



(51) International Patent Classification:

H04W 8/08 (2009.01) *H04W* 92/02 (2009.01)
H04W 8/12 (2009.01) *H04W* 4/14 (2009.01)
H04W 88/06 (2009.01)

(21) International Application Number:

PCT/US2011/032258

(22) International Filing Date:

13 April 2011 (13.04.2011)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

12/789,197 27 May 2010 (27.05.2010) US

(71) Applicant (for all designated States except US): **ALCATEL-LUCENT USA INC.** [US/US]; 600-700 Mountain Avenue, Murray Hill, NJ 07974-0636 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GAFRICK, John, M.** [US/US]; 7 Papago Court, Naperville, IL 60563 (US).
CHIN, Frances, M. [US/US]; 1043 Amberwood Circle, Naperville, IL 60563 (US).

(74) Agent: **MAC INTYRE, John, B.**; Alcatel-lucent Usa Inc., Attention: Docket Administrator - Room 3D-201,

600-700 Mountain Avenue, Murray Hill, NJ 07974-0636 (US).

(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, 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, IS, JP, KE, KG, KM, 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, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: METHOD AND SYSTEM OF DELIVERING A MOBILE-TERMINATED SMS MESSAGE

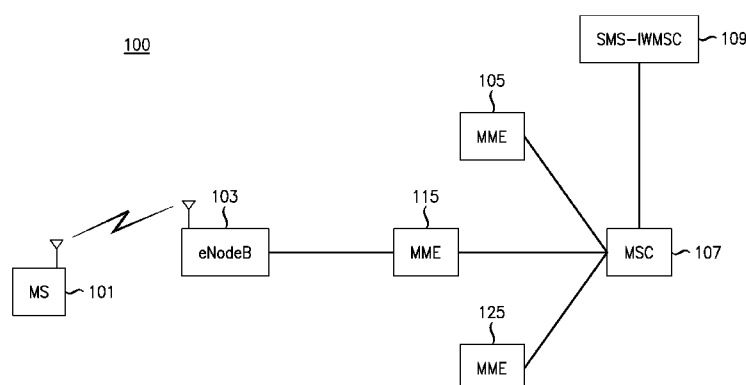


FIG. 1

(57) Abstract: A Mobile Switching Center (MSC) receives a short message intended for a mobile station. The MSC determines whether the mobile station is registered at the MSC. If not registered, the MSC sends a query message to associated Mobility Management Entities (MMEs). One of the MMEs sends a message to the MSC indicating that the MME is serving the mobile station.

METHOD AND SYSTEM OF DELIVERING A
MOBILE-TERMINATED SMS MESSAGE

FIELD OF THE INVENTION

The present invention relates generally to
5 communication systems, and more particularly to Short
Message Service (SMS).

BACKGROUND OF THE INVENTION

Short Message Service (SMS) has become a very
popular feature in communication systems. Because SMS
10 messages are not time-dependent, an acknowledgement
message typically is not sent to the sender of an SMS
message.

Currently, when a Mobile Switching Center (MSC)
receives an SMS message intended for a mobile station
15 that is not indicated to be located at the MSC, the MSC
sends a failure notification to the SMS server. The MSC
server does not attempt to deliver the SMS in such a
scenario. Instead, the Home Location Register (HLR)
waits for the mobile station to register with the HLR so
20 that the SMS delivery may be reattempted. In the
meantime, the sender is still waiting for the SMS
delivery to complete.

Therefore, a need exists for a method and system for
reliably sending SMS messages to a mobile station when an
25 MSC does not know where the mobile station is located.

BRIEF SUMMARY OF THE INVENTION

An exemplary embodiment of the present invention provides a method for delivering an SMS message. The MSC sends an alert message or page message to all subtending
5 MMEs.

An IWMSC sends an SMS message to the MSC. The SMS message is a request to send an SMS message to a mobile station. In accordance with an exemplary embodiment, the SGs association on the MSC between an MME and the MSC is
10 not currently set.

If the mobile station is not registered with the MSC, the MSC queries subtending MMEs, preferably by sending an alert message to all subtending MMEs. The alert messages help the MSC to determine whether the
15 intended mobile station has registered with any of the MMEs.

The MME to which the mobile station is registered sends an acknowledgement message to the MSC to indicate that the mobile station is registered with the associated MME.

20 The MSC preferably stores the SMS message and forwards to the mobile station via the acknowledging MME after receiving the alert acknowledgement message from the MME.

In accordance with an exemplary embodiment, the mobile station sends a TAU (Tracking Area Update) message
25 with combined TA/LA (Tracking Area/Location Area) updating to an eNodeB, which passes the TAU message to the responding MME.

In response to the TAU message, the MME sends a Location Update message to the MSC. In response to the
30 Location Update message, the MSC re-registers the mobile station so that the SGs association between the MME and the MSC can be re-established.

The IWMSC sends an SMS message intended for the mobile station to the MSC. The MSC checks the SGs

association for the mobile station. Since the MSC re-registered the mobile station and re-established an SGs association, the MSC acknowledges the receipt of the SMS message and processes the delivery of the SMS message to
5 the mobile station.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 depicts a portion of a communication system in accordance with an exemplary embodiment of the present invention.

10 FIG. 2 depicts a flow diagram of a method for delivering an SMS message in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

An exemplary embodiment of the present invention can
15 be better understood with reference to FIGs. 1 and 2. FIG. 1 depicts a portion 100 of a communication system in accordance with an exemplary embodiment of the present invention. Portion 100 includes mobile station 101, eNodeB 103, MME 105, MME 115, MME 125, MSC 107, and SMS-IW MSC (SMS Interworking MSC) 109.
20

Mobile station 101 is a device supporting voice and data communication using a wireless air interface. In an exemplary embodiment, mobile station 101 is a Circuit Switch Fall Back (CSFB) mobile station camping on LTE
25 technology.

eNodeB 103 is an LTE base station that communicates, over the air, with mobile station 101.

MME 105, MME 115, and MME 125 are Mobility Management Entities that each manage session states,

authentication, paging, mobility with SGSN nodes, roaming, and other bearer management functions.

MSC 107 is a Mobile Switching Center. In an exemplary embodiment, MSC 107 comprises a 3G MSC. MSC
5 107 is the network element that provides voice services and enables mobile terminals to communicate to the Public Switched Telephone Network (PSTN).

SMS-IW MSC 109 is an MSC that is capable of receiving SMS messages from a mobile network and submitting the SMS
10 messages to an appropriate Short Message Service Center (SMSC).

FIG. 2 depicts a flow diagram 200 of a method for delivering an SMS message in accordance with an exemplary
15 embodiment of the present invention. In this exemplary embodiment, the MSC sends an alert message to all subtending MMEs. In an alternate exemplary embodiment, the MSC can send a page message and deliver the SMS to the MME that responds to the page message.

20 SMS-IW MSC 109 sends ForwardSMS message 217 to MSC 107. ForwardSMS message 217 is a request to send an SMS message to mobile station 101. In the exemplary embodiment depicted in FIG. 2, mobile station 101 is not registered with MSC 107. In an exemplary embodiment, the
25 SGs association on MSC 107 between MME 115 and MSC 107 is not currently set. In a first exemplary embodiment, this can occur when a VLR record associated with mobile station 101 is deleted, for example due to VLR overload control or other administrative reasons. In a second
30 exemplary embodiment, this can occur when the SGs association is equal to SGs=NULL.

In accordance with the exemplary embodiment, MSC 107 queries subtending MMEs, in this exemplary embodiment MME 105, MME 115, and MME 125, by sending SGsAP Alert Request
35 message 213 to MME 115, SGsAP Alert Request message 203

to MME 105, and SGsAP Alert Request message **223** to MME 125. The SGsAP Alert Request messages will help MSC 107 determine whether mobile station 101 has registered with any of the MMEs. In an alternate exemplary embodiment, 5 MSC 107 sends a page message, preferably over an SGs interface, to corresponding MMEs and delivers ForwardSMS message 217 to the MME that responds to the page message.

In this exemplary embodiment, mobile station 101 is registered with MME 115. Therefore MME 105 sends SGs 10 Alert Reject message **205** to MSC 107 and MME 125 sends SGs Alert Reject message **225** to MSC 107.

MME 115 sends SGsAP Alert Ack message **227** to MSC 107. SGsAP Alert Ack message 227 indicates to MSC 107 that mobile station 101 is registered with MME 115.

15 In an exemplary embodiment, MSC 107 stores the SMS message and forwards to mobile station 101 via MME 115 after receiving SGsAP Alert Ack message **227** from MME 115.

In accordance with an exemplary embodiment, mobile station 101 sends a TAU (Tracking Area Update) message 20 **311**, preferably with combined TA/LA (Tracking Area/Location Area) updating to eNodeB 103. In an alternate exemplary embodiment, message 311 can be any message that indicates user activity by mobile station 101.

25 eNodeB 103 passes TAU message 311 to MME 115 via TAU message **313**.

In response to TAU message 313, MME 115 sends an SGsAP Location Update message **315** to MSC 107. In response to SGsAP Location Update message 315, MSC 107 30 re-registers mobile station 101 so that the SGs association between MME 115 and MSC 107 can be re-established.

SMS-IW MSC 109 sends ForwardSMS message **317** to MSC 107. ForwardSMS message 317 is intended for mobile 35 station 101. MSC 107 checks the SGs association for

mobile station 101. Since MSC 107 re-registered mobile station 101 and re-established an SGs association, MSC 107 acknowledges the receipt of ForwardSMS message 317 and processes the delivery of the SMS message to mobile station 101.

While this invention has been described in terms of certain examples thereof, it is not intended that it be limited to the above description, but rather only to the extent set forth in the claims that follow.

We claim:

CLAIMS

1. A method for recovering a location of a mobile station, the method comprising:
 - receiving a short message intended for a mobile station at a mobile switching center (MSC);
 - determining that the mobile station is not registered at the MSC;
 - sending a query message to a plurality of Mobility Management Entities (MMEs); and
 - receiving from one of the plurality of MMEs an indication that the one of the plurality of MMEs is serving the mobile station.
2. A method for recovering a location of a mobile station in accordance with claim 1, wherein the step of determining that the mobile station is not registered at the MSC comprises determining that the MSC has undergone maintenance.
3. A method for recovering a location of a mobile station in accordance with claim 1, wherein the step of determining that the mobile station is not registered at the MSC comprises determining that the MSC has experienced an overload condition.
4. A method for recovering a location of a mobile station in accordance with claim 1, the method further comprising the step of receiving at the MSC a second short message intended for the mobile station.
5. A method for recovering a location of a mobile station in accordance with claim 4, the method further comprising the step of delivering the second short message to the mobile station.

6. A method for recovering a location of a mobile station in accordance with claim 5, the method further comprising the step of delivering the second short message to the mobile station via the one of the
5 plurality of MMEs.

7. A method for recovering a location of a mobile station in accordance with claim 1, the method further comprising the step of delivering the short message
10 subsequent to receiving from one of the plurality of MMEs an indication that the one of the plurality of MMEs is serving the mobile station.

8. A method for recovering a location of a mobile
15 station in accordance with claim 1, wherein the step of sending a query message to a plurality of MMEs comprises paging the plurality of MMEs.

9. A method for recovering a location of a mobile
20 station in accordance with claim 1, wherein the step of sending a query message to a plurality of MMEs comprises sending an alert message to the plurality of MMEs.

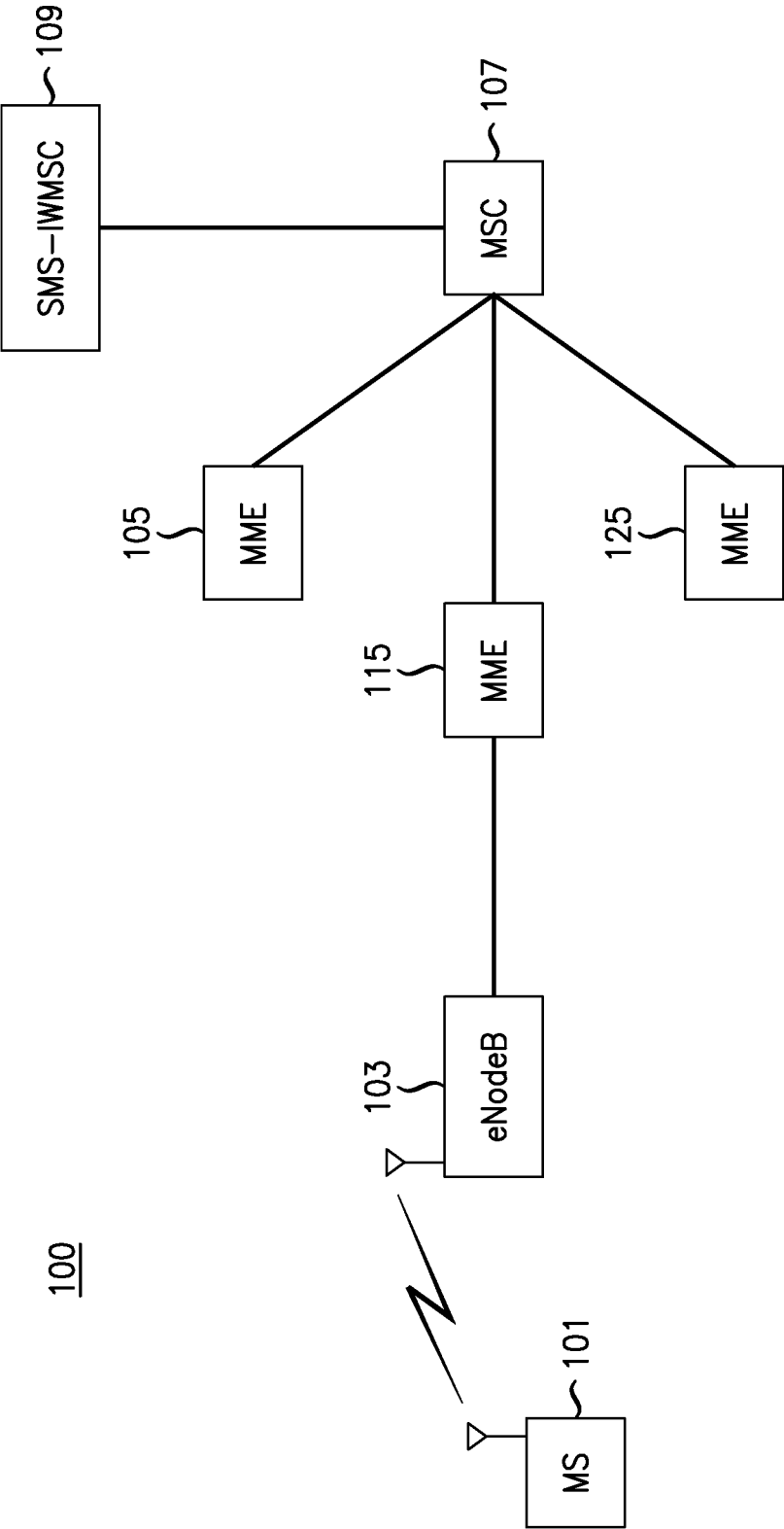


FIG. 1

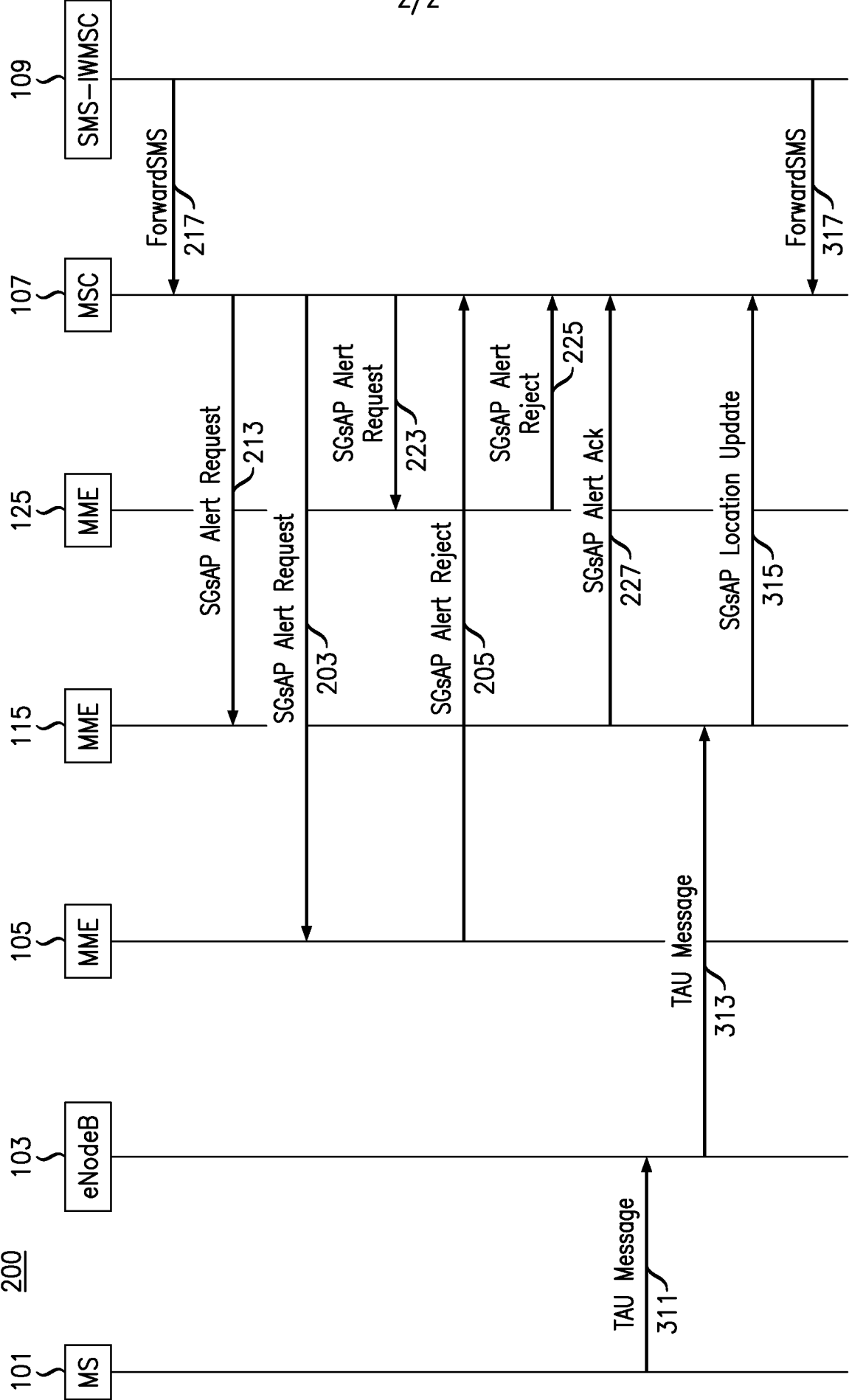


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/032258

A. CLASSIFICATION OF SUBJECT MATTER INV. H04W8/08 H04W8/12 H04W88/06 H04W92/02 H04W4/14 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 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	"3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Mobility Management Entity (MME) â Visitor Location Register (VLR) SGs interface specification (Release 9)", 3GPP STANDARD; 3GPP TS 29.118, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. V9.1.0, 31 March 2010 (2010-03-31), pages 1-55, XP050402254, [retrieved on 2010-03-31] paragraphs [04.1], [5.1.3], [5.2], [5.3] ----- -/--	1-9
☒ 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 "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 26 July 2011		Date of mailing of the international search report 03/08/2011
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Megalou-Nash, M

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/032258

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	VODAFONE ET AL: "SP-090429 SMS over LTE", INTERNET CITATION, 1 June 2009 (2009-06-01), pages 1-9, XP002611731, Retrieved from the Internet: URL:http://ftp.3gpp.org/specs/html-info/TDocExMtg--SP-44--26397.htm [retrieved on 2010-11-26] the whole document -----	1-9