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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
9 December 2010 (09.12.2010)

PCT

(10) International Publication Number
WO 2010/141210 A4

(51) International Patent Classification:
G01R 27/04 (2006.01) *G01R 29/10* (2006.01)

(21) International Application Number:
PCT/US2010/035244

(22) International Filing Date:
18 May 2010 (18.05.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/476,320 2 June 2009 (02.06.2009) US

(71) Applicant *(for all designated States except US)*: **SYMBOL TECHNOLOGIES, INC.** [US/US]; One Motorola Plaza, Holtsville, New York 11742 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **DURON, Mark** [US/US]; 140B La Bonne Vie Drive, East Patchogue, New York 11772 (US). **CONNOLLY, Sean** [US/US]; 5 Acorn Lane, Stony Brook, New York 11790 (US). **STRZELCZYK, Martin** [US/US]; 10603 High Beach Court, New Market, Maryland 21774 (US).

(74) Agents: **FAN, Nong-Qiang** et al.; 1303 East Algonquin Road, Schaumburg, Illinois 60196 (US).

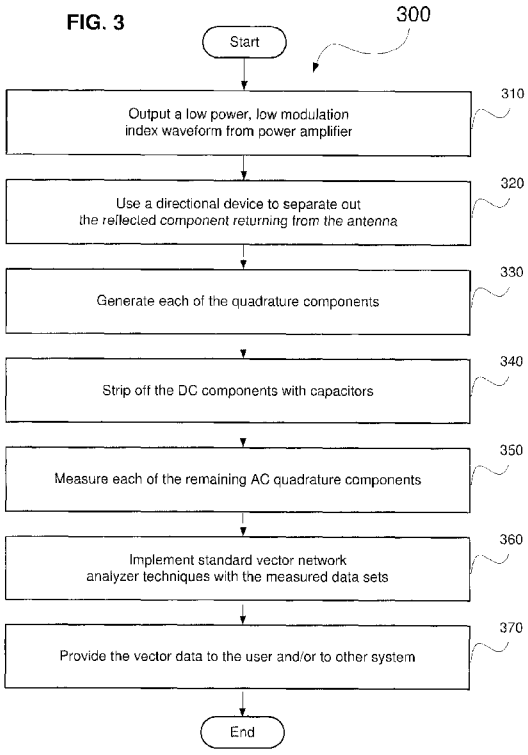
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, 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, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD AND SYSTEM FOR CHOPPED ANTENNA IMPEDANCE MEASUREMENTS WITH AN RFID RADIO

FIG. 3



(57) Abstract: Described herein are methods, devices and systems for characterizing an attached antenna to an electronic device, such as a radio frequency identification ("RFID") reader. One exemplary embodiment is related to a method comprising outputting a low amplitude modulation ("AM") index radio frequency ("RF") waveform, the waveform simulating tag data timing and bandwidth, removing a direct current ("DC") component from the waveform to create a chopped portion of the waveform, applying at least one vector analyzer technique on the chopped portion of the waveform, characterizing at least one antenna impedance vector of the waveform.

WO 2010/141210 A4

WO 2010/141210 A4

Published:

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

— *with amended claims (Art. 19(1))*

(88) Date of publication of the international search report: 27 January 2011

Date of publication of the amended claims: 24 March 2011

AMENDED CLAIMS
received by the International Bureau on 03 February 2011 (03.02.2011)

1. A method, comprising:

outputting a low amplitude modulation ("AM") index radio frequency ("RF") waveform, the waveform simulating tag data timing and bandwidth;

removing a direct current ("DC") component from the waveform to create a chopped portion of the waveform;

determining at least one antenna impedance vector by applying at least one vector analyzer technique on the chopped portion of the waveform;

characterizing the determined antenna impedance vector of the waveform.

2. The method according to claim 1, wherein the chopped portion is substantially proportional to an antenna reflection coefficient present at an in-phase and quadrature ("I/Q") demodulator input.

3. The method according to claim 1, further comprising:

providing the chopped portion of the waveform to a composite receiver.

4. The method according to claim 1, further comprising:

determining a polarity sensitive I-channel received signal strength indication ("RSSI") and a polarity sensitive Q-channel RSSI of the waveform.

5. The method according to claim 4, further comprising:

providing the I-channel and the Q-channel RSSIs to one of an echo canceller and a tunable antenna.

6. The method according to claim 1, wherein the outputting step is performed by an RF transmitter.

7. The method according to claim 6, wherein the RF transmitter is a radio frequency identification reader, and the tag-like data is provided from at least one radio frequency identification tag reader.

8. The method according to claim 1, further comprising:

maximizing an S11 measurement demodulated signal to noise ratio ("SNR") using a low level AM modulation index signal source having a modulation rate substantially similar to a data rate of an RFID tag.

9. The method according to claim 1, further comprising:

decreasing a saturation characteristic of an I and Q receiver function demodulation circuitry using a low level AM modulation index signal source to minimize the demodulator non-linearity and third order intermodulation distortion.

10. The method according to claim 1, further comprising:

using a low level AM modulation index signal source derived from a transmitter running at a power output during an S11 measurement, wherein the S11 measurement is taken simultaneously with a tag charging interval of a tag addressing sequence.

11. The method according to claim 1, further comprising:

using a low level AM modulation index signal source derived from a transmitter running at a power output during an S11 measurement at a normal I and Q receiver demodulators, wherein the S11 measurement is

tag addressing sequence.

12. A communication device, comprising:

a radio frequency ("RF") source outputting a low amplitude modulation ("AM") modulation index radio frequency ("RF") waveform, the waveform simulating tag data timing and bandwidth;

a plurality of direct current ("DC") blocks removing a DC component from the waveform to create a chopped portion of the waveform;

a processor determining at least one antenna impedance vector by applying at least one vector analyzer technique on the chopped portion of the waveform and characterizing the determined antenna impedance vector of the waveform.

13. The communication device according to claim 12, wherein the chopped portion is substantially proportional to an antenna reflection coefficient.

14. The communication device according to claim 12, wherein the chopped portion of the waveform is provided to a composite receiver.

15. The communication device according to claim 12, wherein the processor further determines a polarity sensitive I-channel received signal strength indication ("RSSI") and a polarity sensitive Q-channel RSSI of the waveform.

wherein the I-channel and the Q-channel RSSIs are provided to one of an echo canceller and a tunable antenna.

17. The communication device according to claim 12, wherein the RF transmitter is a radio frequency identification reader, and the tag data is provided from at least one radio frequency identification tag.

18. A system, comprising:

a transmitting means for transmitting a low amplitude modulation ("AM") modulation index radio frequency ("RF") waveform, the waveform simulating tag data;

a means for removing a direct current ("DC") component from the waveform to create a chopped portion of the waveform;

an analyzing means for determining at least one antenna impedance vector by applying at least one vector analyzer technique on the chopped portion of the waveform; and

a characterizing means for characterizing the determined impedance vector of the waveform.

19. The system according to claim 18, wherein the chopped portion is substantially proportional to an antenna reflection coefficient

20. The system according to claim 18, further comprising:

of the waveform to a composite receiver.

21. The system according to claim 18, further comprising:

a determining means for determining a polarity sensitive I-channel received signal strength indication ("RSSI") and a polarity sensitive Q-channel RSSI of the waveform.

22. The system according to claim 21, further comprising:

a means for providing the I-channel and the Q-channel RSSIs to one of an echo canceller and a tunable antenna.

23. The system according to claim 18, wherein the transmitting means is an RF transmitter.

24. The system according to claim 23, wherein the RF transmitter is a radio frequency identification reader, and the tag data is provided from at least one radio frequency identification tag.