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(54) **Title**: METHOD, SYSTEM, BASE STATION AND SIGNAL FOR COMMUNICATING PLANNED FUTURE CELL SYSTEM INFORMATION IN A RADIO TELECOMMUNICATION NETWORK

(57) **Abstract**: The present invention suggests a concept for communicating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, wherein for updating cell system informations a base station communicates a first information about future cell system parameters relating to a predetermined future cell configuration of said communicating base station, and additionally a second information which indicates the time when said future cell system parameters will essentially take effect.

METHOD, SYSTEM, BASE STATION AND SIGNAL FOR COMMUNICATING PLANNED FUTURE CELL SYSTEM INFORMATION IN A RADIO TELECOMMUNICATION NETWORK

FIELD OF THE INVENTION

The present invention relates to a method and an apparatus for communicating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station.

BACKGROUND OF THE INVENTION

In a radio telecommunication network, there is provided a broadcast channel (BCH) for support of a spectrum sharing and flexible spectrum usage (FSU), which is an important issue, in particular for local area deployment. The FSU concept allows multiple operators to share the same frequency spectrum in a decentralized manner using policy based radio resource optimization.

The FSU concept is expected to be implemented in decentralized and uncoordinated manner, where there are a lot of independent base stations (BS), potentially belonging to different operators, which are not connected to each other, but on the other hand they are targeting at sharing the same physical spectrum resources according to certain policies.

The problem of having such a flexible sharing of spectrum among several operators is that the users need to be informed on the current radio parameter configuration of the base station. This requires the transmission of some broadcast information which will typically be sent via the broadcast channel. Normally, the broadcast channel is seen as a static entity which is used as a constant and periodical time-frequency resource and is provided for transmitting semi-static pieces of information – at least in typical cellular network configurations like e.g. GSM (global system for mobile communications), UMTS (universal mobile telecommunication system), and LTE (long term evaluation project). However, when the cell configuration varies in a more frequent manner, mechanisms are needed to handle the time variability

of the used pieces of cell system information. If this is not provided, there is a high risk that all users are dropped from the system whenever the cell system parameters are changed.

SUMMARY OF THE INVENTION

It is an object of the present invention to solve the aforementioned problem, and in particular to suggest a mechanism which is able to successfully handle even a higher time variability of the used pieces of cell system information and to reduce or even avoid the risk that users are dropped from the system whenever the cell system parameters are changed.

In order to achieve the above and further objects, according to a first aspect of the present invention, there is provided a method for communicating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, wherein for updating cell system informations a base station communicates at least a first information about future cell system parameters relating to a predetermined future cell configuration of said communicating base station.

In accordance with a second aspect of the present invention, there is provided a system for communicating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, wherein for updating cell system informations a base station is adapted to communicate at least a first information about future cell system parameters relating to a predetermined future cell configuration of said communicating base station.

According to a third aspect of the present invention, there is provided a base station in a radio telecommunication network including a plurality of base stations and at least a mobile station, comprising a generator for generating at least a first information about future cell system parameters relating to a predetermined future cell configuration of said base station, and a transmitter for transmitting said first

and second informations for updating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations.

According to a fourth aspect of the present invention, there is provided a radio telecommunication network including a plurality of base stations according to the third aspect and at least a mobile station.

According to a fifth aspect of the present invention, there is provided a computer program adapted to carry out a method according to the first aspect.

According to a sixth aspect of the present invention, there is provided a signal for updating cell system informations to be communicated in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, including at least a first information about future cell system parameters relating to a predetermined future cell configuration of a communicating base station.

Further exemplary embodiments and modifications of the present invention are defined in the dependent claims.

It has been found that, if the system configuration of one cell is changed without this being known to the adjacent cells in advance, the set of cells within a system or sub-system cannot jointly optimize their spectrum usage according to certain policies. According to the concept of the present invention, future cell system parameters relating to a predetermined future cell configuration of one cell are advertised to adjacent cells resulting in a joint optimization of the FSU procedure.

Preferably, there is provided a broadcast channel (BCH) which supports synchronous semi-dynamic cell system information updates, while supporting FSU and reducing UE power consumption. The broadcast channel may include the current used cell system information and/or also advertise the cell system information to be used at a certain time into the future. A system Information content switching is required in order to effectively support FSU, i.e. the cell is able to adaptively adjust its settings e.g. according to the load and interference situation. A timer is included

in the broadcast channel to indicate the time instant when the advertised system information will take place. The timer value can include information whether the advertised system information will be used or only tentatively intended for FSU negotiation with other nodes.

It is noted here that the present invention is provided for communicating not only cell system informations, but also a cell system information or pieces thereof.

Further embodiments, details, advantages and modifications of the present invention will become apparent from the following detailed description of an exemplary embodiment.

DESCRIPTION OF AN EXEMPLARY EMBODIMENT

In the following, the concept of the present invention will be described in a more detailed level.

From a conceptual level, it is suggested that the broadcast channel is adapted to transmit a set of cell system parameters which relate to the current or the future cell configuration. It is also suggested that the broadcast channel includes a counter field which indicates the approximate or exact time when changes take effect. One example for this could be a 3-bit field where the values could for instance mean:

Signalled value	Time to change
111	In more than 5 minutes, there will be a change to the new parameters (or parameters might not change at all)
110	In 1-5 min, there will be a change to the new parameters
101	In 10-60 s, there will be a change to the new parameters
100	In 2-10 s, there will be a change to the new parameters
011	In 500-2000 ms, there will be a change to the new parameters
010	In 100-500 ms, there will be a change to the new parameters
001	In 20-100 ms, there will be a change to the new parameters
000	In 0-20 ms, there will be a change to the new parameters

It should be noted that the above values are exemplary and could take different values. The timer values could also have a meaning where e.g. "1XX" indicates only a tentative change, but the user equipment or mobile station needs to listen until the time has a value of "0XX" before a decision as to a system information change is finally made by the base station.

An expected behaviour of the system using the aforementioned concept is described as follows.

When a base station indicates to the system over the broadcast channel that a change is about to happen, the following set of actions can be foreseen:

- The mobile station which is connected to this communicating or originating base station is informed of a change and the time this change will happen, by listening to the broadcast channel on a regular basis.

- Other base stations are listening to the originating base station. The other base stations can decode the next or future cell system parameters and find out whether there will be a conflict with the originating base station and update their own parameters accordingly. In principle a negotiation of resources can take place among base stations before the base stations finally decide to update their cell configuration and system information broadcasted on the broadcast channel.

- In order to improve such information and negotiation between base stations, a mobile station connected to another base station different from the originating base station is capable of listening to the originating base station broadcast channel. This mobile station can potentially forward the future system information communicated from the originating base station as control plane information, such that the other base station can take action according to the new expected usage from the originating base station.

In this way there is provided a control mechanism to handle the adjustment and negotiation of different base station configurations for an optimized FSU.

The above described method may be implemented by computer software or by computer hardware or by a combination of computer software and hardware, preferably in the memory and processor of the base stations.

It should be noted that in the aforementioned exemplary embodiment the broadcast channel is used as a non-limiting example. Other non-limiting examples of common control channels for conveying this information are for instance primary and secondary synchronization channels and dynamic broadcast channels. Further, message blocks for transmitting system information could also be considered as non-limited examples.

Finally, it should be noted that the above described embodiment is of an example for implementing the present invention, but the scope of the present invention should not necessarily be limited by the above description. The scope of the present invention is defined by the following claims.

Claims

1. A method for communicating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, wherein for updating cell system informations a base station communicates at least a first information about future cell system parameters relating to a predetermined future cell configuration of said communicating base station.

2. The method according to claim 1, wherein said communicating base station additionally communicates a second information which indicates a time or a time range when said future cell system parameters will essentially take effect.

3. The method according to claim 2, wherein said second information indicates the approximate time when the future cell system parameters will take effect.

4. The method according to claim 2 or 3, wherein said second information indicates the exact time when the future cell system parameters will take effect.

5. The method according to at least any one of claims 2 to 4, wherein said second information includes a variable value indicating the time which is still required before said future cell system information parameters will take effect.

6. The method according to at least any one of claims 2 to 5, wherein said second information includes an additional information about that said communicating base station has already decided to change to the predetermined future cell configuration.

7. The method according to at least any one of claims 2 to 5, wherein said second information includes an additional information about that said communi-

cating base station only tentatively intends to change to the predetermined future cell configuration.

8. The method according to at least any one of claims 2 to 5, wherein said second information includes an additional information about that a flexible spectrum usage negotiation with other base stations is tentatively intended only.

9. The method according to at least any one of claims 2 to 5, wherein said second information includes an additional information of that said communicating base station will use the future cell system information parameters for a negotiation as to the physical spectrum resources.

10. The method according to at least any one of the preceding claims, wherein said communicating base station communicates a further information about current cell system parameters relating to a current cell configuration of said base station.

11. The method according to at least any one of the preceding claims, wherein said informations are transmitted via a broadcast channel.

12. The method according to at least any one of the preceding claims, wherein other base stations different from said communicating base station receive at least said first information from said communicating base station and make a check whether or not there will be a conflict with said communicating base station.

13. The method according to claim 12, wherein said other base station(s) update(s) its (their) own cell configuration in accordance with said first information.

14. The method according to claim 12 or 13, wherein a negotiation as to resources takes place among said base stations before they will make a final decision whether or not to update their cell configuration.

15. The method according to at least any one of the preceding claims, wherein a mobile station connected to another base station different from said communicating base station receives at least said first information from said communicating base station and forwards them to said other base station.

16. A system for communicating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, wherein for updating cell system informations a base station is adapted to communicate at least a first information about future cell system parameters relating to a predetermined future cell configuration of said communicating base station

17. The system according to claim 16, wherein said communicating base station is adapted to additionally communicate a second information which indicates a time or a time rage when said future cell system parameters will essentially take effect.

18. The system according to claim 17, wherein said second information indicates the approximate time when the future cell system parameters will take effect.

19. The system according to claim 17 or 18, wherein said second information indicates the exact time when the future cell system parameters will take effect.

20. The system according to at least any one of claims 17 to 19, wherein said second information includes a variable value indicating the time which is still required before said future cell system information parameters will take effect.

21. The system according to at least any one of claims 17 to 20, wherein said second information includes an additional information about that said communicating base station has already decided to change to the predetermined future cell configuration.

22. The system according to at least any one of claims 17 to 20, wherein said second information includes an additional information about that said communicating base station only tentatively intends to change to the predetermined future cell configuration.

23. The system according to at least any one of claims 17 to 20, wherein said second information includes an additional information about that a flexible spectrum usage negotiation with other base stations is tentatively intended only.

24. The system according to at least any one of claims 17 to 20, wherein said second information includes an additional information of that said communicating base station will use the future cell system information parameters for a negotiation as to the physical spectrum resources.

25. The system according to at least any one of claims 16 to 24, wherein said communicating base station is adapted to communicate a further information about current cell system parameters relating to a current cell configuration of said base station.

26. The system according to at least any one of claims 16 to 25, comprising a broadcast channel for transferring said informations.

27. The system according to at least any one of claims 16 to 26, wherein other base stations different from said communicating base station are adapted to receive at least said first information from said communicating base station and make a check whether or not there will be a conflict with said communicating base station.

28. The system according to claim 27, wherein said other base station(s) is (are) adapted to update its (their) own cell configuration in accordance with said first information.

29. The system according to claim 27 or 28, wherein a negotiation as to resources takes place among said base stations before they will make a final decision whether or not to update their cell configuration.

30. The system according to at least any one of claims 16 to 29, wherein a mobile station connected to another base station different from said communicating base station is adapted to receive said first and second informations from said communicating base station and to forward them to said other base station.

31. A base station in a radio telecommunication network including a plurality of base stations and at least a mobile station, comprising

a generator for generating at least a first information about future cell system parameters relating to a predetermined future cell configuration of said base station, and

a transmitter for transmitting said first information for updating cell system informations to be used in conjunction with the sharing of physical spectrum resources among base stations.

32. The base station according to claim 31, wherein said generator is adapted to additionally generate a second information which indicates a time or a time range when said future cell system parameters will essentially take effect, and said transmitter is adapted to additionally communicate said second information.

33. The base station according to claim 32, wherein said second information indicates the approximate time when the future cell system parameters will take effect.

34. The base station according to claim 32 or 33 , wherein said second information indicates the exact time when the future cell system parameters will take effect.

35. The base station according to at least any one of claims 32 to 34, wherein said second information includes a variable value indicating the time which is still required before said future cell system information parameters will take effect.

36. The base station according to at least any one of claims 32 to 35, wherein said second information includes an additional information about that said base station has already decided to change to the predetermined future cell configuration.

37. The base station according to at least any one of claims 32 to 35, wherein said second information includes an additional information about that said base station only tentatively intends to change to the predetermined future cell configuration.

38. The base station according to at least any one of claims 32 to 35, wherein said second information includes an additional information about that a flexible spectrum usage negotiation with other base stations is tentatively intended only.

39. The base station according to at least any one of claims 32 to 35, wherein said second information includes an additional information of that said base station will use the future cell system information parameters for a negotiation as to the physical spectrum resources.

40. The base station according to at least any one of claims 31 to 39, wherein said generator is adapted to generate a further information about current cell system parameters relating to a current cell configuration of said base station, and said transmitter is adapted to additionally communicate said further information.

41. The base station according to at least any one of claims 31 to 40, wherein said transmitter is adapted to provide a broadcast channel for transferring said informations.

42. The base station according to at least any one of claims 31 to 41, further comprising a receiver for receiving at least said first information communicated from another base station, and an analyzer for making a check whether or not there will be a conflict with said other communicating base station.

43. The base station according to claim 42, further comprising an updater for updating its cell configuration in accordance with said first information received.

44. The base station according to claim 43, further comprising a negotiator for carrying out a negotiation as to resources with said other communicating base station, and said updater is adapted to make a final decision whether or not to update the cell configuration in accordance with the result of said negotiation.

45. A radio telecommunication network including a plurality of base stations according to at least any one of claims 31 to 44, and at least a mobile station.

46. A computer program adapted to carry out a method according to at least any one of the claims 1 to 15.

47. A signal for updating cell system informations to be communicated in conjunction with the sharing of physical spectrum resources among base stations in a radio telecommunication network including a plurality of base stations and at least a mobile station, including at least a first information about future cell system parameters relating to a predetermined future cell configuration of a communicating base station.

48. The signal according to claim 47, additionally including a second information which indicates a time or a time range when said future cell system parameters will essentially take effect.

49. The signal according to claim 48, wherein said second information indicates the approximate time when the future cell system parameters will take effect.

50. The signal according to claim 48 or 49, wherein said second information indicates the exact time when the future cell system parameters will take effect.

51. The signal according to at least any one of claims 48 to 50, wherein said second information includes a variable value indicating the time which is still required before said future cell system information parameters will take effect.

52. The signal according to at least any one of claims 48 to 51, wherein said second information includes an additional information about that said communicating base station has already decided to change to the predetermined future cell configuration.

53. The signal according to at least any one of claims 48 to 51, wherein said second information includes an additional information about that said communicating base station only tentatively intends to change to the predetermined future cell configuration.

54. The signal according to at least any one of claims 48 to 51, wherein said second information includes an additional information about that a flexible spectrum usage negotiation with other base stations is tentatively intended only.

55. The signal according to at least any one of claims 48 to 51, wherein said second information includes an additional information of that said communicating base station will use the future cell system information parameters for a negotiation as to the physical spectrum resources.

56. The signal according to at least any one of claims 47 to 55, including a further information about current cell system parameters relating to a current cell configuration of said communicating base station.

INTERNATIONAL SEARCH REPORT

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PCT/EP2008/003570

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W16/14
ADD. H04W48/10

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

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/153700 A1 (FARNSWORTH ANDREW J [GB] ET AL FARNSWORTH ANDREW JOHN [GB] ET AL) 14 July 2005 (2005-07-14)	1-4,6, 10,11, 16-19, 21,25, 26, 31-34, 36,40, 41, 45-50, 52,56
Y	abstract	8,9, 11-15, 23,24, 26-30, 38,39, 41-44, 54,55
	pages 1-3 paragraphs [0005], [0006], [0009], -/--	

[X] Further documents are listed in the continuation of Box C.

[X] 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 document but published on or after the international filing date

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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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	[0010] paragraph [0015] paragraph [0039] paragraphs [0042], [0043]	
A		5,7,20, 22,35, 37,51,53
Y	US 2007/287469 A1 (WIJTING CARL [FI] ET AL) 13 December 2007 (2007-12-13) abstract paragraphs [0009], [0010] paragraphs [0033], [0037] claims 5,6	8,9,23, 24,38, 39,54,55
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Information on patent family members

International application No
PCT/EP2008/003570

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