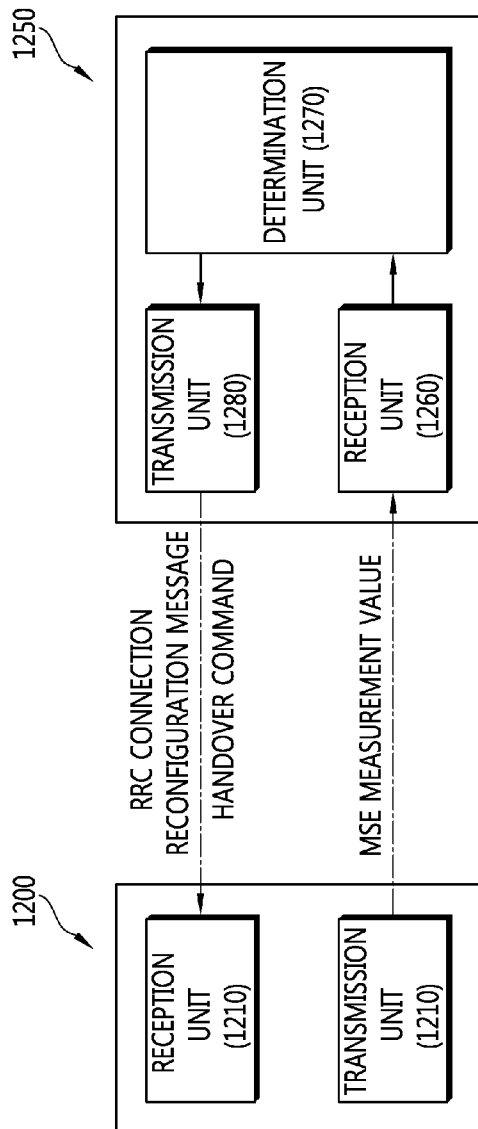
[Fig. 10]



[Fig. 11]



[Fig. 12]



A. CLASSIFICATION OF SUBJECT MATTER***H04W 36/32(2009.01)i, H04W 36/38(2009.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W 36/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: handover, mobility estimation, cell type.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	ANDREAS PITSILLIDES et al. "MBMS Handover control: A new approach for efficient handover in MBMS enabled 3G cellular networks." Computer Networks 51, 2007. See pp. 4902-4903.	1-3,5,8-11,13-18
Y	LARS LINDBOM et al. "Enhanced Inter-cell Interference Coordination for Heterogeneous Networks in LTE-Advanced: A Survey." Retrieved from the Internet <URL:http://arxiv.org/ftp/arxiv/papers/1112/1112.1344.pdf>, 2011.12.7. See pp. 6-7, pp. 14-15.	1-3,5,8-11,13-18
A	KONSTANTINOS DIMOU et al. "Handover within 3GPP LTE: Design Principles and Performance." IEEE, 2009. See pp. 1-5.	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

18 April 2013 (18.04.2013)

Date of mailing of the international search report

19 April 2013 (19.04.2013)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2012/011630

Patent document
cited in search report

Publication
date

Patent family
member(s)

Publication
date

None