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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2007 (15.11.2007)

PCT

(10) International Publication Number
WO 2007/130482 A3

(51) **International Patent Classification:**
G06K 7/08 (2006.01) ***HOlQ 19/00*** (2006.01)
G06K 19/00 (2006.01) ***HOlQ 19/10*** (2006.01)
G06K ***7/00*** (2006.01) ***HOlQ 3/24*** (2006.01)
H04Q *5/22* (2006.01) ***HOlQ 1/36*** (2006.01)

(21) **International Application Number:**
PCT/US2007/0 10675

(22) International Filing Date: 3 May 2007 (03.05.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/417,768 4 May 2006 (04.05.2006) US

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, **BR,** BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

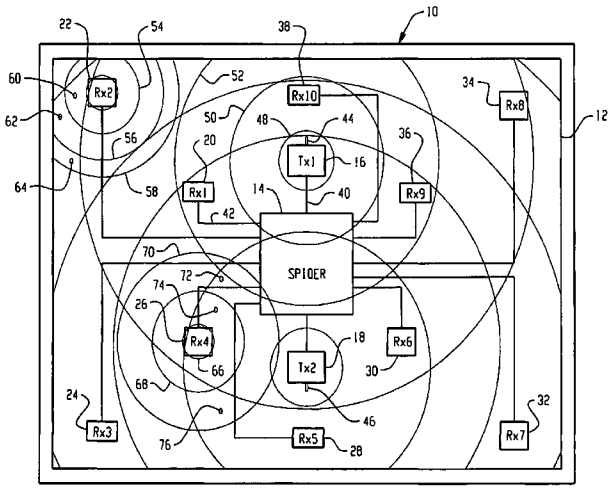
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *with amended claims*

(88) Date of publication of the international search report:
21 August 2008

Date of publication of the amended claims: 9 October 2008

(54) Title: DISTRIBUTED RHD ANTENNA ARRAY UTILIZING CIRCULAR POLARIZED HELICAL ANTENNAS



(57) Abstract: In accordance with the teachings described herein, RFID systems are provided that include a distributed RFID antenna array utilizing one or more circular polarized helical antennas. A plurality of RFID tags may be used, with each RFID tag including a linear polarized antenna for communicating RFID tag signals. One or more receiver antennas may be used for receiving the RFID tag signals from the RFID tags. An RFID tag signal reader may be used to process RFID tag signals received by the receiver antennas. In one example, the receiver antennas may include a circular polarized helical antenna element. One or more transmitter antennas may be used for transmitting an RF signal to the plurality of RFID tags, the transmitter antennas including a circular polarized helical antenna element. A transmitter may be used to generate the RF signal for transmission by the transmitter antennas. In one example, the RFID tag signal reader and the transmitter may be included in a single reader/transmitter unit.

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AMENDED CLAIMS

received by the International Bureau on 08 July 2008 (08.07.08).

28. A distributed antenna array system with a centralized data reader/transmitter for determining presence and location of RF tags comprising:

at least one designated area in a facility;

a plurality of sub-areas in each of the designated areas;

a plurality of RF tags to be dispersed in each sub-area, each of the tags being associated with a particular object in the sub-area;

a single backscatter reader/transmitter (BRT) in each designated area; and

a distributed antenna array in the facility comprising:

at least one transmitting antenna electronically coupled to the single BRT and positioned to illuminate at least a portion of the plurality of RF tags in each designated sub-area with a carrier signal; and

a single circular polarized receiving antenna in each sub-area, each single circular polarized receiving antenna receiving data from each of the RF tags in the sub-area that have been illuminated by the at least one BRT transmitting antenna and transferring the received tag data to a single hub.

29. The system of claim 28, wherein:

the selected facility is a product sale facility; and

the particular object associated with a tag is a product display, sign, merchandising or advertising material.

30. The system of claim 28, wherein the system determines that the particular object is present in a sub-area of the facility where a person is able to see or interact with the particular object.

31. The system of claim 28, wherein the system determines that the particular object is properly installed in a particular location in the sub-area.

32. The system of claim 31, wherein the system determines that the particular object is present in the particular location for an appropriate period of time.

33. The system of claim 28, wherein the RF tag is carried by a person in the facility to enable market testing through the use of data collected concerning the particular object in the particular locations visited by the person and the time spent in each particular location.

34. The system of claim 28, wherein the at least one transmitting antenna is a quadrifiler helix antenna having a shaped beam with low gain on axis and high gain to the sides.

35. The system of claim 28, wherein:

each transmitting antenna is connected to the single backscatter reader/transmitter by a coaxial cable; and

each transmitter antenna contains a high power amplifier to recover coaxial cable signal attenuation and a band-pass filter at the proper frequency to reduce noise and harmonics.

36. The system of claim 28, wherein the distributed antenna array comprises:

a plurality of transmitting antennae, each of the transmitting antennae being located in or near the designated area to transmit communication signals to at least a portion of the RF tags

located in at least some of the sub-areas.

37. The system of claim 28, further comprising:

a plurality of designated areas in the facility;

a single BRT/hub for illuminating at least a portion of the RF tags in each designated area; and

a plurality of BRT/hubs for receiving response signals from at least a portion of the illuminated RF tags and coupling the response signals to the single master BRT/hub that transmits the data to a server that processes data.

38. The system of claim 28, wherein each RF tag comprises:

an antenna system with a resonant aperture; and

a switch coupled to one or more elements of the antenna system to cleanly comment and disconnect selected portions of one or more elements of the antenna system to increase the mark-to-space ratio of the backscatter data.

39. The system of claim 28, wherein each RF tag comprises:

an antenna with two quarter-wavelength antenna elements;

a switch coupled to one of the quarter-wavelength antenna elements for selectively closing and connecting both antenna elements together to form a half-wavelength antenna that reflects the BRT carrier signal for opening to create two quarter-wavelength antenna elements that absorb at least some of the BRT carrier signal; and

a backscatter frequency generator coupled to the switch for selectively opening and

closing the switch.

40. A method of determining presence and location of RP tags using a distributed antenna array with a centralized data hub comprising the steps of:

selecting at least one designated area in a particular facility;

selecting a plurality of sub-areas in each of the designated areas;

placing a plurality of RP tags in each sub-area, each of the tags being associated with a particular object in the sub-area;

placing a reader/transmitter in each designated area; and

forming a distributed antenna array comprising the steps of:

positioning at least one transmitting antenna in or near the designated area to illuminate at least a portion of the plurality of RP tags in the sub-areas with communication data, the transmitting antenna being electronically coupled to the single reader/transmitter;

placing a single circular polarized receiving antenna in each sub-area; and

receiving data from each of the RP tags in each sub-area that has been illuminated by at least one transmitting antenna with the single circular polarized receiving antenna and transferring the received data to the centralized data hub for data transmission to a server for processing.

AMENDED SHEET (ARTICLE 19)