(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 September 2022 (15.09.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/192072 A3

(51) International Patent Classification:
H04B 7/024 (2017.01) *H04B 7/08* (2006.01)
H04B 7/06 (2006.01)

(21) International Application Number:
PCT/US2022/018788

(22) International Filing Date:
03 March 2022 (03.03.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
17/198,917 11 March 2021 (11.03.2021) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, 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, HR, HU, ID, IL, IN, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, 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, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM,

(54) **Title:** TECHNIQUES FOR COMMUNICATIONS ON GRATING LOBES

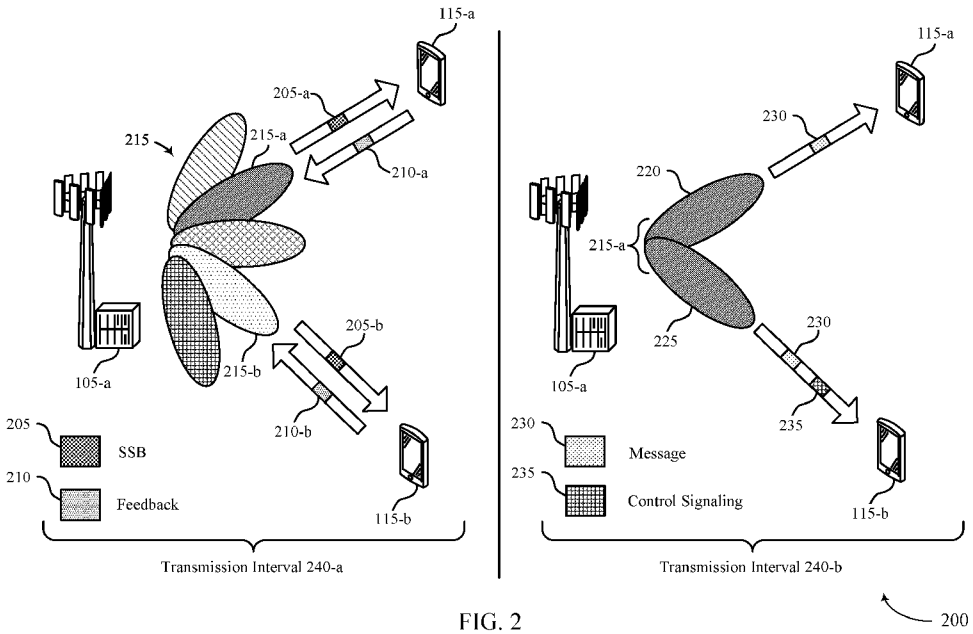

FIG. 2

(57) **Abstract:** Methods, systems, and devices for wireless communications are described. To communicate messages using one or more grating lobes of a directional beam, a first device (e.g., a user equipment (UE), a base station) may transmit, to a second device, control signaling that indicates the transmission of a message on a grating lobe. The first device may determine a set of beamforming parameters for simultaneously transmitting the message to the second device and a third device. The first device may simultaneously transmit the message to third device on a main lobe and to the second device on the grating lobe. Additionally, or alternatively, the first device may simultaneously receive a message on a main lobe and a grating lobe of a directional beam. The first device may also communicate control signaling that indicates whether to simultaneously communicate the message on the main lobe and the grating lobe.

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[Continued on next page]

TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, 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).

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))*

(88) **Date of publication of the international search report:**
13 October 2022 (13.10.2022)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2022/018788

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04B7/024 H04B7/06 H04B7/08
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

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	HUAWEI ET AL: "Beam indication for control and data channels", 3GPP DRAFT; R1-1718238, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Prague, Czech Republic; 20171009 - 20171013 8 October 2017 (2017-10-08), XP051341420, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Docs/ [retrieved on 2017-10-08]	1-6,9,10
Y	page 2 - page 4	7,8, 11-13, 15,16
A		14

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[X] Further documents are listed in the continuation of Box C.

[X] 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

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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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 September 2022	26/09/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Franz, Volker

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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.
A	WO 2019/061085 A1 (BEIJING XIAOMI MOBILE SOFTWARE CO LTD [CN]) 4 April 2019 (2019-04-04) paragraph [0127] - paragraph [0131]; figure 4	2-4
A	US 2014/146863 A1 (SEOL JI-YUN [KR] ET AL) 29 May 2014 (2014-05-29) paragraph [0124] - paragraph [0131]; figure 7	2-4
Y	MEDIATEK INC: "Enhancement on multi-beam operation", 3GPP DRAFT; R1-2100588, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. e-Meeting; 20210125 - 20210205 19 January 2021 (2021-01-19), XP051971059, Retrieved from the Internet: URL:https://ftp.3gpp.org/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100588.zip R1-2100588_MB_final.docx [retrieved on 2021-01-19] page 22; figure 10	7,8
A	CATT: "Beam management for new SCSs for up to 71GHz operation", 3GPP DRAFT; R1-2100373, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. e-Meeting; 20210125 - 20210205 19 January 2021 (2021-01-19), XP051970976, Retrieved from the Internet: URL:https://ftp.3gpp.org/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100373.zip R1-2100373.docx [retrieved on 2021-01-19] page 5 - page 6; figure 3	7,8
2 Y	US 2017/207840 A1 (TUJKOVIC DJORDJE [US]) 20 July 2017 (2017-07-20)	11-13, 15,16
A	paragraphs [0017], [0024], [0031], [0033]; figure 6	14

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2022/018788

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.:

1-16

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, 9, 10

Receiving, from the second wireless device, a second message indicating a difference between a first gain associated with the first lobe of the directional beam and a second gain associated with the second lobe of the directional beam.
Decoding the message received on the first lobe of the directional beam based at least in part on the difference between the first gain and the second gain.
Transmitting, to the second wireless device, a third message indicating a modulation and coding scheme for transmitting the message based at least in part on the difference between the first gain and the second gain.

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2. claims: 5-8

Transmitting, to the second wireless device, feedback associated with communicating with the second wireless device on a second directional beam different from the directional beam, wherein the control signaling indicating that the message is to be transmitted using the first lobe of the directional beam is based at least in part on the feedback.

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3. claims: 11-16

Transmitting, to the second wireless device, second control signaling indicating that a second message is to be transmitted using a first lobe of a second directional beam;determining a second set of beamforming parameters for simultaneously transmitting the second message to the second wireless device and a fourth wireless device based at least in part on indicating that the second message is to be transmitted using the first lobe of the second directional beam; and simultaneously transmitting the second message to the second wireless device and the fourth wireless device, wherein the second message is transmitted to the second wireless device using the first lobe of the second directional beam and transmitted to the fourth wireless device using a second lobe of the second directional beam different from the first lobe of the second directional beam.

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4. claims: 17-20

A method for wireless communication at a first wireless device in a wireless communication system, comprising: receiving, from a second wireless device, control signaling indicating that a message is to be simultaneously

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

transmitted from the second wireless device and from a third wireless device to the first wireless device;determining a set of beamforming parameters for simultaneously receiving the message based at least in part on the control signaling indicating that the message is to be simultaneously transmitted; and simultaneously receiving the message from the second wireless device and the third wireless device based at least in part on determining the set of beamforming parameters, wherein the message is received from the second wireless device on a first lobe of a directional beam and from the third wireless device on a second lobe of the directional beam different from the first lobe.

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5. claims: 21-27

A method for wireless communication at a first wireless device, comprising:receiving control signaling indicating whether to simultaneously communicate a message using a first lobe of a directional beam and a second lobe of the directional beam, wherein the first lobe is used for communications between the first wireless device and a second wireless device, and wherein the second lobe is different from the first lobe and is used for communications between the first wireless device and a third wireless device;determining an operating mode for communicating the message based at least in part on the control signaling indicating whether to simultaneously communicate the message; and communicating the message according to the determined operating mode.

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6. claims: 28-30

A method for wireless communication at a first wireless device, comprising: determining whether simultaneous transmission of a message by a second wireless device using a first lobe of a directional beam and second lobe of the directional beam will cause interference at the first wireless device, wherein the first lobe is used for communications between the first wireless device and the second wireless device, and wherein the second lobe is different from the first lobe and is used for communications between the second wireless device and a third wireless device; and transmitting, to the second wireless device, control signaling indicating whether to simultaneously transmit the message based at least in part on the determination.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2022/018788

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