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(54) Title: UPLINK TRANSMISSION TECHNIQUES IN LOW-LATENCY WIRELESS COMMUNICATION

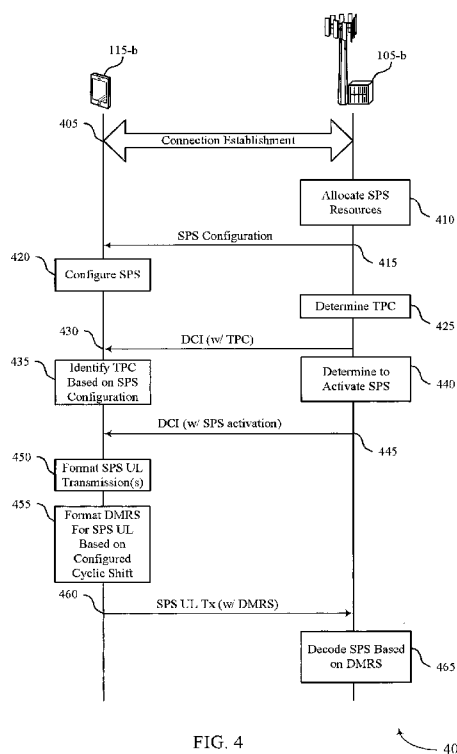


FIG. 4

(57) Abstract: Methods, systems, and devices for wireless communications are described that provide for indicating transmit power control information to a user equipment (UE) for semi-persistent scheduling (SPS) transmissions in short transmission time intervals (TTIs) from the UE, and for configuring reference signal transmissions in SPS transmissions of short TTIs. A UE may be configured with uplink power control information for SPS transmissions that use sTTIs that is separate from uplink power control for longer TTIs. A UE may receive the power control information and apply it in SPS transmissions that use sTTIs. Uplink transmit power for SPS sTTI transmissions may be independent of power control for regular sTTI transmissions and independent of power control for long TTI transmissions. UEs may apply a cyclic shift to reference signals transmitted in SPS transmissions according to a SPS configuration, rather than a cyclic shift indicated in a SPS activation command.



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**INTERNATIONAL SEARCH REPORT**

International application No PCT/US2018/060154
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. H04W52/14 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> 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		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017/273071 A1 (NOGAMI TOSHIZO [US] ET AL) 21 September 2017 (2017-09-21)  paragraph [0042] paragraph [0088] paragraph [0101] - paragraph [0110] paragraph [0128] - paragraph [0141] paragraph [0163] paragraph [0169] - paragraph [0174] paragraph [0266] - paragraph [0270] ----- -/--	1-10, 20-27, 32-49
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		
<input checked="" type="checkbox"/> 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  20 March 2019		Date of mailing of the international search report  23/05/2019
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  Riposati, Benedetto

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2018/060154

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>NTT DOCOMO ET AL: "Uplink power control for sTTI", 3GPP DRAFT; R1-1708423, 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 14 May 2017 (2017-05-14), XP051273616, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-05-14] section 2; page 1 - page 2 page 3, line 7 - line 22</p> <p style="text-align: center;">-----</p>	<p>1-10, 20-27, 32-49</p>
Y	<p>"3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Study on latency reduction techniques for LTE (Release 14)", 3GPP STANDARD; TECHNICAL REPORT; 3GPP TR 36.881, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. V14.0.0, 13 July 2016 (2016-07-13), pages 1-99, XP051450161, section 8.1 section 8.2 section 8.5</p> <p style="text-align: center;">-----</p>	<p>1-10, 20-27, 32-49</p>
A	<p>"3 Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding (Release 14)", 3GPP STANDARD ; TECHNICAL SPECIFICATION ; 3GPP TS 36.212, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. V14.4.0, 26 September 2017 (2017-09-26), pages 1-198, XP051337332, section 5.3.3.1.6 section 5.3.3.1.7</p> <p style="text-align: center;">-----</p> <p style="text-align: center;">-/--</p>	<p>1-10, 20-27, 32-49</p>

**INTERNATIONAL SEARCH REPORT**

International application No PCT/US2018/060154
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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.
A	<p>"3 Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 14)",                      3GPP STANDARD ; TECHNICAL SPECIFICATION ;                      3GPP TS 36.213, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ;                      650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE,                      vol. RAN WG1, no. V14.4.0,                      26 September 2017 (2017-09-26), pages 8-49, XP051337377,                      section 5.1.1.1                      section 5.1.2.1</p> <p align="center">-----</p>	<p>1-10,                      20-27,                      32-49</p>

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2018/060154

## 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.:

1-10, 20-27, 32-49

### 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: 1-10, 20-27, 32-49

power control

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2. claims: 11-19, 28-31, 50-63

DMRS

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/060154

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2017273071 A1	21-09-2017	CN 109417808 A	01-03-2019
		EP 3434057 A1	30-01-2019
		US 2017273071 A1	21-09-2017
		WO 2017165198 A1	28-09-2017
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