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(54) Title: CONFIGURATION OF DEMODULATION REFERENCE SIGNALS IN BEAMFORMED WIRELESS COMMUNICATION SYSTEMS

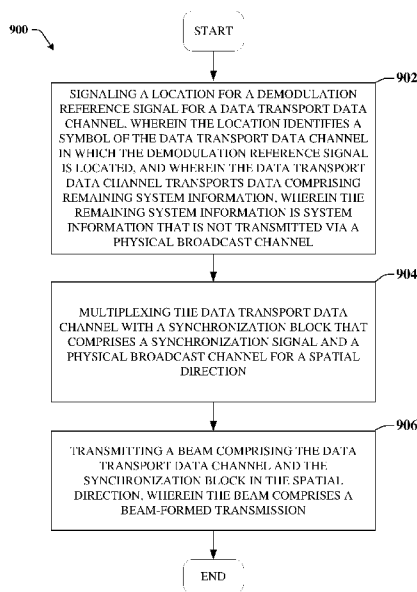


FIG. 9

(57) Abstract: Various embodiments disclosed herein provide for efficient configuration of demodulation reference signals in beamformed wireless communications systems. In an embodiment, the transmitter can signal the location of demodulation reference signals (DMRS) by including an indicator bit in downlink control information indicating which DMRS scheme is used in the transmission. A first DMRS scheme can let the user equipment (UE) device know that the DMRS position for the PDSCH carrying the RMSI is as signaled on the master information block (MIB) - referred to as PDSCH Mapping Type A. A second DMRS scheme can let the UE device know that the DMRS position for the PDSCH carrying the RMSI is the first orthogonal frequency division multiplexing (OFDM) symbol of said PDSCH allocation - referred to as PDSCH mapping type B).



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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L5/00 H04B7/04 H04L27/26 H04W72/04
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 H04W H04B

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	<p>NTT DOCOMO ET AL: "Discussion on remaining details on NR-PBCH and PBCH-DMRS", 3GPP DRAFT; R1-1716070 REMAINING DETAILS ON NR-PBCH FINAL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Nagoya, Japan; 20170918 - 20170921 17 September 2017 (2017-09-17), XP051339528, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-09-17] figures 2, 3</p> <p style="text-align: right;">-/--</p>	1,12,19

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
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"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 28 June 2019	Date of mailing of the international search report 12/07/2019
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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
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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2018/063118

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>sections 1, 3, 3.1, 3.2 -----</p> <p>LG ELECTRONICS: "Discussion on search space design", 3GPP DRAFT; R1-1717952 SEARCH SPACE DESIGN FINAL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Prague, CZ; 20171009 - 20171013 8 October 2017 (2017-10-08), XP051341136, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-10-08] figures 1, 2 sections 1, 2.5</p>	1,12,19
X	<p>-----</p> <p>AT&T: "Remaining details for DMRS design", 3GPP DRAFT; R1-1719637 REMAINING DETAILS ON DMRS V3, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Reno, USA; 20171127 - 20171201 18 November 2017 (2017-11-18), XP051369444, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F91/Docs/ [retrieved on 2017-11-18] figures 1-3 sections 1, 2.1, 2.2, 3</p>	1-4, 12-15, 19,20
X	<p>-----</p> <p>US 2010/303034 A1 (CHEN RUNHUA [US] ET AL) 2 December 2010 (2010-12-02)</p> <p>abstract; table 2 paragraph [0006] - paragraph [0008] paragraph [0011] - paragraph [0013] paragraph [0027] - paragraph [0031] paragraph [0045] paragraph [0060] paragraph [0067] - paragraph [0069] paragraph [0078] - paragraph [0083] paragraph [0094]</p> <p>----- -/--</p>	1-4, 12-15, 19,20

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2018/063118

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>SPREADTRUM COMMUNICATIONS: "Remaining issues on DMRS", 3GPP DRAFT; R1-1719692 REMAINING ISSUES ON DMRS, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Reno, USA; 20171127 - 20171201 17 November 2017 (2017-11-17), XP051368850, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F91/Docs/ [retrieved on 2017-11-17] figures 1-4; tables 1-3 sections 2.1-2.3, 3.1, 7</p> <p>-----</p>	1,5,6,9, 12,16, 18,19
X	<p>AT&T: "On DCI contents and formats", 3GPP DRAFT; R1-1719643 ATT DCI, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Reno, USA; 20171127 - 20171201 18 November 2017 (2017-11-18), XP051369449, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F91/Docs/ [retrieved on 2017-11-18] figure 3 sections 1, 2, 2.1, 3, 6</p> <p>-----</p>	1,5,6,9, 12,16, 18,19
X	<p>ZTE: "Discussion on downlink DMRS design", 3GPP DRAFT; R1-1707130 DISCUSSION ON DOWNLINK DMRS DESIGN, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Hangzhou; 20170515 - 20170519 7 May 2017 (2017-05-07), XP051262918, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_89/Docs/ [retrieved on 2017-05-07] figures 2-6 sections 2, 2.2, 2.5, 2.7, 2.8</p> <p>-----</p>	1,7,8, 10-12, 17,19
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/063118

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>INTERDIGITAL COMMUNICATIONS: "On NR-PBCH Transmission", 3GPP DRAFT; R1-1705500 ON NR-PBCH TRANSMISSION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Spokane, USA; 20170403 - 20170407 25 March 2017 (2017-03-25), XP051251957, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_88b/Docs/ [retrieved on 2017-03-25] figure 1 sections 2.2, 2.4, 3, 3.1 -----</p>	1,7,8, 10-12, 17,19
A	<p>"NR-PBCH design", 3GPP DRAFT; R1-1705321, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Spokane, USA; 20170403 - 20170407 2 April 2017 (2017-04-02), XP051243451, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-04-02] figure 1; table 1 sections 2, 3 -----</p>	1,7,8, 10-12, 17,19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/063118

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-4, 12-15, 19, 20

Setting an indicator bit in downlink control information.

2. claims: 1, 5, 6, 9, 12, 16, 18, 19

Using tables of resource allocation locations.

3. claims: 1, 7, 8, 10-12, 17, 19

Identifying the location of DMRS based on various parameters.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/063118

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010303034	A1	US 2010303034	A1 02-12-2010
		US 2014348109	A1 27-11-2014
