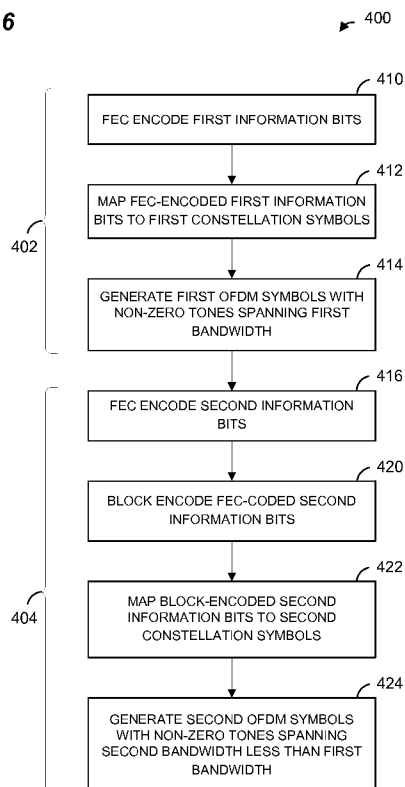




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(75) **Inventors/Applicants (for US only):** **ZHANG, Hongyuan** [CN/US]; 4707 Paseo Padre Parkway, Fremont, CA 94555 (US). **BANERJEA, Raja** [US/US]; 970 Corte Madera Ct., Apt. 203, Sunnyvale, CA 94085 (US). **SRINIVASA, Sudhir** [IN/US]; 1030 Michelangelo Drive, Sunnyvale, CA (US).
- (74) **Agents:** **BATEMAN, Andrew, W.** et al.; Marshall, Gerstein & Borun LLP, 233 S. Wacker Drive, 6300 Willis Tower, Chicago, IL 60606-6357 (US).
- (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, 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,

[Continued on next page]

(54) **Title:** LOW BANDWIDTH PHY FOR WLAN**FIG. 6**

(57) **Abstract:** A method includes generating first and second data units corresponding to first and second PHY modes, respectively. Generating the first data unit includes FEC encoding first information bits, mapping the FEC-encoded bits to first constellation symbols, and generating first OFDM symbols to include the first constellation symbols. The first OFDM symbols utilize a first tone spacing, and include a first number of non-zero tones collectively spanning a first bandwidth. Generating the second data unit includes FEC encoding second information bits, block encoding the FEC-encoded bits, mapping the block-encoded bits to second constellation symbols, and generating second OFDM symbols to include the second constellation symbols. The second OFDM symbols utilize the first tone spacing, and include a second number of non-zero tones collectively spanning a second bandwidth less than the first bandwidth. The second number of non-zero tones is less than the first number of non-zero tones.



HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER INV. H04L1/00 H04L1/08 H04L27/26 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) 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, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/051845 A1 (SCHMIDL TIMOTHY M [US] ET AL) 3 March 2011 (2011-03-03) page 3 - page 4	1-28
X	----- WO 2008/004155 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; DU YONGGANG [DE]) 10 January 2008 (2008-01-10) page 2, line 26 - line 34 page 4, line 13 - line 17 page 13, line 24 - page 14, line 34; figures 7,13 page 20, line 29 - line 31 page 18, line 5 - page 19, line 2 ----- -/--	1-28
☒ 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		
Date of the actual completion of the international search 21 August 2012	Date of mailing of the international search report 27/03/2013	
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 Martínez Martínez, V	

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/042027

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
T	Sameer Vermani: "Preamble format for 1 Mhz", 7 November 2011 (2011-11-07), XP055035936, Retrieved from the Internet: URL:https://mentor.ieee.org/mentor/bp/Star tPage [retrieved on 2012-08-21] the whole document -----	
T	Hongyuan Zhang: "1Mhz Waveform in wider BW", 12 March 2012 (2012-03-12), XP055035940, Retrieved from the Internet: URL:https://mentor.ieee.org/mentor/bp/Star tPage [retrieved on 2012-08-21] the whole document -----	
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/042027

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.:

1-28

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-28

OFDM PHY modes, same tone spacing but different bandwidth.

2. claims: 29-48

Packet preambles for two OFDM PHY modes: structure, duration, modulation.

3. claims: 49-68

Determination of frequency band for second OFDM PHY mode.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/042027

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011051845	A1	03-03-2011	NONE

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