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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 October 2013 (31.10.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/162917 A3

(51) International Patent Classification:
H04W 48/16 (2009.01) *H04W 8/00* (2009.01)

(21) International Application Number:
PCT/US2013/036315

(22) International Filing Date:
12 April 2013 (12.04.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

61/639,245	27 April 2012 (27.04.2012)	US
61/793,405	15 March 2013 (15.03.2013)	US
13/858,662	8 April 2013 (08.04.2013)	US

(71) Applicant: **MARVELL WORLD TRADE LTD.** [BB/BB]; L'Horizon Gunsite Road, BB 14027 Brittons Hill, St. Michael (BB).

(72) Inventors; and

(71) Applicants *(for US only)*: **LIU, Yong** [CN/US]; 1625 Westmont Ave., Campbell, California 95008 (US). **BANERJEA, Raja** [US/US]; 970 Corte Madera Ct., Apt. 203, Sunnyvale, California 94085 (US).

(74) Agents: **WIGGINS, Michael D.** et al.; Harness, Dickey & Pierce, P.L.C., P.O. Box 828, Bloomfield Hills, Michigan 48303 (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, 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, 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, PA, 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.

(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, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR SCANNING MULTIPLE CHANNELS IN A WIRELESS NETWORK

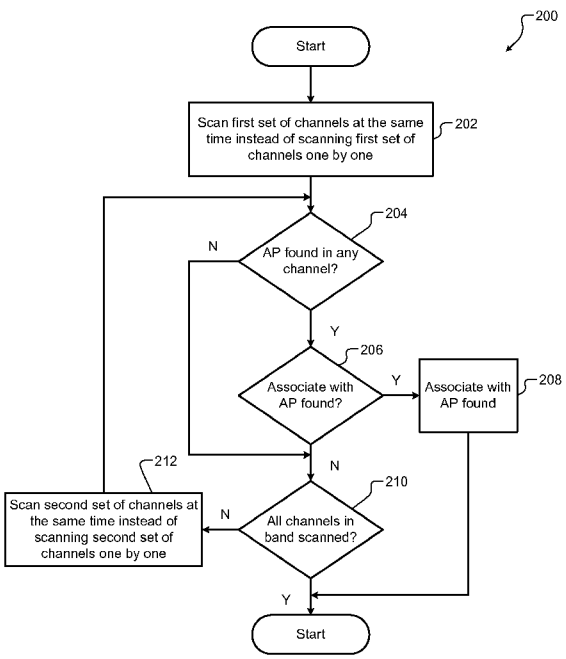


FIG. 3

(57) Abstract: A client station including a transceiver module, a scanning module, and an association module. The transceiver module is configured to transmit and receive data via a frequency band, where the frequency band includes a plurality of channels. The scanning module is configured to simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and to determine whether one or more access points are available for association in one or more of the multiple channels. The association module is configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association.

WO 2013/162917 A3

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, 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:
19 December 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/036315

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W48/16
ADD. H04W8/00

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

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	WO 2011/106538 A1 (INTERDIGITAL PATENT HOLDINGS [US]; AHMAD SAAD [CA]; GAUVREAU JEAN-LOUI) 1 September 2011 (2011-09-01) paragraph [0004] - paragraph [0006] paragraph [0031] - paragraph [0046] paragraph [0055] paragraph [0060] - paragraph [0061] paragraph [0139] - paragraph [0144] figures -----	1-3,21, 22
A	US 2012/052900 A1 (LIU YONG [US] ET AL) 1 March 2012 (2012-03-01) abstract paragraph [0004] - paragraph [0017] paragraph [0040] - paragraph [0042] figures -----	1-3,21, 22

-/--

[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

"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	Date of mailing of the international search report
28 August 2013	28/10/2013

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	Aguilar Cabarrus, E

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/036315

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006/203784 A1 (CROMER DARYL C [US] ET AL) 14 September 2006 (2006-09-14) paragraph [0003] - paragraph [0015]	2,3,22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/036315

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.:

1-3, 21, 22

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: 1-3, 21, 22

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to
simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;
wherein the scanning module is configured to determine whether one or more access points are available for association in one or more of the multiple channels by detecting whether one or more beacons are received from the one or more access points via one or more of the multiple channels;
wherein the scanning module is configured to scan the multiple channels and determine whether one or more access points are available for association in one or more of the multiple channels by: (i) transmitting a probe request via each of the multiple channels, and (ii) detecting whether one or more responses to the probe request are received from the one or more access points via one or more of the multiple channels.

---

2. claims: 1, 4-9, 21, 23-25

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to
simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;
wherein the scanning module further includes: a preamble detection module configured to detect whether a preamble of

a frame is received via a first channel of the multiple channels; anda decoding module configured to attempt to decode a signal field of the frame in response to the preamble detection module detecting that the preamble of the frame is received via the first channel of the multiple channels, wherein the signal field follows the preamble.

---

3. claims: 1, 10-13, 21, 26, 27

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;
wherein the scanning module includes:a preamble detection module configured to detect whether a preamble of a frame is received via one of the multiple channels; anda decoding module configured to, in response to the preamble detection module detecting that the preamble of the frame is received via one of the multiple channels,decode the preamble or a signal field following the preamble, anddetermine, based on the decoding of the preamble or the signal field, whether the preamble or the signal field includes an indication that the frame is (i) a beacon, (ii) a probe response, or (ii) transmitted by one of the access points.

---

4. claims: 1, 14, 21, 28

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;

wherein the scanning module is configured to transmit a probe request via each of the multiple channels, and wherein in response to the scanning module having detected that multiple responses to the probe request have been received from more than one of the access points via more than one of the multiple channels, the scanning module includes:a decoding module configured to attempt to decode a first response of the multiple responses, wherein the first response is received via a first channel of the multiple channels; anda preamble detection module configured to detect, while the decoding module is decoding the first response received via the first channel, whether a preamble of a frame is received via a second channel of the multiple channels,wherein the scanning module is configured to, in response to the preamble detection module having detected that the preamble of the frame is received via the second channel, retransmit the probe request via the second channel.

---

5. claims: 1, 15-18, 21, 29, 30

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to
simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;
wherein the scanning module includes:a preamble detection module configured to detect whether a preamble of a frame is received via any of the multiple channels; anda decoding module configured to decode a signal field of the frame in response to the preamble detection module having detected that the preamble of the frame has been received via a predetermined channel of the multiple channels, wherein the signal field follows the preamble.

---

6. claims: 1, 19

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to
simultaneously scan multiple channels of the frequency band

at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;
wherein the frequency band is a 2.4GHz band; and the transceiver module is configured to transmit and receive data via a single 20MHz channel in the 2.4GHz band.

---

7. claims: 1, 20

A client station comprising:
a transceiver module configured to transmit and receive data via a frequency band, wherein the frequency band includes a plurality of channels;
a scanning module configured to
simultaneously scan multiple channels of the frequency band at the same time instead of scanning the plurality of channels of the frequency band one channel at a time, and determine whether one or more access points are available for association in one or more of the multiple channels; and
an association module configured to, in response to the scanning module determining that one or more access points are available for association, determine whether to associate with one of the one or more access points determined to be available for association;
wherein the frequency band is a 5GHz band; and the transceiver module is configured to transmit and receive data via a plurality of contiguous 20MHz channels in the 5GHz band.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/036315

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011106538 A1	01-09-2011	CN 102742309 A	17-10-2012
		EP 2540107 A1	02-01-2013
		JP 2013520938 A	06-06-2013
		KR 20120130753 A	03-12-2012
		TW 201204110 A	16-01-2012
		US 2012026941 A1	02-02-2012
		WO 2011106538 A1	01-09-2011
US 2012052900 A1	01-03-2012	CN 103155447 A	12-06-2013
		EP 2612455 A2	10-07-2013
		US 2012052900 A1	01-03-2012
		WO 2012030677 A2	08-03-2012
US 2006203784 A1	14-09-2006	NONE	