

(51) International Patent Classification:
H04W 36/00 (2009.01)(21) International Application Number:
PCT/US2014/020037(22) International Filing Date:
3 March 2014 (03.03.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/772,493 4 March 2013 (04.03.2013) US
14/195,681 3 March 2014 (03.03.2014) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, 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).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

[Continued on next page]

(54) Title: RE-ESTABLISHMENT IN HETNET ROBUSTNESS BY USE OF OVERLAY MACRO CELL AS RE-ESTABLISHMENT CANDIDATE

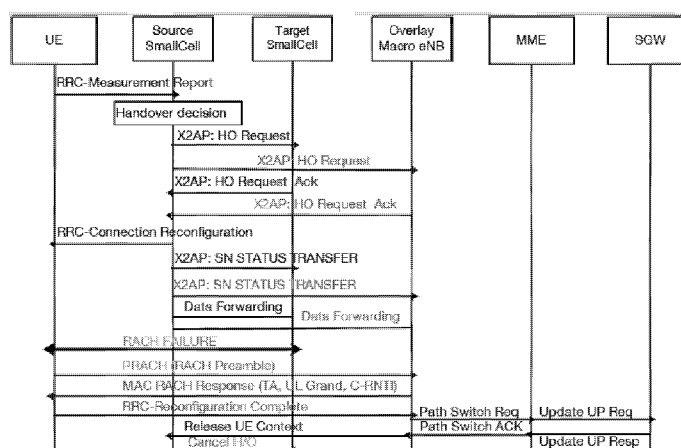


Figure 6

(57) Abstract: The application relates to HetNet mobility improvements and in particular to reduce handover failures. When handing over from a source small cell to a target small cell, it is likely that a UE can end up on a cell that does not have a prepared UE context, because typical small cells are single sector in nature. Then, RRC reestablishment can fail and the UE will be required to perform an attach or service request procedure to recover from the radio frequency (RF) loss. The attach or service request procedure can adversely impact the performance of the UE. The application proposes, in an attempt to improve handover success rate for the UE in a HetNet deployment, the source eNB prepares the overlay macro eNodeB in addition to a target small cell as handover candidates during handover decision making. The UE is informed about the target small cell and eNodeB using RRC messaging. After receiving handover command or detecting RF loss, the UE can try to connect with the target small cell. If UE is unable to connect (RACH FAILURE) to the target small cell, the UE will connect to the macro eNodeB (PRACH RACH & MACH RACH Response)



(88) Date of publication of the international search report:
30 October 2014

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/020037

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W36/00
ADD.

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 practicable, 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.
Y	WO 2013/019153 A1 (ERICSSON TELEFON AB L M [SE]; TEYEB OUMER [SE]; MUELLER WALTER [SE]; D) 7 February 2013 (2013-02-07) figure 2 ----- -/--	1-14



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

30 June 2014

Date of mailing of the international search report

25/08/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/020037

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	NOKIA SIEMENS NETWORK ET AL: "Re-establishment issues in HetNet scenarios", 3GPP DRAFT; R2-124030, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG2, no. Qingdao, China; 20120813 - 20120817 7 August 2012 (2012-08-07), XP050665764, Retrieved from the Internet: URL: http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_79/Docs/ [retrieved on 2012-08-07] paragraph [0003] -----	1-14
X	QUALCOMM EUROPE: "Further evaluation of mobility performance in LTE", 3GPP DRAFT; R1-091446 FURTHER EVALUATIONS OF MOBILITY PERFORMANCE IN LTE, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Seoul, South Korea; 20090323 - 20090327, 28 March 2009 (2009-03-28), XP050597371, paragraph [03.2] -----	1-14
X	WO 2012/146276 A1 (FUJITSU LTD [JP]; LI ZHAOJUN [GB]; BUCKNELL PAUL [GB]) 1 November 2012 (2012-11-01) page 18; figure 5 -----	1-14
A	WO 2008/042906 A2 (QUALCOMM INC [US]; KITAZOE MASATO [US]; FLORE ORONZO [US]) 10 April 2008 (2008-04-10) paragraph [0027] - paragraph [0033] paragraph [0044] - paragraph [0046]; figure 6 -----	1-14
X,P	EP 2 693 829 A1 (BLACKBERRY LTD [CA]) 5 February 2014 (2014-02-05) paragraph [0018] - paragraph [0025] paragraph [0117] - paragraph [0124]; figure 7 -----	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/020037

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013019153 A1	07-02-2013	CN 103797846 A EP 2740293 A1 US 2014148174 A1 WO 2013019153 A1	14-05-2014 11-06-2014 29-05-2014 07-02-2013
WO 2012146276 A1	01-11-2012	CN 103493537 A EP 2702803 A1 KR 20130139351 A US 2014023045 A1 WO 2012146276 A1	01-01-2014 05-03-2014 20-12-2013 23-01-2014 01-11-2012
WO 2008042906 A2	10-04-2008	BR PI0719822 A2 CA 2662572 A1 CN 101523951 A EP 2070377 A2 JP 5043948 B2 JP 2010506506 A KR 20090095559 A RU 2009116628 A TW 200830912 A US 2010178920 A1 WO 2008042906 A2	06-05-2014 10-04-2008 02-09-2009 17-06-2009 10-10-2012 25-02-2010 09-09-2009 10-11-2010 16-07-2008 15-07-2010 10-04-2008
EP 2693829 A1	05-02-2014	EP 2693829 A1 WO 2014020089 A1	05-02-2014 06-02-2014

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/020037

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-14

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14

System, method and apparatus for improving the success rate of HetNet handovers

2. claims: 15-22

System and method for shortening service interruption during HetNet handovers
