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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 July 2015 (30.07.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/112627 A3

(51) International Patent Classification:
H04L 5/14 (2006.01)

(21) International Application Number:
PCT/US2015/012285

(22) International Filing Date:
21 January 2015 (21.01.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
14/164,081 24 January 2014 (24.01.2014) 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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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,

[Continued on nextpage]

(54) Title: CHANNEL OPTIMIZATION IN HALF DUPLEX COMMUNICATIONS SYSTEMS

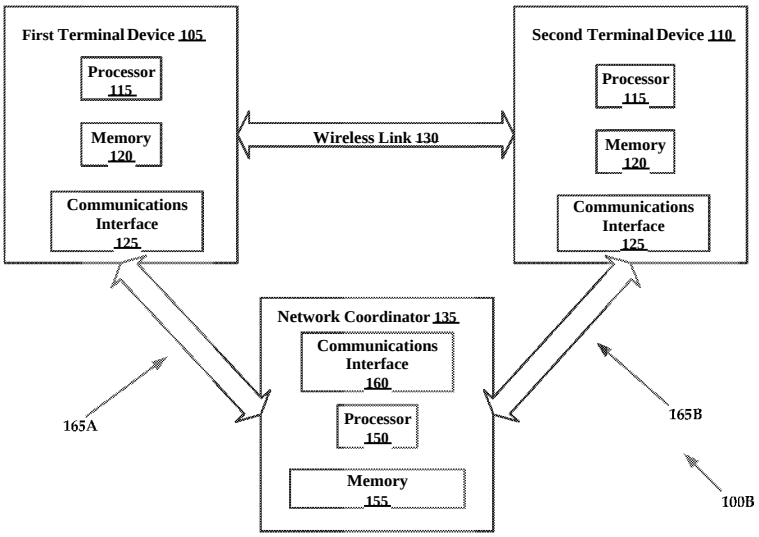

FIG. 1B

(57) Abstract: Channel Optimization in Half Duplex Communications Systems is provided herein. Methods may include obtaining at a first terminal, radio frequency (RF) spectral information local to the first terminal, analyzing at the first terminal, RF spectral information for a second terminal that is not co-located with the first terminal, transmitting data to the second terminal on a second terminal optimal frequency band, and receiving data from the second terminal on the first terminal optimal frequency band, where the first terminal optimal frequency being based upon the RF spectral information local to the first terminal.

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SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(88) Date of publication of the international search report: 12 November 2015

Published:

— *with international search report (Art. 21(3))*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US201 5/01 2285

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04L 5/14 (2015.01)
CPC - H04B 7/2628 (2014.12)
According to International Patent Classification (IPC) or to both national classiflcation and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - H04B 17/00; H04L 5/14; H04W 16/10 (2015.01)
USPC - 370/295, 296; 455/423

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - H04B 7/2628; H04W 12/12; H04W 16/10 (2014.12) (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Orbit, Google Patents, Google.
Search terms used: RF spectral information, half-duplex, communications, analyzing, frequencies, terminals.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	uuss 2007/0268848 A1 (KHANDEKAR et al) 22 November 2007 (22.11.2007) entire document	1, 4-8 --- 2-3, 9, 13, 17, 26
Y	US 2007/0173199 A1 (SINHA) 26 July 2007 (26.07.2007) entire document	2-3
Y	us 2007/0173260 A1 (LOVE et al) 26 July 2007 (26.07.2007) entire document	9, 28
X -- Y	us 2012/0134280 A1 (ROTVOLD et al) 31 May 2012 (31.05.2012) entire document	19-25, 27 --- 10-17, 26, 28
-Y	us 2010/0029282 A1 (STAMOULIS et al) 04 February 2010 (04.02.2010) entire document	10-17
A	us 2002/0102948 A1 (STANWOOD et al) 01 August 2002 (01.08.2002) entire document	1-17, 19-28

☐ Further documents are listed in the continuation of Box C. ☐

* 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 May 2015

Date of mailing of the international search report
29 JUN 2015

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

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PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/012285

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. HI 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 Extra 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 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.:
1-17, 19-28

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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US201 5/01 2285

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1 . In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-9, drawn to a method for transmitting data.
Group II, claims 10-17, drawn to a network coordinator for a network using time division duplexing or time division multiple access.
Group III, claims 18, drawn to a dual channel network device.
Group IV, claims 19-28, drawn to a terminal device.

The inventions listed as Groups I, II, III or IV do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: transmitting data between network devices using channel optimization in half duplex communications as claimed therein is not present in the invention of Groups II, III or IV. The special technical feature of the Group II invention: negotiating a frequency band for each of the plurality of terminal devices such that a product or a sum of a forward link and a reverse link throughput for each plurality of terminal devices is jointly maximized on the wireless link as claimed therein is not present in the invention of Groups I, III or IV. The special technical feature of the Group III invention: a time division duplexing interface for transmitting or receiving data on a first channel; a time division duplexing and frequency division duplexing interface for transmitting or receiving data on a second channel as claimed therein is not present in the invention of Groups I, II or IV. The special technical feature of the Group IV invention: determine an optimal frequency band for each of the one or more additional terminal devices as claimed therein is not present in the invention of Groups I, II or III.

Groups I, II, III, and IV lack unity of invention because even though the inventions of these groups require the technical feature of a processor; and a memory for storing executable instructions; obtaining at a first terminal, radio frequency (RF) spectral information local to the first terminal; analyzing at the first terminal, RF spectral information for a second terminal that is not co-located with the first terminal; transmitting data to the second terminal on a second terminal optimal frequency band; and receiving data from the second terminal on the first terminal optimal frequency band, the first terminal optimal frequency being based upon the RF spectral information local to the first terminal, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, (US 2007/0268848 A 1 (KHANDEKAR et al) 22 November 2007 (22.1 1.2007) teaches (a processor (a component may be, but is not limited to being, a process running on a processor, [0039]); and a memory for storing executable instructions (Processor 1314 can be coupled to memory 1316, which can store information, [0092]); obtaining at a first terminal (the first terminal is assigned resources in frames of the half-duplex interlace determined for use in the act described in block 1102, [0083]),
radio frequency (RF) spectral information local to the first terminal (These instructions may include communicating with a first terminal using half-duplex in a frequency division duplex (FDD) [which use a range of frequencies] communication system, [0014]; the base station can exchange data [spectral information or range of frequencies] with the first terminal in frames of the half-duplex, [0084]); analyzing at the first terminal (can then be analyzed by a processor 1314 ... can store information related to code clusters, access terminal assignments [relating to both terminals], [0092]),
RF spectral information for a second terminal that is not co-located with the first terminal (the base station can receive signaling from the first terminal in a CDMA control segment for this half-duplex interlace ... the base station can exchange data [RF spectral information] with the second terminal in any frame [not co-located with the first terminal] of the multiple half-duplex interlaces, [0084]);
transmitting data to the second terminal on a second terminal optimal frequency band (the forward link and reverse link frames of each half-duplex interlace in order to give a half-duplex terminal [relates to both terminals] an amount of time to switch between transmitting and receiving, [0061]; the forward link may be associated with a first frequency channel [first optimal frequency band], and the reverse link may be associated with a second frequency channel [second optimal frequency band], [0077]);
and receiving data from the second terminal on the first terminal optimal frequency band (wherein a second terminal is assigned resources in any of the frames [second terminal can receive any of the frequency bands] of the multiple half-duplex interlaces, [0083]),
the first terminal optimal frequency being based upon the RF spectral information local to the first terminal (wherein a terminal [related to either first or second terminal] or base station employing methodology 900 communicates using frames [RF spectral information] of the half-duplex interlace ... data may be received via a first frequency channel [in this case, receiving on the first terminal] in forward link frames [RF spectral information] of the half-duplex interlace determined for use in the act described in block 902, [0079]).