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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR OFDMA TONE ALLOCATION IN NEXT GENERATION WI-FI NETWORKS

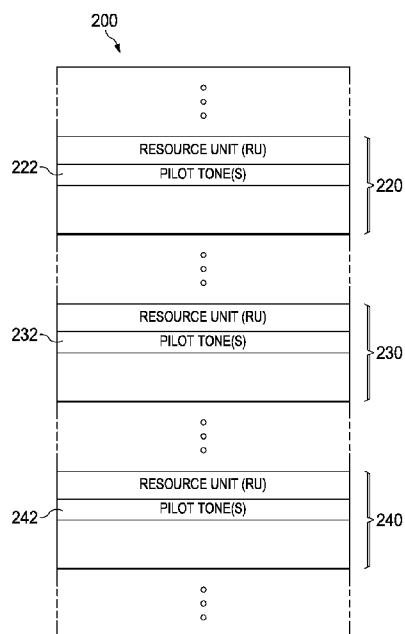


FIG. 2

(57) Abstract: An orthogonal frequency division multiple access (OFDMA) frame tone allocation includes a 256 tone payload consisting of 228 data and pilot tones and 28 null tones. The 28 null tones consist of guard tones and at least one direct current (DC) tone. In one example, the 256 tone payload consists of 224 data tones, 4 common pilot tones, and 28 null tones. In another example, the 256 tone payload consists of 222 data tones, 6 common pilot tones, and 28 null tones. In yet another example, the 256 tone payload may consist of 220 data tones, 8 common pilot tones, and 28 null tones. The OFDMA frame may be a downlink OFDMA frame or an uplink OFDMA frame.



LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/35697

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04W 72/12 (2015.01)

CPC - H04W 72/1268

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)

IPC(8) Classification(s): H04W 72/04, H04W 72/12, H04J 11/00 (2015.01)

CPC Classification(s): H04W 72/04, H04W 72/1268, H04J 11/00

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)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); IP.com; ProQuest; Google

Keywords: OFDMA, resource unit, pilot, tone

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/0038324 A1 (PARK, S et al.) 17 February 2011, paragraphs [0017], [0025], [0027], [0055].	9, 11, 14, 16
Y		1-8, 10, 12, 13, 15, 17, 18
Y	PASCUAL-ISERTE, A et al. "Residual Carrier Frequency Offset Estimation and Correction in OFDM MIMO Systems". 18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, September 2007. Retrieved from the Internet: <URL: https://spcom.upc.edu/documents/file_1656.pdf >.	1-8, 10, 15
Y	US 2005/0259569 A1 (CIMINI, L et al.) 24 November 2005, paragraph [0037].	3, 7, 12, 17
Y	US 2012/0008571 A1 (LI, J et al.) 12 January 2012, paragraphs [0029] and [0031].	4, 8, 13, 18
A	US 2006/0279435 A1 (KRISHNAN, R et al) 14 December 2006, paragraphs [0036], [0038], [0043]	1-18

☐ 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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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/35697

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:

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 fee must be paid.

Group I: Claims 1-18 are directed toward methods and apparatuses for communicating an uplink signal with separate pilot signals.

Group II: Claims 19-30 are directed toward methods for transmitting resource units in a wireless communication system with specified tones.

The inventions listed as Groups I and II 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:

---See Supplemental Page---

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.:
1-18

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
Information on patent family members

International application No.

PCT/US15/35697

.***-Continued from Box III: Lack of Unity of Invention-***

The special technical features of Group I include wherein the uplink OFDMA frame comprises resource units (RUs) communicated by different mobile devices, wherein each of the RUs in the uplink OFDMA frame carries a separate pilot signal; and performing residual carrier frequency offset estimation on the uplink OFDMA frame in accordance with the separate pilot signals carried by the RUs, which are not present in Group II.

The special technical features of Group II include wherein the OFDMA frame comprises a 256 tone payload that consists of specified numbers of data and pilot tones and specified numbers of null tones, the specified number of null tones consisting of guard tones and at least one direct current (DC) tone, which is not present in Group I.

The common technical features shared by Groups I and II are a method for transmitting resource units in a wireless communication system, the method comprising: generating, by a transmitter, an orthogonal frequency division multiple access (OFDMA) frame for communicating over a 20 megahertz (MHz) frequency channel, wherein the OFDMA frame comprises a payload that consists of pilot signals; and transmitting the OFDMA frame to at least one receiver.

However, these common features are previously disclosed by US 2006/0279435 A1 to Krishnan, R et al. (hereinafter 'Krishnan'). Krishnan discloses a method for transmitting resource units in a wireless communication system, the method comprising: generating, by a transmitter, an orthogonal frequency division multiple access (OFDMA) frame for communicating over a 20 megahertz (MHz) frequency channel (OFDM communication over a plurality of subbands (resource units) with a total bandwidth of 20 MHz (channel), paragraph [0036]), wherein the OFDMA frame comprises a payload that consists of pilot signals (terminals may transmit pilot signals on the uplink, paragraph [0043]); and transmitting the OFDMA frame to at least one receiver (a receiver receives the OFDM signals, paragraph [0038]).

Since the common technical features are previously disclosed by the Krishnan reference, these common features are not special and so Groups I and II lack unity.