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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,
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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,

(54) Title: SOUNDING REFERENCE SIGNAL CONFIGURATIONS TO SUPPORT UPLINK TRANSMISSIONS WITH CYCLIC DELAY DIVERSITY

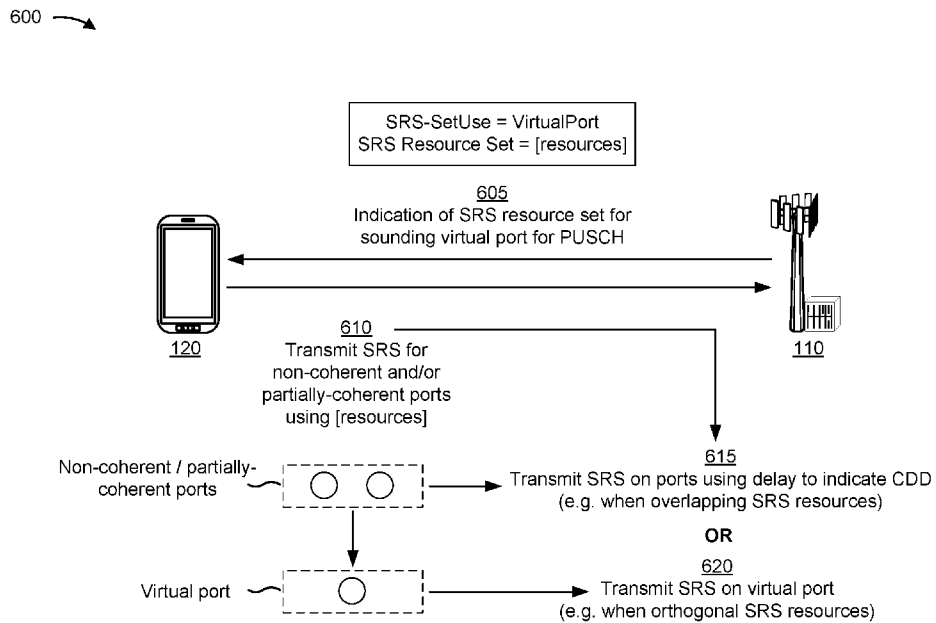


FIG. 6

(57) Abstract: Various aspects of the present disclosure generally relate to wireless communication. In some aspects, a user equipment (UE) may receive an indication of a sounding reference signal (SRS) resource set to be used to signal a virtual port used for a physical uplink shared channel (PUSCH) communication, wherein the virtual port is a combination of at least two non-coherent or partially-coherent antenna ports of the UE using precoding and cyclic delay diversity; and transmit an SRS for the at least two non-coherent or partially-coherent antenna ports using one or more resources of the SRS resource set. Numerous other aspects are provided.



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.

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A. CLASSIFICATION OF SUBJECT MATTER
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 ADD. H04B7/04 H04L5/14 H04L27/26 H04W72/04

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	ZTE: "Diversity based uplink transmission schemes", 3GPP DRAFT; R1-1712287 DIVERSITY BASED UPLINK TRANSMISSION SCHEMES, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRA , vol. RAN WG1, no. Prague, Czechia; 20170821 - 20170825 20 August 2017 (2017-08-20), XP051315103, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-08-20] figure 1 sections 1, 2, 2.1, 2.2 ----- -/--	1,21,41

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

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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
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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>US 2014/112168 A1 (CHEN WANSHI [US] ET AL) 24 April 2014 (2014-04-24) abstract; claims 4-6 paragraph [0071] paragraph [0081] - paragraph [0083] paragraph [0088] - paragraph [0091] paragraph [0097] - paragraph [0099] paragraph [0107]</p> <p style="text-align: center;">-----</p>	1,21,41
X	<p>QUALCOMM INCORPORATED: "Discussion on SRS Design", 3GPP DRAFT; R1-1708600, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Hangzhou, China; 20170515 - 20170519 14 May 2017 (2017-05-14), XP051273791, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-05-14] figures 6, 8 sections 1, 2.1, 2.2, 2.4, 2.5, 2.7-2.9</p> <p style="text-align: center;">-----</p>	1-3, 21-23,41
X	<p>NTT DOCOMO: "SRS Enhancement for Elevation BF and FD-MIMO", 3GPP DRAFT; R1-154663 SRS, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Beijing, China; 20150824 - 20150828 23 August 2015 (2015-08-23), XP051039542, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2015-08-23] figures 1, 3 sections 1, 2.1, 2.2</p> <p style="text-align: center;">-----</p> <p style="text-align: center;">-/--</p>	1-3, 21-23,41

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/052175

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>US 2018/048365 A1 (YOO TAESANG [US] ET AL) 15 February 2018 (2018-02-15)</p> <p>abstract; figures 5, 9B paragraph [0008] paragraph [0025] paragraph [0030] - paragraph [0036] paragraph [0037] - paragraph [0038] paragraph [0052] - paragraph [0053] paragraph [0060] - paragraph [0065] paragraph [0117] - paragraph [0124] paragraph [0136]</p> <p style="text-align: center;">-----</p>	<p>1,4, 7-10, 15-18, 21,24, 27-30, 35-38,41</p>
X	<p>US 2017/353931 A1 (STERN-BERKOWITZ JANET A [US] ET AL) 7 December 2017 (2017-12-07)</p> <p>figure 3 paragraph [0005] paragraph [0052] paragraph [0064] paragraph [0073] - paragraph [0075] paragraph [0084] - paragraph [0085] paragraph [0301]</p> <p style="text-align: center;">-----</p>	<p>1,4, 7-10, 15-18, 21,24, 27-30, 35-38,41</p>
X	<p>HUAWEI ET AL: "UL SRS design for beam management and CSI acquisition", 3GPP DRAFT; R1-1715474, 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), XP051338942, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_ SYNC/RAN1/Docs/ [retrieved on 2017-09-17] figures 6, 7 sections 1, 2.1.1, 2.1.2.4, 2.2.2, 2.3, 2.4</p> <p style="text-align: center;">-----</p> <p style="text-align: center;">-/--</p>	<p>1,5,6, 13,14, 19-21, 25,26, 33,34, 39-42</p>

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2019/052175

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>CATT: "Discussion on remaining details of non-codebook based transmission", 3GPP DRAFT; R1-1720179, 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), XP051369815, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F91/Docs/ [retrieved on 2017-11-18] sections 1, 2.1-2.3</p> <p>-----</p>	1,5,6, 13,14, 19-21, 25,26, 33,34, 39-42
X	<p>HUAWEI ET AL: "UL SRS design for beam management and CSI acquisition", 3GPP DRAFT; R1-1712238, 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, Czech Republic; 20170821 - 20170825 20 August 2017 (2017-08-20), XP051315055, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-08-20] figures 6, 7 sections 1, 2.1.2, 2.2.2, 2.2.3, 2.3, 2.5</p> <p>-----</p>	1,11,12, 21,31, 32,41
X	<p>CATT: "Issues on reference signals", 3GPP DRAFT; R1-1808376, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE</p> <p>, vol. RAN WG1, no. Gothenburg, Sweden; 20180820 - 20180824 11 August 2018 (2018-08-11), XP051515758, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F94/Docs/R1%2D1808376%2Ezip [retrieved on 2018-08-11] sections 6.2.1, 6.2.1.3</p> <p>-----</p>	1,11,12, 21,31, 32,41

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/052175

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: 1-3, 21-23, 41

Using non-overlapping SRS resource sets having different uses.

2. claims: 1, 4, 7-10, 15-18, 21, 24, 27-30, 35-38, 41

Transmitting SRS with a delay that indicates use of cyclic delay diversity.

3. claims: 1, 5, 6, 13, 14, 19-21, 25, 26, 33, 34, 39-42

Utilizing (up to) three SRS resource sets partially or fully overlapping in time.

4. claims: 1, 11, 12, 21, 31, 32, 41

Activating SRS resource sets for a same duration as PUSCH or with different periodicity.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2019/052175

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