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(71) Applicant: **QUALCOMM INCORPORATED** [US/US];
 Attn: International IP Administration, 5775 Morehouse Drive,
 San Diego, California 92121-1714 (US).

(72) Inventors: **CHAKRABORTY, Kaushik**; 5775 Morehouse Drive,
 San Diego, California 92121 (US). **LUO, Tao**; 5775 Morehouse Drive,
 San Diego, California 92121 (US). **AKKARAKARAN, Sony**; 5775 Morehouse Drive,
 San Diego, California 92121 (US). **JOHN WILSON, Makesh Pravin**;
 5775 Morehouse Drive, San Diego, California 92121 (US). **WANG, Xiao Feng**;
 5775 Morehouse Drive, San Diego, California 92121 (US). **CHEN, Shengbo**;
 5775 Morehouse Drive, San Diego, California 92121 (US).

(74) Agent: **HARRITY, John E.** et al.; 11350 Random Hills Road,
 Suite 600, Fairfax, Virginia 22030 (US).

(54) Title: TECHNIQUES AND APPARATUSES FOR UPLINK PRECODER DETERMINATION USING DOWNLINK REFERENCE SIGNALS OR DOWNLINK PRECODER DETERMINATION USING UPLINK REFERENCE SIGNALS

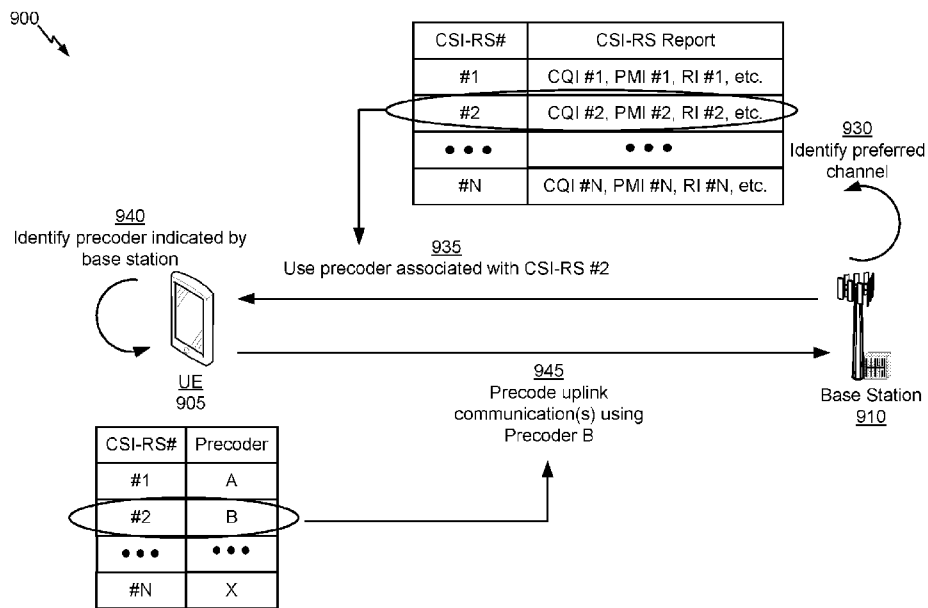


FIG. 9B

(57) Abstract: Certain aspects of the present disclosure generally relate to wireless communication. In some aspects, a user equipment (UE) may receive an indication of whether to use uplink reference signals or downlink reference signals for uplink precoder determination. The UE may selectively transmit a plurality of uplink reference signals or one or more measurement reports based at least in part on the indication, wherein the one or more measurement reports are determined based at least in part on measuring a plurality of downlink reference signals. The UE may receive an indication of a precoder, of a plurality of precoders, to be used to precoder an uplink communication, wherein the precoder is identified based at least in part on the plurality of uplink reference signals or the one or more measurement reports. The UE may precoder the uplink communication using the precoder. Numerous other aspects are provided.

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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))*

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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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)
H04B 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, 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 Y	WO 2017/007377 A1 (ERICSSON TELEFON AB L M [SE]) 12 January 2017 (2017-01-12) figures 1,2,3,4 page 7, last paragraph page 8, paragraph 1 - page 10, last paragraph page 11, paragraph 6	1,3, 5-13,29 14,30
A	US 2015/318908 A1 (KO HYUNSOO [KR] ET AL) 5 November 2015 (2015-11-05) paragraph [0267]; claim 1 ----- -/--	1

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 4 September 2018	Date of mailing of the international search report 24/09/2018
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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 Panahandeh, Ali
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INTERNATIONAL SEARCH REPORT

International application No
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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>VIVO: "Discussion on beam management for NR MIMO", 3GPP DRAFT; R1-1700274 DISCUSSION ON BEAM MANAGEMENT FOR NR MIMO, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANC</p> <p>, vol. RAN WG1, no. Spokane, USA; 20170116 - 20170120 16 January 2017 (2017-01-16), XP051207812, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_ SYNC/RAN1/Docs/ [retrieved on 2017-01-16] page 2 - page 5; figures 1-5; table 1</p> <p>-----</p>	24-28
X	<p>US 2013/072243 A1 (YU HYUN-KYU [KR] ET AL) 21 March 2013 (2013-03-21)</p>	15,18-23
Y	<p>paragraphs [0046], [0047], [0052], [0053], [0056], [0058], [0059], [0064], [0090], [0106] - paragraphs [0110], [0138]; claim 1; figures 1A,7,8,9,11</p> <p>-----</p>	1,2, 4-11,14, 16,17, 29,30
Y	<p>ZTE ET AL: "QCL/QCB design for UL MIMO", 3GPP DRAFT; R1-1701820 QCL QCB DESIGN FOR UL MIMO, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Athens, Greece; 20170213 - 20170217 12 February 2017 (2017-02-12), XP051208986, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_ SYNC/RAN1/Docs/ [retrieved on 2017-02-12] pages 1,3 - page 5; table 1</p> <p>-----</p>	1,2, 4-11,14, 16,17, 29,30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/018218

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017007377 A1	12-01-2017	CN 107735958 A EP 3317976 A1 US 2017141823 A1 WO 2017007377 A1	23-02-2018 09-05-2018 18-05-2017 12-01-2017

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/018218

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: 3, 12, 13(completely); 1, 5-11, 29(partially)

alternative 1 in claim 1 for determining UL precoder using UL reference signal refers to:

A method of wireless communication performed by a user equipment (UE), comprising: receiving an indication of whether to use Up-link reference signals for uplink precoder determination;

selectively transmitting a plurality of uplink reference signals based at least in part on the indication, receiving an indication of a precoder, of a plurality of precoders, to be used to precoder an uplink communication, wherein the precoder is identified based at least in part on the plurality of uplink reference signals and precoding the uplink communication using the precoder. Claim 29 is the corresponding apparatus of claim 1

2. claims: 2, 4, 15, 16, 18-23(completely); 1, 5-11, 29(partially)

alternative 2 in claim 1 for determining UL precoder using DL reference signal refers to:

A method of wireless communication performed by a user equipment (UE), comprising:receiving an indication of whether to use downlink reference w signals for uplink precoder determination;

selectively transmitting one or more measurement reports based at least in part on the indication, wherein the one or more measurement reports are determined based at least in part on measuring a plurality of downlink reference signals; receiving an indication of a precoder, of a plurality of precoders, to be used to precoder an uplink communication, wherein the precoder is identified based at least in part on the one or more measurement reports; and precoding the uplink communication using the precoder.

Claim 29 is the corresponding apparatus of claim 1

Claim 15 is the corresponding method at base station

3. claims: 14, 17, 24-28, 30

Claim 24 refers to:

A method of wireless communication performed by a base station, comprising:

determining a degree of reciprocity between one or more downlink beams and one or more corresponding uplink beams that form reciprocal beam pairs with the one or more downlink beams;

selectively identifying a precoder, of a plurality of precoders, to be used to precoder a downlink communication based at least in part on the degree of reciprocity, wherein the precoder is identified based at least in part on

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

measuring a plurality of uplink reference signals using the plurality of precoders or receiving one or more measurement reports associated with one or more downlink reference signals; and
precoding the downlink communication using the precoder.
