(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 November 2017 (30.11.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/205475 A3

(51) International Patent Classification:
H04W 8/20 (2009.01) *H04W 12/06* (2009.01)
H04W 8/18 (2009.01) *H04W 88/06* (2009.01)

(21) International Application Number:
PCT/US2017/034188

(22) International Filing Date:
24 May 2017 (24.05.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
15/166,031 26 May 2016 (26.05.2016) 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, DJ, 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, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, ST, 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,

(54) Title: OPTIMAL TUNE AWAY SCHEME FOR CIRCUIT SWITCHED CALLS ON VIRTUAL SUBSCRIBER IDENTITY MODULE

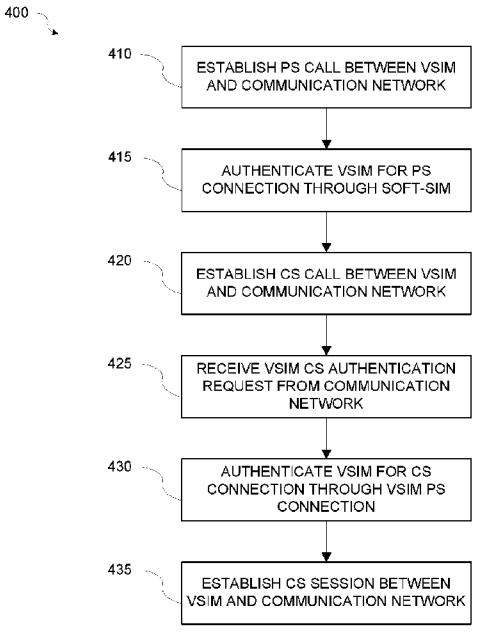

FIG. 4

(57) Abstract: A method for authenticating a circuit switched (CS) call on a virtual subscriber identity module (VSIM) includes: authenticating the VSIM for a packet switched (PS) call connection using authentication information obtained from a remote server through a software subscriber identity module (soft-SIM) connection to the remote server; initiating a call connection on a CS radio access technology (RAT) between the VSIM and a first communication network; and authenticating the VSIM CS call connection to the first communication network through the VSIM PS connection in response to an authentication request for the call connection on the CS RAT.

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[Continued on next page]

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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))*

(88) Date of publication of the international search report:
04 January 2018 (04.01.2018)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/034188

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W8/20
ADD. H04W8/18 H04W12/06 H04W88/06

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, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2015/304506 A1 (ZHU XIPENG [CN] ET AL) 22 October 2015 (2015-10-22)	1-16
A	paragraphs [0029], [0031], [0034], [0052] - [0055]; figure 2	17-26
Y	EP 1 850 607 A2 (TELECOM EN CONSULTING [BE]) 31 October 2007 (2007-10-31) paragraphs [0009], [0021], [0024]; figure 1	1-16
A	WO 2014/110606 A1 (QUALCOMM INC [US]) 17 July 2014 (2014-07-17) abstract paragraphs [0008], [0056], [0057], [0065]	17-26

☐ 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
28 November 2017	07/12/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Aguiar, Jorge

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/034188

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.:

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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2017/034188

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015304506 A1	22-10-2015	US 2015304506 A1	22-10-2015
		WO 2015157933 A1	22-10-2015
EP 1850607 A2	31-10-2007	NONE	
WO 2014110606 A1	17-07-2014	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-16

Authenticating a CS call on a virtual SIM VSIM, by: authenticating the VSIM for a PS call connection using authentication information obtained from a remote server through a soft-SIM connection to the remote server; initiating a call connection on a CS RAT between the VSIM and a first communication network; and authenticating the VSIM CS call connection to the first communication network through the VSIM PS call connection in response to an authentication request for a call on the CS RAT.

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2. claims: 17-26

Tuning away to authenticate a VSIM for a call connection on a CS RAT , by: authenticating the VSIM for a PS call through a soft-SIM connection to a remote server ; determining whether a call connection authorization request for a call connection on a CS RAT on the VSIM is received; in response to determining that the call connection authorization request for the call connection on the CS RAT on the VSIM is received, tuning away from the CS RAT to the remote server through the soft-SIM connection to the remote server ; determining whether an authorization for the call connection on the CS RAT on the VSIM is taking place through TCH signaling or through SDCCH signaling; and in response to determining that the authorization for the call connection on the CS RAT on the VSIM is taking place through TCH signaling, tuning back to the CS RAT based on SACCH bursts in a configuration of the TCH signaling.
