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(54) **Title**: INITIAL ACCESS FOR STANDALONE CARRIER TYPE

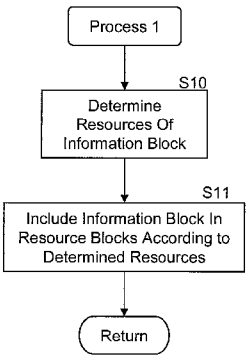

Fig. 2A

(57) **Abstract**: For providing initial access for a standalone carrier type of a cell of a mobile communication system, frequency and time resources of an information block which includes parameters necessary for a user equipment to access the cell are determined (S10) with respect to synchronization signals used to synchronize the user equipment with the cell in time and frequency. The information block is included (Sll) in resource blocks to be broadcasted in the cell, according to the determined frequency and time resources. A use equipment synchronizes with the cell in time and frequency based on the synchronization signals broadcasted in the cell, and searches, in resource blocks broadcasted in the cell which are within a predetermined detection range from frequency and/or time resources of the synchronization signals, for the information block. The user equipment accesses the cell with the parameters included in the information block detected as a result of the searching.

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INITIAL ACCESS FOR STANDALONE CARRIER TYPE

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to providing initial access for a standalone carrier type of a cell of a mobile communication system.

Related background Art

Prior art which is related to this technical field can e.g. be found in:

[1] Ericsson, "Views on TD-LTE for Rel-12", presentation on CMCC TD-LTE workshop, Apr. 2012.

[2] China Mobile, "TD-LTE Evolution and Sharing of TD-LTE Trial", presentation on CMCC TD-LTE workshop, Apr. 2012.

[3] R1-121808, "Configurable Time-Frequency locations for PSS/SSS signals on the NCT", NEC group, TSG-RAN WG1#68Bis, Jeju, Korea, 26th – 30th March 2012.

The following meanings for the abbreviations used in this specification apply:

3GPP	third generation partnership project
CC	component carrier
CRS	cell-specific reference signal
CSI	channel state information
DCI	downlink control information
DL	downlink
DM	demodulation
eCSS	enhanced channel state signal
eNB	enhanced NodeB (name for NodeB in LTE)
ePDCCH	enhanced PDCCH
FFT	fast Fourier transformation
HARQ	hybrid acknowledge request
ID	identifier

LTE	long term evolution
LTE-A	long term evolution advanced
MIB	master information block
NCT	new carrier type
PCC	primary cell carrier
PCI	physical cell ID
PDCCH	physical downlink control channel
PRB	physical resource block
PS	power saving
PSS	primary synchronization signal
RB	resource block
RNTI	radio network temporary identifier
RRC	radio resource control
RS	reference signal
SA	stand alone
SCC	secondary cell carrier
SF	system frame
SI	system information
SIB	SI block
SSS	secondary synchronization signal
UE	user equipment
UL	uplink

3GPP Release 11 brings changes to a number of features by means of a non-standalone new carrier type (R11 NCT). The features comprise an enhanced control channel (ePDCCH) replacing PDCCH, and the control channels are no longer fixed to certain time-frequency resources, but can be more flexibly allocated, and CRS can be significantly reduced, if not completely removed. Besides, the system operation on the NCT is mostly based on CSI-RS and DM-RS instead of CRS.

A new standalone non-backwards compatible carrier type without CRS and legacy control channels will further enhance spectrum efficiency and improve cell deployment flexibilities. An example of the targeted scenario is shown in Fig. 1 which illustrates a stand-alone local access of a UE to a local access node AN

which may or may not reside in an area of a base station BS and does not connect to a macro BS and thus can work standalone (see also references [1] and [2]). However, initial access techniques used for non-standalone carriers cannot simply be reused to provide initial access for standalone carriers.

SUMMARY OF THE INVENTION

The present invention aims at overcoming the above drawbacks. For example, the invention aims at providing methods and apparatuses for enabling an initial access for a standalone carrier type of a cell of a mobile communication system.

This is achieved by the methods and apparatuses as defined in the appended claims. The invention may also be implemented by a computer program product.

According to an embodiment of the invention, in order to provide initial access for an SA-NCT, methods are proposed for MIB indication in the SA-NCT.

The proposed methods offer higher spectrum efficiency and better inter-cell interference reduction/mitigation. Besides, CRS can be removed in the SA-NCT.

In the following the invention will be described by way of embodiments thereof with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a diagram illustrating an example standalone new carrier type scenario.

Figs. 2A and 2B show flowcharts illustrating processes of providing initial access for a standalone carrier type of a cell of a mobile communication system according to embodiments of the invention.

Fig. 3 shows a diagram for explaining determination of MIB frequency and time resources according to a first implementation example of the invention.

Fig. 4 shows a diagram for explaining determination of MIB frequency and time resources according to a second implementation example of the invention.

Fig. 5 shows a schematic block diagram illustrating a configuration of control units in which examples of embodiments of the invention are implementable.

DESCRIPTION OF THE EMBODIMENTS

To enable a standalone non-backward compatible new carrier type (SA-NCT), initial access aspects have to be addressed. For R11 NCT, the initial access is not considered since it comprises no non-standalone carriers.

Here it is assumed that the SA-NCT will reuse current PSS/SSS structure/design, and e.g. the following issues are addressed:
- how can an MIB be indicated to a UE, and
- how can the UE detect the MIB after detecting PSS/SSS in the SA-NCT.
Besides, in case the deployment of an NCT cell is rather dense, in order to improve spectrum efficiency and reduce inter-cell interference for SA-NCT, optimization is proposed in this aspect as well.

In Rel-11 NCT (non-standalone NCT), there is a proposal on configurable frequency or time position for Primary and Secondary Synchronization Signal PSS/SSS, as described in reference [3]. Two possible alternatives are described in reference [3] on how UEs can find out the location of PSS/SSS signals (i.e. the subframe within the radio frame). According to one method, the Pcell informs the UE about the location of PSS/SSS explicitly by RRC signaling relating to the time and frequency location. In the other method the UE can work out the location of PSS/SSS from the detected Cell ID based on an equation.

However, in the prior art only PSS/SSS is considered.

In the following, embodiments of the invention will be described which are concerned with MIB resource indication in SA-NCT, for example.

For the standalone carrier type, this application proposes that MIB frequency and time resources are determined by each cell independently.

In a first embodiment, the same frequency resources as used for synchronization signals, used to synchronize a user equipment (UE) with a cell of a mobile communication system in time and frequency, e.g. PSS/SSS, and a fixed time offset to the synchronization signals are used for an information block, which includes parameters necessary for the user equipment to access the cell, e.g. an MIB.

Fig. 2A shows a flowchart illustrating a process 1 for providing initial access for a standalone carrier type, e.g. an SA-NCT, of a cell of a mobile communication system. The process 1 may be carried out by an entity of the mobile communication system, e.g. an eNB. In step S10, frequency and time resources of the information block (e.g. MIB) are determined with respect to the synchronization signals (e.g. PSS/SSS), and in step S11 the information block is included in resource blocks to be broadcasted in the cell, according to the determined frequency and time resources. According to the first embodiment, the frequency resources of the information block are determined to be the same as frequency resources of the synchronization signals, and the time resources of the information block are determined to have a fixed offset relative to time resources of the synchronization signals.

According to a second embodiment, the frequency and time resources of the information block are determined to have offsets relative to frequency and time resources of the synchronization signals. The offsets may be determined to be linked to an identification of the cell or a physical cell identification. Alternatively, the offsets may be determined to be obtainable by the user equipment via blind detections among several possible offsets. In addition, in case frequency hopping for the information block is enabled, a hopping position of the information block may be indicated in a sequence based on the synchronization signals or a new sequence.

According to a third embodiment, the frequency and time resources of the information block are determined by using a downlink control channel (e.g. an

ePDCCH) in a common search space linked to the synchronization signals. The frequency and time resources of the information block may be determined aperiodically directly after detection of the synchronization signals, or the resource blocks in which the information block is included may have a format of downlink control information of the downlink control channel.

For example, in the third embodiment, an ePDCCH in the common search space is used to schedule the resources of MIB aperiodically directly after PSS/SSS detection, or to carry MIB directly by a predefined ePDCCH DCI format. The common search space location may be linked implicitly to PSS/SSS.

For the standalone carrier type, this application further proposes determining the center frequency in case the information block is not in the center frequency. Once information block resources are determined, the user equipment will determine an offset between the information block frequency resources and the center frequency via implicit linkage to cell ID or PCI, or via an explicit configuration in the information block.

Fig. 2B shows a flowchart illustrating a process 2 of providing initial access for a standalone carrier type of a cell of a mobile communication system. The process 2 may be carried out by an entity of the user equipment. In step S20, the user equipment synchronizes with the cell in time and frequency based on synchronization signals broadcasted in the cell, e.g. based on PSS/SSS. In step S21, the user equipment searches, in resource blocks broadcasted in the cell which are within a predetermined detection range from frequency and/or time resources of the synchronization signals, e.g. 6RB around the location of PSS/SSS, for an information block, which includes parameters necessary for the user equipment to access the cell, e.g. an MIB. In step S22, the user equipment accesses the cell with the parameters included in the information block detected as a result of the searching.

According to the second embodiment, the user equipment may determine an offset between frequency resources of the information block and a center frequency for fast Fourier transformation from an identification of the cell or a

physical cell identification, and/or configuration information contained in the information block.

According to the third embodiment, the user equipment may search for the information block based on information in the downlink control channel in the common search space linked to the synchronization signals. The information in the downlink control channel may be acquired directly after detection of the synchronization signals, or the user equipment may search for the information block in resource blocks having a format of downlink control information of the downlink control channel as mentioned above.

Fig. 3 illustrates a first implementation example of the invention. As shown in Fig. 3, neighbor cells Cell1, Cell2, Cell3 have frequency offsets for transmitting PSS/SSS and MIB. The cell IDs of Cell1, Cell2, Cell3 can be used to implicitly find the offset from the center frequency, or the offset can be indicated in MIB. With this implementation example, better inter-cell interference handling for initial access can be enabled.

In the following, cases of determining the center frequency are described for different relationships between PSS/SSS and MIB resources.

Case 1: PSS/SSS and MIB shift together

In this case, since the signals PSS/SSS are also in a non-center frequency position, the UE synchronizes first with a non-center frequency, called virtual center frequency Fc_v. That is, frequency location of PSS/SSS/MIB is on Fc_v, which is different from the actual center frequency Fc.

The channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz. Further, the difference "Fc_v – Fc" should be larger than 6RB, and should be a multiple of 100kHz. For example, Fc_v may be Fc-1.8MHz or Fc+1.8MHz.

In a first step, the UE detects SSS/PSS in Fc_v, assuming Fc_v as center frequency for FFT, and detects 6RB around Fc_v to detect MIB.

In a second step, the UE is informed on the actual center frequency Fc by implicit linkage to cell ID or explicit configuration in MIB message as described above. If Fc_v is not Fc, the UE retunes the carrier frequency and performs a new FFT procedure e.g. according to a DL bandwidth as indicated in MIB. Alternatively, the UE may implicitly know the offset between Fc and Fc_v from PCI.

For indicating the offset in MIB, a PRB number of higher part and lower part of the MIB may be used. A predefined granularity with a few bits may be used to reduce the signaling overhead, e.g., 2 or 4 fixed possible locations and restricted to 1 or 2 bits. Besides, since the same oscillator is used to generate the signals PSS/SSS, the time/frequency offset can be directly reused by the cell for MIB. However, the UE needs one retuning gap to tune to the actual center frequency.

Case 2: PSS/SSS remains in the center and MIB shifts among different frequency positions

In a first step, since PSS/SSS is at the center frequency Fc, the UE synchronizes with Fc.

In a second step, if the offset is linked to cell ID (or PCI), the UE knows the MIB frequency offset after PSS/SSS detection, and detects the MIB at a frequency "Fc+offset". Otherwise, the UE may search for the MIB in 6RB at a few possible resources, for example at Fc (Fc-3RB to Fc+3RB), Fc+6RB (Fc+3RB, Fc+9RB), Fc-6RB (Fc-3RB, Fc-9RB), as an example of three possible predefined locations, and blind detect the MIB.

Case 3: PSS/SSS and MIB hop over different frequency positions

1. PSS/SSS hopping

The PSS/SSS frequency position hops randomly. This may be useful for a femto type of deployment (no cell planning). This is up to eNB implementation and is covered by cases 1 and 2 with explicit offset indication in MIB.

2. MIB hopping

MIB always hops together with PSS/SSS. This is covered by case 1 with explicit offset indication in MIB.

Alternatively, MIB further hops on its own. PSS/SSS sequence (which is used to indicate first 5ms, second 5ms in R8) can be used to indicate the MIB hopping position. Two predefined hopping positions are possible in this case. Alternatively, a sequence other than the PSS/SSS sequence may be transmitted with a predefined relative position to PSS/SSS, which is used to indicate the hopping position for MIB if more hopping positions are needed. The number of hopping positions depends on the sequence number selected.

Fig. 4 illustrates a second implementation example of the invention.

In a first step, the UE detects PSS/SSS. In a second step, the UE switches directly to PCI linked eCSS region for ePDCCH detection. In Fig. 4, since the UE tries to access cell 1, the UE switches to "ePDCCH eCSS Cell1". Cells with different PCI have orthogonal eCSS resources.

In a third step, the UE detects an ePDCCH using a dedicated reserved MIB-RNTI. Alternatively, the UE may detect the ePDCCH using an SI-RNTI. For such case, the UE performs measurements only in certain SFs when no other SIBs are transmitted, or leaves a possible collision of normal SIB and PBCH to be handled by eNB implementation. For example, the UE detects a certain valid DCI format X2, and the content in this DCI format itself represents MIB information bits. Otherwise, the MIB information bits are included in a PBCH resource as allocated in a granted access, and the size can be rather flexible.

For both implementation examples described above, the MIB can be defined to use DMRS or truncated CRS in the 6RBs containing MIB. The UE can detect the MIB after detecting PSS/SSS.

Both implementation examples offer improved spectrum efficiency and reduce inter-cell interference for SA-NCT.

The second implementation example offers a higher flexibility than the first one, and even can schedule MIB together with SIB information since the resource is very flexible. eICIC is implicitly supported since the resources are very flexible.

Now reference is made to Fig. 5 for illustrating a simplified block diagram of various electronic devices that are suitable for use in practicing the exemplary embodiments of this invention.

Fig. 5 shows a control unit 10 which may be used by or be part of an entity of a mobile communication system, e.g. an eNB. The control unit 10 includes processing resources (processing circuitry) 11, memory resources (memory circuitry) 12, which may comprise a program, and interfaces (interfacing circuitry) 13 which are connected by a link 14. The control unit 10 may be connected to a control unit 20 through a link 30 via the interfaces 13.

The control unit 20 which may be used by or be part of an entity of a user equipment includes processing resources (processing circuitry) 21, memory resources (memory circuitry) 22, which may comprise a program, and interfaces (interfacing circuitry) 23 which are connected by a link 24. The control unit 20 may be connected to the control unit 10 through the link 30 via the interfaces 23.

The terms "connected," "coupled," or any variant thereof, mean any connection or coupling, either direct or indirect, between two or more elements, and may encompass the presence of one or more intermediate elements between two elements that are "connected" or "coupled" together. The coupling or connection between the elements can be physical, logical, or a combination thereof. As employed herein two elements may be considered to be "connected" or "coupled" together by the use of one or more wires, cables and printed electrical connections, as well as by the use of electromagnetic energy, such as electromagnetic energy having wavelengths in the radio frequency region, the microwave region and the optical (both visible and invisible) region, as non-limiting examples.

At least one of the programs stored in the memory resources 12, 22 is assumed to include program instructions that, when executed by the associated processing resources 11, 21, enable the electronic device to operate in accordance with the exemplary embodiments of this invention, as detailed above. Inherent in the processing resources 11, 21 is a clock to enable synchronism among the various apparatus for transmissions and receptions within the

appropriate time intervals and slots required, as the scheduling grants and the granted resources/subframes are time dependent. The interfaces 13, 23 include transceivers which include both transmitter and receiver, and inherent in each is a modulator/demodulator commonly known as a modem.

In general, the exemplary embodiments of this invention may be implemented by computer software stored in the memory resources 12, 22 and executable by the processing resources 11, 21, or by hardware, or by a combination of software and/or firmware and hardware in any or all of the devices shown.

In general, the various embodiments of the UE described above can include, but are not limited to, mobile stations, cellular telephones, personal digital assistants (PDAs) having wireless communication capabilities, portable computers having wireless communication capabilities, image capture devices such as digital cameras having wireless communication capabilities, gaming devices having wireless communication capabilities, music storage and playback appliances having wireless communication capabilities, Internet appliances permitting wireless Internet access and browsing, as well as portable units or terminals that incorporate combinations of such functions.

The memory resources 12, 22 may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor-based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The processing resources 11, 21 may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on a multi-core processor architecture, as non-limiting examples.

As used in this application, the term 'circuitry' refers to all of the following:
(a) hardware-only circuit implementations (such as implementations in only analog and/or digital circuitry) and
(b) to combinations of circuits and software (and/or firmware), such as (as applicable):

(i) to a combination of processor(s) or

(ii) to portions of processor(s)/software (including digital signal processor(s)), software, and memory(ies) that work together to cause an apparatus, such as a mobile phone or server, to perform various functions) and

(c) to circuits, such as a microprocessor(s) or a portion of a microprocessor(s), that require software or firmware for operation, even if the software or firmware is not physically present.

This definition of 'circuitry' applies to all uses of this term in this application, including in any claims. As a further example, as used in this application, the term 'circuitry' would also cover an implementation of merely a processor (or multiple processors) or portion of a processor and its (or their) accompanying software and/or firmware. The term 'circuitry' would also cover, for example and if applicable to the particular claim element, a baseband integrated circuit or applications processor integrated circuit for a mobile phone or a similar integrated circuit in server, a cellular network device, or other network device.

According to an aspect of the invention, an apparatus providing initial access for a standalone carrier type of a cell of a mobile communication system, which may contain or use the control unit 10, comprises means for determining frequency and time resources of an information block which includes parameters necessary for a user equipment to access the cell, with respect to synchronization signals used to synchronize the user equipment with the cell in time and frequency, and means for including the information block in resource blocks to be broadcasted in the cell, according to the determined frequency and time resources.

The means for determining may determine the frequency resources of the information block to be the same as frequency resources of the synchronization signals, and determine the time resources of the information block to have a fixed offset relative to time resources of the synchronization signals.

Alternatively, the means for determining may determine the frequency and time resources of the information block to have offsets relative to frequency and time resources of the synchronization signals.

Alternatively, the means for determining may determine the offsets to be linked to an identification of the cell or a physical cell identification. Alternatively or in addition, the means for determining may determine the offsets to be obtainable by the user equipment via blind detections among several possible offsets. Alternatively or in addition, in case frequency hopping for the information block is enabled, the means for determining may indicate a hopping position of the information block in a sequence based on the synchronization signals or a new sequence.

Alternatively, the means for determining may determine the frequency and time resources of the information block by using a downlink control channel in a common search space linked to the synchronization signals. The means for determining may determine the frequency and time resources of the information block aperiodically directly after detection of the synchronization signals, or the means for including may include the information block in resource blocks of a format of downlink control information of the downlink control channel.

The means for determining and including may implemented by the processing resources 11, the memory resources 12 and the interfaces 13.

According to an aspect of the invention, an apparatus for providing initial access for a standalone carrier type of a cell of a mobile communication system, which may contain or use the control unit 20, comprising means for synchronizing with the cell in time and frequency based on synchronization signals broadcasted in the cell, means for searching, in resource blocks broadcasted in the cell which are within a predetermined detection range from frequency and/or time resources of the synchronization signals, for an information block which includes parameters necessary for a user equipment to access the cell, and means for accessing the cell with the parameters included in the information block detected as a result of the searching.

The apparatus may comprise means for determining an offset between frequency resources of the information block and a center frequency for fast Fourier transformation from an identification of the cell or a physical cell identification, and/or configuration information contained in the information block.

The means for searching may search for the information block based on information in a downlink control channel in a common search space linked to the synchronization signals. The information in the downlink control channel may be acquired by the means for searching directly after detection of the synchronization signals by the means for synchronization. Alternatively, the means for searching may search for the information block in resource blocks having a format of downlink control information of the downlink control channel.

The means for synchronizing, searching, accessing and determining may be implemented by the processing resources 21, memory resources 22 and interfaces 23.

According to an aspect of the invention, for providing initial access for a standalone carrier type of a cell of a mobile communication system, frequency and time resources of an information block which includes parameters necessary for a user equipment to access the cell are determined with respect to synchronization signals used to synchronize the user equipment with the cell in time and frequency. The information block is included in resource blocks to be broadcasted in the cell, according to the determined frequency and time resources. A use equipment synchronizes with the cell in time and frequency based on the synchronization signals broadcasted in the cell, and searches, in resource blocks broadcasted in the cell which are within a predetermined detection range from frequency and/or time resources of the synchronization signals, for the information block. The user equipment accesses the cell with the parameters included in the information block detected as a result of the searching.

It is to be understood that the above description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and applications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method of providing initial access for a standalone carrier type of a cell of a mobile communication system, the method comprising:

determining frequency and time resources of an information block which includes parameters necessary for a user equipment to access the cell, with respect to synchronization signals used to synchronize the user equipment with the cell in time and frequency; and

including the information block in resource blocks to be broadcasted in the cell, according to the determined frequency and time resources.

2. The method of claim 1, wherein the frequency resources of the information block are determined to be the same as frequency resources of the synchronization signals, and the time resources of the information block are determined to have a fixed offset relative to time resources of the synchronization signals.

3. The method of claim 1, wherein the frequency and time resources of the information block are determined to have offsets relative to frequency and time resources of the synchronization signals.

4. The method of claim 3, wherein

the offsets are determined to be linked to an identification of the cell or a physical cell identification, and/or

the offsets are determined to be obtainable by the user equipment via blind detections among several possible offsets, and/or

in case frequency hopping for the information block is enabled, a hopping position of the information block is indicated in a sequence based on the synchronization signals or a new sequence.

5. The method of claim 1, wherein the frequency and time resources of the information block are determined by using a downlink control channel in a common search space linked to the synchronization signals.

6. The method of claim 5, wherein the frequency and time resources of the information block are determined aperiodically directly after detection of the synchronization signals, or the resource blocks in which the information block is included have a format of downlink control information of the downlink control channel.

7. A method of providing initial access for a standalone carrier type of a cell of a mobile communication system, the method comprising:

synchronizing with the cell in time and frequency based on synchronization signals broadcasted in the cell;

searching, in resource blocks broadcasted in the cell which are within a predetermined detection range from frequency and/or time resources of the synchronization signals, for an information block which includes parameters necessary for a user equipment to access the cell; and

accessing the cell with the parameters included in the information block detected as a result of the searching.

8. The method of claim 7, comprising:

determining an offset between frequency resources of the information block and a center frequency for fast Fourier transformation from an identification of the cell or a physical cell identification, and/or configuration information contained in the information block.

9. The method of claim 7, wherein the information block is searched for based on information in a downlink control channel in a common search space linked to the synchronization signals.

10. The method of claim 9, wherein the information in the downlink control channel is acquired directly after detection of the synchronization signals, or the information block is searched for in resource blocks having a format of downlink control information of the downlink control channel.

11. A computer program product including a program for a processing device, comprising software code portions for performing the steps of any one of claims 1 to 10 when the program is run on the processing device.

12. The computer program product according to claim 11, wherein the computer program product comprises a computer-readable medium on which the software code portions are stored.

13. The computer program product according to claim 11, wherein the program is directly loadable into an internal memory of the processing device.

14. An apparatus for providing initial access for a standalone carrier type of a cell of a mobile communication system, the apparatus comprising:

at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to perform:

determining frequency and time resources of an information block which includes parameters necessary for a user equipment to access the cell, with respect to synchronization signals used to synchronize the user equipment with the cell in time and frequency; and

including the information block in resource blocks to be broadcasted in the cell, according to the determined frequency and time resources.

15. The apparatus of claim 14, wherein the frequency resources of the information block are determined to be the same as frequency resources of the synchronization signals, and the time resources of the information block are determined to have a fixed offset relative to time resources of the synchronization signals.

16. The apparatus of claim 14, wherein the frequency and time resources of the information block are determined to have offsets relative to frequency and time resources of the synchronization signals.

17. The apparatus of claim 16, wherein

the offsets are determined to be linked to an identification of the cell or a physical cell identification, and/or

the offsets are determined to be obtainable by the user equipment via blind detections among several possible offsets, and/or

in case frequency hopping for the information block is enabled, a hopping position of the information block is indicated in a sequence based on the synchronization signals or a new sequence.

18. The apparatus of claim 14, wherein the frequency and time resources of the information block are determined by using a downlink control channel in a common search space linked to the synchronization signals.

19. The apparatus of claim 18, wherein the frequency and time resources of the information block are determined aperiodically directly after detection of the synchronization signals, or the resource blocks in which the information block is included have a format of downlink control information of the downlink control channel.

20. An apparatus for providing initial access for a standalone carrier type of a cell of a mobile communication system, the apparatus comprising:

at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to perform:

synchronizing with the cell in time and frequency based on synchronization signals broadcasted in the cell;

searching, in resource blocks broadcasted in the cell which are within a predetermined detection range from frequency and/or time resources of the synchronization signals, for an information block which includes parameters necessary for a user equipment to access the cell; and

accessing the cell with the parameters included in the information block detected as a result of the searching.

21. The apparatus of claim 20, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform:

determining an offset between frequency resources of the information block and a center frequency for fast Fourier transformation from an identification of the cell or a physical cell identification, and/or configuration information contained in the information block.

22. The apparatus of claim 20, wherein the information block is searched for based on information in a downlink control channel in a common search space linked to the synchronization signals.

23. The apparatus of claim 22, wherein the information in the downlink control channel is acquired directly after detection of the synchronization signals, or the information block is searched for in resource blocks having a format of downlink control information of the downlink control channel.

Fig. 1

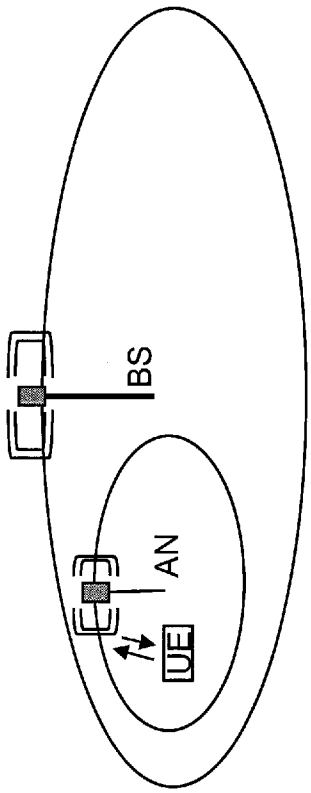
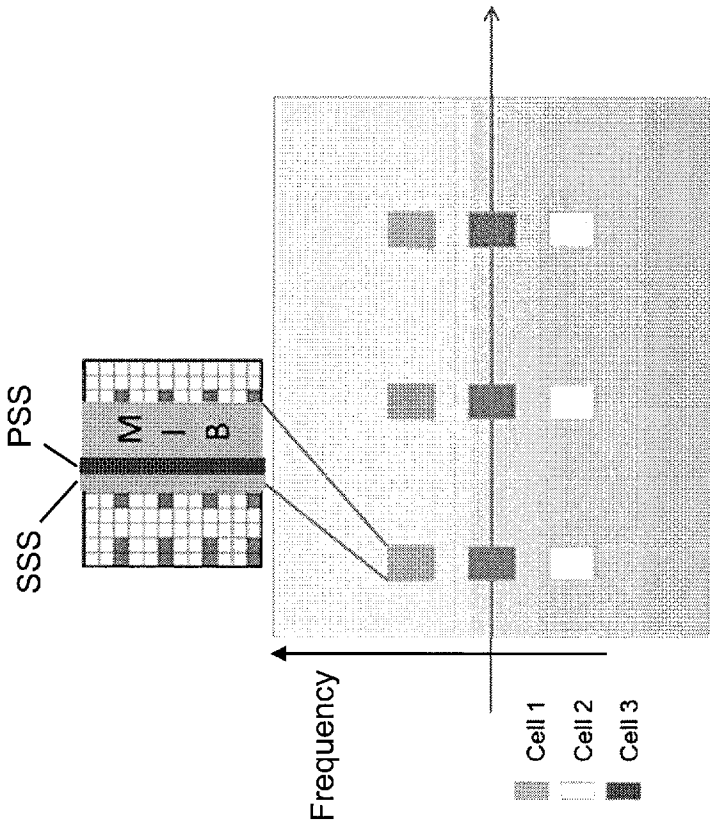


Fig. 3



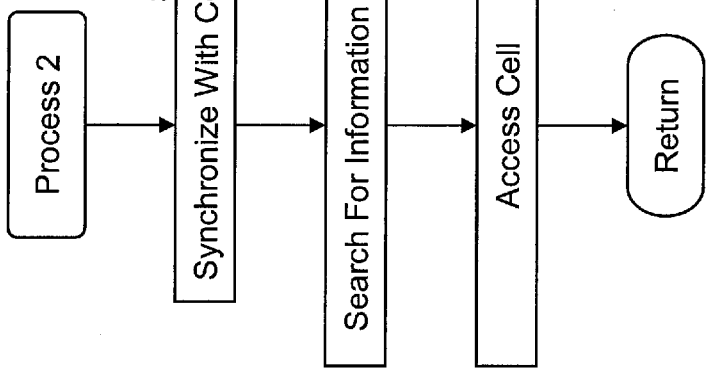

Process 2
S20
Synchronize With Cell
S21
Search For Information Block
S22
Access Cell
Return

Fig. 2B

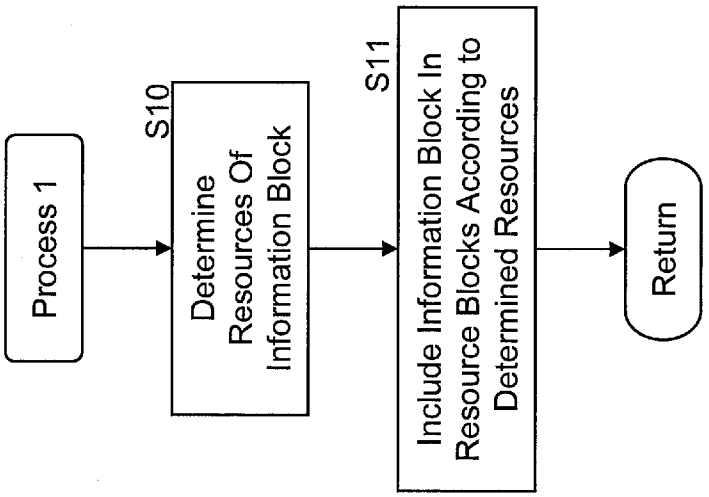
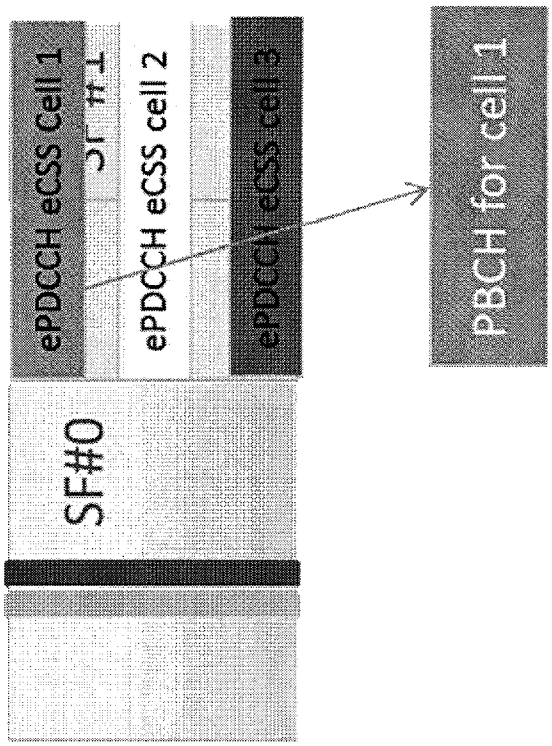

Process 1
S10
Determine Resources Of Information Block
S11
Include Information Block In Resource Blocks According to Determined Resources
Return

Fig. 2A

Fig. 4


SF#0
ePDCCH eCSS Cell 1
ePDCCH eCSS cell 2
ePDCCH eCSS cell 3
PBCH for cell 1

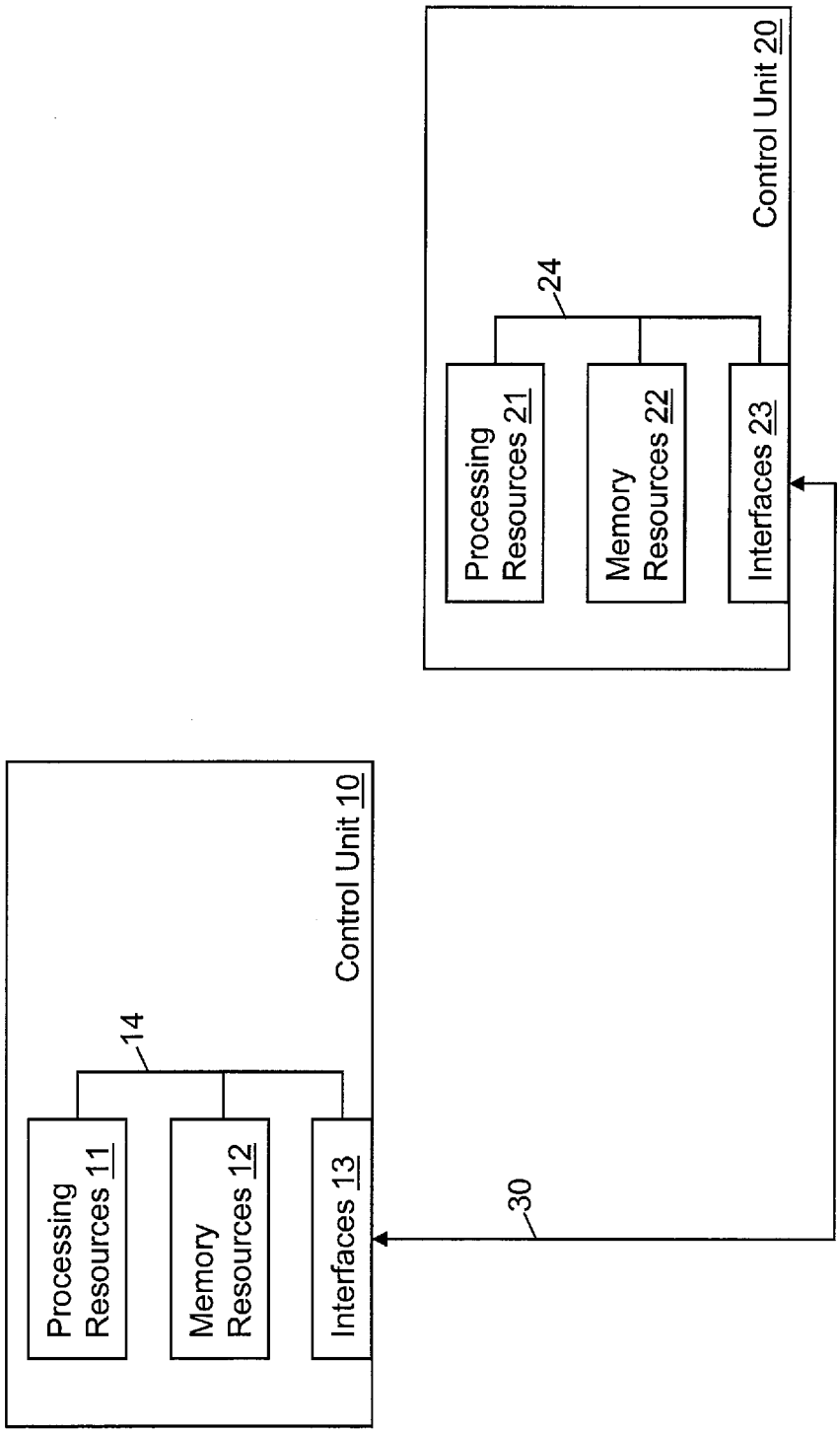

Control Unit 20
24
Processing Resources 21
Memory Resources 22
Interfaces 23
30
Control Unit 10
14
Processing Resources 11
Memory Resources 12
Interfaces 13

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/083009

A. CLASSIFICATION OF SUBJECT MATTER

H04W 28/16 (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)

IPC: H04L;H04Q;H04W;H04B

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

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

WPI,EPODOC,CNPAT,CNKI: standalone, NCT, new carrier type, access, synchroniz+, time, frequency, IB, information block, PDCCH, offset, same

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim
X	CN 102648589 A (HUAWEI TECHNOLOGIES CO., LTD.) 22 August 2012(22.08.2012) description, paragraphs [0028] to [0055] and figure 6	1-23
A	CN 102714812 A (INTERDIGITAL PATENT HOLDINGS INC.) 03 October 2012(03.10.2012) the whole document	1-23
A	CN 102461270 A (NOKIA CORP.) 16 May 2012(16.05.2012) the whole document	1-23
A	US 2003/0043761 A1(HLADIK, Stephen Michael) 06 March 2003(06.03.2003) the whole document	1-23

☐ 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
27 June 2013(27.06.2013)	**18 Jul. 2013 (18.07.2013)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer WANG, Xin Telephone No. (86-10)62413913

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/083009

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102648589 A	22.08.2012	WO 2011023126 A1	03.03.2011
		US 2011051654 A1	03.03.2011
		EP 2471194 A1	04.07.2012
CN 102714812 A	03.10.2012	WO 2011085238 A2	14.07.2011
		US 2012015657 A1	19.01.2012
		EP 2537364 A2	26.12.2012
		AU 2011203949 A1	02.08.2012
		KR 20120113779 A	15.10.2012
		TW 201143491 A	01.12.2011
		AR 079864 A1	22.02.2012
CN 102461270 A	16.05.2012	WO 2010149829 A1	29.12.2010
		US 2012094673 A1	19.04.2012
US 2003/0043761 A1	06.03.2003	None	