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(54) Title: AUTONOMOUS UPLINK TRANSMISSION TECHNIQUES USING SHARED RADIO FREQUENCY SPECTRUM

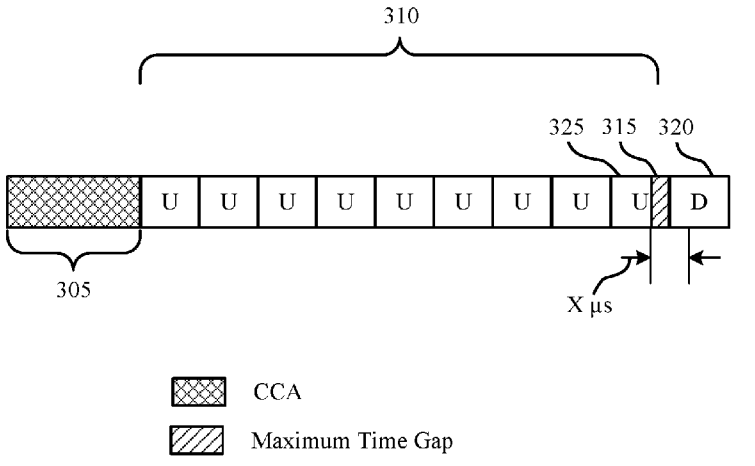

FIG. 3

(57) Abstract: Techniques for autonomous uplink (AUL) transmissions are provided that allow for efficient use of shared radio frequency spectrum band resources. A user equipment (UE) may determine a duration of an AUL transmission and modify an uplink waveform or provide an indication to a base station of one or more channel resources that may be available for base station transmissions, in order to more fully utilize shared radio frequency spectrum band resources within a maximum channel occupancy time (MCOT). A base station may activate or deactivate AUL transmissions through downlink control information (DCI) transmitted to the UE. A UE and base station may exchange various other control information to provide relatively efficient autonomous uplink transmissions and use of the shared radio frequency spectrum band resources.

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[Continued on next page]

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, KM, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/016807

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W74/08 H04W74/00 H04W72/04 H04L1/00 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)
H04W 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	INTEL CORPORATION: "UL URLLC transmission schemes", 3GPP DRAFT; R1-1612004 INTEL - URLLC UL_TX, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Reno, USA; 20161114 - 20161118 6 November 2016 (2016-11-06), XP051190814, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_87/Docs/ [retrieved on 2016-11-06]	1,6,7,9, 12,13
Y	Section 3.2 "Semi-Static Resource Allocation (SPS-based transmission)"	2-5,8, 10,11, 19-24
A		14-18,

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[X] 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

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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	Date of mailing of the international search report
28 August 2018	07/09/2018

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
		25-30

Y	ERICSSON [ZTE] [MEDIATEK] [WILUS]: "WF on MCOT limit Signaling and Modifying LBT type", 3GPP DRAFT; R1-165716, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Nanjing, China; 20160523 - 20160527 30 May 2016 (2016-05-30), XP051111902, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_85/Docs/ [retrieved on 2016-05-30]	2,3,10, 11
A	slide 3 - slide 5	1,4-9, 12-30

Y	LENOVO: "UL eMBB transmission multiplexing with UL URLLC", 3GPP DRAFT; R1-1700558, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Spokane, USA; 20170116 - 20170120 16 January 2017 (2017-01-16), XP051208088, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-01-16]	4,5
A	Section 2 "Discussion"	1-3,6-30

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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	HUAWEI ET AL: "Support of contention based uplink transmission", 3GPP DRAFT; R2-166808 SUPPORT OF CONTENTION BASED UPLINK TRANSMISSION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; , vol. RAN WG2, no. Kaohsiung; 20161010 - 20161014 9 October 2016 (2016-10-09), XP051151261, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN2/Docs/ [retrieved on 2016-10-09]	14,16-18
Y	section 2.1 "PUSCH resource waste problem"	15
A	section 2.2 "Contention based uplink transmission solution"	1-13, 19-30

Y	SAMSUNG: "On UCI Multiplexing in PUSCH", 3GPP DRAFT; R1-1700948 UCI ON PUSCH, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Spokane, USA; 20170116 - 20170120 16 January 2017 (2017-01-16), XP051208464, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-01-16]	8,19-24
A	section 2.1 "HARQ-ACK"	1-7, 9-18, 25-30

X	ERICSSON: "SPS operation on sTTI", 3GPP DRAFT; R2-1701610 - SPS AND STTI, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG2, no. Athens, Greece; 20170213 - 20170217 3 February 2017 (2017-02-03), XP051223068, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_97/Docs/ [retrieved on 2017-02-03]	25-30
Y	section 2 "Discussion"	15
A		1-14, 16-24

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/016807

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: 1-13

   Sharing the MCOT that the UE acquires for UL transmission with the base station for downlink transmission in a contention-based autonomous uplink transmission.

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2. claims: 14-18

   Activating autonomous uplink transmission..

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3. claims: 19-24

   Achieving spectrum efficiency for signaling in autonomous uplink transmission.

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4. claims: 25-30

   Performing HARQ process in autonomous uplink transmission.
