(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)
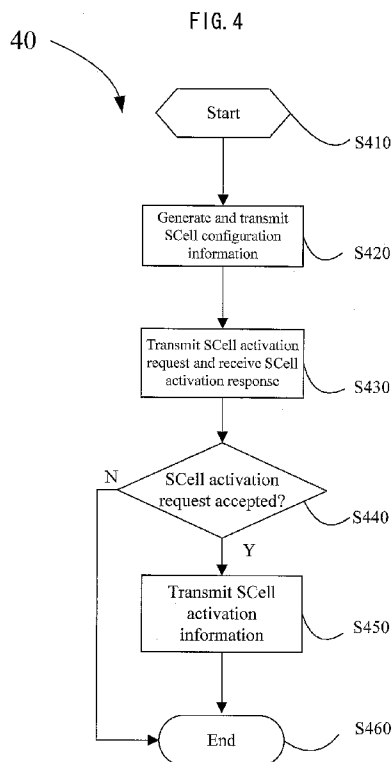
(74) Agent: HARAKENZO WORLD PATENT & TRADE-MARK; Daiwa Minamimorimachi Building, 2-6, Tenjin-bashi 2-chome Kita, Kita-ku, Osaka-shi, Osaka, 5300041 (JP).

[Continued on next page]

(54) Title: METHOD FOR COMPONENT CARRIER CONFIGURATION, BASE STATION AND USER EQUIPMENT

FIG. 4

40

Start — S410

Generate and transmit SCell configuration information — S420

Transmit SCell activation request and receive SCell activation response — S430

SCell activation request accepted? — S440
N / Y

Transmit SCell activation information — S450

End — S460

(57) Abstract: A method for component carrier configuration is provided. The method includes: generating, by a Base Station (BS), secondary cell (SCell) configuration information and transmitting it to a User Equipment (UE); transmitting, by the BS, an SCell activation request for the UE to a micro BS and receiving from the micro BS an SCell activation response to the SCell activation request; and transmitting, by the BS, SCell activation information to the UE if the received SCell activation response indicates that the SCell activation request is accepted by the micro BS. The SCell configuration information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a secondary primary cell (S-PCell) associated with the micro BS. The present invention also provides a BS and a UE. With the method for component carrier configuration and the corresponding BS and UE according to the present invention, the channel state information of the UE can be fed back on an uplink working carrier of the micro cell base station.

MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Description

Title of Invention: METHOD FOR COMPONENT CARRIER CONFIGURATION, BASE STATION AND USER EQUIPMENT

Technical Field

[0001]   The present invention relates to wireless communication technology, and more particularly, to a method for component carrier configuration, a base station and a user equipment.

Background Art

[0002]   Inter-Site Carrier Aggregation technique can be considered as an enhancement to the Carrier Aggregation technique for heterogeneous networks. As described in the following Non Patent Literature 1 ("RWS-120010, NTT DoCoMo, Requirements Candidate Solutions & Technology Roadmap for LTE Rel-12 Onward"), in heterogeneous networks, a macro cell base station can operate on a carrier at 2GHz and a micro cell base station can operate on a carrier at 3.5GHz. A user equipment (UE) can be served by a macro cell and a micro cell simultaneously. In this case the UE transmits data on the control plane (C-plane) via the macro cell base station and the micro base station data is only involved in transmission of data on the user plane (U-plane). In this way, the UE can have better connectivity and mobility via the macro cell base station operating at a low frequency band and higher system throughput via the micro cell base station operating at a high frequency band for a broader bandwidth.

[0003]   According to Long Term Evolution (LTE) Release 12 and its subsequent releases, when a system utilizes the inter-site carrier aggregation technique, it will necessarily have some impacts on the existing system, e.g., with respect to the design of Physical Uplink Control Channel (PUCCH). In the current release of LTE, since the carrier aggregation technique is only applied in a single base station, a pair of component carriers is defined as primary component carriers. The PUCCH is only transmitted on the primary component carriers.

[0004]   In a scenario where the inter-site carrier aggregation technique is employed, according to its characteristics, the pair of primary component carriers should be a pair of working carriers of a macro cell base station since the primary component carriers are closely related to UE measurement and mobility management which are essential functions of the macro cell base station.

Citation List

Non Patent Literature

[0005]   NPL 1: "RWS-120010, NTT DoCoMo, Requirements Candidate Solutions & Technology Roadmap for LTE Rel-12 Onward"(June 11, 2012)

Summary of Invention

Technical Problem

[0006]   However, depending on the actual system configuration, there may be a shorter transmission distance and a higher uplink data transmission capacity between a UE and a micro cell base station. Thus, it is desired to feed back channel state information of the UE on an uplink working carrier of the micro cell base station.

Solution to Problem

[0007]   In order to overcome the above problem, the prevent invention provides a method for component carrier configuration, a base station and a user equipment.

[0008]   According to an aspect of the present invention, a method for component carrier con- figuration is provided. The method includes: generating, by a Base Station (BS), secondary cell (SCell) configuration information and transmitting it to a User Equipment (UE); transmitting, by the BS, an SCell activation request for the UE to a micro BS and receiving from the micro BS an SCell activation response to the SCell activation request; and transmitting, by the BS, SCell activation information to the UE if the received SCell activation response indicates that the SCell activation request is accepted by the micro BS. The SCell configuration information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a secondary primary cell (S-PCell) associated with the micro BS.

[0009]   According to another aspect of the present invention, a Base Station (BS) is provided. The BS includes: a secondary cell (SCell) configuration unit configured to generate secondary cell (SCell) configuration information and transmit it to a User Equipment (UE); an SCell activation request unit configured to transmit an SCell ac- tivation request for the UE to a micro BS and receive from the micro BS an SCell ac- tivation response to the SCell activation request; and an SCell activation unit configured to transmit SCell activation information to the UE if the received SCell ac- tivation response indicates that the SCell activation request is accepted by the micro BS. The SCell configuration information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a secondary primary cell (S-PCell) associated with the micro BS.

[0010]   According to yet another aspect of the present invention, a User Equipment (UE), is provided. The UE includes: a reception unit configured to receive from a Base Station (BS) secondary cell (SCell) configuration information containing group numbers and indices of SCells associated with the BS and a micro BS, respectively, and indicating a secondary primary cell (S-PCell) associated with the micro BS; and a transmission unit configured to transmit a Physical Uplink Control Channel (PUCCH) on an uplink component carrier corresponding to the S-PCell upon receiving the SCell activation in-

formation from the BS.

Advantageous Effects of Invention

[0011]   With the method for component carrier configuration and the corresponding BS and UE according to the present invention, the channel state information of the UE can be fed back on an uplink working carrier of the micro cell base station.

Brief Description of Drawings

[0012]   [fig.1(a)]Fig. 1(a) is a schematic diagram showing a process in which a BS notifies a UE of SCell configuration information according to the prior art;

[fig.1(b)]Fig. 1(b) is a schematic diagram of a MAC control unit according to the prior art;

[fig.2]Fig. 2 is a schematic diagram showing a scenario in which a BS transmits data to a UE on a number of carriers according to the prior art;

[fig.3]Fig. 3 is a schematic diagram showing carrier aggregation of a BS and a micro BS according to the prior art;

[fig.4]Fig. 4 is a flowchart illustrating a method for component carrier configuration according to an embodiment of the present invention;

[fig.5]Fig. 5 is a schematic diagram showing carrier aggregation of a BS and a micro BS according to an embodiment of the present invention;

[fig.6]Fig. 6 is a schematic diagram of a MAC control unit according to an embodiment of the present invention;

[fig.7]Fig. 7 is a schematic diagram showing carrier aggregation of a BS and a micro BS according to another embodiment of the present invention;

[fig.8]Fig. 8 is a block diagram of a BS according to an embodiment of the present invention;

[fig.9]Fig. 9 is a block diagram of a UE according to an embodiment of the present invention.

Description of Embodiments

[0013]   The embodiments of the present disclosure will be detailed below with reference to the drawings. It should be noted that the following embodiments are illustrative only, rather than limiting the scope of the present disclosure. In the following description, details of well known techniques which are not directly relevant to the present invention will be omitted so as not to obscure the concept of the invention.

[0014]   In the following, a number of embodiments of the present invention will be detailed in an exemplary application environment of LTE Rel-12 mobile communication system and its subsequent evolutions. Herein, it is to be noted that the present invention is not limited to the application exemplified in the embodiments. Rather, it is applicable to other communication systems, such as the future 5G cellular commu-

nication system.

[0015]   In order to better explain the contents of the present invention, a process of configuring component carriers in a LTE Rel-10 system will be briefly described at first.

[0016]   Initially, a UE performs random access and RRC connection operations in a primary cell (PCell) (in LTE Rel-10, a cell is defined as a pair of carriers for uplink/downlink data transmission and a PCell is defined as a cell capable of providing all the necessary control information and functions). After security verification of the system, a BS can configure, for a UE that supports carrier aggregation, one or more secondary cells (SCells) (other serving cells configured for the UE in addition to the PCell). (Generally, the serving cells include the PCell and the SCells.) As shown in Fig. 1(a), the BS notifies the UE of the SCell configuration information via RRC signaling to add or release an SCell of the UE. In Reference 2 ("3GPP TS 36.331, Radio Resource Control (RRC) Protocol specification (Release 10)"), the above RRC signaling is defined as follows:

RRC Connection Reconfiguration message

```
-- ASN1START
...
RRCConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
     sCellToReleaseList-r10         SCellToReleaseList-r10      OPTIONAL,   -- Need ON
     sCellToAddModList-r10          SCellToAddModList-r10       OPTIONAL,   -- Need ON
     ...
}

SCellToAddModList-r10 ::=       SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellToAddMod-r10

SCellToAddMod-r10 ::=           SEQUENCE {
                                sCellIndex-r10             SCellIndex-r10,
                                cellIdentification-r10     SEQUENCE {
                                    physCellId-r10              PhysCellId,
                                    dl-CarrierFreq-r10          ARFCN-ValueEUTRA
                                }OPTIONAL,   -- Cond SCellAdd
                                ...
}

SCellToReleaseList-r10 ::=      SEQUENCE (SIZE (1..maxSCell-r10)) OF SCellIndex-r10

...
-- ASN1STOP
```

[0017]   The above RRC signaling message contains two fields related to the SCell configuration information. The first one is an sCellToReleaseList-r10 field which defines a set of SCells to be released by this signaling message. The set of SCells is represented by ID numbers of the SCells (i.e., SCellIndex-r10). The second one is an SCellToAddModList-r10 field which defines a set of SCells to be added by this signaling message. The set of SCells is represented by SCellToAddMod-r10 containing information on the SCells. In particular, SCellToAddMod-r10 contains ID numbers of the SCells, ID numbers of physical cells and carrier frequency numbers of the SCells.

[0018]   As shown in Fig. 1(a), after successfully configuring one or more SCells for the UE via the above RRC signaling message, the configured SCells can be activated or deactivated by MAC layer signaling. In particular, Reference 3 (3GPP TS 36.321,

Medium Access Control (MAC) protocol specification (Release 10)) defines a MAC control unit, as shown in Fig. 1(b), for activating and deactivating an SCell. As shown in Fig. 1(b), if an SCell having an SCellIndex of i is configured for the UE, Ci indicates the active state of the SCell. Otherwise the UE ignores the Ci field. Ci equal to 1 indicates that the SCell having the SCellIndex of i is to be activated, while Ci equal to 0 indicates that the SCell having the SCellIndex of i is to be deactivated. The R field is a reserved bit set to a constant of 0.

[0019]   In the LTE Rel-10 system, since the carrier aggregation is only possible in a single BS, as shown in Fig. 2, a BS can transmit data to a UE on a number of carriers. For each UE, there is only one PCell defined for operations such as system information acquisition, random access, semi-static data scheduling, RLM measurement and transmission of PUCCH information. Additionally, up to four SCells can be configured for a UE to transmit UE data. Any of the SCells can be activated or deactivated via the above MAC signaling, but the PCell cannot be deactivated.

[0020]   In LTE Rel-12 and its subsequent releases, a system may employ an inter-BS carrier aggregation as shown in Fig. 3. As shown in Fig. 3, a UE is served by two serving cells of a macro BS (also referred to as "BS" herein) and three serving cells of a micro BS simultaneously. The control plane data is transmitted via the serving cells of the macro BS and the user plane data is transmitted via the serving cells of the micro BS. According to the current specification, a UE can only have one PCell which is one of the serving cells of the macro BS. While the UE may have a better link condition with the micro BS, according to the current specification, the SPS service of the UE can only be scheduled to be communicated with the macro BS on the PCell. Also, since the PUCCH can only be transmitted on the PCell, CSI can only be fed back to the macro BS on an uplink component carrier corresponding to the PCell. This will necessarily have impacts on the system performance.

[0021]   In view of this, according to the present invention, the serving cells are divided into groups based on BS sites (BS or micro BS) and one of the serving cells associated with the micro BS is selected as a secondary PCell (S-PCell). The UE can transmit the PUCCH on the uplink component carrier corresponding to the S-PCell to feed back CSI for the downlink component carriers corresponding to the serving cells of the micro BS. The UE can also transmit its SPS service on the downlink component carrier corresponding to the S-PCell. The PUCCH that is transmitted by the UE on the uplink component carrier corresponding to the PCell of the BS is only used to feed back CSI for the downlink component carriers corresponding to the serving cells of the BS. In the following, the solutions of component carrier configuration according to the present invention will be detailed with reference to Figs. 4-6.

[0022]   Fig. 4 is a flowchart illustrating a method for component carrier configuration

according to an embodiment of the present invention. The method starts with step S410.

[0023] At step S420, a BS generates SCell configuration information and transmits it to a UE via RRC signaling.

[0024] Then, at Step S430, the BS transmits an SCell activation request for a particular UE to a micro BS via X2 interface signaling. Accordingly, the micro BS feeds back an SCell activation response to the BS.

[0025] After receiving the SCell activation response, the BS transmits SCell activation information to the UE via MAC layer signaling at step S450 if the received SCell activation response indicates that the SCell activation request is accepted by the micro BS ("yes" in Step S440). Then the method ends at step S460. The SCell configuration information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a S-PCell associated with the micro BS.

[0026] If it is "no" in step S440, the method will skip the step S450 and jump to the step S460 where it ends.

[0027] Fig. 5 is a schematic diagram showing carrier aggregation of a BS and a micro BS according to an embodiment of the present invention. In the example shown in Fig. 5, two or more SCells configured for the UE can be divided into a number of groups depending on the station sites associated with the SCells (BS or micro BS). The SCells in each group have the same physical cell ID and the indices of the SCells in different groups are numbered separately. Different groups can be distinguished from each other based on their physical cell IDs. In each of the SCell groups other than the one to which the PCell belongs, the S-PCell within the group is determined based on the values of the indices of the SCells in the group. For example, as shown in Fig. 5, the SCell having the smallest SCell index can be determined as the S-PCell. Of course, alternatively, the SCell having the largest SCell index can be determined as the S-PCell.

[0028] Accordingly, the RRC signaling in the above embodiment can be described as follows.

RRC Connection Reconfiguration message

```
-- ASN1START
...
RRCConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
     sCellToReleaseList-r12          SCellToReleaseList-r12        OPTIONAL,    -- Need ON
     sCellToAddModList-r12           SCellToAddModList-r12         OPTIONAL,    -- Need ON
     ...
}

SCellToAddModList-r12 ::=         SEQUENCE (SIZE (1..maxSCell-r12)) OF SCellToAddMod-r12

SCellToAddMod-r12 ::=             SEQUENCE {
                                     sCellIndex-r12               SCellIndex-r12,
                                     cellIdentification-r12       SEQUENCE {
                                        physCellId-r12               PhysCellId,
                                        dl-CarrierFreq-r12           ARFCN-ValueEUTRA
                                     }OPTIONAL,    -- Cond SCellAdd
                                     ...
}

SCellToReleaseList-r12 ::=        SEQUENCE (SIZE (1..maxSCell-r12)) OF SCellToReleaseMod-r12

SCellToReleaseMod-r12 ::=         SEQUENCE {
                                     sCellIndex-r12       SCellIndex-r12,
                                     physCellId-r12       PhysCellId
                                  }
...
-- ASN1STOP
```

[0029]   In the above signaling message, since for a particular UE each SCell does not have a unique SCell index, in a list of SCells to be released, an SCell to be released needs to be uniquely determined based on its SCell index and physical cell ID (i.e., group number of the SCell).

[0030]   Accordingly, another RRC signaling in the above embodiment can be described as follows.

RRC Connection Reconfiguration message

```
-- ASN1START
...
RRCConnectionReconfiguration-v1020-IEs ::= SEQUENCE {
     sCellToReleaseList-r12-g1       SCellToReleaseList-r12-g1     OPTIONAL,    -- Need ON
     sCellToReleaseList-r12-g2       SCellToReleaseList-r12-g2     OPTIONAL,    -- Need ON

     sCellToAddModList-r12-g1        SCellToAddModList-r12-g1      OPTIONAL,    -- Need ON
     sCellToAddModList-r12-g2        SCellToAddModList-r12-g2      OPTIONAL,    -- Need ON
     ...
}

SCellToAddModList-r12-g1 ::=      SEQUENCE (SIZE (1..maxSCell-r12-g1)) OF SCellToAddMod-r12
SCellToAddModList-r12-g2 ::=      SEQUENCE (SIZE (1..maxSCell-r12-g2)) OF SCellToAddMod-r12

SCellToAddMod-r12 ::=             SEQUENCE {
                                     sCellIndex-r12               SCellIndex-r12,
                                     cellIdentification-r12       SEQUENCE {
                                        physCellId-r12               PhysCellId,
                                        dl-CarrierFreq-r12           ARFCN-ValueEUTRA
                                     }OPTIONAL,    -- Cond SCellAdd
                                     ...
}

SCellToReleaseList-r12-g1 ::=     SEQUENCE (SIZE (1..maxSCell-r12-g1)) OF sCellIndex-r12
SCellToReleaseList-r12-g2 ::=     SEQUENCE (SIZE (1..maxSCell-r12-g2)) OF sCellIndex-r12
...
-- ASN1STOP
```

[0031]   In the above signaling message, different groups are configured separately such that the SCells in each group can be added or released.

[0032]   Alternatively, in the example shown in Fig. 5, the SCells can be grouped based on their respective Timing Advance (TA) group numbers. For example, in LTE Rel-11, a

secondary timing advance group (sTAG) will be introduced for each SCell. The SCells having the same sTAG number will have the same TA. Since, in LTE Rel-12 and its subsequent releases, high frequency carriers will be used in a micro cell, a micro cell BS and a macro BS will have different TAs with respect to a UE and serving cells of the BSs will belong to different TA groups. Thus, it is possible to set the SCell group numbers based on the sTAG numbers. In other words, the group number of each SCell may be set based on a Timing Advance (TA) group number corresponding to the SCell.

[0033]   Accordingly, in a MAC control unit for activating or deactivating an SCell, the Least Significant Bit (LSB) can be redefined as G for indicating the group to which the SCell to be activated or deactivated by the MAC signaling belongs. Fig. 6 is a schematic diagram of a MAC control unit according to an embodiment of the present invention. As shown in Fig. 6, if G is 0, an SCell of the BS can be activated or deactivated and the definition of Ci can be the same as that in LTE Rel-10. If G is 1, an SCell of the micro BS can be activated or deactivated.

[0034]   Fig. 7 is a schematic diagram showing carrier aggregation of a BS and a micro BS according to another embodiment of the present invention. In the example shown in Fig. 7, two or more SCells configured for the UE can be divided into a number of groups depending on the station sites associated with the SCells (BS or micro BS). The SCells in each group have the same physical cell ID and the indices of the SCells in all the groups are numbered jointly. In each of the SCell groups other than the one to which the PCell belongs, the S-PCell within the group is determined based on the values of the indices of the SCells in the group. For example, as shown in Fig. 5, each of the SCells (including the SCells of the macro BS and the SCells of the micro BS) has a unique SCell index and the SCell of the micro BS that has the smallest SCell index is selected as the S-PCell. Of course, alternatively, the SCell having the largest SCell index can be selected as the S-PCell.

[0035]   Fig. 8 is a block diagram of a BS according to an embodiment of the present invention. As shown in Fig. 8, the BS 80 includes an SCell configuration unit 810, an SCell activation request unit 820 and an SCell activation unit 830. The BS 80 shown in Fig. 8 can be used as the macro BS (BS) in the exemplary scenarios shown in Figs. 5 and 7.

[0036]   The SCell configuration unit 810 is configured to generate SCell configuration information and transmit it to a UE. The SCell activation information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a S-PCell associated with the micro BS. Preferably, the group numbers of the SCells associated with the BS are set to be identical to each other and the group numbers of the SCells associated with the micro BS ate set to be identical to each

other. In addition, the SCell configuration unit 810 can number the indices of the SCells having different group numbers separately, or number the indices of all the SCells jointly. Further, the SCell configuration unit 810 can select one of the SCells associated with the micro BS which has the largest or smallest index as the S-PCell associated with the micro BS.

[0037] The SCell activation request unit 820 is configured to transmit an SCell activation request for the UE to a micro BS and receive from the micro BS an SCell activation response to the SCell activation request.

[0038] The SCell activation unit 830 is configured to transmit SCell activation information to the UE if the received SCell activation response indicates that the SCell activation request is accepted by the micro BS. Preferably, the SCell activation information can contain a bit indicating a group number of an SCell to be activated (e.g., the bit "G" as shown in Fig. 6). The group number of each SCell can include a physical cell identifier.

[0039] Fig. 9 is a block diagram of a UE according to an embodiment of the present invention. As shown in Fig. 9, the UE 90 includes a reception unit 910 and a transmission unit 920. The UE 90 shown in Fig. 9 can be used as the UE in the exemplary scenarios of Figs. 5 and 7.

[0040] The reception unit 910 is configured to receive, from a BS, SCell configuration information containing group numbers and indices of SCells associated with the BS and a micro BS, respectively, and indicating an S-PCell associated with the micro BS. Preferably, the group numbers of the SCells associated with the BS are identical to each other and the group numbers of the SCells associated with the micro BS are identical to each other. Preferably, the S-PCell associated with the micro BS is one of the SCells associated with the micro BS which has the largest or smallest index.

[0041] The transmission unit 920 is configured to transmit a Physical Uplink Control Channel (PUCCH) on an uplink component carrier corresponding to the S-PCell upon receiving the SCell activation information from the BS. Preferably, the SCell activation information contains a bit indicating a group number of an SCell to be activated (e.g., the bit "G" as shown in Fig. 6).

[0042] With the method for component carrier configuration and the corresponding BS and UE according to the present invention, the channel state information of the UE can be fed back on an uplink working carrier of the micro cell base station.

[0043] It can be appreciated that the above embodiments of the present invention can be implemented in software, hardware or any combination thereof. For example, the internal components of the BS and the UE in the above embodiments can be implemented using various devices including, but not limited to, analog circuit device, digital circuit device, Digital Signal Processing (DSP) circuit, programmable processor, Application

Specific Integrated Circuit (ASIC), Field Programmable Gate Array (FPGA), Programmable Logic Device (CPLD) and so on.

[0044]   In the present application, the term "base station" means a mobile communication data and control exchange center with a large transmit power and a wide coverage area and including functions such as resource allocation/scheduling, data reception/ transmission and the like. The term "user equipment" means a user mobile terminal, including e.g., a mobile phone, a notebook computer and other terminal devices that can wirelessly communicate with a BS or and micro BS.

[0045]   The present disclosure has been described above with reference to the preferred embodiments thereof. It should be understood that various modifications, alternations and additions can be made by those skilled in the art without departing from the spirits and scope of the present disclosure. Therefore, the scope of the present disclosure is not limited to the above particular embodiments but only defined by the claims as attached and the equivalents thereof.

[0046]   The present invention can also be expressed as follows.

[0047]   According to an aspect of the present invention, a method for component carrier configuration is provided. The method includes: generating, by a Base Station (BS), secondary cell (SCell) configuration information and transmitting it to a User Equipment (UE); transmitting, by the BS, an SCell activation request for the UE to a micro BS and receiving from the micro BS an SCell activation response to the SCell activation request; and transmitting, by the BS, SCell activation information to the UE if the received SCell activation response indicates that the SCell activation request is accepted by the micro BS. The SCell configuration information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a secondary primary cell (S-PCell) associated with the micro BS.

[0048]   Preferably, the group numbers of the SCells associated with the BS are set to be identical to each other and the group numbers of the SCells associated with the micro BS are set to be identical to each other.

[0049]   Preferably, the group number of each SCell is set based on a Timing Advance (TA) group number corresponding to the SCell.

[0050]   Preferably, the indices of the SCells having different group numbers are numbered separately.

[0051]   Preferably, the indices of all the SCells are numbered jointly.

[0052]   Preferably, one of the SCells associated with the micro BS which has the largest or smallest index is selected as the S-PCell associated with the micro BS.

[0053]   Preferably, the SCell activation information contains a bit indicating a group number of an SCell to be activated.

[0054]   Preferably, the group number of each SCell comprises a physical cell identifier.

[0055]   According to another aspect of the present invention, a Base Station (BS) is provided. The BS includes: a secondary cell (SCell) configuration unit configured to generate secondary cell (SCell) configuration information and transmit it to a User Equipment (UE); an SCell activation request unit configured to transmit an SCell activation request for the UE to a micro BS and receive from the micro BS an SCell activation response to the SCell activation request; and an SCell activation unit configured to transmit SCell activation information to the UE if the received SCell activation response indicates that the SCell activation request is accepted by the micro BS. The SCell configuration information contains group numbers and indices of SCells associated with the BS and the micro BS, respectively, and indicates a secondary primary cell (S-PCell) associated with the micro BS.

[0056]   Preferably, the SCell configuration unit is further configured to set the group numbers of the SCells associated with the BS to be identical to each other and set the group numbers of the SCells associated with the micro BS to be identical to each other.

[0057]   Preferably, the SCell configuration unit is further configured to set the group number of each SCell based on a Timing Advance (TA) group number corresponding to the SCell.

[0058]   Preferably, the SCell configuration unit is further configured to number the indices of the SCells having different group numbers separately.

[0059]   Preferably, the SCell configuration unit is further configured to number the indices of all the SCells jointly.

[0060]   Preferably, the SCell configuration unit is further configured to select one of the SCells associated with the micro BS which has the largest or smallest index as the S-PCell associated with the micro BS.

[0061]   Preferably, the SCell activation information contains a bit indicating a group number of an SCell to be activated.

[0062]   Preferably, the group number of each SCell comprises a physical cell identifier.

[0063]   According to yet another aspect of the present invention, a User Equipment (UE), is provided. The UE includes: a reception unit configured to receive from a Base Station (BS) secondary cell (SCell) configuration information containing group numbers and indices of SCells associated with the BS and a micro BS, respectively, and indicating a secondary primary cell (S-PCell) associated with the micro BS; and a transmission unit configured to transmit a Physical Uplink Control Channel (PUCCH) on an uplink component carrier corresponding to the S-PCell upon receiving the SCell activation information from the BS.

[0064]   Preferably, the group numbers of the SCells associated with the BS are identical to each other and the group numbers of the SCells associated with the micro BS are identical to each other.

[0065]   Preferably, the S-PCell associated with the micro BS is one of the SCells associated with the micro BS which has the largest or smallest index.

[0066]   Preferably, the SCell activation information contains a bit indicating a group number of an SCell to be activated.

[0067]   With the method for component carrier configuration and the corresponding BS and UE according to the present invention, the channel state information of the UE can be fed back on an uplink working carrier of the micro cell base station.

Claims

[Claim 1]   A method for component carrier configuration, comprising:
                 generating, by a Base Station (BS), secondary cell (SCell) con-
                 figuration information and transmitting it to a User Equipment (UE);
                 transmitting, by the BS, an SCell activation request for the UE to a
                 micro BS and receiving from the micro BS an SCell activation response
                 to the SCell activation request; and
                 transmitting, by the BS, SCell activation information to the UE if the
                 received SCell activation response indicates that the SCell activation
                 request is accepted by the micro BS,
                 wherein the SCell configuration information contains group numbers
                 and indices of SCells associated with the BS and the micro BS, re-
                 spectively, and indicates a secondary primary cell (S-PCell) associated
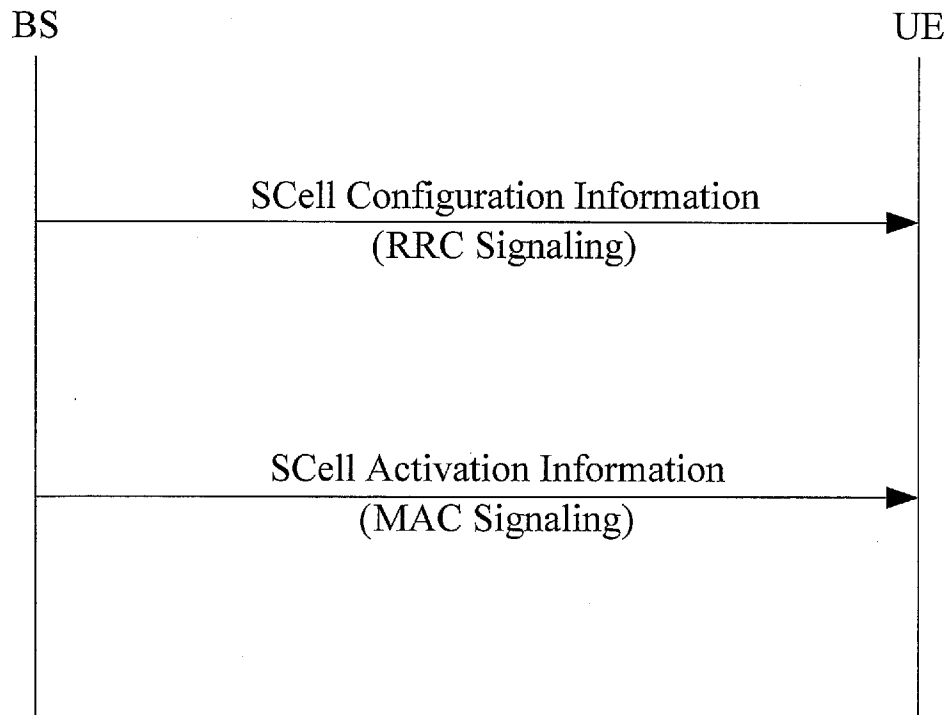   with the micro BS.

[Claim 2]   The method of claim 1, wherein the group numbers of the SCells as-
                 sociated with the BS are set to be identical to each other, and the group
                 numbers of the SCells associated with the micro BS are set to be
                 identical to each other.

[Claim 3]   The method of claim 1, wherein the group number of each SCell is set
                 based on a Timing Advance (TA) group number corresponding to the
                 SCell.

[Claim 4]   The method of claim 1, wherein the indices of the SCells having
                 different group numbers are numbered separately.

[Claim 5]   The method of claim 1, wherein the indices of all the SCells are
                 numbered jointly.

[Claim 6]   The method of claim 1, wherein one of the SCells associated with the
                 micro BS which has the highest or smallest index is selected as the S-
                 PCell associated with the micro BS.

[Claim 7]   The method of claim 1, wherein the SCell activation information
                 contains a bit indicating a group number of an SCell to be activated.

[Claim 8]   The method of claim 1, wherein the group number of each SCell
                 comprises a physical cell identifier.

[Claim 9]   A Base Station (BS), comprising:
                 a secondary cell (SCell) configuration unit configured to generate
                 secondary cell (SCell) configuration information and transmit it to a
                 User Equipment (UE);
                 an SCell activation request unit configured to transmit an SCell ac-

tivation request for the UE to a micro BS and receive from the micro
BS an SCell activation response to the SCell activation request; and
an SCell activation unit configured to transmit SCell activation in-
formation to the UE if the received SCell activation response indicates
that the SCell activation request is accepted by the micro BS,
wherein the SCell configuration information contains group numbers
and indices of SCells associated with the BS and the micro BS, re-
spectively, and indicates a secondary primary cell (S-PCell) associated
with the micro BS.

[Claim 10]   The BS of claim 9, wherein the SCell configuration unit is further
configured to set the group numbers of the SCells associated with the
BS to be identical to each other and set the group numbers of the SCells
associated with the micro BS to be identical to each other.

[Claim 11]   The BS of claim 9, wherein the SCell configuration unit is further
configured to set the group number of each SCell based on a Timing
Advance (TA) group number corresponding to the SCell.

[Claim 12]   The BS of claim 9, wherein the SCell configuration unit is further
configured to number the indices of the SCells having different group
numbers separately.

[Claim 13]   The BS of claim 9, wherein the SCell configuration unit is further
configured to number the indices of all the SCells jointly.

[Claim 14]   The BS of claim 9, wherein the SCell configuration unit is further
configured to select one of the SCells associated with the micro BS
which has the largest or smallest index as the S-PCell associated with
the micro BS.

[Claim 15]   The BS of claim 9, wherein the SCell activation information contains a
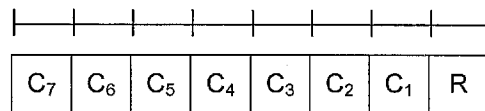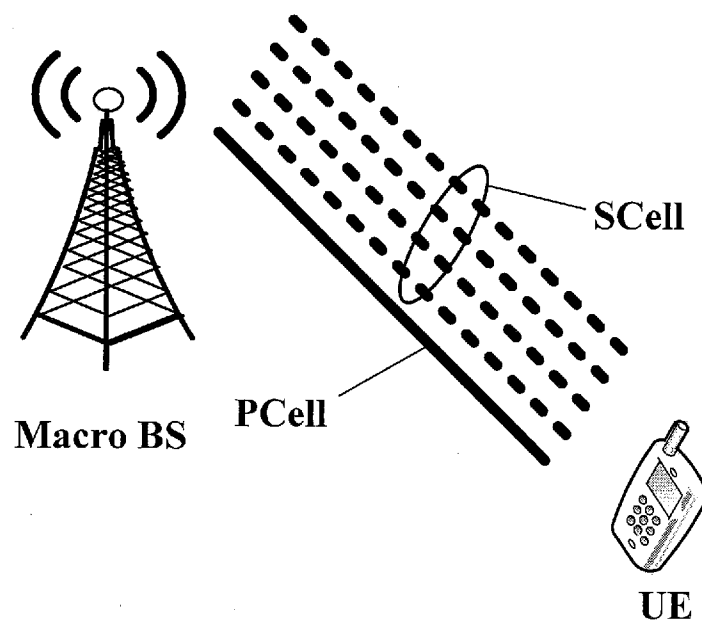bit indicating a group number of an SCell to be activated.

[Claim 16]   The BS of claim 9, wherein the group number of each SCell comprises
a physical cell identifier.

[Claim 17]   A User Equipment (UE), comprising:
a reception unit configured to receive from a Base Station (BS)
secondary cell (SCell) configuration information containing group
numbers and indices of SCells associated with the BS and a micro BS,
respectively, and indicating a secondary primary cell (S-PCell) as-
sociated with the micro BS; and
a transmission unit configured to transmit a Physical Uplink Control
Channel (PUCCH) on an uplink component carrier corresponding to
the S-PCell upon receiving the SCell activation information from the

BS.

[Claim 18]   The UE of claim 17, wherein the group numbers of the SCells as-sociated with the BS are identical to each other and the group numbers of the SCells associated with the micro BS are identical to each other.

[Claim 19]   The UE of claim 17, wherein the S-PCell associated with the micro BS is one of the SCells associated with the micro BS which has the largest or smallest index.

[Claim 20]   The UE of claim 17, wherein the SCell activation information contains a bit indicating a group number of an SCell to be activated.

[Fig. 1(a)]

FIG. 1 (a)

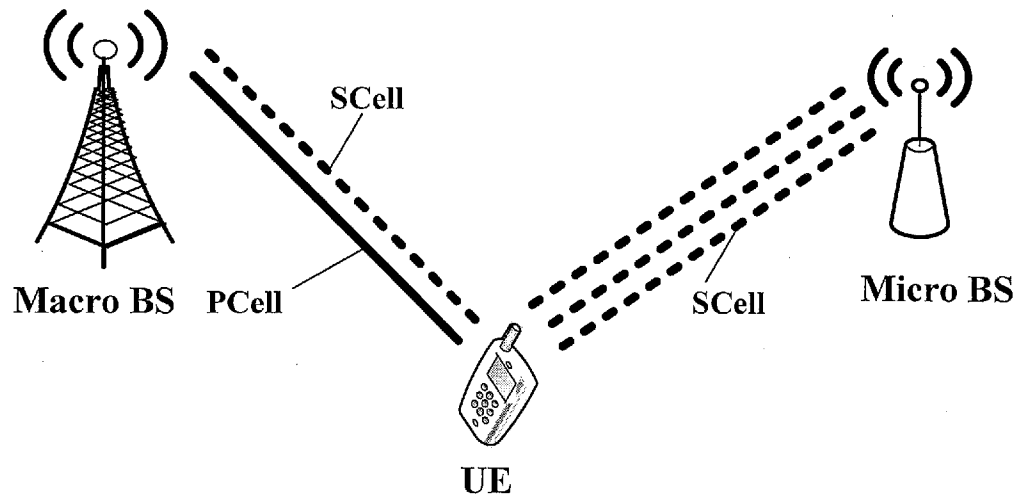BS   UE

SCell Configuration Information
(RRC Signaling)

SCell Activation Information
(MAC Signaling)

[Fig. 1(b)]

FIG. 1 (b)

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R

[Fig. 2]

FIG. 2

Macro BS   PCell   SCell   UE

[Fig. 3]

FIG. 3

Macro BS   PCell   SCell   UE   SCell   Micro BS

[Fig. 4]

FIG. 4
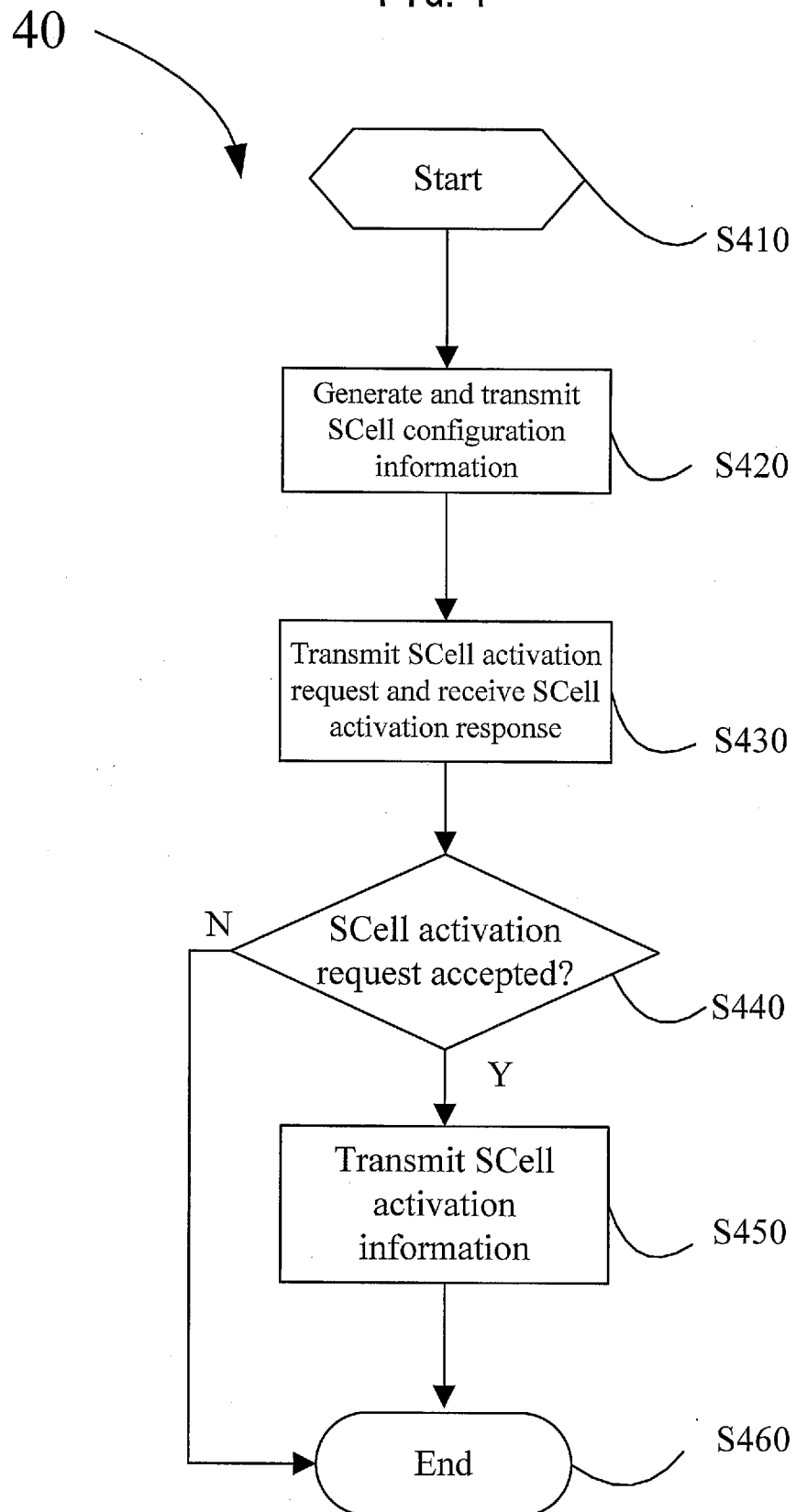
[Fig. 5]

FIG. 5
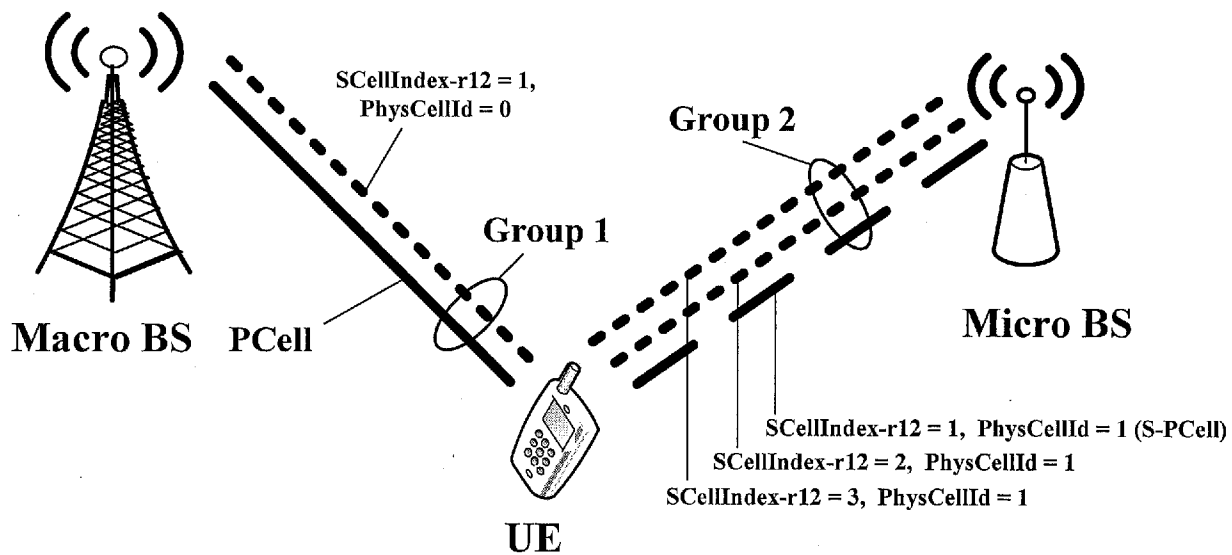
[Fig. 6]

FIG. 6
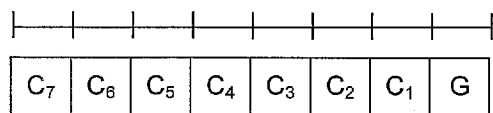
[Fig. 7]

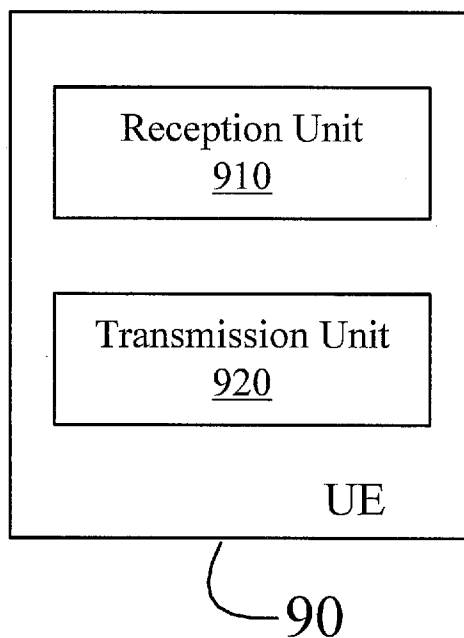# FIG. 7
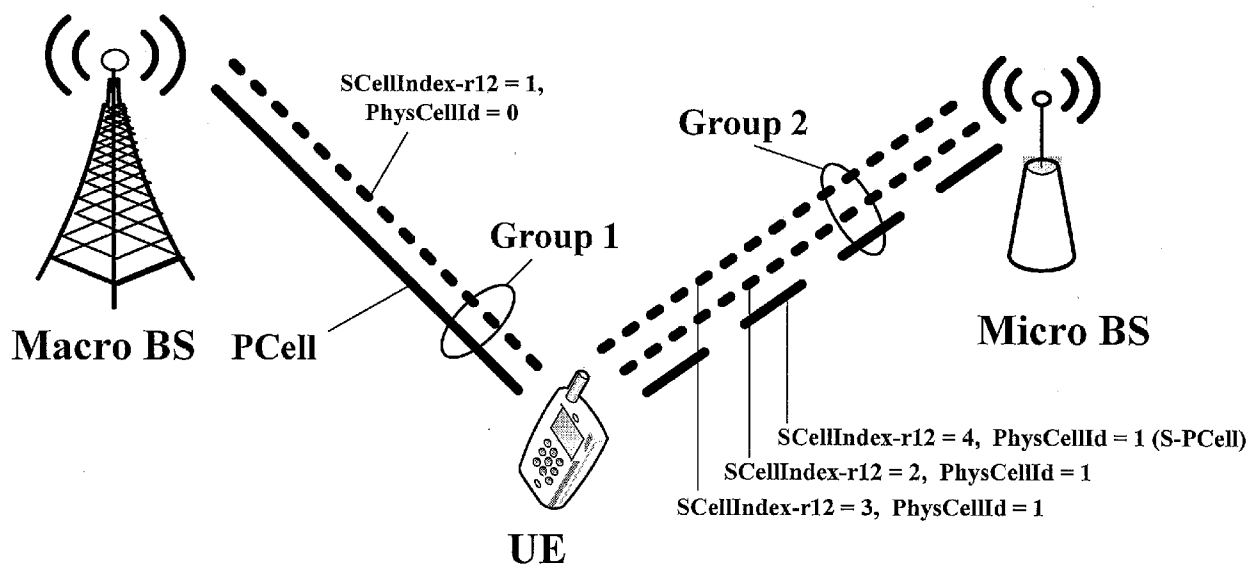
[Fig. 8]

FIG. 8
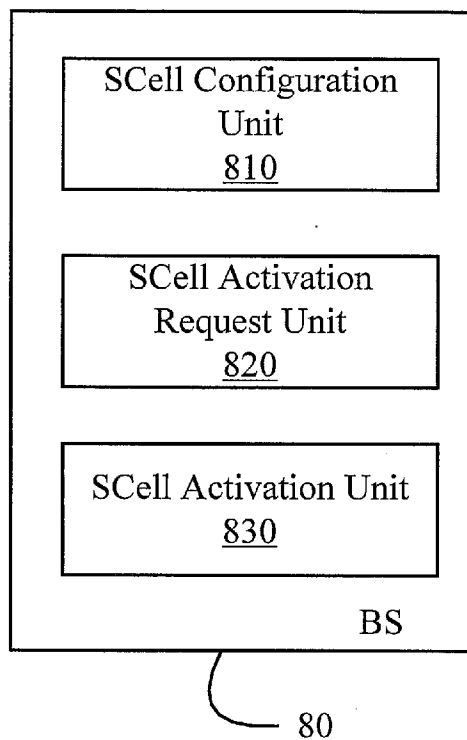
SCell Configuration
Unit
810

SCell Activation
Request Unit
820

SCell Activation Unit
830

BS

80

[Fig. 9]

FIG. 9

Reception Unit
910

Transmission Unit
920

UE

90

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. H04W72/04(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)

Int.Cl. H04B7/24-7/26, H04W4/00-99/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2013
Registered utility model specifications of Japan 1996-2013
Published registered utility model applications of Japan 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification(Release 10), 3GPP TS 36.331 V10.6.0, 2012.06, pp.46-50,59-62,128-129	1-20
A	NTT DOCOMO, Views on UE-Specific UL RS Assignment, 3GPP TSG RAN WG1 Meeting #68 R1-120408, 2012.02.10	1-20
A	WO 2012/022096 A1 (ZTE CORPORATION) 2012.02.23, whole document & JP 2013-524700 A & US 2013/0142134 A1 & EP 2547139 A1 & CN 101908951 A & KR 10-2012-0127674	1-20

☑ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "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 "&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26.09.2013	08.10.2013

Name and mailing address of the ISA/JP	Authorized officer	5J 4682
Japan Patent Office	Keiko Abe	
3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No. +81-3-3581-1101 Ext. 3534	

Form PCT/ISA/210 (second sheet) (July 2009)

C (Continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A		