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13/672,148 8 November 2012 (08.11.2012) US
- (71) **Applicant: QUALCOMM INCORPORATED [US/US];**  
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- (74) **Agents: READ, Randol, W.** et al.; Patterson & Sheridan, L.L.P./Qualcomm, 3040 Post Oak Blvd., Suite 1500, Houston, TX 77056-6582 (US).

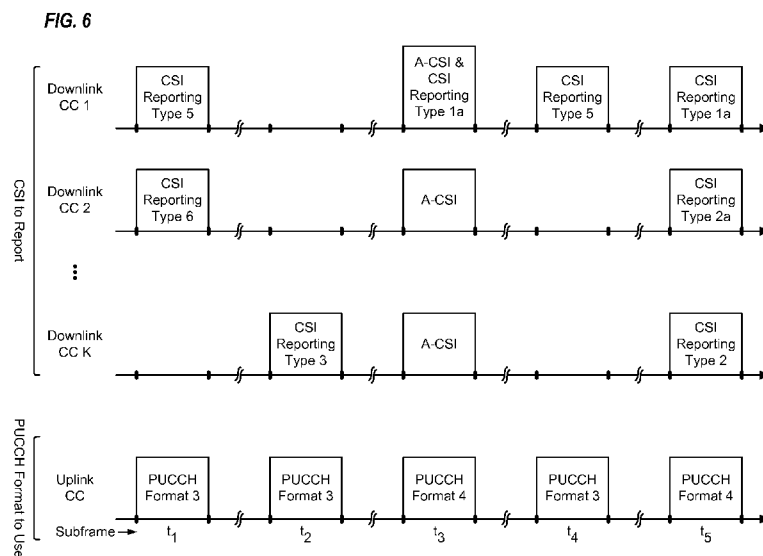
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, 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:** METHOD AND APPARATUS FOR SENDING CHANNEL STATE INFORMATION USING SUBFRAME-DEPENDENT CONTROL CHANNEL FORMATS



(57) **Abstract:** Techniques for reporting channel state information (CSI) for multiple cells (e.g., carriers) using multiple control channel formats are disclosed. A user equipment (UE) may be configured for operation on a plurality of cells. The UE may be configured to periodically report CSI for the plurality of cells and may also report CSI whenever requested. The UE may be configured with a plurality of control channel formats for sending CSI and possibly other control information in different subframes. The plurality of control channel formats may be associated with at least two different capacities. The UE may report CSI for the plurality of cells in the plurality of subframes based on the plurality of control channel formats.



**(88)** Date of publication of the international search report:  
5 December 2013

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2012/064333

## 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

International application No  
PCT/US2012/064333

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H04L5/00  
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)  
H04L  
  
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, COMPENDEX, INSPEC, 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	US 2009/196247 A1 (FAN ZHIFEI [US] ET AL) 6 August 2009 (2009-08-06)  figure 1 paragraph [0034] - paragraph [0039] paragraph [0044] paragraph [0048] - paragraph [0049] paragraph [0058]  ----- -/--	1,12,17, 22,23, 33,38,43

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  1 October 2013	Date of mailing of the international search report  11/10/2013
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  Faber, Thomas

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/064333

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SAMSUNG: "Details of CQI definition for LTE-A", 3GPP DRAFT; R1-106034, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Jacksonville, USA; 20101115, 9 November 2010 (2010-11-09), XP050466815, [retrieved on 2010-11-09] sections 1-3, 7.2.3 -----	1-3,12, 13,17, 18, 22-24, 33,34, 38,39,43
X	EP 2 230 786 A1 (PANASONIC CORP [JP]) 22 September 2010 (2010-09-22)  paragraph [0008] paragraph [0015] - paragraph [0019] paragraph [0031] - paragraph [0032] paragraph [0036] paragraph [0064] paragraph [0071] paragraph [0107] - paragraph [0110] -----	1-3,12, 13,17, 18, 22-24, 33,34, 38,39,43
X	US 2010/098012 A1 (BALA ERDEM [US] ET AL) 22 April 2010 (2010-04-22)  paragraph [0007] paragraph [0061] - paragraph [0063] paragraph [0083] - paragraph [0098] paragraph [0113] paragraph [0118] - paragraph [0119] tables 1-4 -----	1,4,6,7, 9,12, 15-17, 20-23, 25,27, 28,30, 33, 36-38, 41-43
A	WO 2011/040751 A2 (LG ELECTRONICS INC [KR]; KIM KI JUN [KR]; SEO HAN BYUL [KR]; KIM EUN S) 7 April 2011 (2011-04-07)  abstract; figures 7, 11; tables 3, 4 page 10, line 12 - line 30 page 20, line 24 - page 21, line 23 page 25, line 3 - page 29, line 10 page 32, line 14 - page 36, line 25 -----	4,6,7,9, 15,16, 20,21, 25,27, 28,30, 36,37, 41,42
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## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/064333

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 2011/188393 A1 (MALLIK SIDDHARTHA [US] ET AL) 4 August 2011 (2011-08-04)</p> <p>abstract  paragraph [0007] - paragraph [0010]  paragraph [0023] - paragraph [0027]  paragraph [0059] - paragraph [0064]  paragraph [0077] - paragraph [0081]  paragraph [0088]  paragraph [0095]  paragraph [0103] - paragraph [0105]</p>	<p>4,6,7,9,  15,16,  20,21,  25,27,  28,30,  36,37,  41,42</p>
X	<p>HUAWEI ET AL: "Periodic CQI/PMI/RI reporting for CA",  3GPP DRAFT; R1-105833, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE,  vol. RAN WG1, no. Jacksonville, USA; 20101115, 9 November 2010 (2010-11-09), XP050489403,  [retrieved on 2010-11-09]  sections 1-3</p>	<p>1,5,8,  10-12,  14,17,  19,22,  23,26,  29,  31-33,  35,38,  40,43</p>
X	<p>WO 2011/085230 A2 (INTERDIGITAL PATENT HOLDINGS [US]; NAYEB NAZAR SHAHROKH [CA]; OLESEN R) 14 July 2011 (2011-07-14)</p> <p>abstract; figures 3, 4, 13, 15; table 1  paragraph [0003]  paragraph [0007]  paragraph [0055] - paragraph [0056]  paragraph [0061] - paragraph [0063]  paragraph [0070]  paragraph [0100]  paragraph [0106] - paragraph [0107]  paragraph [0148]  paragraph [0183] - paragraph [0184]</p>	<p>1,5,8,  10-12,  14,17,  19,22,  23,26,  29,  31-33,  35,38,  40,43</p>
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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2012/064333

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>NOKIA SIEMENS NETWORKS ET AL: "Views on PUCCH enhancements for Carrier Aggregation", 3GPP DRAFT; R1-114306, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. San Francisco, USA; 20111114 - 20111118, 8 November 2011 (2011-11-08), XP050562180, [retrieved on 2011-11-08] sections 1-2</p> <p style="text-align: center;">-----</p>	5,8,10, 11,14, 19,26, 29,31, 32,35,40

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No  
PCT/US2012/064333

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US 2009196247	A1	06-08-2009	CA 2711574 A1	13-08-2009
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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

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

1. claims: 1-3, 12, 13, 17, 18, 22-24, 33, 34, 38, 39, 43

Using a plurality of CSI reporting configurations in a plurality of subframes.

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2. claims: 1, 4, 6, 7, 9, 12, 15-17, 20, 21, 23, 25, 27, 28, 30, 33, 36-38, 41, 42

Reporting CSI for coordinated multi-point (CoMP) transmission.

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3. claims: 1, 5, 8, 10-12, 14, 17, 19, 23, 26, 29, 31-33, 35, 38, 40

Selecting a first or second control channel format for carrier aggregation.

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