



US 20140240177A1

(19) **United States**

(12) **Patent Application Publication**  
**Wang et al.**

(10) **Pub. No.: US 2014/0240177 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **ANTENNA DEVICE AND WIRELESS COMMUNICATION DEVICE**

**Publication Classification**

(71) Applicant: **Wistron NeWeb Corporation**, Hsinchu (TW)

(51) **Int. Cl.**  
**H01Q 1/22** (2006.01)  
**H01Q 13/10** (2006.01)

(72) Inventors: **Chih-Ming Wang**, Hsinchu (TW);  
**Chung-Hung Chen**, Hsinchu (TW);  
**Shih-Chiang Wei**, Hsinchu (TW);  
**Kai-Yang Cheng**, Hsinchu (TW);  
**Ming-Feng Chang**, Hsinchu (TW)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/2266** (2013.01); **H01Q 13/10** (2013.01)  
USPC ..... **343/702**; 343/767

(21) Appl. No.: **13/909,026**

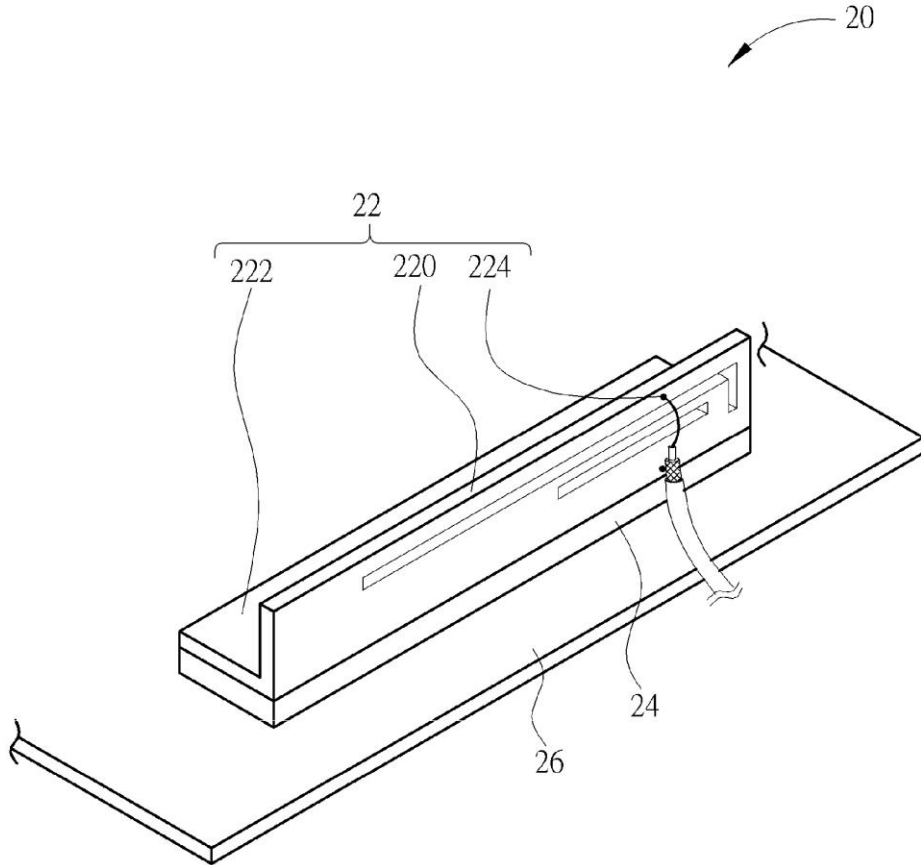
(57) **ABSTRACT**

(22) Filed: **Jun. 3, 2013**

An antenna device for a wireless communication device is disclosed. The antenna device includes a metal plate including a radiating element formed with at least a slot structure and a feed-in terminal and a grounding element, and a connecting unit electrically connected between the grounding element and a system grounding unit of the wireless communication device.

(30) **Foreign Application Priority Data**

Feb. 27, 2013 (TW) ..... 102107048





US 20140240179A1

(19) **United States**

(12) **Patent Application Publication**  
**KIM et al.**

(10) **Pub. No.: US 2014/0240179 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **HEAT RADIATION ANTENNA DEVICE,  
PORTABLE TERMINAL AND BATTERY  
COVER THEREWITH, AND METHOD FOR  
MANUFACTURING THE BATTERY COVER**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/24* (2006.01)  
*H01P 11/00* (2006.01)

(71) Applicant: **Samsung Electronics Co., Ltd.**,  
Suwon-si (KR)

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/243* (2013.01); *H01P 11/001*  
(2013.01)

(72) Inventors: **Jin-Man KIM**, Gumi-si (KR); **Hong-Ki  
KIM**, Seoul (KR); **Byung-Kyu KIM**,  
Gumi-si (KR); **Sang-Tae LEE**, Gumi-si  
(KR); **Jung-Sik CHOI**, Gumi-si (KR)

USPC ..... **343/702; 29/601**

(73) Assignee: **Samsung Electronics Co., Ltd.**,  
Suwon-si (KR)

(57) **ABSTRACT**

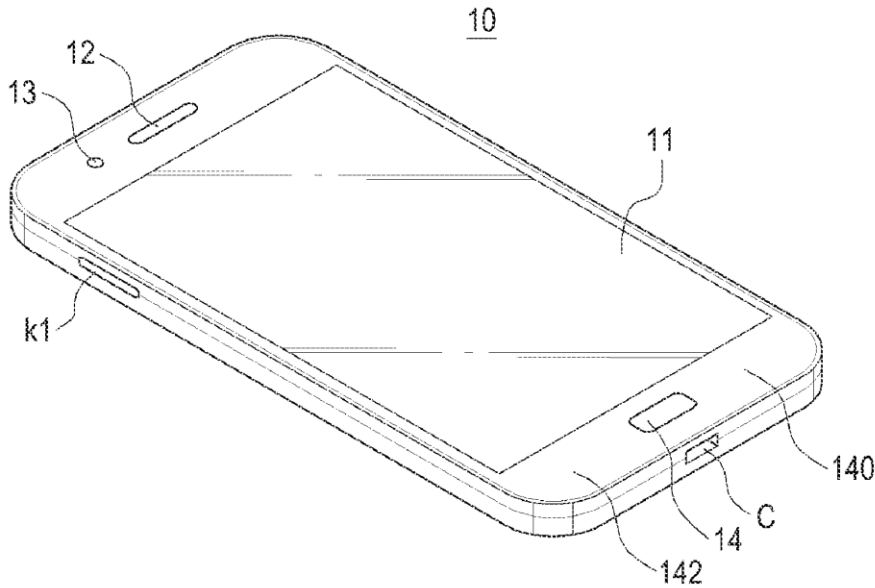
A portable terminal employing a near field communication antenna with a heat radiation function is provided. The portable terminal includes a cover provided for the portable terminal, and an antenna device mounted on an inner surface of the cover. The antenna device includes a near field communication antenna coupled to a location on the inner surface of the cover, a shield sheet coupled to an upper surface of the antenna, a heat radiation sheet coupled to an upper surface of the shield sheet so as to discharge heat transmitted from the portable terminal, and a protection cover coupled to an upper surface of the heat radiation sheet.

(21) Appl. No.: **14/155,924**

(22) Filed: **Jan. 15, 2014**

(30) **Foreign Application Priority Data**

Feb. 22, 2013 (KR) ..... 10-2013-0019466





US 20140240185A1

(19) **United States**

(12) **Patent Application Publication**  
**LAURENT**

(10) **Pub. No.: US 2014/0240185 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **MULTIBAND RF ANTENNA**

(71) Applicant: **BANG & OLUFSEN A/S**, Struer (DK)

(72) Inventor: **Claude LAURENT**, Aalborg (DK)

(73) Assignee: **BANG & OLUFSEN A/S**, Struer (DK)

(21) Appl. No.: **14/187,948**

(22) Filed: **Feb. 24, 2014**

(30) **Foreign Application Priority Data**

Feb. 22, 2013 (DK) ..... PA 2013 00105

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 9/04** (2006.01)

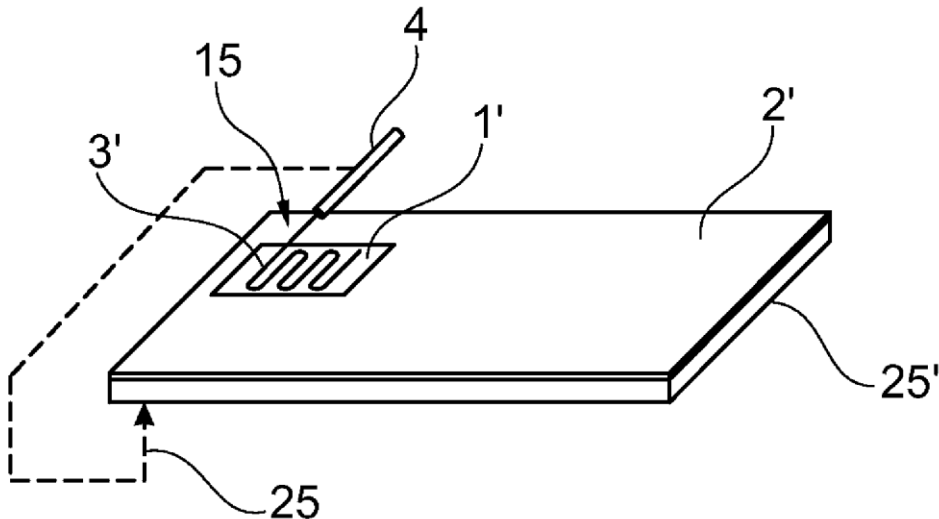
(52) **U.S. Cl.**

CPC ..... **H01Q 9/0407** (2013.01)

USPC ..... **343/767; 343/700 MS; 343/905**

(57) **ABSTRACT**

This invention relates to a miniature multiband antenna, in which a substrate being the carrier of a conductive element, and the conductive element configured as a layer onto the substrate and being the radiator in form of a slot, and a conductive layer configured onto the substrate and being the antenna feed line in form of a polygon patch area. Alternative embodiments illustrate use of slot type—and meander type antennas. The invention may be applied in any kind of electronic equipment, where a high capacity wireless system is required and within a very small physical embodiment.





US 20140240186A1

(19) **United States**

(12) **Patent Application Publication**  
**Zhou et al.**

(10) **Pub. No.: US 2014/0240186 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **OPEN END ANTENNA, ANTENNA ARRAY,  
AND RELATED SYSTEM AND METHOD**

(52) **U.S. Cl.**

CPC ..... *H01Q 13/00* (2013.01)

USPC ..... **343/772; 29/601**

(71) Applicant: **Samsung Electronics Co., Ltd.**,  
Suwon-si (KR)

(72) Inventors: **Hongyu Zhou**, Richardson, TX (US);  
**Farshid Aryanfar**, Allen, TX (US)

(57)

**ABSTRACT**

(73) Assignee: **Samsung Electronics Co., Ltd.**,  
Suwon-si (KR)

A system includes an antenna array and a transceiver configured to communicate wirelessly via the antenna array. The antenna array includes a substrate having first and second ground plates. The antenna array also includes multiple substrate integrated waveguide (SIW) antenna elements located along an edge of the substrate. The antenna array further includes feed lines configured to provide signals to the antenna elements and receive signals from the antenna elements. Each antenna element includes a waveguide between the first and second ground plates and enclosed by vias through the substrate, where the waveguide has one open edge along the edge of the substrate. The system could include multiple antenna arrays, where each antenna array includes multiple SIW antenna elements and the antenna arrays are located along different edges of the substrate.

(21) Appl. No.: **14/108,071**

(22) Filed: **Dec. 16, 2013**

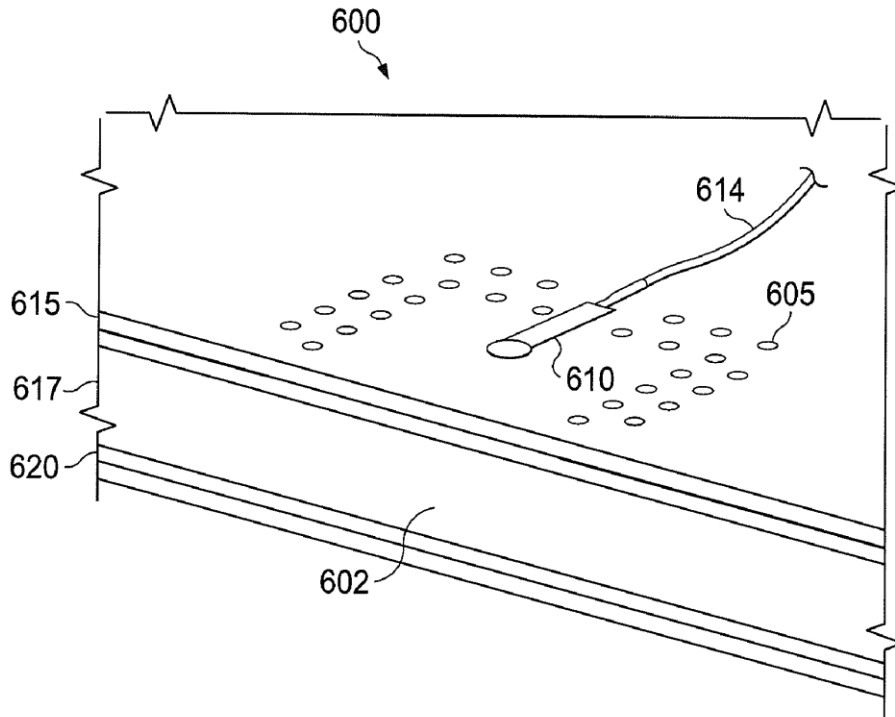
**Related U.S. Application Data**

(60) Provisional application No. 61/770,837, filed on Feb. 28, 2013.

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 13/00*

(2006.01)





US 20140240190A1

(19) **United States**

(12) **Patent Application Publication**  
**Chen et al.**

(10) **Pub. No.: US 2014/0240190 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **ANTENNA**

(71) Applicant: **Wistron NeWeb Corporation**, Hsinchu (TW)

(72) Inventors: **Chung-Hung Chen**, Hsinchu (TW);  
**Chih-Sen Hsieh**, Hsinchu (TW);  
**Chih-Ming Wang**, Hsinchu (TW)

(21) Appl. No.: **13/919,990**

(22) Filed: **Jun. 17, 2013**

(30) **Foreign Application Priority Data**

Feb. 27, 2013 (TW) ..... 102107051

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 5/00** (2006.01)

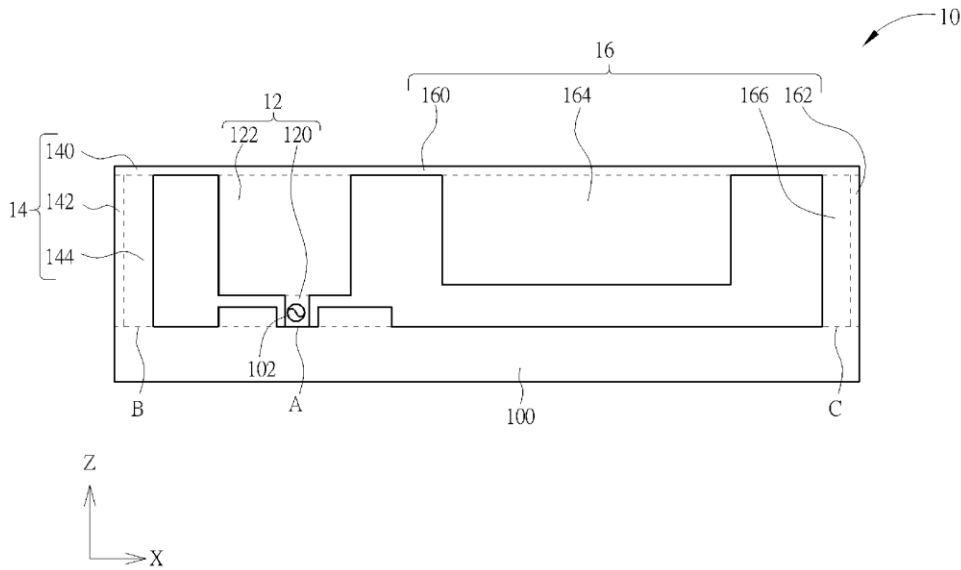
(52) **U.S. Cl.**

CPC ..... **H01Q 5/0027** (2013.01)

USPC ..... **343/843**

(57) **ABSTRACT**

An antenna for receiving radio signals of at least a first frequency band and a second frequency band includes a grounding unit for providing grounding, a connecting unit electrically connected to a first terminal of the grounding unit, a feeding terminal, formed on the connecting unit, for transmitting the radio signals of the first frequency band and the second frequency band, a first radiating element electrically connected between the connecting unit and a second terminal of the grounding unit, and a second radiating element electrically connected between the connecting unit and a third terminal of the grounding unit. Lengths of signal routes from the feeding terminal through the first radiating element and the second radiating element to the grounding unit are substantially equal to a half wavelength of the radio signals of the first frequency band and a half wavelength of the radio signals of the second frequency band, respectively.





US 20140240191A1

(19) **United States**

(12) **Patent Application Publication**

**LEE et al.**

(10) **Pub. No.: US 2014/0240191 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **2-PORT ANTENNA HAVING OPTIMUM IMPEDANCES OF A TRANSMITTER AND A RECEIVER**

(30) **Foreign Application Priority Data**

Feb. 22, 2013 (KR) ..... 10-2013-0019399

(71) Applicants: **SNU R&DB FOUNDATION**, Seoul (KR); **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/50** (2006.01)

(72) Inventors: **Jaе Sup LEE**, Yongin-si (KR); **Seong Joong KIM**, Suwon-si (KR); **Seok Ju YUN**, Hwaseong-si (KR); **Sang Wook NAM**, Seoul (KR); **Su Min YUN**, Incheon (KR)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/50** (2013.01)  
USPC ..... **343/852**

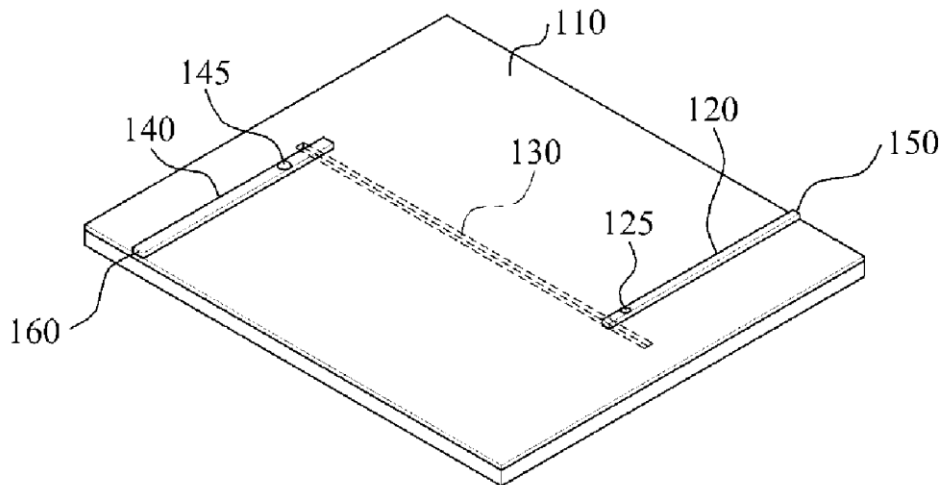
(73) Assignees: **SNU R&DB FOUNDATION**, Seoul (KR); **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)

(57) **ABSTRACT**

An antenna is described including a slot formed in a cavity, a substrate configured to cover a portion of the cavity and the slot, and a first port and a second port configured to supply power to the antenna using a first feeding line and a second feeding line. Each of the feeding line and the second feeding line is connected to the slot in a vertical direction and disposed to be separate from one another. A first input impedance of the antenna from the first port differs from a second input impedance of the antenna from the second port.

(21) Appl. No.: **14/186,553**

(22) Filed: **Feb. 21, 2014**





US 20140240474A1

(19) **United States**

(12) **Patent Application Publication**  
**Kondo**

(10) **Pub. No.: US 2014/0240474 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **WIRELESS COMMUNICATION DEVICE**

**Publication Classification**

(75) Inventor: **Toshinori Kondo**, Osaka-shi (JP)

(51) **Int. Cl.**  
**H04N 13/04** (2006.01)

(73) Assignee: **SHARP KABUSHIKI KAISHA**,  
Osaka-shi, Osaka (JP)

(52) **U.S. Cl.**  
CPC ..... **H04N 13/0497** (2013.01); **H04N 13/0438**  
(2013.01)

(21) Appl. No.: **14/351,030**

USPC ..... **348/56**

(22) PCT Filed: **Sep. 6, 2012**

(57) **ABSTRACT**

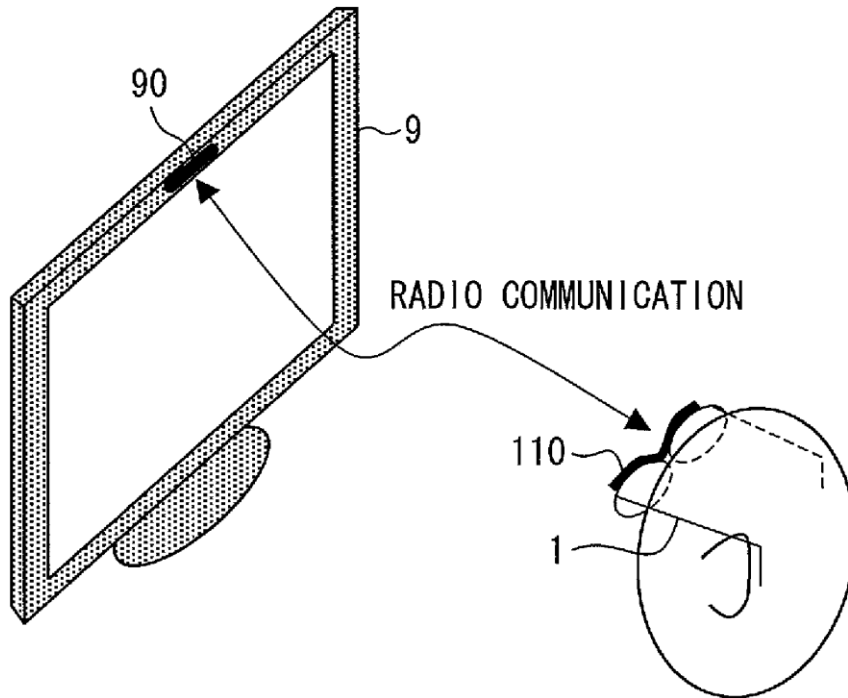
(86) PCT No.: **PCT/JP2012/072821**

§ 371 (c)(1),  
(2), (4) Date: **Apr. 10, 2014**

A glasses-type radio communication device (1) which is to be worn on the head of a user, includes: right and left eyepiece parts (11); and an antenna (110) for carrying out radio communication, the antenna (110) being a dipole antenna including an antenna element (100) and a power feeding section (101) which supplies electric power to the antenna element (100), the power feeding section (101) being provided between the right and left eyepiece parts (11).

(30) **Foreign Application Priority Data**

Oct. 14, 2011 (JP) ..... 2011-227258





US 20140242903A1

(19) **United States**

(12) **Patent Application Publication**  
**DeLuis et al.**

(10) **Pub. No.: US 2014/0242903 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **DUAL BAND ANTENNA PAIR WITH HIGH ISOLATION**

(52) **U.S. Cl.**

CPC ..... *H01Q 21/28* (2013.01)

USPC ..... **455/39**; 343/893; 343/841

(71) Applicant: **MICROSOFT CORPORATION**,  
Redmond, WA (US)

(57)

**ABSTRACT**

(72) Inventors: **Javier R. DeLuis**, Kirkland, WA (US);  
**Alireza Mahanfar**, Bellevue, WA (US);  
**Benjamin Shewan**, Redmond, WA (US);  
**Mark Casebolt**, Seattle, WA (US); **Jeff Reents**, Carnation, WA (US)

A dual band printed antenna pair operates simultaneously at both WLAN frequency bands (2.4 GHz/5 GHz). The antenna pair provides high isolation between both antennas while having an efficient over the air performance. The antenna pair achieve greater than 20 dB isolation at 2.4 GHz and 5 GHz band, while having antennas positioned in close proximity. The high isolation is accomplished using an orthogonal antenna configuration (exploiting orthogonal polarization) and a parasitic element to further enhance isolation at 2.4 GHz. The antenna pair and parasitic element are printed on a Printed Circuit Board (PCB) adding relatively little cost to the Radio Frequency (RF) interface. The PCB is then fixed on top of a metal chassis with the antenna keep out area overhanging a corner of the metal chassis to enhance performance.

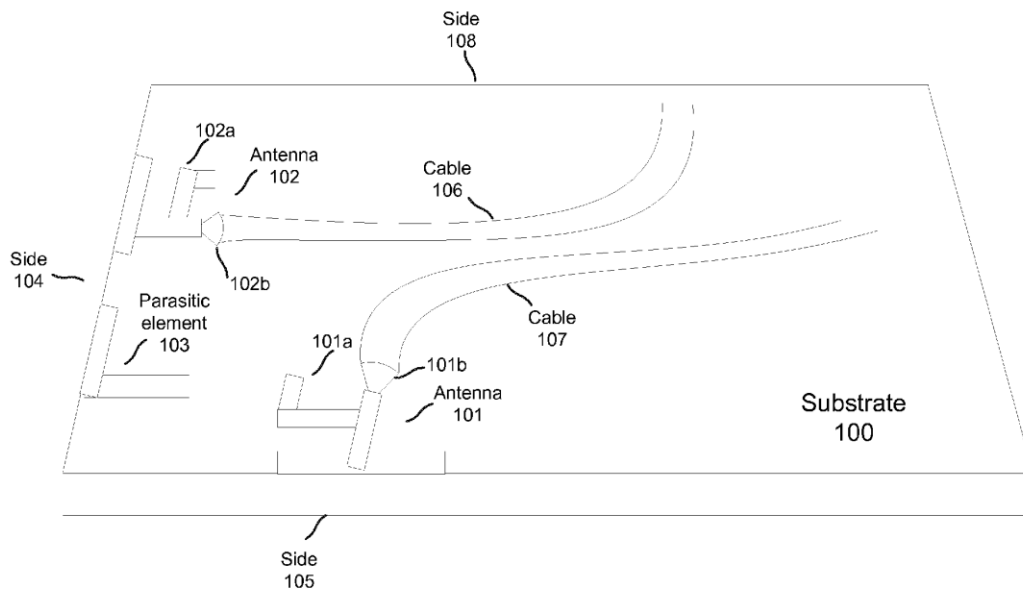
(73) Assignee: **MICROSOFT CORPORATION**,  
Redmond, WA (US)

(21) Appl. No.: **13/779,697**

(22) Filed: **Feb. 27, 2013**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 21/28* (2006.01)







US 20140243052A1

(19) **United States**

(12) **Patent Application Publication**  
**Hobson et al.**

(10) **Pub. No.: US 2014/0243052 A1**

(43) **Pub. Date: Aug. 28, 2014**

(54) **HANDBEHeld ELECTRONIC DEVICE WITH CABLE GROUNDING**

(22) Filed: **Apr. 30, 2014**

**Related U.S. Application Data**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(63) Continuation of application No. 14/158,403, filed on Jan. 17, 2014, which is a continuation of application No. 13/021,689, filed on Feb. 4, 2011, now Pat. No. 8,681,056, which is a continuation of application No. 11/821,329, filed on Jun. 21, 2007, now Pat. No. 7,889,139.

(72) Inventors: **Phillip Michael Hobson**, Menlo Park, CA (US); **Erik L. Wang**, Redwood City, CA (US); **Kenneth A. Jenks**, Capitola, CA (US); **Robert J. Hill**, Salinas, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Richard H. Dinh**, San Jose, CA (US); **Tang Yew Tan**, Palo Alto, CA (US); **Adam D. Mittleman**, San Francisco, CA (US); **Bartley K. Andre**, Palo Alto, CA (US); **Daniel J. Coster**, San Francisco, CA (US); **Daniele De Iulii**, San Francisco, CA (US); **Richard P. Howarth**, San Francisco, CA (US); **Jonathan P. Ivc**, San Francisco, CA (US); **Steven P. Jobs**, Palo Alto, CA (US); **Duncan Robert Kerr**, San Francisco, CA (US); **Shin Nishibori**, Kailua, HI (US); **Matthew Dean Rohrbach**, San Francisco, CA (US); **Douglas B. Satzger**, San Francisco, CA (US); **Calvin Q. Seid**, Palo Alto, CA (US); **Christopher J. Stringer**, Woodside, CA (US); **Eugene Antony Whang**, San Francisco, CA (US); **Rico Zorkendorfer**, San Francisco, CA (US)

**Publication Classification**

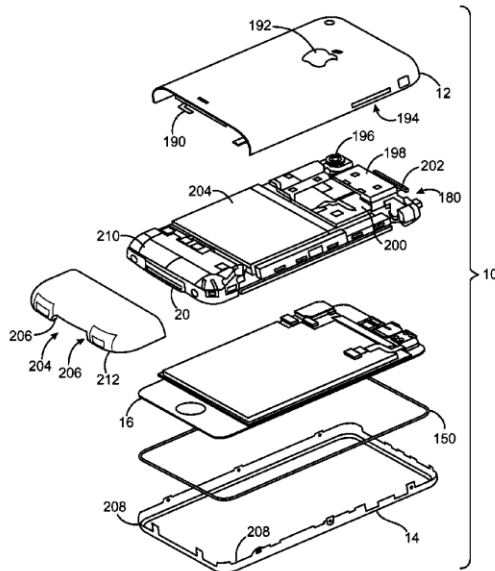
(51) **Int. Cl.**  
**H04M 1/02** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H04M 1/0202** (2013.01)  
USPC ..... **455/575.7**

(57) **ABSTRACT**

A handheld electronic device may be provided that contains a conductive housing and other conductive elements. The conductive elements may form an antenna ground plane. One or more antennas for the handheld electronic device may be formed from the ground plane and one or more associated antenna resonating elements. Transceiver circuitry may be connected to the resonating elements by transmission lines such as coaxial cables. Ferrules may be crimped to the coaxial cables. A bracket with extending members may be crimped over the ferrules to ground the coaxial cables to the housing and other conductive elements in the ground plane. The ground plane may contain an antenna slot. A dock connector and flex circuit may overlap the slot in a way that does not affect the resonant frequency of the slot. Electrical components may be isolated from the antenna using isolation elements such as inductors and resistors.

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **14/266,567**





US 20140247188A1

(19) **United States**

(12) **Patent Application Publication**  
NAKANO et al.

(10) **Pub. No.: US 2014/0247188 A1**

(43) **Pub. Date: Sep. 4, 2014**

(54) **ANTENNA DEVICE AND ELECTRONIC APPARATUS INCLUDING ANTENNA DEVICE**

(30) **Foreign Application Priority Data**

(71) Applicant: **Murata Manufacturing Co., Ltd.**,  
Nagaokakyo-shi (JP)

Sep. 26, 2012 (JP) ..... 2012-211709  
Jul. 5, 2013 (JP) ..... 2013-141969

(72) Inventors: **Shinichi NAKANO**, Nagaokakyo-shi (JP); **Masahiro OZAWA**, Nagaokakyo-shi (JP); **Nobuhito TSUBAKI**, Nagaokakyo-shi (JP)

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H01Q 1/241** (2013.01)  
USPC ..... **343/702**

(73) Assignee: **Murata Manufacturing Co., Ltd.**,  
Nagaokakyo-shi (JP)

(57) **ABSTRACT**

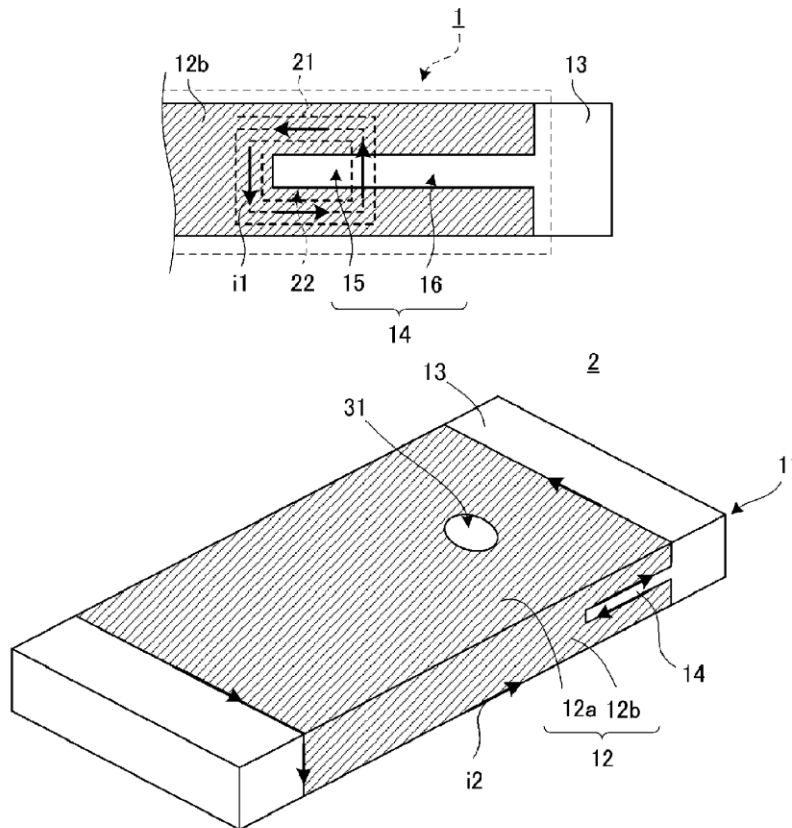
(21) Appl. No.: **14/278,080**

An antenna device includes a casing including a metal casing portion and a feed coil. The metal casing portion includes a main surface, a side surface connected to the main surfaces, and a notch portion located in the side surface. The feed coil is disposed inside the casing to be coupled with the metal casing portion by a magnetic field, and includes a winding central portion forming a coil opening portion. The feed coil is disposed near the notch portion, with the coil opening portion directed to a region including the notch portion.

(22) Filed: **May 15, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2013/074477, filed on Sep. 11, 2013.





US 20140247190A1

(19) **United States**

(12) **Patent Application Publication**  
**Loftus**

(10) **Pub. No.: US 2014/0247190 A1**

(43) **Pub. Date: Sep. 4, 2014**

(54) **DUAL PORT SINGLE FREQUENCY ANTENNA**

**Publication Classification**

(71) Applicant: **Robert Francis Joseph Loftus**, Sydney (AU)

(51) **Int. Cl.**  
*H01Q 1/50* (2006.01)  
*H01Q 9/16* (2006.01)  
*H01Q 13/10* (2006.01)

(72) Inventor: **Robert Francis Joseph Loftus**, Sydney (AU)

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/50* (2013.01); *H01Q 13/10* (2013.01); *H01Q 9/16* (2013.01)  
USPC ..... **343/767**; 343/793; 343/906

(21) Appl. No.: **14/195,298**

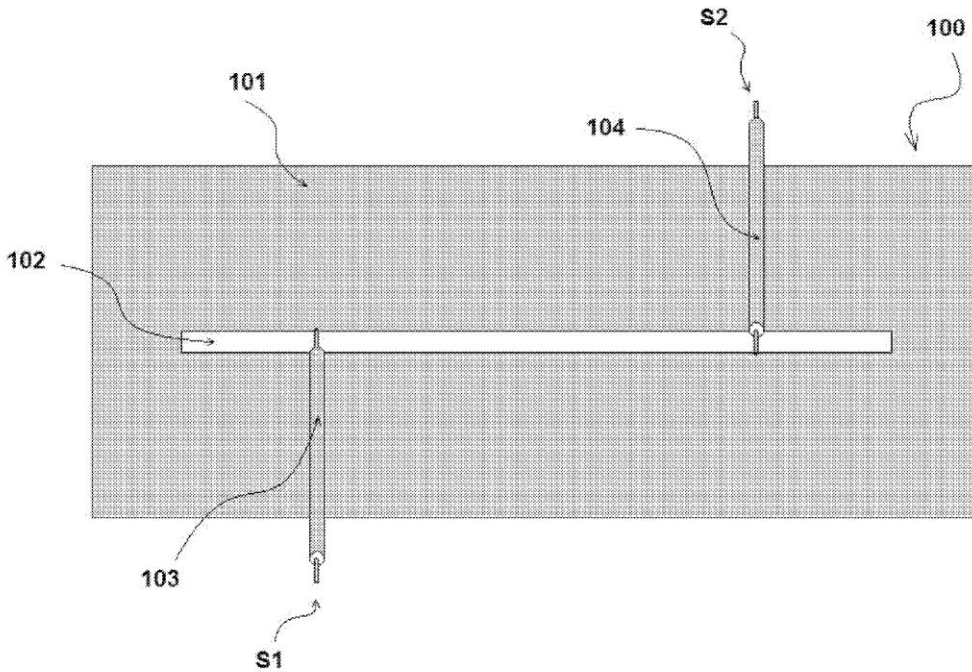
(22) Filed: **Mar. 3, 2014**

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Mar. 4, 2013 (AU) ..... 2013900724  
Apr. 14, 2013 (AU) ..... 2013205196

An antenna further comprising: a first port, a second port, where the first port is 180-degrees out of phase with respect to the second port.





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(19) **United States**

(12) **Patent Application Publication**  
**Yarga et al.**

(10) **Pub. No.: US 2014/0253392 A1**

(43) **Pub. Date: Sep. 11, 2014**

(54) **ELECTRONIC DEVICE WITH CAPACITIVELY LOADED ANTENNA**

(52) **U.S. Cl.**  
CPC . **H01Q 1/36** (2013.01); **H01Q 1/243** (2013.01)  
USPC ..... **343/702**; 343/749; 343/750

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

(57) **ABSTRACT**

(72) Inventors: **Salih Yarga**, Sunnyvale, CA (US);  
**Qingxiang Li**, Mountain View, CA (US);  
**Robert W. Schlub**, Cupertino, CA (US)

An electronic device may have an antenna for providing coverage in wireless communications bands of interest such as a low frequency communications band, a middle frequency communications band, and a high frequency communications band. Slot structures in the antenna that might reduce efficiency in the high frequency communications band may be avoided by capacitively loading the antenna and omitting meandering paths in the antenna. A capacitor may be coupled between an antenna ground formed from a metal housing structure and an antenna resonating element having a curved shape that conforms to the shape of the edge of the electronic device. The capacitor may have interdigitated fingers and may be adjustable to tune the antenna. The antenna may transmit and receive radio-frequency signals through a display cover layer in a display and a dielectric antenna window portion of the housing.

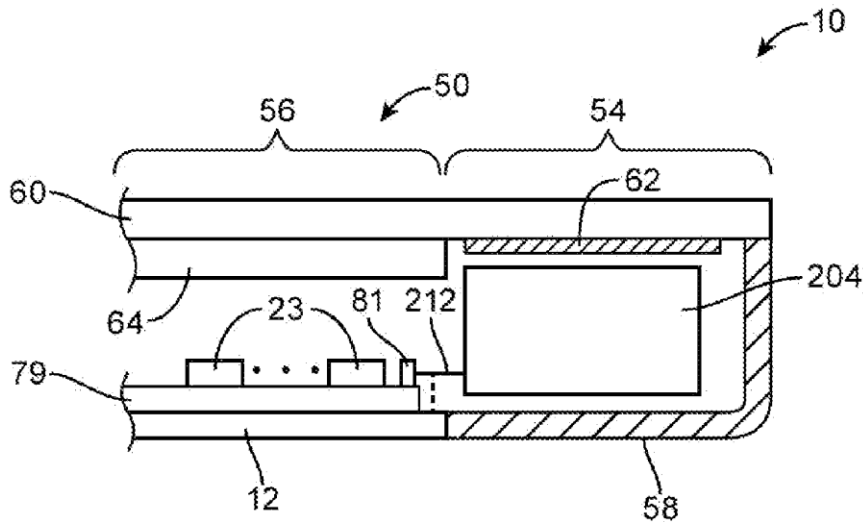
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **13/790,549**

(22) Filed: **Mar. 8, 2013**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/36** (2006.01)  
**H01Q 1/24** (2006.01)





US 20140253398A1

(19) **United States**

(12) **Patent Application Publication**  
**HSIEH et al.**

(10) **Pub. No.: US 2014/0253398 A1**

(43) **Pub. Date: Sep. 11, 2014**

(54) **TUNABLE ANTENNA**

(30) **Foreign Application Priority Data**

(71) Applicant: **ASUSTeK COMPUTER INC., TAIPEI (TW)**

Dec. 25, 2013 (TW) ..... 102148213

**Publication Classification**

(72) Inventors: **Tsung-Hsun HSIEH, TAIPEI (TW); Ting-Yi LIN, TAIPEI (TW); Yeh-Chun KAO, TAIPEI (TW); Yu-Chia CHANG, TAIPEI (TW); You-Fu CHENG, TAIPEI (TW)**

(51) **Int. Cl.**  
**H01Q 9/14** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/145** (2013.01)  
USPC ..... **343/745**

(73) Assignee: **ASUSTeK COMPUTER INC., TAIPEI (TW)**

(57) **ABSTRACT**

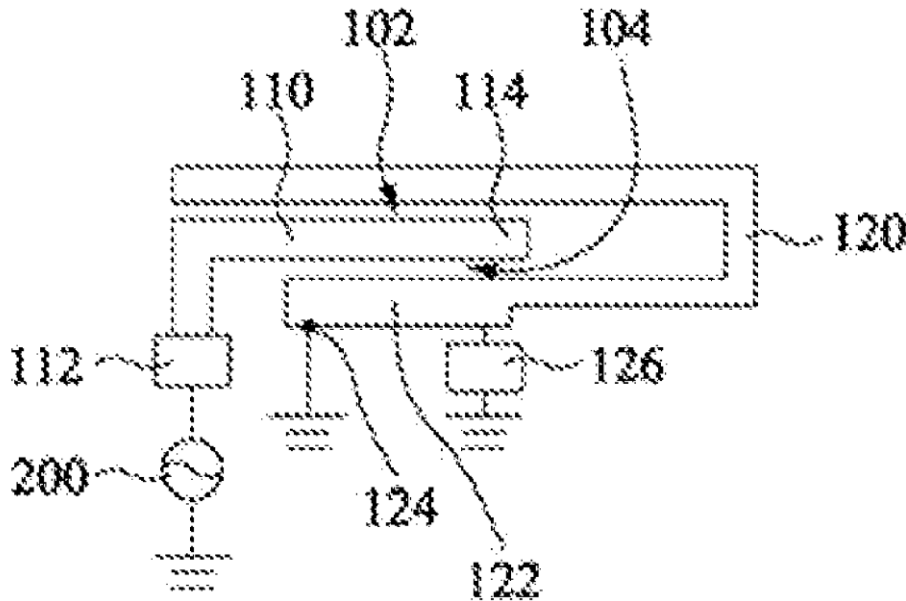
(21) Appl. No.: **14/190,114**

A tunable antenna includes a ground plane, a first radiation unit and a second radiation unit. The first radiation unit includes a feeding portion and a coupling portion. The feeding portion is electrically connected to a signal source. The second radiation unit surrounds a part of the coupling portion and includes a grounding end and a switch unit. The grounding end is electrically connected to the ground plane. The switch unit is electrically connected to the grounding end and the ground plane selectively.

(22) Filed: **Feb. 26, 2014**

**Related U.S. Application Data**

(60) Provisional application No. 61/773,161, filed on Mar. 6, 2013.





US 20140253399A1

(19) **United States**

(12) **Patent Application Publication**  
**Yang et al.**

(10) **Pub. No.: US 2014/0253399 A1**

(43) **Pub. Date: Sep. 11, 2014**

(54) **WIDEBAND SLOT ANTENNA FOR WIRELESS COMMUNICATION DEVICES**

**Publication Classification**

(71) Applicant: **FUTUREWEI TECHNOLOGIES, INC.**, Plano, TX (US)

(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)

(72) Inventors: **Shing Lung Steven Yang**, San Diego, CA (US); **Hongyu Wang**, Shenzhen (CN); **Ping Shi**, San Diego, CA (US); **Daejong Kim**, San Diego, CA (US); **Wee Kian Toh**, San Diego, CA (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 13/106** (2013.01)  
USPC ..... **343/770**

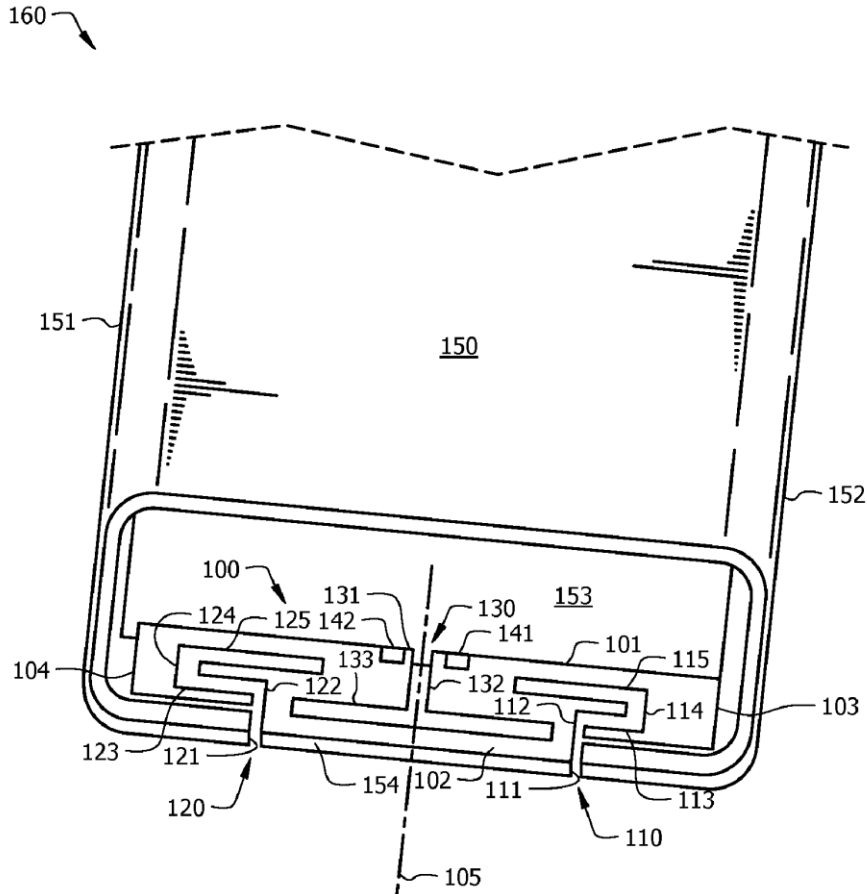
(73) Assignee: **FUTUREWEI TECHNOLOGIES, INC.**, Plano, TX (US)

(57) **ABSTRACT**

(21) Appl. No.: **13/792,512**

An antenna comprising a conductive base comprising a west edge, an east edge, a north edge, a south edge, and a center axis, a left slot of nonconductive material extending from the south edge toward the north edge and positioned between the west edge and the center axis, and a right slot of nonconductive material extending from the south edge toward the north edge and positioned between the east edge and the center axis.

(22) Filed: **Mar. 11, 2013**





US 20140253406A1

(19) **United States**

(12) **Patent Application Publication**  
**Toh et al.**

(10) **Pub. No.: US 2014/0253406 A1**  
(43) **Pub. Date: Sep. 11, 2014**

(54) **SEGMENTED ANTENNA**

(71) Applicant: **FUTUREWEI TECHNOLOGIES, INC.**, Plano, TX (US)

(72) Inventors: **Wee Kian Toh**, San Diego, CA (US);  
**Daejong Kim**, San Diego, CA (US);  
**Shing Lung Yang**, San Diego, CA (US);  
**Ping Shi**, San Diego, CA (US)

(73) Assignee: **FUTUREWEI TECHNOLOGIES, INC.**, Plano, TX (US)

(21) Appl. No.: **13/792,613**

(22) Filed: **Mar. 11, 2013**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 9/04** (2006.01)  
**H01Q 7/00** (2006.01)

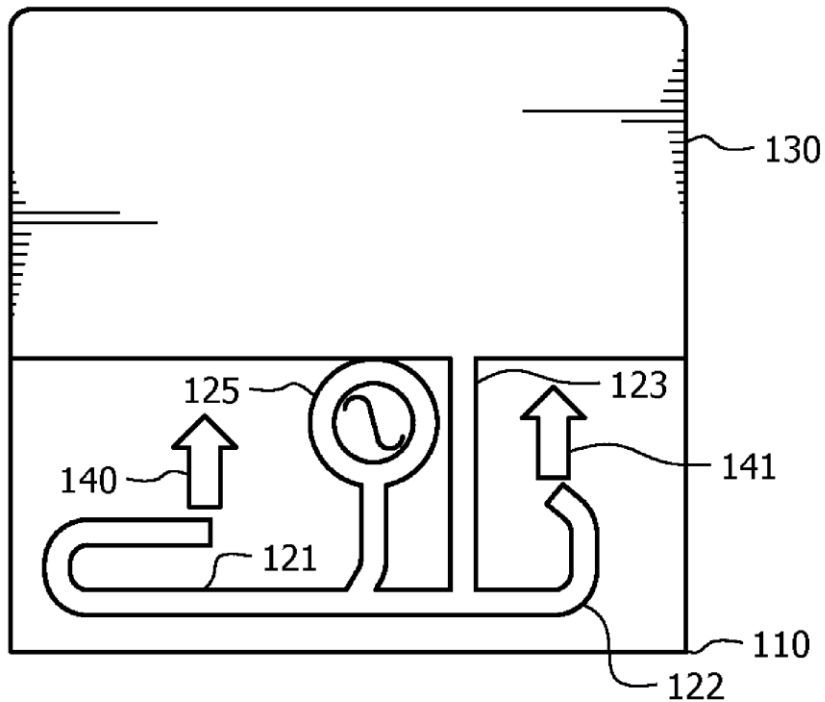
(52) **U.S. Cl.**

CPC ..... **H01Q 9/0407** (2013.01); **H01Q 7/00** (2013.01)  
USPC ..... **343/867**; 343/700 MS; 343/866; 343/868

(57) **ABSTRACT**

An antenna comprising a main arm comprising conductive material, wherein the main arm is connected to a signal feed, and a first coupling arm comprising conductive material, wherein the first coupling arm is electrically coupled to a ground, and wherein the first coupling arm is electrically coupled to the main arm across a first span of nonconductive material. Also disclosed is a mobile node (MN) comprising a signal feed, a ground, and an antenna comprising a main arm comprising conductive material, wherein the main arm is connected to the signal feed, and a first coupling arm comprising conductive material, wherein the first coupling arm is connected to the ground, and wherein the first coupling arm is electrically coupled to the main arm across a first span of nonconductive material.

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US 20140253411A1

(19) **United States**

(12) **Patent Application Publication**  
**Zhang et al.**

(10) **Pub. No.: US 2014/0253411 A1**

(43) **Pub. Date: Sep. 11, 2014**

(54) **WIRELESS TERMINAL**

**Publication Classification**

(75) Inventors: **Lu Zhang**, Shenzhen City (CN); **Long Li**, Shenzhen City (CN); **Yang Yang**, Shenzhen City (CN)

(51) **Int. Cl.**  
**H01Q 9/04** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/0407** (2013.01)  
USPC ..... **343/904**

(73) Assignee: **ZTE CORPORATION**

(57) **ABSTRACT**

(21) Appl. No.: **14/352,287**

(22) PCT Filed: **Feb. 20, 2012**

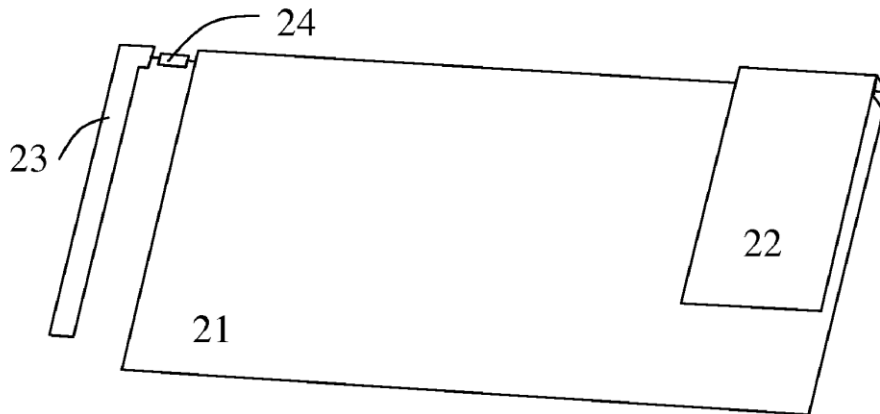
(86) PCT No.: **PCT/CN2012/071356**

§ 371 (c)(1),  
(2), (4) Date: **Apr. 16, 2014**

Disclosed is a wireless terminal. The wireless terminal comprises: a printed circuit board (21), an antenna (22) coupled onto the printed circuit board (21) and configured to transmit electromagnetic waves, a parasitic unit (23) coupled onto the printed circuit board (21) and configured to lower an SAR peak value of the electromagnetic waves, and a lumped element (24) coupled onto the parasitic unit (23) and configured to adjust the amplitude and phase of the current in the parasitic unit (23). The disclosure lowers the SAR under the premise of not affecting the communication quality of the wireless terminal, thereby reducing production costs.

(30) **Foreign Application Priority Data**

Oct. 18, 2011 (CN) ..... 201120396693.2







US 20140256377A1

(19) **United States**

(12) **Patent Application Publication**  
**Sai Ananthanarayanan et al.**

(10) **Pub. No.: US 2014/0256377 A1**

(43) **Pub. Date: Sep. 11, 2014**

(54) **ELECTRONIC DEVICE WITH THROUGH-DISPLAY NEAR FIELD COMMUNICATION CAPABILITY**

**Publication Classification**

(51) **Int. Cl.**  
**H04W 88/06** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H04W 88/06** (2013.01)  
USPC ..... **455/552.1**

(71) Applicant: **MOTOROLA MOBILITY LLC**,  
Libertyville, IL (US)

(72) Inventors: **Peruvemba Raganathan Sai Ananthanarayanan**, Naperville, IL (US); **Vijay L. Asrani**, Round Lake, IL (US); **Katherine H. Coles**, Libertyville, IL (US)

(57) **ABSTRACT**

An electronic device (200) includes a control circuit (304) disposed on a substrate (220). The control circuit is operable with a display (509), a near field communication circuit (201) and a wide area communication circuit (302). The near field communication circuit is operable with a near field communication circuit antenna (344). The wide area communication circuit is operable with one or more wide area communication circuit antennas (312). In a housing (511) of the electronic device, the substrate separates the near field communication antenna from the battery and the wide area network communication antenna.

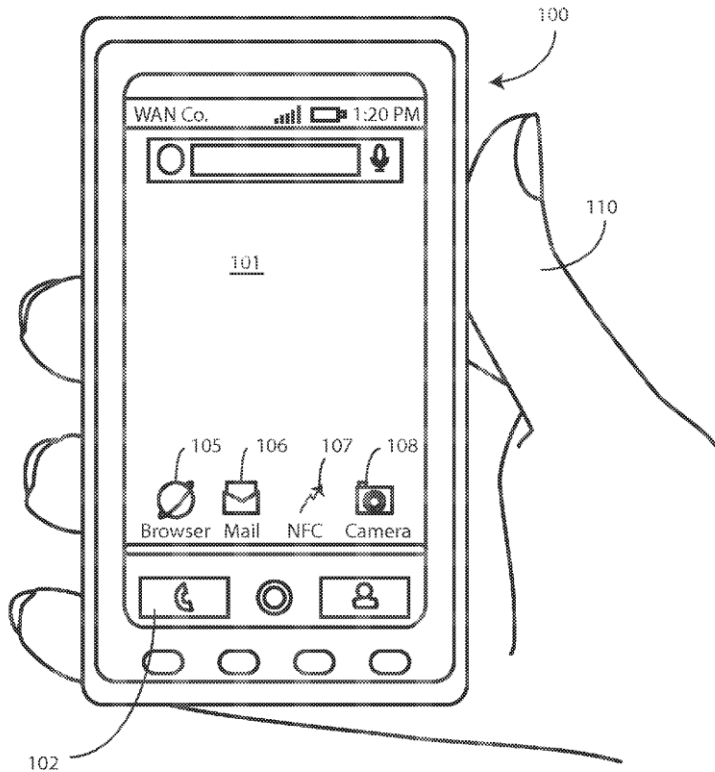
(73) Assignee: **MOTOROLA MOBILITY LLC**,  
Libertyville, IL (US)

(21) Appl. No.: **13/946,099**

(22) Filed: **Jul. 19, 2013**

**Related U.S. Application Data**

(60) Provisional application No. 61/775,999, filed on Mar. 11, 2013.





US 20140256388A1

(19) **United States**

(12) **Patent Application Publication**  
LIN et al.

(10) **Pub. No.: US 2014/0256388 A1**

(43) **Pub. Date: Sep. 11, 2014**

(54) **HAIRPIN ELEMENT FOR IMPROVING ANTENNA BANDWIDTH AND ANTENNA EFFICIENCY AND MOBILE DEVICE WITH THE SAME**

(22) Filed: **Mar. 7, 2013**

**Publication Classification**

(71) Applicant: **HTC CORPORATION**, (US)

(51) **Int. Cl.**  
*H04M 1/02* (2006.01)

(72) Inventors: **Chia-Cheng LIN**, Taoyuan City (TW);  
**Yu-Che LIN**, Taoyuan City (TW);  
**Chung-Ting HUNG**, Taoyuan City (TW);  
**Kuo-Cheng CHEN**, Taoyuan City (TW)

(52) **U.S. Cl.**  
CPC ..... *H04M 1/0202* (2013.01)  
USPC ..... *455/575.7*

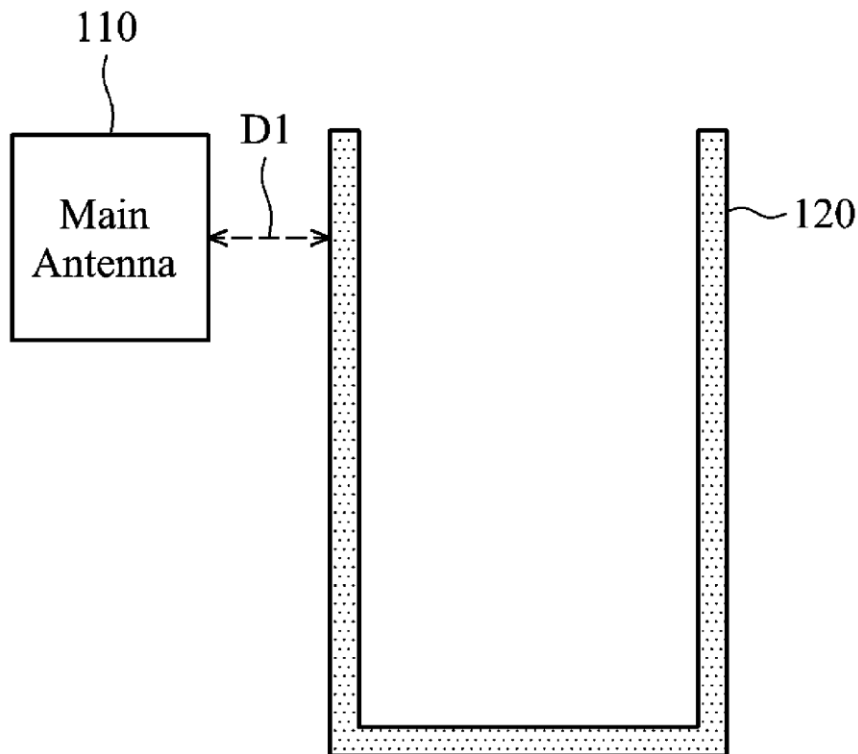
(73) Assignee: **HTC CORPORATION**, Taoyuan City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **13/788,983**

A mobile device includes a main antenna and a hairpin element. The hairpin element is disposed adjacent to the main antenna, and substantially has a U-shape. The hairpin element is configured to increase bandwidth and antenna efficiency of the main antenna.

100





US 20140266917A1

(19) **United States**

(12) **Patent Application Publication**  
**De Luis et al.**

(10) **Pub. No.: US 2014/0266917 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **DUAL BAND WLAN COUPLED RADIATOR ANTENNA**

**Publication Classification**

(71) Applicants: **Javier Rodriguez De Luis**, Redmond, WA (US); **Alireza Mahanfar**, Bellevue, WA (US); **Benjamin Shewan**, Redmond, WA (US)

(51) **Int. Cl.**  
**H01Q 19/00** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01Q 19/005** (2013.01)  
USPC ..... **343/700 MS**

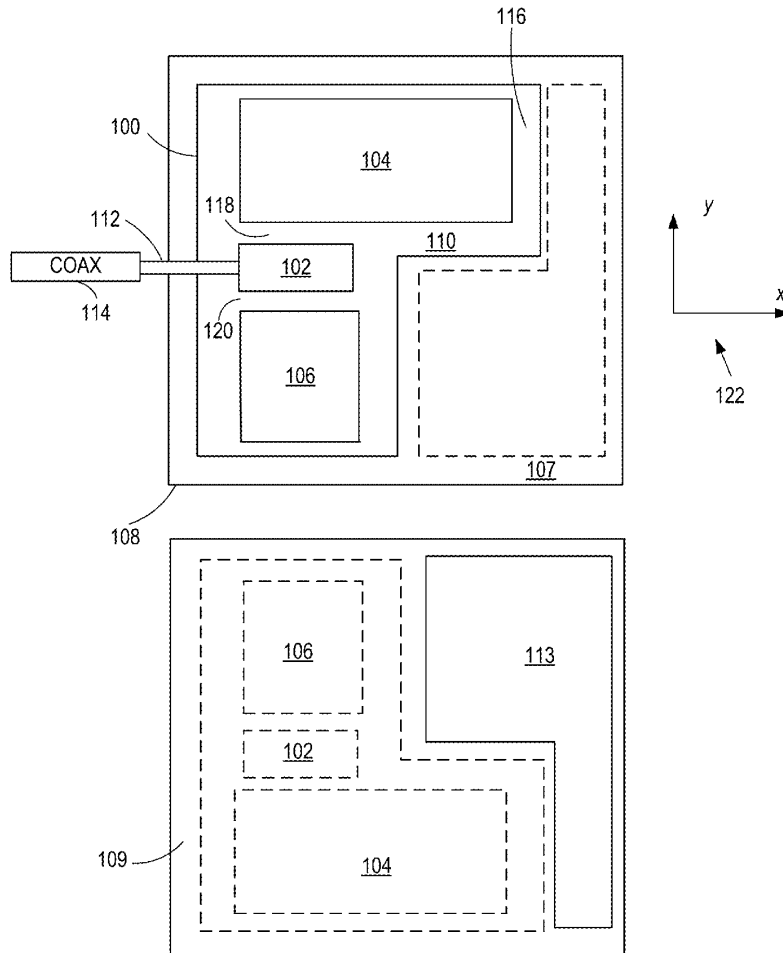
(72) Inventors: **Javier Rodriguez De Luis**, Redmond, WA (US); **Alireza Mahanfar**, Bellevue, WA (US); **Benjamin Shewan**, Redmond, WA (US)

(57) **ABSTRACT**

Planar antennas comprise capacitively coupled antenna patches. A first antenna patch configured to radiate in a first frequency band is coupled to a transmitter/receiver. The first antenna patch is situated to capacitively couple radiation in the first frequency band and a second frequency band to second and third antenna patches, respectively. The first and second antenna patches extend antenna bandwidth in the first frequency band, and the third antenna patch is bent so that the antenna patches can be situated in a predetermined substrate area.

(21) Appl. No.: **13/801,302**

(22) Filed: **Mar. 13, 2013**





US 20140266920A1

(19) **United States**

(12) **Patent Application Publication**  
**TRAN et al.**

(10) **Pub. No.: US 2014/0266920 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **MULTIPURPOSE ANTENNA**

(71) Applicant: **QUALCOMM INCORPORATED**, San Diego, CA (US)

(72) Inventors: **Allen M. TRAN**, San Diego, CA (US);  
**Jatupum JENWATANAVET**, San Diego, CA (US)

(73) Assignee: **QUALCOMM INCORPORATED**, San Diego, CA (US)

(21) Appl. No.: **13/831,714**

(22) Filed: **Mar. 15, 2013**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)

(52) **U.S. Cl.**

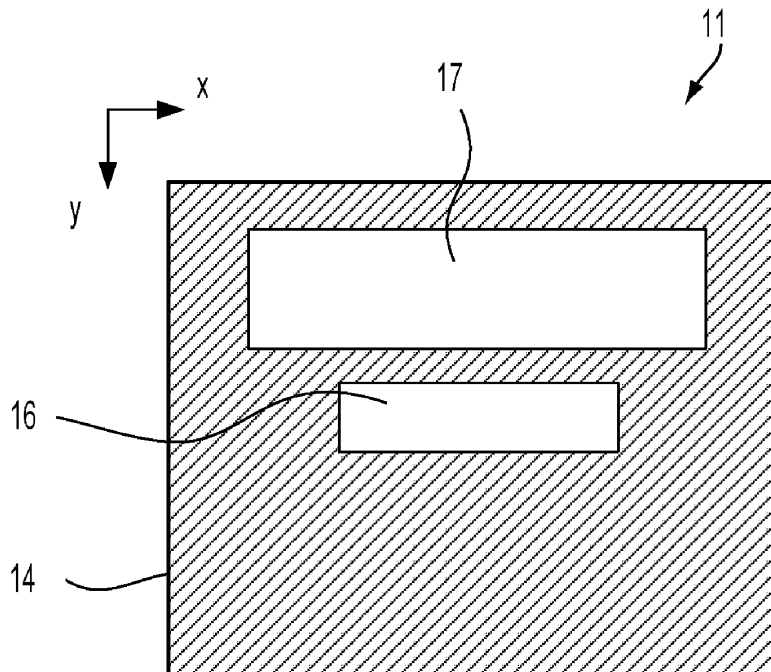
CPC ..... **H01Q 1/243** (2013.01)

USPC ..... **343/702**

(57)

**ABSTRACT**

A multiband antenna for a wireless device includes a housing base portion, housing antenna portion and a feed contact. The housing base portion configured to receive radio circuitry thereon and include a first peripheral edge and a first conductive material. The housing antenna portion spaced away from and substantially opposed to the housing base portion, including a second peripheral edge and a second conductive material. The housing base and antenna portions together forming an outermost housing of the mobile wireless device, enclosing the radio circuitry there between. The first and second peripheral edges forming opposed lengthwise edges of a slot having a width formed by a distance between the first and second peripheral edges. The feed contact coupling the housing base portion, the housing antenna portion and the radio circuitry for providing at least one driving frequency to at least the housing antenna portion from the radio circuitry.





US 20140266922A1

(19) **United States**

(12) **Patent Application Publication**  
**Jin et al.**

(10) **Pub. No.: US 2014/0266922 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **TUNABLE ANTENNA WITH SLOT-BASED PARASITIC ELEMENT**

(52) **U.S. Cl.**

CPC ..... **H01Q 21/28** (2013.01); **H01Q 1/24** (2013.01); **H01Q 9/06** (2013.01)

USPC ..... **343/702**; 343/729; 343/750

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

(72) Inventors: **Nanbo Jin**, Sunnyvale, CA (US);  
**Yuehui Ouyang**, Sunnyvale, CA (US);  
**Yijun Zhou**, Sunnyvale, CA (US);  
**Enrique Ayala Vazquez**, Watsonville, CA (US);  
**Anand Lakshmanan**, San Jose, CA (US);  
**Robert W. Schlub**, Cupertino, CA (US);  
**Mattia Pascolini**, Campbell, CA (US);  
**Matthew A. Mow**, Los Altos, CA (US)

(57)

**ABSTRACT**

Electronic devices may be provided that contain wireless communications circuitry. The wireless communications circuitry may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may form a dual arm inverted-F antenna. The antenna may have a resonating element formed from portions of a peripheral conductive electronic device housing member and may have an antenna ground that is separated from the antenna resonating element by a gap. A short circuit path may bridge the gap. An antenna feed may be coupled across the gap in parallel with the short circuit path. Low band tuning may be provided using an adjustable inductor that bridges the gap. The antenna may have a slot-based parasitic antenna resonating element with a slot formed between portions of the peripheral conductive electronic device housing member and the antenna ground. An adjustable capacitor may bridge the slot to provide high band tuning.

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **13/846,471**

(22) Filed: **Mar. 18, 2013**

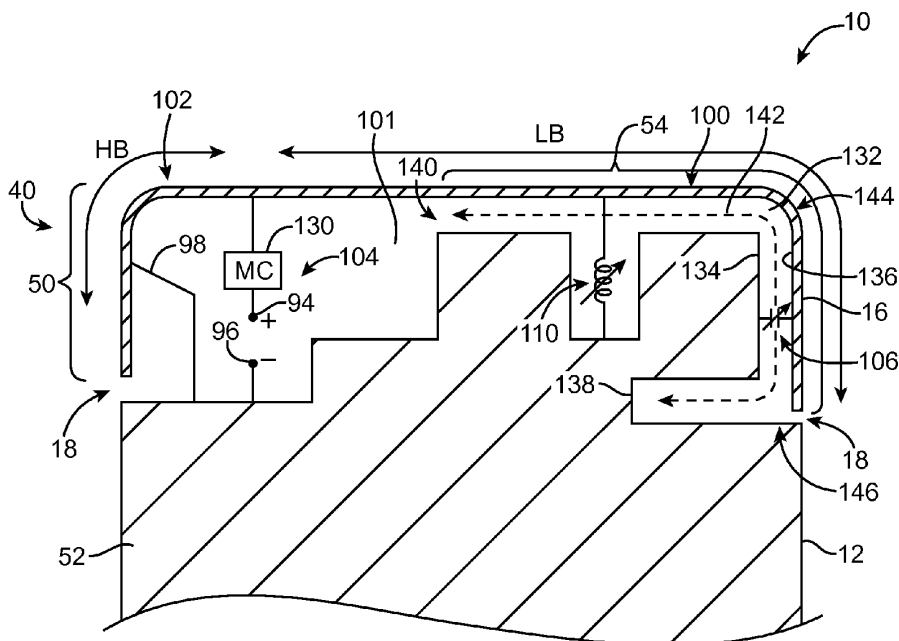
**Publication Classification**

(51) **Int. Cl.**

**H01Q 21/28** (2006.01)

**H01Q 9/06** (2006.01)

**H01Q 1/24** (2006.01)





(19) **United States**

(12) **Patent Application Publication**  
**Zhou et al.**

(10) **Pub. No.: US 2014/0266923 A1**  
(43) **Pub. Date: Sep. 18, 2014**

(54) **ANTENNA SYSTEM HAVING TWO ANTENNAS AND THREE PORTS**

(52) **U.S. CL.**  
CPC ..... **H01Q 21/28** (2013.01); **H01Q 9/06** (2013.01); **H01Q 1/24** (2013.01)  
USPC ..... **343/702**; 343/729; 343/750

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

(72) Inventors: **Yijun Zhou**, Sunnyvale, CA (US); **Nanbo Jin**, Sunnyvale, CA (US); **Yuehui Ouyang**, Sunnyvale, CA (US); **Enrique Ayala Vazquez**, Watsonville, CA (US); **Anand Lakshmanan**, San Jose, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Mattia Pascolini**, Campbell, CA (US); **Matthew A. Mow**, Los Altos, CA (US)

(57) **ABSTRACT**

Electronic devices may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may form a dual arm inverted-F antenna and a monopole antenna sharing a common antenna ground. The antenna structures may have three ports. A first antenna port may be coupled to an inverted-F antenna resonating element at a first location and a second antenna port may be coupled to the inverted-F antenna resonating element at a second location. A third antenna port may be coupled to the monopole antenna. Tunable circuitry can be used to tune the antenna structures. An adjustable capacitor may be coupled to the first port to tune the inverted-F antenna. An additional adjustable capacitor may be coupled to the third port to tune the monopole antenna. Transceiver circuitry for supporting wireless local area network communications, satellite navigation system communications, and cellular communications may be coupled to the first, second, and third antenna ports.

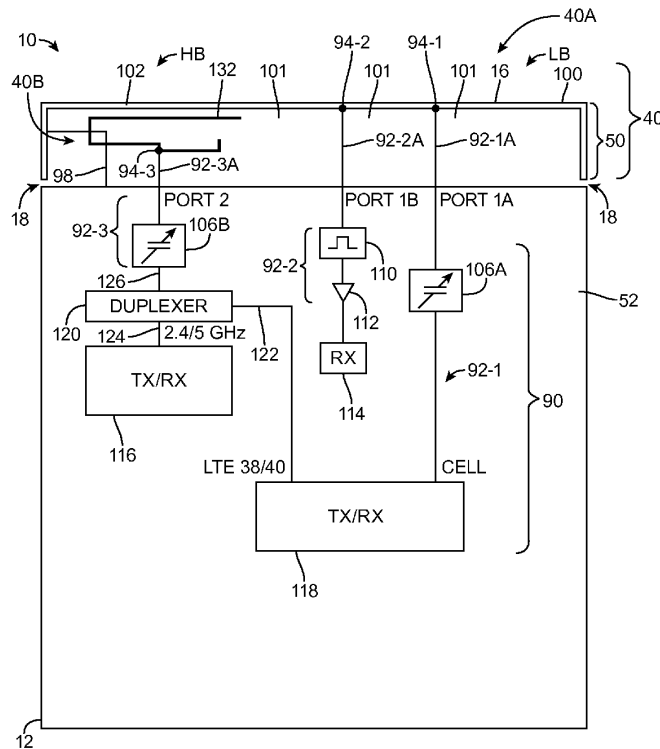
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **13/846,481**

(22) Filed: **Mar. 18, 2013**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 21/28** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 9/06** (2006.01)





US 20140266926A1

(19) **United States**

(12) **Patent Application Publication**  
Merz et al.

(10) **Pub. No.: US 2014/0266926 A1**  
(43) **Pub. Date: Sep. 18, 2014**

(54) **ENGAGEMENT FEATURES AND ADJUSTMENT STRUCTURES FOR ELECTRONIC DEVICES WITH INTEGRAL ANTENNAS**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/24* (2006.01)  
(52) **U.S. Cl.**  
CPC ..... *H01Q 1/243* (2013.01)  
USPC ..... **343/702**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)  
(72) Inventors: **Nicholas G. L. Merz**, San Francisco, CA (US); **Dean F. Darnell**, San Jose, CA (US)

(57) **ABSTRACT**

Electronic devices may be provided that contain wireless communications circuitry. The wireless communications circuitry may include antenna structures that are formed from an internal ground plane and a peripheral conductive housing member. The internal ground plane and peripheral conductive housing member may be separated by a gap. The internal ground plane may be formed from sheet metal structures having engagement features such as tabs bent upwards at an angle. Plastic structures may be insert molded over the engagement features. When the internal ground plane is mounted in the electronic device, the plastic structures may bridge the gap between the internal ground plane and the peripheral conductive housing member. An adjustable structure such as a washer with a selectable thickness may be mounted to the peripheral conductive housing member opposing conductive structures across the gap. The thickness may be adjusted to adjust antenna performance.

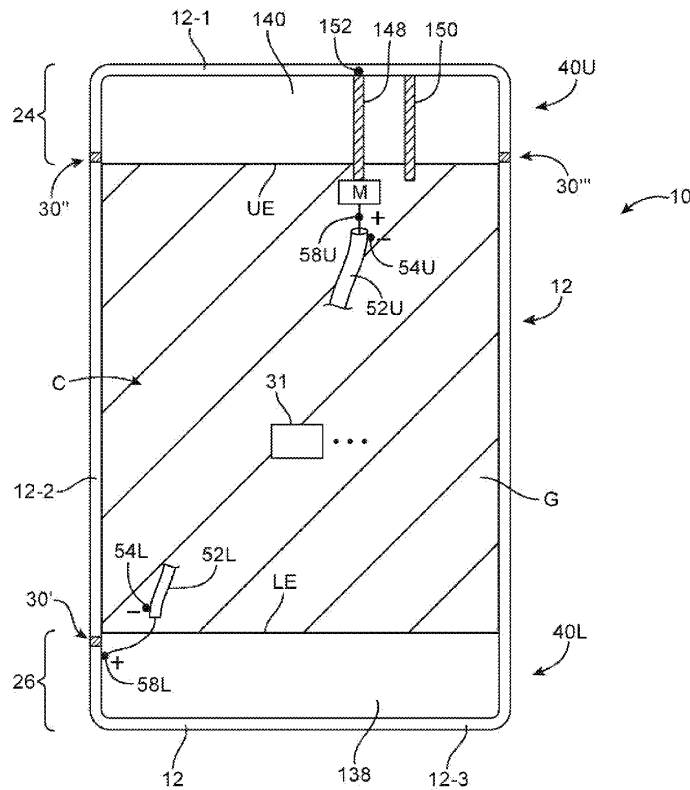
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **14/287,747**

(22) Filed: **May 27, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. 13/018,263, filed on Jan. 31, 2011, now Pat. No. 8,750,949.  
(60) Provisional application No. 61/431,523, filed on Jan. 11, 2011.





US 20140266928A1

(19) **United States**

(12) **Patent Application Publication**  
**Gummalla**

(10) **Pub. No.: US 2014/0266928 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **ANTENNAS FOR COMPUTERS WITH CONDUCTIVE CHASSIS**

**Publication Classification**

(71) Applicant: **GOOGLE INC.**, Mountain View, CA (US)

(51) **Int. Cl.**  
**H01Q 1/22** (2006.01)  
**H01Q 13/10** (2006.01)

(72) Inventor: **Ajay Chandra Venkata Gummalla**, Sunnyvale, CA (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/2258** (2013.01); **H01Q 13/10** (2013.01)

(73) Assignee: **GOOGLE INC.**, Mountain View, CA (US)

USPC ..... **343/702**

(21) Appl. No.: **14/290,535**

(57) **ABSTRACT**

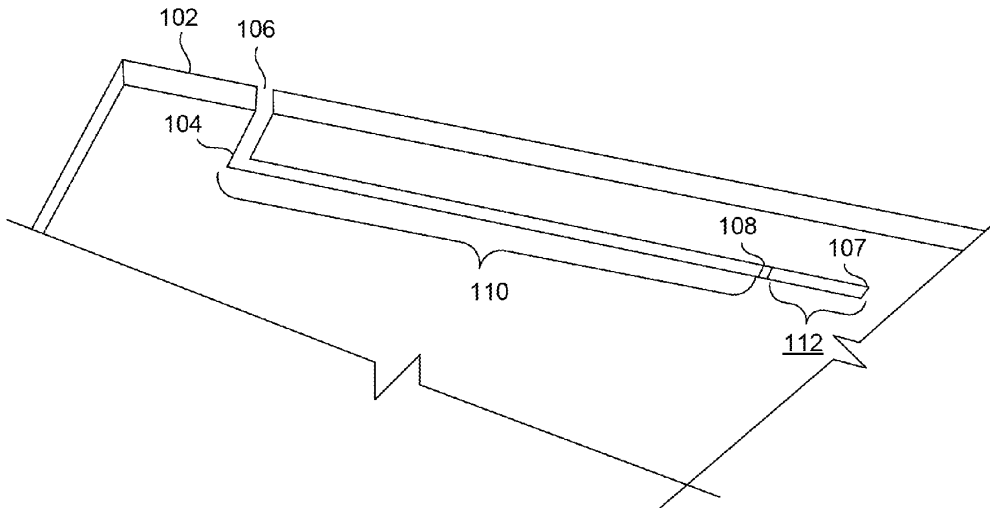
(22) Filed: **May 29, 2014**

According to one general aspect, a computing device may include a conductive frame and a slot antenna formed, at least in part, by the conductive frame. The slot antenna defines a cavity that extends into the conductive frame from an opening on the conductive frame to a closed end defined by an internal portion of the conductive frame. The slot antenna includes a feed point disposed at a position along the slot antenna such that the slot antenna forms an open-circuited portion and a short-circuited portion, and the feed point is disposed between the open-circuited portion and the short-circuited portion. The computing device may also include a coupling element configured to be excited by an electrical signal via the feed point.

**Related U.S. Application Data**

(63) Continuation of application No. 13/269,572, filed on Oct. 8, 2011, now Pat. No. 8,779,999.

(60) Provisional application No. 61/541,740, filed on Sep. 30, 2011.







US 20140266932A1

(19) **United States**

(12) **Patent Application Publication**  
**Schmidt et al.**

(10) **Pub. No.: US 2014/0266932 A1**  
(43) **Pub. Date: Sep. 18, 2014**

(54) **ANTENNA ELEMENT WITH HIGH GAIN  
TOWARD THE HORIZON**

**Publication Classification**

- (71) Applicant: **Smartsky Networks LLC**, Charlotte, NC (US)
- (72) Inventors: **Stefan Schmidt**, Cary, NC (US);  
**Gerard James Hayes**, Wake Forest, NC (US)
- (73) Assignee: **Smartsky Networks LLC**, Charlotte, NC (US)

- (51) **Int. Cl.**  
*H01Q 1/50* (2006.01)  
*H01Q 13/10* (2006.01)  
*H01Q 1/28* (2006.01)  
*H01Q 9/16* (2006.01)
- (52) **U.S. Cl.**  
CPC . *H01Q 1/50* (2013.01); *H01Q 9/16* (2013.01);  
*H01Q 13/10* (2013.01); *H01Q 1/286* (2013.01)  
USPC ..... **343/712**; 343/843; 343/793; 343/767

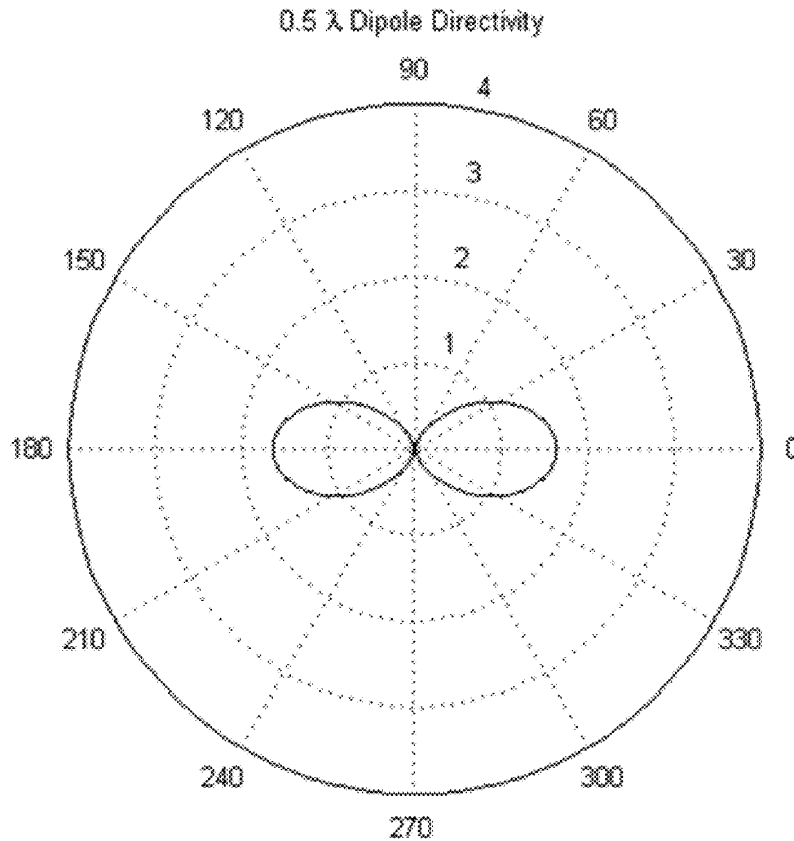
- (21) Appl. No.: **14/208,656**
- (22) Filed: **Mar. 13, 2014**

**Related U.S. Application Data**

- (60) Provisional application No. 61/779,100, filed on Mar. 13, 2013.

(57) **ABSTRACT**

An air-to-ground network communication device may include a conductive groundplane and an antenna element. The conductive groundplane may be disposed to be substantially parallel to a surface of the earth. The antenna element may extend substantially perpendicularly away from the groundplane and may have an effective length between about  $1\lambda$  to about  $1.5\lambda$ . The antenna element may be disposed at a distance of about  $0.5\lambda$  to about  $1\lambda$  from the groundplane.





US 20140266936A1

(19) **United States**

(12) **Patent Application Publication**  
**EMMANUEL et al.**

(10) **Pub. No.: US 2014/0266936 A1**  
(43) **Pub. Date: Sep. 18, 2014**

(54) **ENHANCED HIGH EFFICIENCY 3G/4G/LTE ANTENNAS, DEVICES AND ASSOCIATED PROCESSES**

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/30** (2013.01); **H01Q 21/0087** (2013.01)

(71) Applicant: **NETGEAR, INC.**, San Jose, CA (US)

USPC ..... **343/725; 29/601**

(72) Inventors: **Joseph Amalan Arul EMMANUEL**,  
Cupertino, CA (US); **Chia-Wei LIU**,  
Fremont, CA (US)

(57) **ABSTRACT**

(73) Assignee: **NETGEAR, INC.**, San Jose, CA (US)

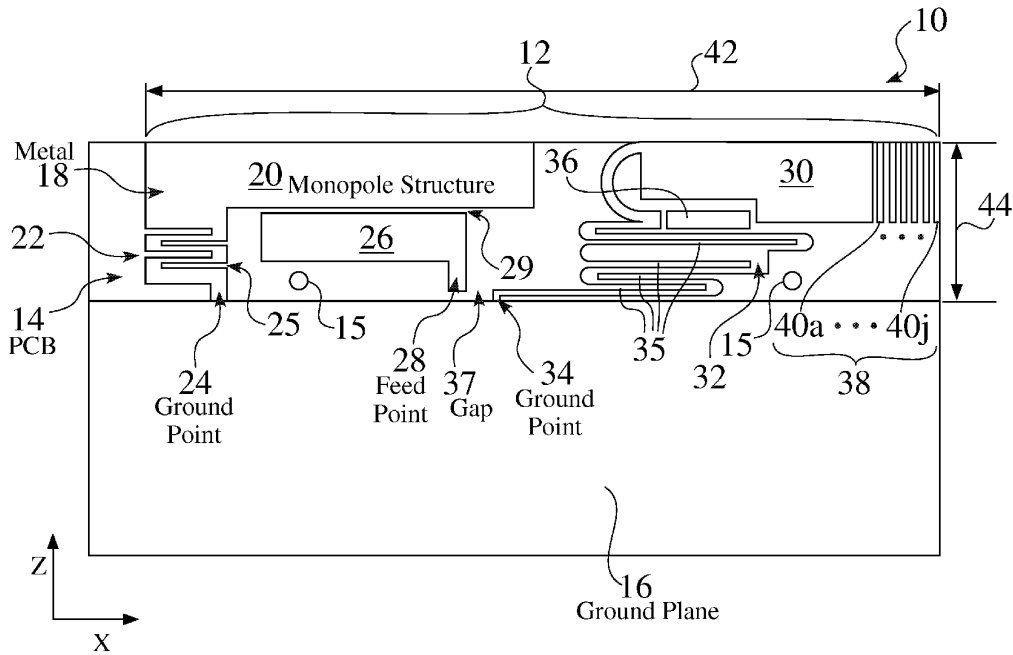
(21) Appl. No.: **13/830,018**

(22) Filed: **Mar. 14, 2013**

Embodiments of the invention provide several antenna designs that exhibit both high bandwidth and efficiency, such as for operation in one or more bands, such as but not limited to operation in 3G, 4G, LTE bands. A first aspect of the invention concerns the form factor of the enhanced antenna; a second aspect of the invention concerns the ease with which the enhanced antenna is manufactured; and a third aspect concerns the superior performance exhibited by the enhanced antenna across one or more bandwidths.

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 21/30** (2006.01)  
**H01Q 21/00** (2006.01)





US 20140266938A1

(19) **United States**

(12) **Patent Application Publication**  
**Ouyang et al.**

(10) **Pub. No.: US 2014/0266938 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **ELECTRONIC DEVICE HAVING MULTIPORT ANTENNA STRUCTURES WITH RESONATING SLOT**

**Publication Classification**

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

(51) **Int. Cl.**  
**H01Q 21/28** (2006.01)

(72) Inventors: **Yuehui Ouyang**, Sunnyvale, CA (US); **Nanbo Jin**, Sunnyvale, CA (US); **Yijun Zhou**, Sunnyvale, CA (US); **Enrique Ayala Vazquez**, Watsonville, CA (US); **Anand Lakshmanan**, San Jose, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Mattia Pascolini**, Campbell, CA (US); **Matthew A. Mow**, Los Altos, CA (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/28** (2013.01)  
USPC ..... **343/729**

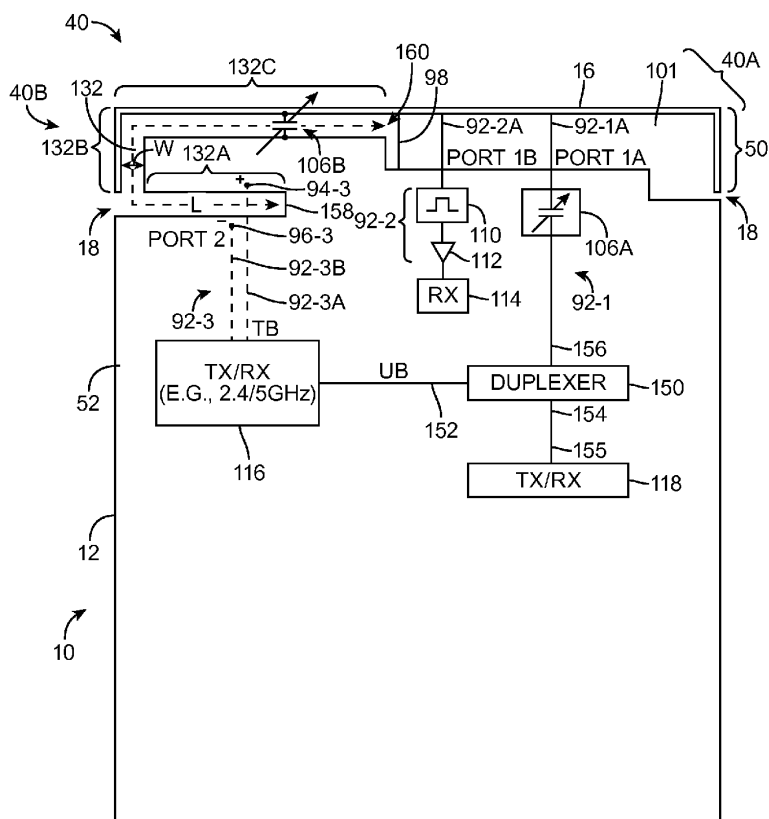
(57) **ABSTRACT**

Electronic devices may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may include an inverted-F antenna resonating element and an antenna ground that form an inverted-F antenna having first and second antenna ports. The antenna structures may include a slot antenna resonating element. The slot antenna resonating element may serve as a parasitic antenna resonating element for the inverted-F antenna at frequencies in a first communications band and may serve as a slot antenna at frequencies in a second communications band. The slot antenna may be directly fed using a third antenna port. An adjustable capacitor may be coupled to the first port to tune the inverted-F antenna. The inverted-F antenna may also be tuned using an adjustable capacitor bridging the slot antenna resonating element.

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(21) Appl. No.: **13/846,459**

(22) Filed: **Mar. 18, 2013**





US 20140266941A1

(19) **United States**

(12) **Patent Application Publication**  
**Vazquez et al.**

(10) **Pub. No.: US 2014/0266941 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **ELECTRONIC DEVICE WITH HYBRID  
INVERTED-F SLOT ANTENNA**

**Publication Classification**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)

(72) Inventors: **Enrique Ayala Vazquez**, Watsonville, CA (US); **Hongfei Hu**, Santa Clara, CA (US); **Mattia Pascolini**, San Mateo, CA (US); **Yuehui Ouyang**, Sunnyvale, CA (US); **Yijun Zhou**, Sunnyvale, CA (US); **Matthew A. Mow**, Los Altos, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Erdinc Irci**, Sunnyvale, CA (US); **Salih Yarga**, Sunnyvale, CA (US); **Ming-Ju Tsai**, Cupertino, CA (US); **Liang Han**, Sunnyvale, CA (US); **Thomas E. Biedka**, San Jose, CA (US); **Nicholas S. Reimnitz**, Campbell, CA (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 13/103** (2013.01)  
USPC ..... **343/746; 343/767**

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(57) **ABSTRACT**

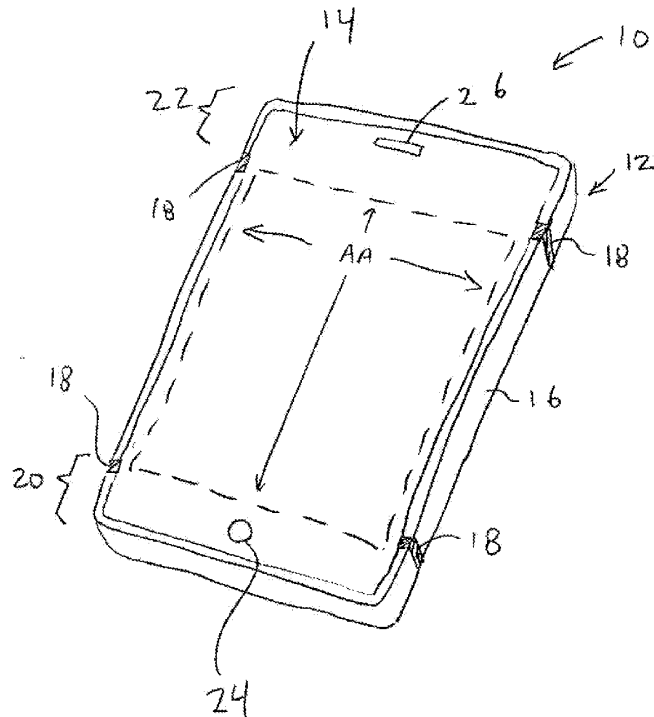
(21) Appl. No.: **14/096,417**

(22) Filed: **Dec. 4, 2013**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 13/797,513, filed on Mar. 12, 2013.

An electronic device may be provided with a housing. The housing may have a periphery that is surrounded by peripheral conductive structures such as a segmented peripheral metal member. A segment of the peripheral metal member may be separated from a ground by a slot. An antenna feed may have a positive antenna terminal coupled to the peripheral metal member and a ground terminal coupled to the ground and may feed both an inverted-F antenna structure that is formed from the peripheral metal member and the ground and a slot antenna structure that is formed from the slot. Control circuitry may tune the antenna by controlling adjustable components that are coupled to the peripheral metal member. The adjustable components may include adjustable inductors and adjustable capacitors.





US 20140266945A1

(19) **United States**

(12) **Patent Application Publication**  
**Dou**

(10) **Pub. No.: US 2014/0266945 A1**  
(43) **Pub. Date: Sep. 18, 2014**

(54) **REFLECTORS FOR REFLECTING ELECTROMAGNETIC ENERGY AWAY FROM A USER DEVICE IN A FIRST DIRECTION**

**Publication Classification**

(71) Applicant: **AMAZON TECHNOLOGIES, INC.**,  
Reno, NV (US)

(51) **Int. Cl.**  
*H01Q 13/10* (2006.01)  
*H01Q 19/10* (2006.01)

(72) Inventor: **Weiping Dou**, San Jose, CA (US)

(52) **U.S. Cl.**  
CPC ..... *H01Q 13/10* (2013.01); *H01Q 19/10* (2013.01)  
USPC ..... **343/770; 29/601**

(73) Assignee: **AMAZON TECHNOLOGIES, INC.**,  
Reno, NV (US)

(57) **ABSTRACT**

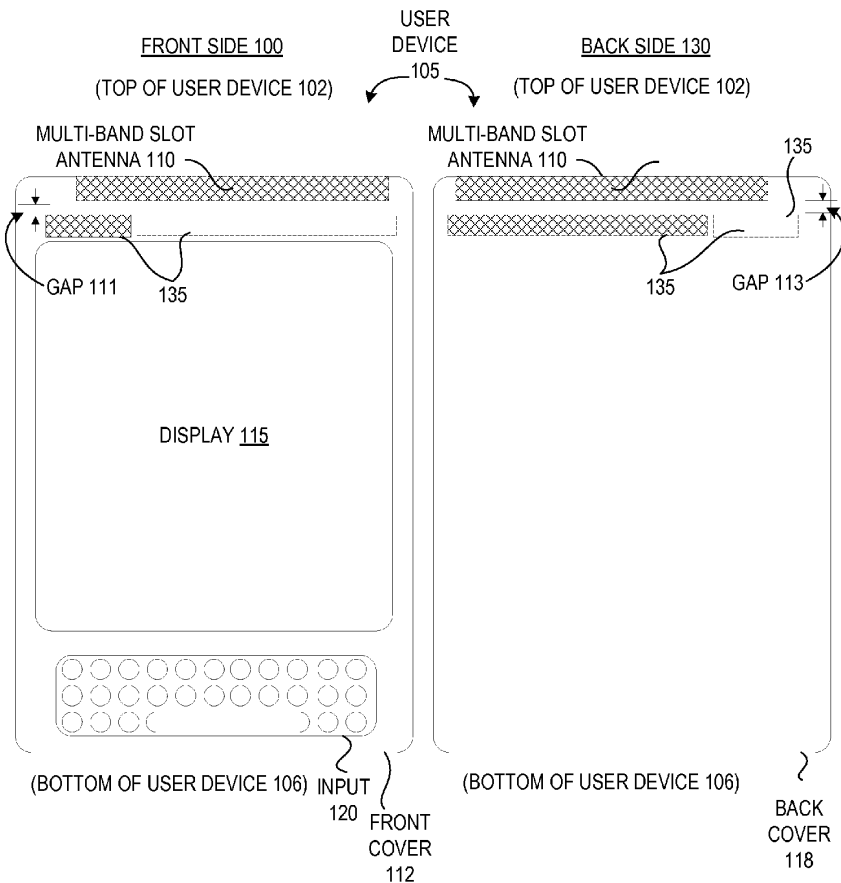
(21) Appl. No.: **14/280,399**

A user device having a dielectric carrier, a multi-band slot antenna, a reflector and a feed line connector is described. The multi-band slot antenna has slot openings in a second portion of conductive material disposed on a second side of the user device and is operable to radiate electromagnetic energy. The reflector is additional conductive material disposed on the second side and is operable to reflect a majority of the radiated electromagnetic energy away from the user device in a first direction.

(22) Filed: **May 16, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. 12/857,987, filed on Aug. 17, 2010, now Pat. No. 8,754,822.





US 20140266950A1

(19) **United States**

(12) **Patent Application Publication**  
**Cicero**

(10) **Pub. No.: US 2014/0266950 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **DIRECTIVE, INSTANTANEOUS WIDE BANDWIDTH ANTENNA**

(52) **U.S. Cl.**

CPC ..... *H01Q 1/28* (2013.01)

USPC ..... *343/789*; 29/600

(71) Applicant: **Raytheon Company**, (US)

(57) **ABSTRACT**

(72) Inventor: **Patrick Cicero**, Waltham, MA (US)

A directive, instantaneous wide bandwidth antenna is disclosed. The antenna can include a ground plane having a recess with a tapered region accessible by an electromagnetic field via a radiating aperture at a forward end of the recess. The antenna can also include an elongate dielectric feed disposed in the recess. The dielectric feed can have a tapered portion proximate the tapered region to guide the electromagnetic field into the recess through the radiating aperture and influence pattern directivity. The antenna can further include a conductive plating disposed at least partially about the dielectric feed in a wedge configuration to influence pattern beam width. The conductive plating can have a taper to facilitate propagation of the electromagnetic field over a range of frequencies. The conductive plating can be disposed toward a rearward end of the recess relative to the radiating aperture.

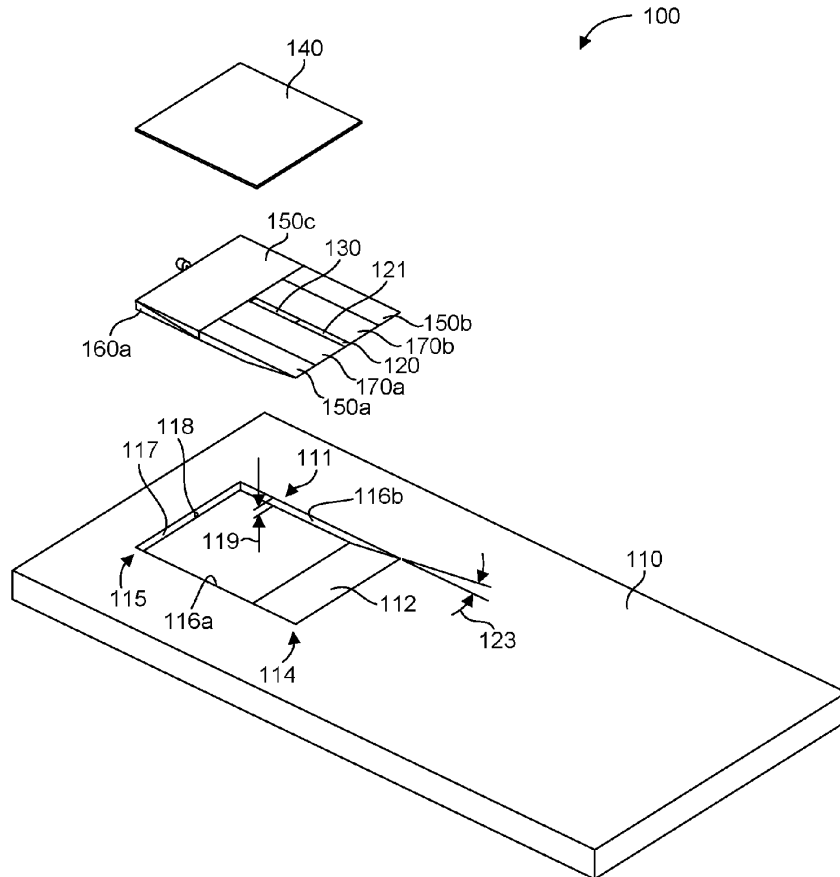
(73) Assignee: **Raytheon Company**, Waltham, MA (US)

(21) Appl. No.: **13/797,376**

(22) Filed: **Mar. 12, 2013**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/28* (2006.01)





US 20140266965A1

(19) **United States**

(12) **Patent Application Publication**  
**Herrero et al.**

(10) **Pub. No.: US 2014/0266965 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **ANTENNA TUNER CONTROL SYSTEM USING STATE TABLES**

**Publication Classification**

(71) Applicants: **Pablo Herrero**, Munich (DE); **Andreas Langer**, Lohhof (DE); **Gunther Kraut**, Egming (DE); **Grigory Itkin**, Munich (DE); **Jan-Erik Mueller**, Ottobrunn (DE)

(51) **Int. Cl.**  
**H01Q 1/50** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/50** (2013.01)  
USPC ..... **343/861**

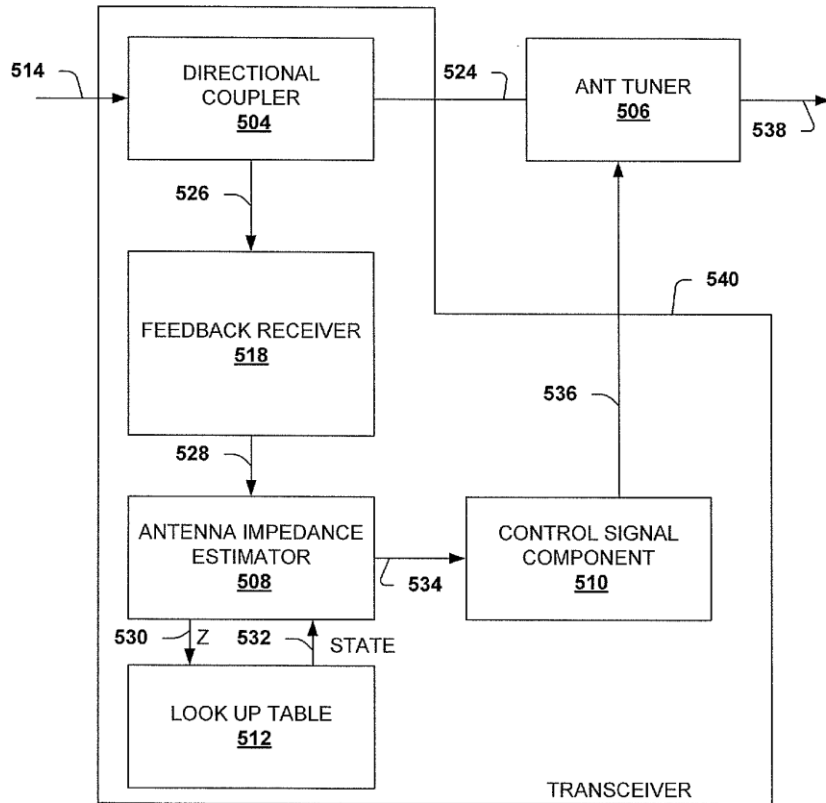
(72) Inventors: **Pablo Herrero**, Munich (DE); **Andreas Langer**, Lohhof (DE); **Gunther Kraut**, Egming (DE); **Grigory Itkin**, Munich (DE); **Jan-Erik Mueller**, Ottobrunn (DE)

(57) **ABSTRACT**

An antenna tuner control system includes an RF path, a lookup table and a state table analysis component. The RF path is configured to generate an RF signal. The lookup table has a state table that correlates antenna states with impedance values. The state table analysis component is configured to generate a tuner control signal from the RF signal using the lookup table.

(21) Appl. No.: **13/800,399**

(22) Filed: **Mar. 13, 2013**



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US 20140266968A1

(19) **United States**

(12) **Patent Application Publication**  
**WONG et al.**

(10) **Pub. No.: US 2014/0266968 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **COMMUNICATION DEVICE AND ANTENNA ELEMENT THEREIN**

(52) **U.S. Cl.**

CPC ..... *H01Q 1/50* (2013.01)

USPC ..... **343/876**

(71) Applicant: **ACER INCORPORATED**, New Taipei City (TW)

(57) **ABSTRACT**

(72) Inventors: **Kin-Lu WONG**, New Taipei City (TW);  
**Meng-Ting CHEN**, New Taipei City (TW)

A communication device including a ground element and an antenna element is provided. The antenna element includes a first portion and a second portion. The first portion has a first end and a second end. The first end is used as a first feeding point of the antenna element. The second portion has a third end and a fourth end. The third end is used as a second feeding point of the antenna element, and the fourth end is open. A first switch is coupled between the second end of the first portion and the third end of the second portion. The first switch is further coupled through the first portion and a first reactive circuit to a communication module. A second switch is coupled to the third end of the second portion. The second switch is further coupled through a second reactive circuit to the communication module.

(73) Assignee: **ACER INCORPORATED**, New Taipei City (TW)

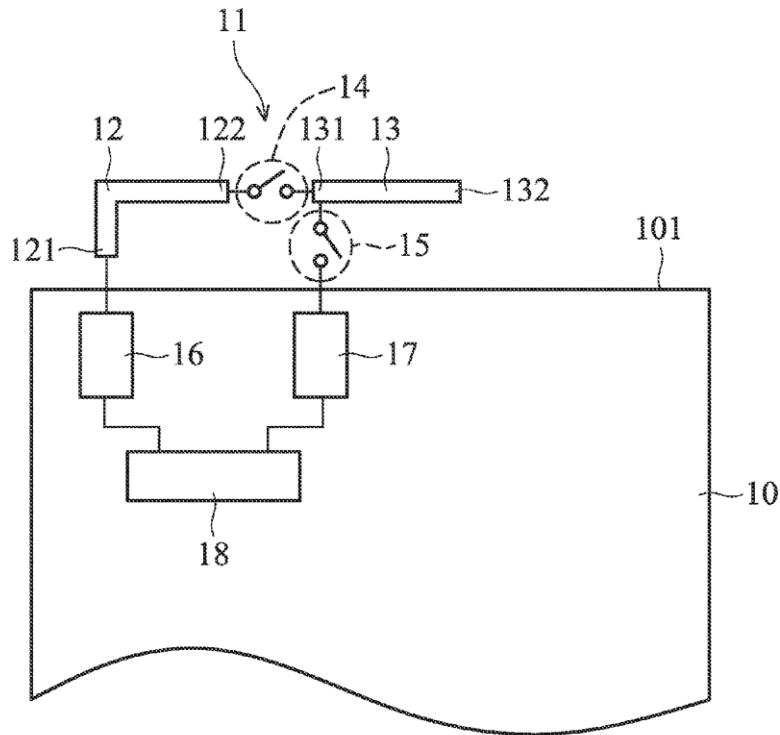
(21) Appl. No.: **13/795,627**

(22) Filed: **Mar. 12, 2013**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/50* (2006.01)

100







US 20140266972A1

(19) **United States**

(12) **Patent Application Publication**  
**YANG**

(10) **Pub. No.: US 2014/0266972 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **SURFACE MOUNT DEVICE**  
**MULTI-FREQUENCY ANTENNA MODULE**

(52) **U.S. Cl.**  
CPC ..... *H01Q 5/0093* (2013.01)  
USPC ..... **343/893**

(71) Applicant: **CIROCOMM TECHNOLOGY**  
**CORP.**, Tainan City (TW)

(57) **ABSTRACT**

(72) Inventor: **Tsai-Yi YANG**, Tainan City (TW)

A surface mount device multi-frequency antenna module includes a base plate, a carrier, a first ground layer, a first signal feed-in line, a second signal feed-in line, and a third signal feed-in line, wherein the last four parts are arranged on the base plate. The carrier includes a first radiator, a second radiator, a third radiator, and a fourth radiator. The first radiator is electrically connected to the second radiator. The first radiator is not electrically connected to the third radiator and the fourth radiator. A contact connecting the first radiator and the second radiator is electrically connected to the first signal feed-in line when the carrier is electrically connected to the base plate. The third radiator is electrically connected to the second signal feed-in line. The fourth radiator is electrically connected to the third signal feed-in line.

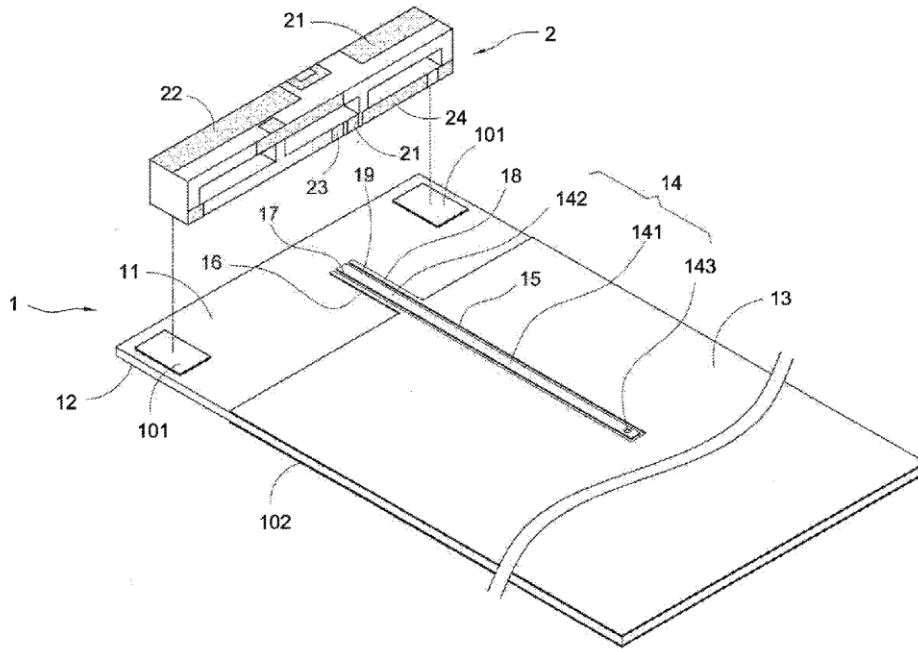
(73) Assignee: **CIROCOMM TECHNOLOGY**  
**CORP.**, Tainan City (TW)

(21) Appl. No.: **13/828,916**

(22) Filed: **Mar. 14, 2013**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 5/00* (2006.01)





US 20140266973A1

(19) **United States**

(12) **Patent Application Publication**  
DeVries et al.

(10) **Pub. No.:** US 2014/0266973 A1

(43) **Pub. Date:** Sep. 18, 2014

(54) **FLEX PCB FOLDED ANTENNA**

(71) Applicant: **RESEARCH IN MOTION LIMITED,**  
Waterloo (CA)

(72) Inventors: **Christopher Andrew DeVries,** Waterloo  
(CA); **Houssam Kanj,** Waterloo (CA)

(73) Assignee: **RESEARCH IN MOTION LIMITED,**  
Waterloo (CA)

(21) Appl. No.: **13/834,714**

(22) Filed: **Mar. 15, 2013**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01P 11/00** (2006.01)  
**H01Q 21/24** (2006.01)

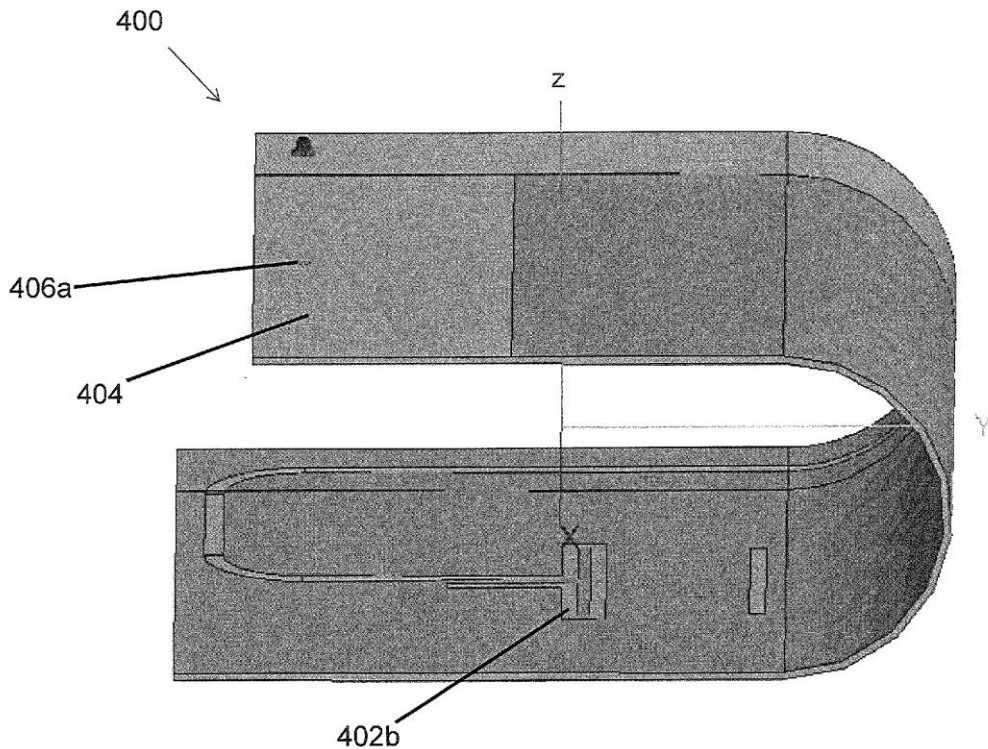
(52) **U.S. Cl.**

CPC ..... **H01Q 1/38** (2013.01); **H01Q 21/24**  
(2013.01); **H01P 11/001** (2013.01)

USPC ..... **343/893; 29/601**

(57) **ABSTRACT**

Embodiments are directed to a flexible substrate, and an end-fire antenna array mounted on the flexible substrate, wherein the flexible substrate is configured to be oriented so that array gain is oriented in a direction perpendicular to a plane of the flexible substrate. Embodiments are directed to mounting an end-fire antenna array on a flexible substrate, and orienting the flexible substrate so that array gain is oriented in a direction perpendicular to a plane of the flexible substrate.





US 20140266974A1

(19) **United States**

(12) **Patent Application Publication**  
**SHARAWI et al.**

(10) **Pub. No.: US 2014/0266974 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **CSRR-LOADED MIMO ANTENNA SYSTEMS**

**Publication Classification**

(71) Applicant: **KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS, Dhahran (SA)**

(51) **Int. Cl.**  
**H01Q 21/28** (2006.01)

(72) Inventors: **MOHAMMAD S. SHARAWI, DHAHRAN (SA); MUHAMMAD UMAR KHAN, DHAHRAN (SA); AHMAD BILAL NUMAN, DHAHRAN (SA)**

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/28** (2013.01)  
USPC ..... **343/893**

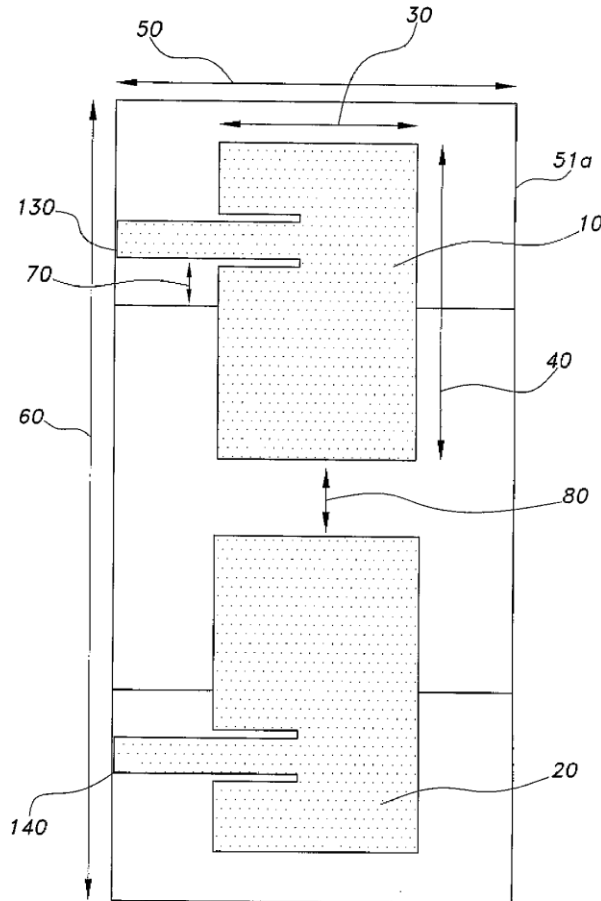
(73) Assignee: **KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS, Dhahran (SA)**

(57) **ABSTRACT**

(21) Appl. No.: **13/846,841**

The CSRR-loaded MIMO antenna systems provide highly compact designs for multiple-input-multiple-output (MIMO) antennas for use in wireless mobile devices. Exemplary two element (2x1), and four element (2x2) MIMO antenna systems are disclosed in which complementary split-ring resonators load patch antennas elements. The overall dimensions of the exemplary MIMO antenna system designed for operation from 750 MHz to 6 GHz band remain within 100x50x0.8 mm<sup>2</sup>.

(22) Filed: **Mar. 18, 2013**





US 20140269862A1

(19) **United States**

(12) **Patent Application Publication**  
**Krewski et al.**

(10) **Pub. No.: US 2014/0269862 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **WIRELESS ANTENNA SYSTEM**

(71) Applicant: **OPTION NV**, Leuven (BE)

(72) Inventors: **Aleksander Krewski**, Mainz (DE);  
**Werner Schroeder**, Wiesbaden (DE);  
**Jan Vercruyse**, Blanden (BE)

(73) Assignee: **OPTION NV**, Leuven (BE)

(21) Appl. No.: **14/353,555**

(22) PCT Filed: **Oct. 23, 2012**

(86) PCT No.: **PCT/EP2012/070974**

§ 371 (c)(1),  
(2), (4) Date: **Apr. 23, 2014**

(30) **Foreign Application Priority Data**

Oct. 23, 2011 (EP) ..... 11186274.4

**Publication Classification**

(51) **Int. Cl.**  
**H04L 27/26** (2006.01)

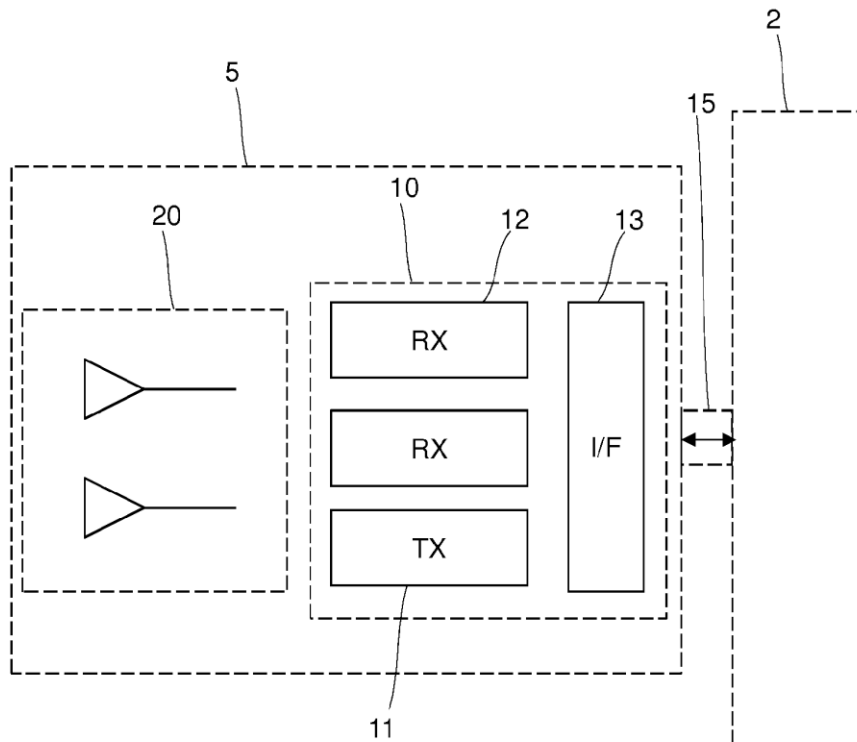
(52) **U.S. Cl.**

CPC ..... **H04L 27/2626** (2013.01); **H04L 27/2647**  
(2013.01)

USPC ..... **375/219**

(57) **ABSTRACT**

A wireless antenna system for a terminal comprises an antenna structure and frontend ports for connecting to transmit and/or receive circuitry of the terminal. The antenna system is operable in a first radiation mode and a second radiation mode, wherein the modes are orthogonal. The circuitry is arranged to map the first feed port to the antenna structure for the first radiation mode across a first frequency band having a bandwidth which covers one of an uplink frequency band and a downlink frequency band of the transmit/receive circuitry. The circuitry is arranged to map the second feed port to the antenna structure for the second radiation mode across a second frequency band, wherein the second frequency band covers both of an uplink frequency band of the transmit/receive circuitry and a downlink frequency band of the transmit/receive circuitry. The above concepts are extendible to more than two modes.





US 20140270917A1

(19) **United States**  
(12) **Patent Application Publication**  
**MALEK**

(10) **Pub. No.:** US 2014/0270917 A1  
(43) **Pub. Date:** Sep. 18, 2014

(54) **DUAL ANTENNA FEED CLIP**  
(71) Applicant: **APPLE INC.**, Cupertino, CA (US)  
(72) Inventor: **Shayan MALEK**, San Jose, CA (US)  
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)  
(21) Appl. No.: **13/861,212**  
(22) Filed: **Apr. 11, 2013**

(52) **U.S. Cl.**  
CPC . **H01Q 1/24** (2013.01); **H01P 11/00** (2013.01)  
USPC ..... **403/188**; 29/601

(57) **ABSTRACT**

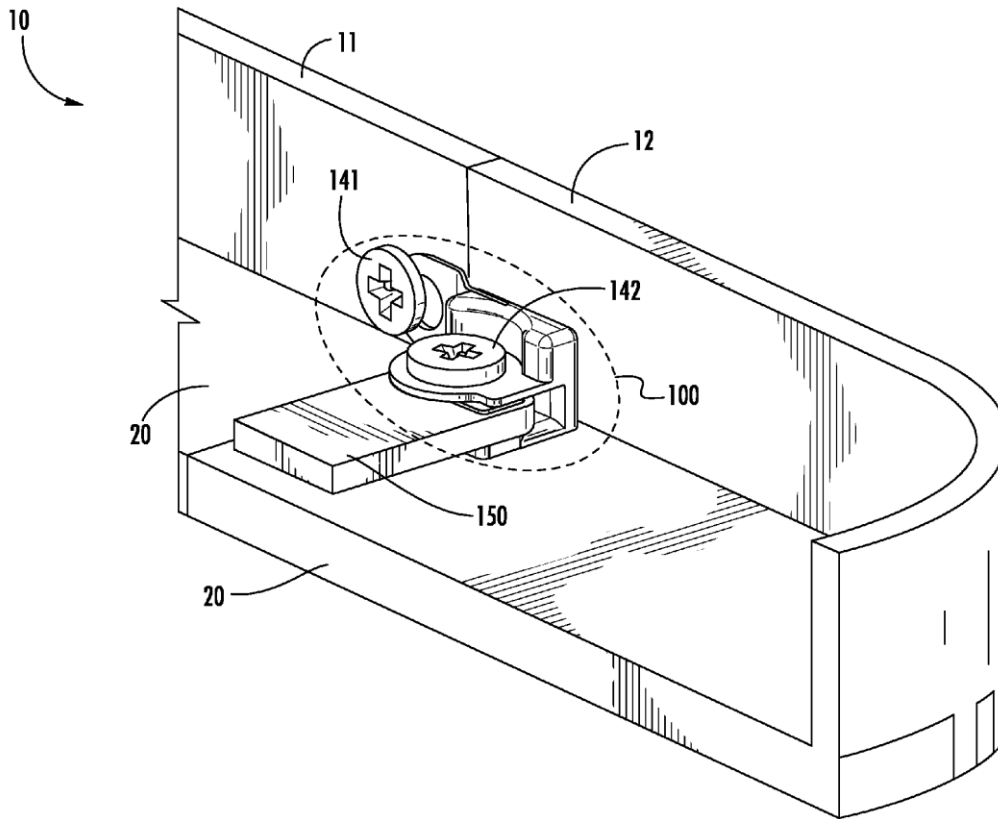
A multiple antenna feed assembly including an antenna feed support having a body made of an electrically insulating material and a method of forming the antenna feed assembly, are provided. The antenna feed support may have a slot adapted to receive a connector; and a gap formed in the body having a thickness to fit a printed circuit board (PCB). The multiple antenna feed assembly may include a first connector adapted to fit in the slot of the antenna feed support; and a second connector electrically isolated from the first connector. Also provided is an antenna feed support to provide structural support and electrical isolation for the components of a multiple antenna feed assembly as above.

**Related U.S. Application Data**

(60) Provisional application No. 61/794,755, filed on Mar. 15, 2013.

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01P 11/00** (2006.01)





US 20140273865A1

(19) **United States**

(12) **Patent Application Publication**  
**Skarda et al.**

(10) **Pub. No.: US 2014/0273865 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **EXPANDABLE IN-WALL ANTENNA FOR A SECURITY SYSTEM CONTROL UNIT**

*H04B 7/24* (2006.01)

*H01Q 7/02* (2006.01)

(71) Applicant: **VIVINT, INC.**, Provo, UT (US)

(52) **U.S. Cl.**

CPC ..... *H01Q 1/084* (2013.01); *H01Q 7/02* (2013.01); *H01Q 9/16* (2013.01); *H04B 7/24* (2013.01)

(72) Inventors: **Brian V. Skarda**, Provo, UT (US);  
**Chester Ferry**, Pleasant Grove, UT (US)

USPC ..... **455/66.1**; 343/899; 343/868; 343/805

(73) Assignee: **VIVINT, INC.**, Provo, UT (US)

(21) Appl. No.: **14/210,926**

(57)

**ABSTRACT**

(22) Filed: **Mar. 14, 2014**

**Related U.S. Application Data**

(60) Provisional application No. 61/793,352, filed on Mar. 15, 2013.

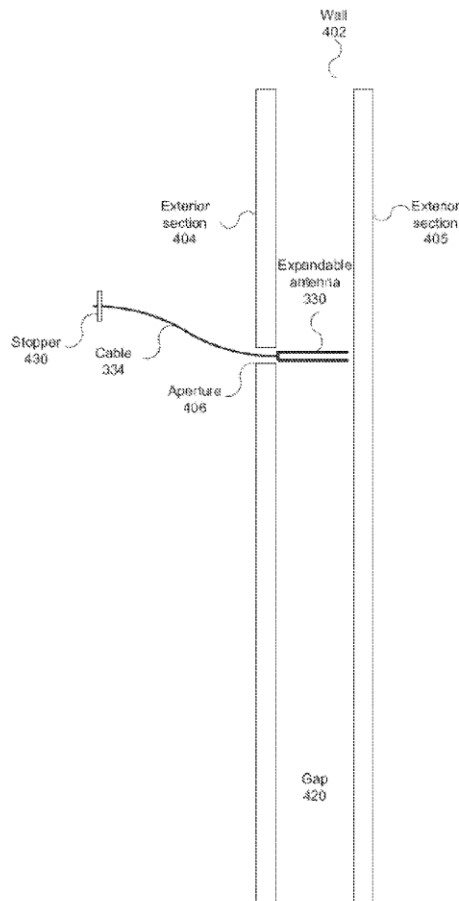
**Publication Classification**

(51) **Int. Cl.**

*H01Q 1/08* (2006.01)

*H01Q 9/16* (2006.01)

The present disclosure relates to an expandable antenna for a security system that is installed within a wall. The security system may include a control unit. The control unit may include a casing that houses one or more internal components of the control unit and a radio-frequency (RF) communication module that is situated within the casing. The RF communication module includes an antenna connected that is exposed to the exterior of the casing. An expandable antenna connects to the antenna connector. The expandable antenna is fit through an aperture in a wall and is then expanded to an enlarged size within the gap of the wall.





US 20140274231A1

(19) **United States**

(12) **Patent Application Publication**  
**De Luis et al.**

(10) **Pub. No.: US 2014/0274231 A1**

(43) **Pub. Date: Sep. 18, 2014**

(54) **MULTIBAND ANTENNA USING DEVICE  
METAL FEATURES AS PART OF THE  
RADIATOR**

**Publication Classification**

(51) **Int. Cl.**  
*H04W 88/06* (2006.01)  
*H04M 1/02* (2006.01)  
(52) **U.S. Cl.**  
CPC ..... *H04W 88/06* (2013.01); *H04M 1/026*  
(2013.01)  
USPC ..... **455/575.7**

(71) Applicants: **Javier Rodriguez De Luis**, Kirkland, WA (US); **Alireza Mahanfar**, Bellevue, WA (US); **Benjamin Shewan**, Redmond, WA (US); **Stanley Ng**, Bellevue, WA (US)

(72) Inventors: **Javier Rodriguez De Luis**, Kirkland, WA (US); **Alireza Mahanfar**, Bellevue, WA (US); **Benjamin Shewan**, Redmond, WA (US); **Stanley Ng**, Bellevue, WA (US)

(21) Appl. No.: **13/839,879**

(22) Filed: **Mar. 15, 2013**

(57) **ABSTRACT**

Mobile communication devices include multi-band antennas that use an internal conductor and a perimeter conductor to define antenna sections that are coupled together based on an RF wavelength of interest. The antenna sections can be selected or deselected by shunting to ground using a passive filter device or an active RF switch. In other examples, filters or switches are configured to couple an internal conductor and a portion of a perimeter conductor together to provide an effective antenna length associated with a selected frequency.

