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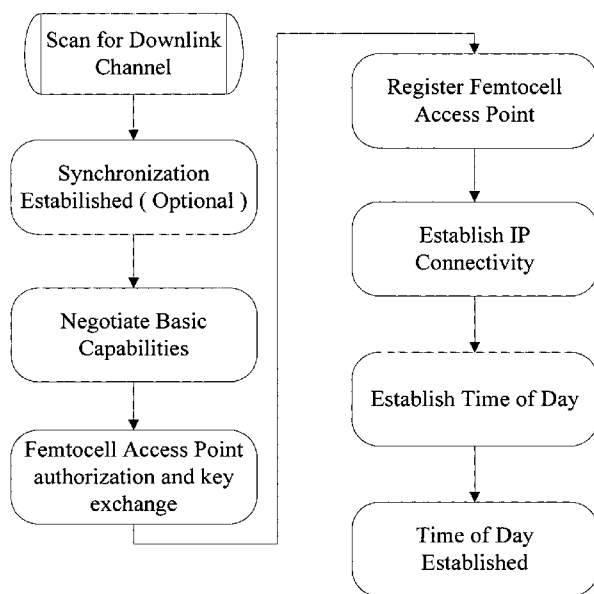
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(54) Title: A METHOD FOR ENTRY OF A BASE STATION INTO A NETWORK AND A NETWORK



Femtocell Access Point network entry procedure

(57) Abstract: For providing a simple and reliable entry of a base station into a network a method for entry of a base station is claimed, which is comprising the following steps: Performing a downlink scan by the base station to detect neighbour network elements; establishing of a radio layer synchronization and/or a network layer synchronization; negotiating capabilities between the base station and one or more high layer network controllers; authenticating of the base station by the one or more high layer network controllers; performing a security key exchange to enable further traffic; and registering of the base station to the network. Further, an according network comprising a plurality of network elements and at least one base station is claimed, which has entered the network by the above method.

Fig. 1



MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, **Published:**
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, — *with international search report (Art. 21(3))*
ML, MR, NE, SN, TD, TG).

A METHOD FOR ENTRY OF A BASE STATION INTO A NETWORK AND A NETWORK

The present invention relates to a method for entry of a base station into a network, comprising at least the following steps:

- Performing a downlink scan by the base station to detect neighbour network elements;
- establishing of a radio layer synchronization and/or a network layer synchronization;
- negotiating capabilities between the base station and one or more high layer network controllers;
- authentication and authorization of the base station by the one or more high layer network controllers;
- performing a security key exchange to enable further traffic; and
- registering of the base station to the network.

Further, the present invention relates to a network comprising a plurality of network elements and at least one base station, which has entered the network by the above method.

Methods for entry of a base station into a network are known with regard to current standard networks. However, a general network entry procedure is not yet defined with regard to some further network developments, such as WiMAX (Worldwide Interoperability for Microwave Access) telecommunication technology. The WiMAX technology is obtainable from IEEE 802.16 TGM System Requirements Document (SRD) IEEE 802.16m-07/002r9 and IEEE Std 802.16-2009.

It is an object of the present invention to improve and further develop a method and a network for entry of a base station into a network for allowing a simple and reliable entry of a base station into a network.

In accordance with the invention, the aforementioned object is accomplished by a method comprising the features of claim 1 and a network comprising the features of claim 10. According to claim 1 the method for entry of a base station into a

network is comprising first a performing of a downlink scan by the base station to detect neighbour network elements. As a next step a radio layer synchronization and/or a network layer synchronization will be established. The next step is comprising the negotiating of capabilities between the base station and one or more high layer network controllers. Then, the one or more high layer network controllers authenticate the base station. After the following performing of a security key exchange to enable further traffic the base station will be registered to the network. According to claim 11 the network is comprising a plurality of network elements and at least one base station, which has entered the network by the above method.

According to the invention it has been recognized that it is possible to provide a simple and reliable entry procedure by the combination of the above method steps. Such a method is particularly beneficial with regard to current and future telecommunication technology.

The method could further comprise the establishing of an IP connection between the base station and the one or more high layer network controllers, preferably after the registering of the base station to the network.

Preferably, the method is further comprising the step of setting up the date and/or time by the base station after the establishing of an IP connection. This will provide a synchronization of the base station with a core network.

With regard to a very reliable entry procedure the downlink scan could comprise the scanning of downlink preamble sequences for obtaining information such as the index of the received preamble, the RSSI of the received preamble and/or other downlink transmission information.

Within a further preferred embodiment the base station could report the obtained information or a part of the obtained information to one or more high layer network controllers, such as an ASN gateway.

Further, the one or more high layer network controllers could allocate an appropriate transmission power, preamble, one or more subchannels and/or other transmission parameters to the base station. Such a procedure could preferably be based on the received information from the base station.

Within a further preferred embodiment the network could be a WiMAX network. This technology is based on the IEEE 802.16 standard and will provide a Broadband Wireless Access.

With regard to a concrete application of the above method the base station could be a femtocell AP (Access Point) and/or femtocell base station or femto ABS, wherein ABS means a base station capable of action as a YBS and additionally implementing the protocol defined in IEEE 802.16m, wherein YBS (Yardstick Base Station) means a base station compliant with the WirelessMAN-OFDMA Reference System.

Preferably, the base station could be synchronized to an overlay Macro ABS network.

Within a preferred network the neighbour network elements could comprise at least one base station, relay station and/or femtocell AP and/or base station. However, the network could comprise further network elements.

The method according to the invention is particularly suitable for performing a WiMAX Femtocell Access Point network entry. Such a WiMAX femtocell base station has similar functionalities as a WiMAX macrocell base station. The inventive method is able to make sure that the network is aware of the new joining base station or femtocell base station.

The present invention is especially providing a new network entry procedure which is suitable for a WiMAX femtocell access point. The proposed method minimizes the interference to neighbouring cellular systems as enabling method and is able to make sure that the neighbouring cellular systems are aware of the new joining base station or femtocell access point.

There are several ways how to design and further develop the teaching of the present invention in an advantageous way. To this end, it is to be referred to the claims subordinate to claim 1 on the one hand and to the following explanation of preferred embodiments of the invention by way of example, illustrated by the figure on the other hand. In connection with the explanation of the preferred embodiments of the invention by the aid of the figure, generally preferred embodiments and further developments of the teaching will be explained. In the drawings

Fig. 1 is illustrating a preferred embodiment of a method for entry of a base station into a network according to the invention.

Fig. 1 is showing a WiMAX femtocell base station BS network entry procedure according to a preferred embodiment of the present invention. In a first step the femtocell BS performs a downlink scan to detect neighbouring BS/RS/Femtocell BSs, wherein RS is meaning a Relay Station. The femtocell BS may scan the downlink preamble sequences to obtain information such as the index of the received preamble, the RSSI of the received preamble, and other downlink transmission information. The femtocell BS reports these parameters to high layer network controllers, such as an ASN gateway. The high layer network controllers can allocate the appropriate transmission power, preamble, subchannels and other transmission parameters to the new entering femtocell BS based on the received information from the femtocell BS. During the above downlink scan the base station could generate a list of neighbour network elements.

In a next step, the femtocell BS is establishing the radio layer synchronization and network layer synchronization.

After synchronization, the femtocell BS will start to negotiate with high layer network controller on the capabilities on each side. For example, the femtocell BS will let high layer network controller know the maximum number of terminals the BS supports.

After capability negotiation, the femtocell BS will be authenticated by the high layer network controller, and then will perform the security key exchange to enable further traffic.

In a next step, the femtocell BS will be registered to the network. As a next step, an IP connection between the femtocell BS and the high layer network controller will be established.

After establishing the IP connection, the femtocell BS will set up the date and time, thus synchronizing with the core network.

According to the invention, there is provided a network entry procedure that supports the entry of WiMAX femtocell AP and/or BS into a communication network. The impact on existing BS designs is minimized as the number of modifications required for entry are minimal. The proposed method can make sure that the neighbouring cellular systems are aware of the new joining femtocell access point by synchronization with the core network.

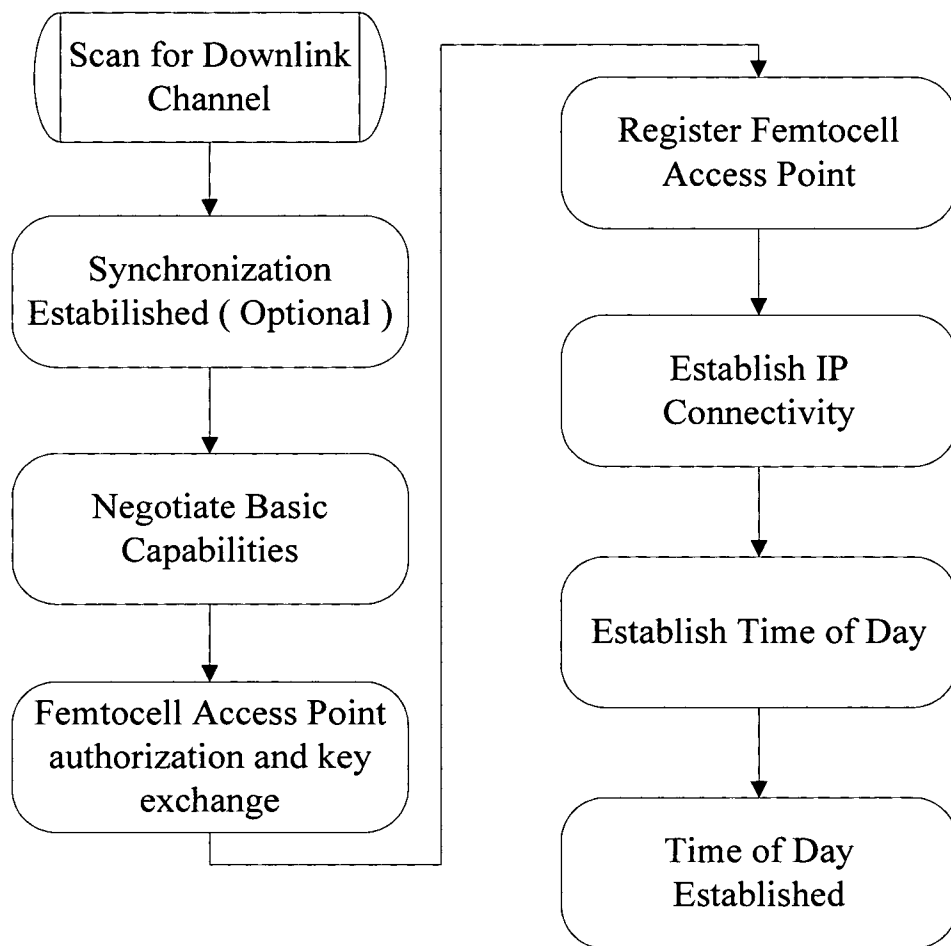
Many modifications and other embodiments of the invention set forth herein will come to mind the one skilled in the art to which the invention pertains having the benefit of the teachings presented in the foregoing description and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A method for entry of a base station (BS) into a network, comprising at least the following steps:
 - Performing a downlink scan by the base station (BS) to detect neighbour network elements;
 - establishing of a radio layer synchronization and/or a network layer synchronization;
 - negotiating capabilities between the base station (BS) and one or more high layer network controllers;
 - authentication and authorization of the base station (BS) by the one or more high layer network controllers;
 - performing a security key exchange to enable further traffic; and
 - registering of the base station (BS) to the network.
2. A method according to claim 1, further comprising the step of establishing of an IP connection between the base station (BS) and the one or more high layer network controllers.
3. A method according to claim 2, further comprising the step of setting up the date and/or time by the base station (BS) after the establishing of an IP connection.
4. A method according to one of claims 1 to 3, wherein the downlink scan is comprising the scanning of downlink preamble sequences for obtaining information such as the index of the received preamble, the RSSI (Received Signal Strength Indication) of the received preamble and/or other downlink transmission information.
5. A method according to claim 4, wherein the base station (BS) reports the obtained information or a part of the obtained information to one or more high layer network controllers, such as an ASN (Access Service Network) gateway.

6. A method according to claim 5, wherein the one or more high layer network controllers allocates an appropriate transmission power, preamble, one or more subchannels and/or other transmission parameters to the base station (BS), based on the received information from the base station (BS).
7. A method according to one of claims 1 to 6, wherein the network is a WiMAX network.
8. A method according to one of claims 1 to 7, wherein the base station (BS) is a femtocell AP (Access Point) and/or BS or femto ABS.
9. A method according to one of claims 1 to 8, wherein a synchronization to an overlay Macro ABS network will be established.
10. A method according to one of claims 1 to 9, wherein the neighbour network elements comprise at least one base station (BS), relay station (RS) and/or femtocell AP and/or BS.
11. A network comprising a plurality of network elements and at least one base station (BS), which has entered the network by a method according to any one of claims 1 to 10.

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**Femtocell Access Point network entry procedure****Fig. 1**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/007657

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W24/02

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HUAWEI: "Self-configuration considerations of Home NodeB" 3GPP DRAFT; R3-071466 SELF-CONFIGURATION CONSIDERATIONS OF HOME NODEB, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG3, no. Athens, Greece; 20070815, 15 August 2007 (2007-08-15), XP050162291 [retrieved on 2007-08-15] the whole document ----- -/--	1-11

☒ 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 document but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

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Date of mailing of the international search report

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/007657

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NTT DOCOMO: "Clarification of functions for self-optimization and self-configuration" 3RD GENERATION PARTNERSHIP PROJECT (3GPP); TECHNICAL SPECIFICATION GROUP (TSG) RADIO ACCESS NETWORK (RAN); WORKING GROUP 3 (WG3),, no. R3-061509, 13 October 2006 (2006-10-13), pages 1-3, XP002477484 the whole document	1-11
X	ANTON AMBROSY, DIRK HOFMANN: "Self-configuration and self-optimization of 4G Radio Access Networks (IEEE C802.16m-07/169)" IEEE 802.16, [Online] 29 August 2007 (2007-08-29), pages 1-9, XP002565296 Retrieved from the Internet: URL:ieee802.org/16> [retrieved on 2010-01-26] Radio network self-configuration (pages 5-6) Radio network self-optimization (pages 6-7)	1-11
X	US 2007/097939 A1 (NYLANDER TOMAS [SE] ET AL) 3 May 2007 (2007-05-03) abstract figures 1A-1E,5 paragraph [0024] - paragraph [0026] paragraph [0029] - paragraph [0037] paragraph [0059] paragraph [0067] - paragraph [0070]	1-11
X	WO 2008/082587 A1 (INTERDIGITAL TECH CORP [US]; WANG PETER S [US]; GUCCIONE LOUIS J [US];) 10 July 2008 (2008-07-10) abstract paragraph [0008] paragraph [0024] - paragraph [0031] claims 1,8,12,17 figures 3,4	1-11
X	US 2005/148368 A1 (SCHEINERT STEFAN [US] ET AL SCHEINERT STEFAN [US] ET AL) 7 July 2005 (2005-07-07) abstract figures 2,3 paragraph [0005] - paragraph [0010] paragraph [0034] - paragraph [0059] paragraph [0090] - paragraph [0101]	1-11
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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/007657

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	3GPP: "3rd Generation Partnership Project; Technical Specification Group Service and System Aspects; Security of H(e)NB; (Release 8)" 3GPP DRAFT; 33820-110 CB-VERSION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. Kyoto; 20081015, 15 October 2008 (2008-10-15), XP050334328 [retrieved on 2008-10-15] chapter 4.4 chapter 7 -----	1,11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/007657

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007097939	A1	03-05-2007	NONE
WO 2008082587	A1	10-07-2008	AR 064549 A1 08-04-2009
		AU 2007339304 A1 10-07-2008	
		CA 2674040 A1 10-07-2008	
		CN 101578893 A 11-11-2009	
		EP 2127415 A1 02-12-2009	
		KR 20090098997 A 18-09-2009	
		US 2008167003 A1 10-07-2008	
US 2005148368	A1	07-07-2005	NONE