



US 20160149290A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0149290 A1**

(43) **Pub. Date: May 26, 2016**

(54) **ANTENNA AND ELECTRONIC DEVICE INCLUDING THE SAME**

(30) **Foreign Application Priority Data**

Nov. 21, 2014 (KR) 10-2014-0163512

(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)

Publication Classification

(72) Inventors: **Jung-Sik PARK**, Gyeonggi-do (KR);
Yeon-Woo KIM, Gyeonggi-do (KR);
Woo-Sup LEE, Gyeonggi-do (KR);
Seung-Gil JEON, Gyeonggi-do (KR);
Ju-Seok NOH, Gyeonggi-do (KR);
Jae-Bong CHUN, Gyeonggi-do (KR);
Hyun-Ju HONG, Gyeonggi-do (KR)

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

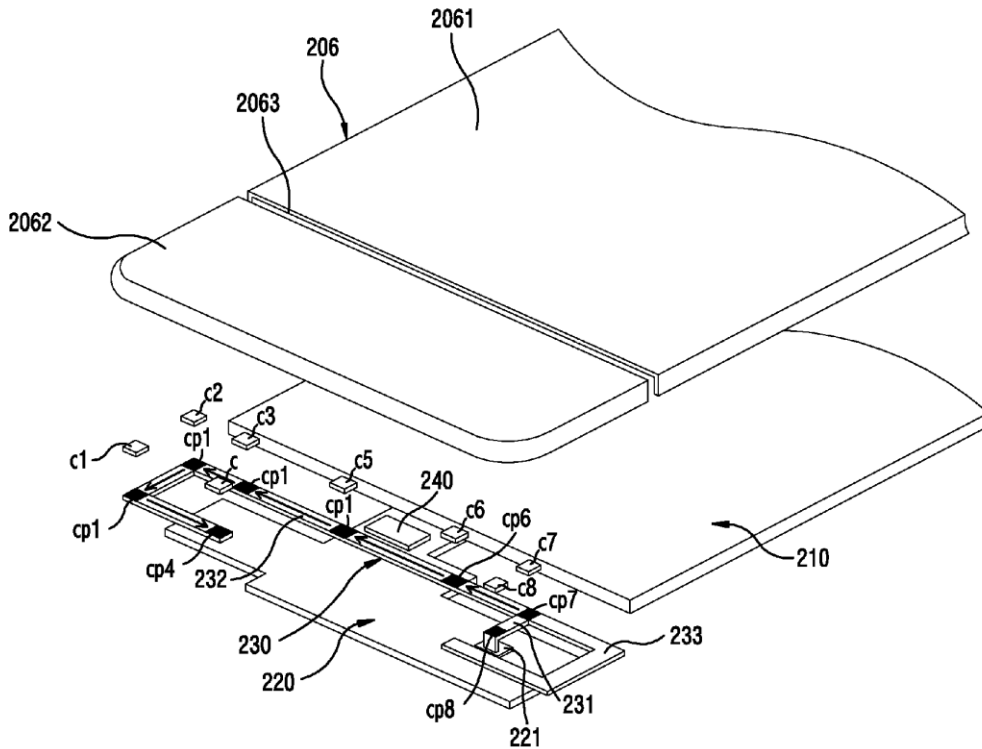
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01)

(57) **ABSTRACT**

An electronic device comprising: a housing; a wireless communication transceiver provided within the housing; an antenna radiator provided within the housing; and a cover arranged to cover at least a portion of the antenna radiator and form at least a portion of a surface of the housing, wherein the cover includes a conductive material, and the cover is at least partially detachable from the housing.

(21) Appl. No.: **14/945,597**

(22) Filed: **Nov. 19, 2015**





US 20160149291A1

(19) **United States**

(12) **Patent Application Publication**
PARK

(10) **Pub. No.: US 2016/0149291 A1**

(43) **Pub. Date: May 26, 2016**

(54) **ANTENNA AND ELECTRONIC DEVICE INCLUDING THE SAME**

Publication Classification

(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventor: **Joo-Hwan PARK**, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC . *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01)

(21) Appl. No.: **14/946,267**

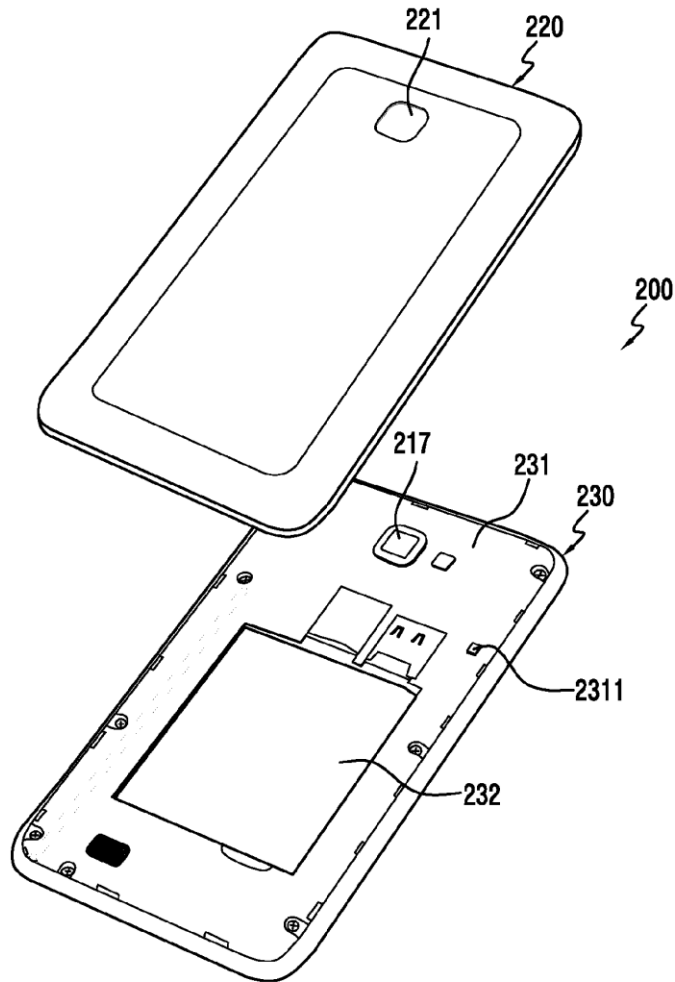
(57) **ABSTRACT**

(22) Filed: **Nov. 19, 2015**

Provided are an antenna and an electronic device including the same. The antenna includes a substrate, an antenna radiator fed from the substrate, at least one metallic member disposed near the antenna radiator, a connector member electrically connected to the substrate, and a capacitor formed by a dielectric interposed between the connector member and the at least one metallic member.

(30) **Foreign Application Priority Data**

Nov. 21, 2014 (KR) 10-2014-0163756





US 20160149299A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0149299 A1**

(43) **Pub. Date: May 26, 2016**

(54) **MULTIBAND ANTENNA STRUCTURE**

Publication Classification

(71) Applicant: **Skycross, Inc.**, San Jose, CA (US)

(51) **Int. Cl.**
H01Q 1/52 (2006.01)

(72) Inventors: **Chang Gyun Yoo**, Gyeonggi-do (KR);
Jin Su Kim, Gyeonggi-do (KR); **Jaе Nam Han**, Gyeonggi-do (KR); **Juno Lim**, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/521** (2013.01); **H01Q 1/526** (2013.01)

(57) **ABSTRACT**

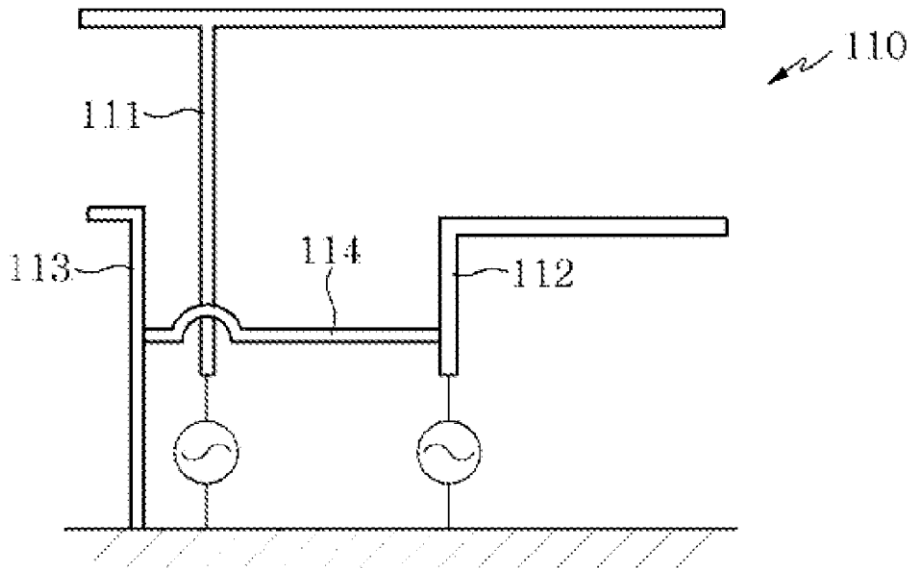
The present disclosure relates to a multiband antenna structure which is capable of preventing interference between individual antennas in an antenna structure including a plurality of antennas having different shapes and bandwidths and maintaining a high level of isolation, although a distance between the antennas is reduced. A multiband antenna structure is capable of increasing a level of isolation by directly connecting an antenna connected to one feeding point and a ground coupling antenna (having a high frequency band) arranged adjacent to antenna connected to the feeding point.

(21) Appl. No.: **14/568,801**

(22) Filed: **Dec. 12, 2014**

(30) **Foreign Application Priority Data**

Nov. 25, 2014 (KR) 10-2014-0165046





US 20160149303A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0149303 A1**

(43) **Pub. Date: May 26, 2016**

(54) **ANTENNA WITH QUARTER WAVE PATCH ELEMENT, U-SLOT, AND SLOTTED SHORTING WALL**

(52) **U.S. Cl.**
CPC *H01Q 5/357* (2015.01); *H01Q 13/16* (2013.01); *H01Q 9/0421* (2013.01)

(71) Applicant: **Cisco Technology, Inc.**, San Jose, CA (US)

(57) **ABSTRACT**

(72) Inventors: **Erin Mcgough**, Richfield, OH (US);
Thomas Lutman, Richfield, OH (US)

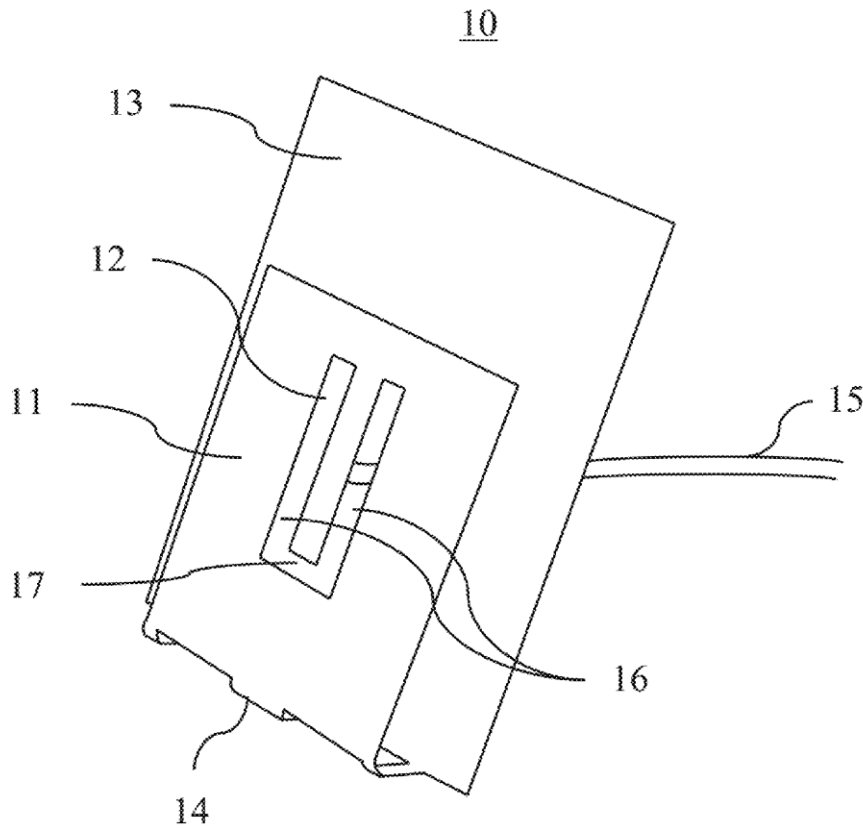
(21) Appl. No.: **14/550,241**

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

Publication Classification

(51) **Int. Cl.**
H01Q 5/357 (2006.01)
H01Q 9/04 (2006.01)
H01Q 13/16 (2006.01)

In one embodiment, an apparatus is formed using a quarter wave (QW) patch element with a U-Slot, a ground plane, and a slotted shorting wall. A feed line runs through the ground plane and connects to the QW patch element. The slotted shorting wall connects the QW patch element to the ground plane. The QW patch element, slotted shorting wall, and ground plane are composed of a single contiguous folded material.





US 20160149317A1

(19) **United States**

(12) **Patent Application Publication**
Tai

(10) **Pub. No.: US 2016/0149317 A1**

(43) **Pub. Date: May 26, 2016**

(54) **COMMUNICATION APPARATUS WITH
IMPROVED RADIATED SPURIOUS
EMISSION AND LOSS**

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

CPC *H01Q 23/00* (2013.01); *H01Q 1/48*
(2013.01); *H01Q 1/50* (2013.01)

(71) Applicant: **MediaTek Inc.**, Hsinchu (TW)

(72) Inventor: **Chen-Fang Tai**, New Taipei (TW)

(57)

ABSTRACT

(21) Appl. No.: **14/981,731**

(22) Filed: **Dec. 28, 2015**

Examples of a tunable antenna and various implementations thereof are described. The tunable antenna may include a radiator and one or more varactors. The radiator may include at least one feeding port and at least one shorting port. Each of the one or more varactors may be coupled to the radiator and configured to operate in either an isolation state or a connection state when the tunable antenna operates in a radio-frequency (RF) frequency range.

Publication Classification

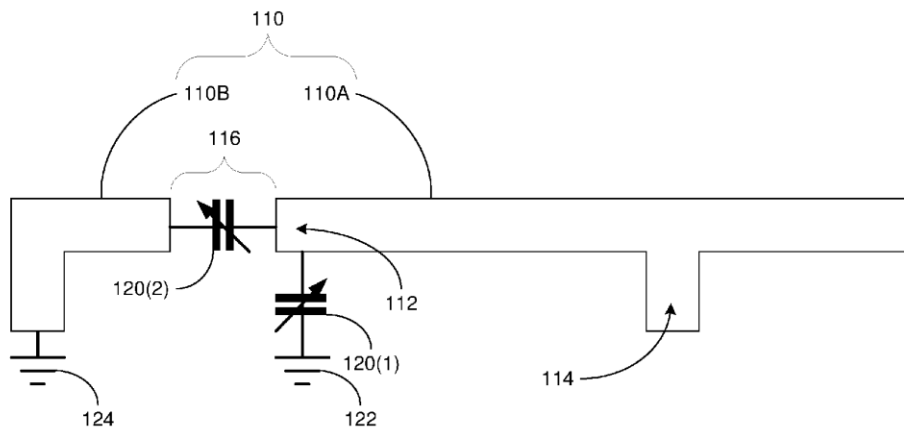
(51) **Int. Cl.**

H01Q 23/00 (2006.01)

H01Q 1/50 (2006.01)

H01Q 1/48 (2006.01)

100





US 20160154438A1

(19) **United States**

(12) **Patent Application Publication**
Sato

(10) **Pub. No.: US 2016/0154438 A1**

(43) **Pub. Date: Jun. 2, 2016**

(54) **ELECTRONIC APPARATUS**

Publication Classification

(71) Applicant: **Kabushiki Kaisha Toshiba**, Tokyo (JP)

(51) **Int. Cl.**
G06F 1/16 (2006.01)

(72) Inventor: **Koichi Sato**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **G06F 1/1654** (2013.01); **G06F 1/1664** (2013.01); **G06F 1/1698** (2013.01); **G06F 1/162** (2013.01); **G06F 1/169** (2013.01)

(21) Appl. No.: **14/834,234**

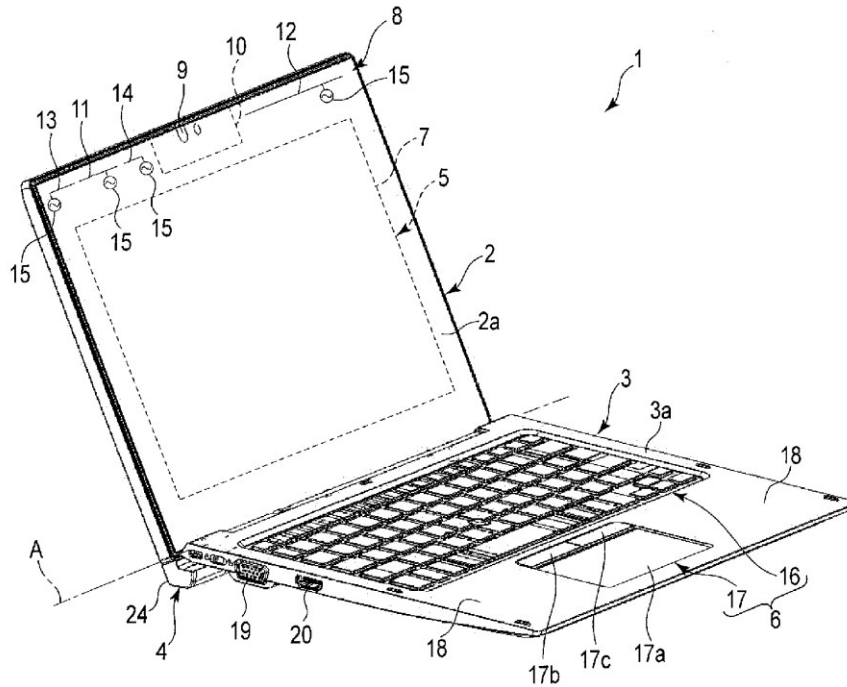
(57) **ABSTRACT**

(22) Filed: **Aug. 24, 2015**

An electronic apparatus in one embodiment is brought to a tablet state, in which a first housing having antennas and a display unit is placed over a second housing having an electrically conductive member and allows input from the display unit. In the tablet state, a part of one of the antennas is over the electrically conductive member.

Related U.S. Application Data

(60) Provisional application No. 62/086,067, filed on Dec. 1, 2014.





US 20160156093A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0156093 A1**

(43) **Pub. Date: Jun. 2, 2016**

(54) **ANTENNA STRUCTURE AND WIRELESS COMMUNICATION DEVICE USING SAME**

Publication Classification

(71) Applicant: **FIH (HONG KONG) LIMITED**,
Kowloon (HK)

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

(72) Inventors: **CHUAN-CHOU CHI**, New Taipei (TW); **CHENG-HUNG KO**, New Taipei (TW); **HAO-YING CHANG**, New Taipei (TW)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01)

(57) **ABSTRACT**

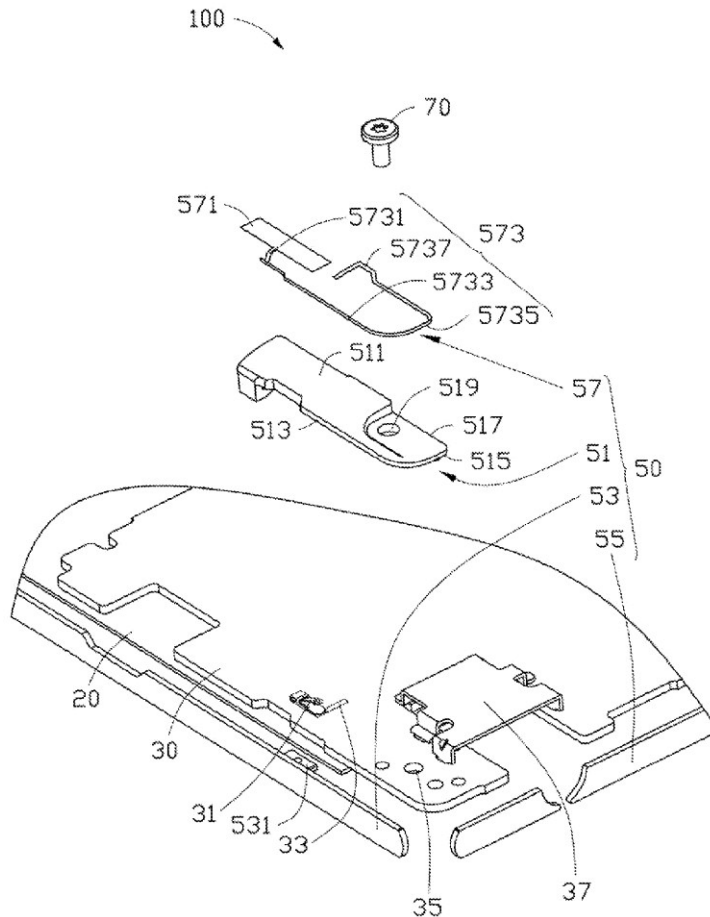
An antenna structure includes an antenna holder, a first metallic portion, a second metallic portion, and a radiator. The antenna holder includes a top wall, a first sidewall, and a second sidewall. The first sidewall and the second sidewall are both substantially perpendicularly connected to a periphery of the top wall. The radiator is positioned at least on the top wall, the first sidewall, and the second sidewall. The first metallic portion is substantially parallel to the first sidewall. The second metallic portion is substantially parallel to the second sidewall. The first metallic portion and the second metallic portion are both configured for being coupled to the radiator.

(21) Appl. No.: **14/591,163**

(22) Filed: **Jan. 7, 2015**

(30) **Foreign Application Priority Data**

Nov. 28, 2014 (TW) 103141307





US 20160156097A1

(19) **United States**
(12) **Patent Application Publication**
KOBAYASHI et al.

(10) **Pub. No.: US 2016/0156097 A1**
(43) **Pub. Date: Jun. 2, 2016**

(54) **ANTENNA DEVICE**

H01Q 5/20 (2006.01)
G04G 17/04 (2006.01)
H01Q 1/27 (2006.01)
H01Q 5/307 (2006.01)

(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd., Osaka (JP)**

(52) **U.S. Cl.**
CPC *H01Q 1/48* (2013.01); *H01Q 1/273* (2013.01); *H01Q 5/307* (2015.01); *H01Q 5/20* (2015.01); *G04G 17/04* (2013.01); *G04G 21/04* (2013.01)

(72) Inventors: **YUKARI KOBAYASHI, Ishikawa (JP); TAKENOBU ARIMA, Kanagawa (JP); HIROYUKI UEJIMA, Ishikawa (JP)**

(21) Appl. No.: **14/935,525**

(22) Filed: **Nov. 9, 2015**

(30) **Foreign Application Priority Data**

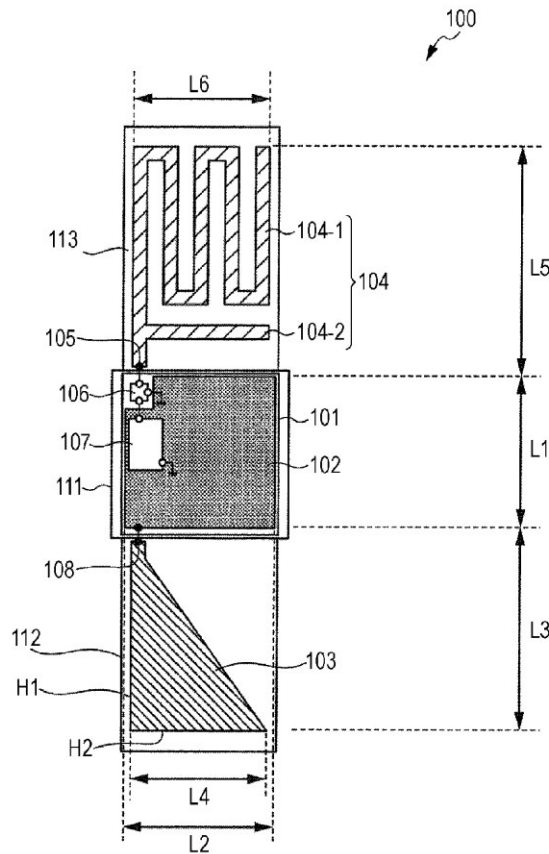
Dec. 2, 2014 (JP) 2014-243878

Publication Classification

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
G04G 21/04 (2006.01)

(57) **ABSTRACT**

An antenna device includes a ground conductor; a ground conductor extension that is connected to the ground conductor; and an antenna element that is connected to the ground conductor and that operates in both a first frequency band and a second frequency band higher than the first frequency band, the ground conductor and the ground conductor extension having a length that is $\frac{1}{4}$ of a wavelength of a frequency included in a middle range between the first frequency band and the second frequency band and that is not a natural number multiple of $\frac{1}{4}$ of a wavelength of the first frequency band.





US 20160156098A1

(19) **United States**

(12) **Patent Application Publication**
KIM

(10) **Pub. No.: US 2016/0156098 A1**

(43) **Pub. Date: Jun. 2, 2016**

(54) **WIRELESS COMMUNICATIONS MODULE**

Publication Classification

(71) Applicant: **SAMSUNG ELECTRO-MECHANICS CO., LTD.**, Suwon-Si (KR)

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventor: **Hyo Jin KIM**, Suwon-Si (KR)

(52) **U.S. Cl.**
CPC . *H01Q 1/526* (2013.01); *H01Q 1/48* (2013.01)

(73) Assignee: **SAMSUNG ELECTRO-MECHANICS CO., LTD.**, Suwon-Si (KR)

(57) **ABSTRACT**

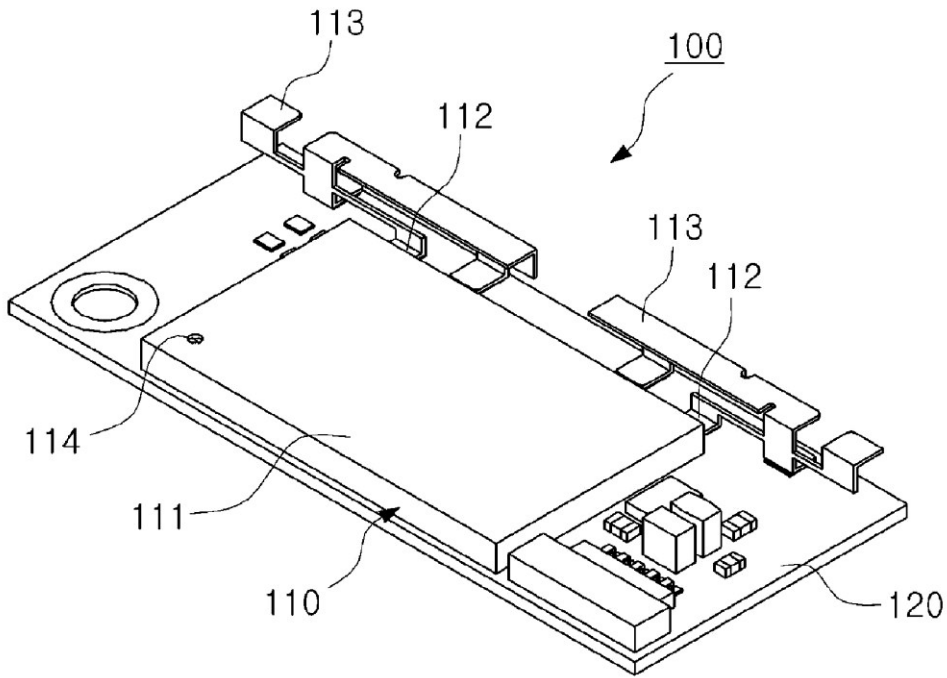
(21) Appl. No.: **14/947,264**

A wireless communications module, including a module substrate, wherein a plurality of elements, a ground pattern, and a conduction pattern are disposed on a surface of the module substrate. A shield integrated antenna is disposed on the surface of the module substrate, wherein the shield integrated antenna includes a shield part enclosing at least one element of the plurality of elements; a ground part extending from a side surface of the shield part and electrically connected to the ground pattern; and an antenna part extending from the ground part and electrically connected to the conduction pattern.

(22) Filed: **Nov. 20, 2015**

(30) **Foreign Application Priority Data**

Dec. 2, 2014 (KR) 10-2014-0170632





US 20160156101A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0156101 A1**

(43) **Pub. Date: Jun. 2, 2016**

(54) **MULTIBAND SWITCHABLE ANTENNA STRUCTURE**

Publication Classification

(71) Applicant: **Quanta Computer Inc.**, Taoyuan City (TW)

(51) **Int. Cl.**
H01Q 5/328 (2006.01)

(72) Inventors: **Chin-Lung TSAI**, Taoyuan City (TW);
Chung-Ting HUNG, Taoyuan City (TW);
Ying-Cong DENG, Taoyuan City (TW);
Chung-Hung LO, Taoyuan City (TW);
Kuan-Hsien LEE, Taoyuan City (TW)

(52) **U.S. Cl.**
CPC *H01Q 5/328* (2015.01)

(57) **ABSTRACT**

A multiband switchable antenna structure includes a feeding element, a first radiation element, a second radiation element, circuit branches, and a switch circuit. A first end of the feeding element is a feeding point. A first end of the first radiation element is coupled to a second end of the feeding element. A second end of the first radiation element is open. A first end of the second radiation element is coupled to the second end of the feeding element. The circuit branches have different impedance values. The switch circuit selects one of the circuit branches as a matching branch according to a control signal. A second end of the second radiation element is coupled through the matching branch to a ground voltage.

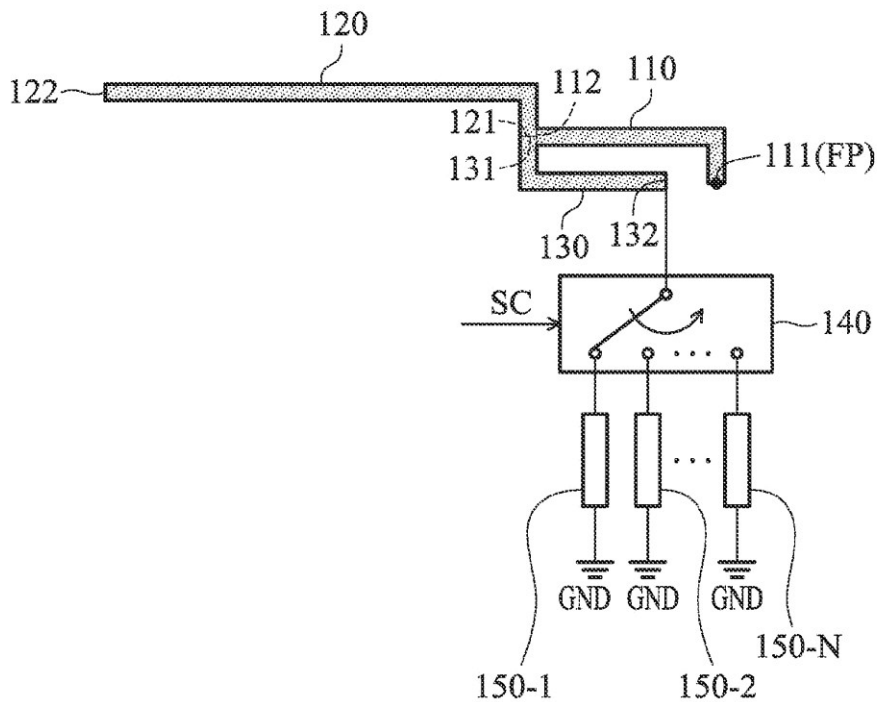
(21) Appl. No.: **14/695,817**

(22) Filed: **Apr. 24, 2015**

(30) **Foreign Application Priority Data**

Nov. 28, 2014 (TW) 103141339

100





US 20160156102A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0156102 A1**
(43) **Pub. Date: Jun. 2, 2016**

(54) **ANTENNA HAVING ASYMMETRIC T SHAPE COUPLED FEED**

(52) **U.S. CL.**
CPC **H01Q 5/378** (2015.01); **H01Q 1/50** (2013.01); **H01Q 9/04** (2013.01)

(71) Applicant: **Wistron Corporation**, New Taipei City (TW)

(72) Inventors: **Mohammed Ziaul Azad**, Rolling Meadows, IL (US); **Firass Badaruzzaman**, Rolling Meadows, IL (US); **Hou-Chun Huang**, New Taipei City (TW)

(57) **ABSTRACT**

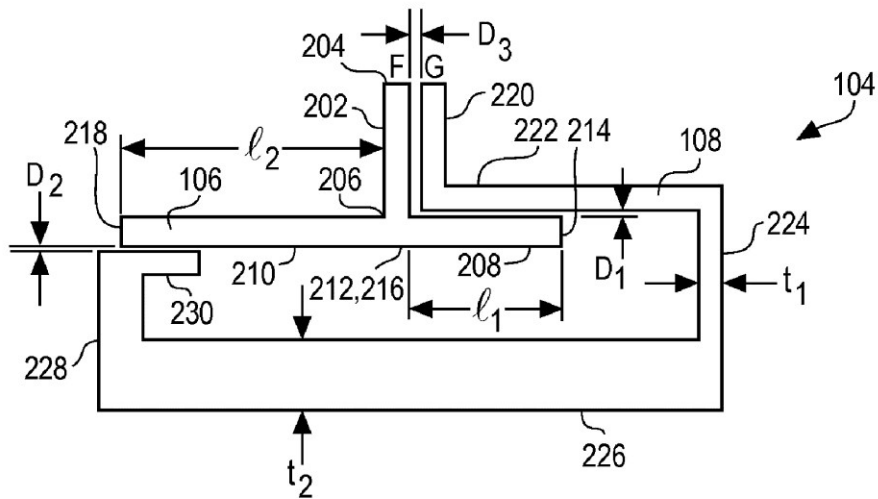
(21) Appl. No.: **14/557,016**

(22) Filed: **Dec. 1, 2014**

Publication Classification

(51) **Int. Cl.**
H01Q 5/378 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/50 (2006.01)

A broadband antenna for interfacing an electronic device with a plurality of radio access technologies is provided. The antenna includes an excitation element and a parasitic element. The excitation element includes a feed line with a first distal end and a second distal end with first and second arms extending from the second distal end, wherein one of the first or second arms is shorter than the other such that the excitation element forms an asymmetrical T shape. The length of the first and second arms determines at least two modes of operation of the antenna. The parasitic element wraps around the asymmetrical T shape and includes a length configured to provide another mode of operation of the antenna.





US 20160156756A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0156756 A1**

(43) **Pub. Date: Jun. 2, 2016**

(54) **COMMUNICATION DEVICE**

Publication Classification

(71) Applicant: **KABUSHIKI KAISHA TOSHIBA**,
Tokyo (JP)

(51) **Int. Cl.**
H04M 1/02 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Ippei KASHIWAGI**, Tokyo (JP); **Isao OHBA**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **H04M 1/0266** (2013.01); **H01Q 1/24** (2013.01)

(73) Assignee: **KABUSHIKI KAISHA TOSHIBA**,
Tokyo (JP)

(57) **ABSTRACT**

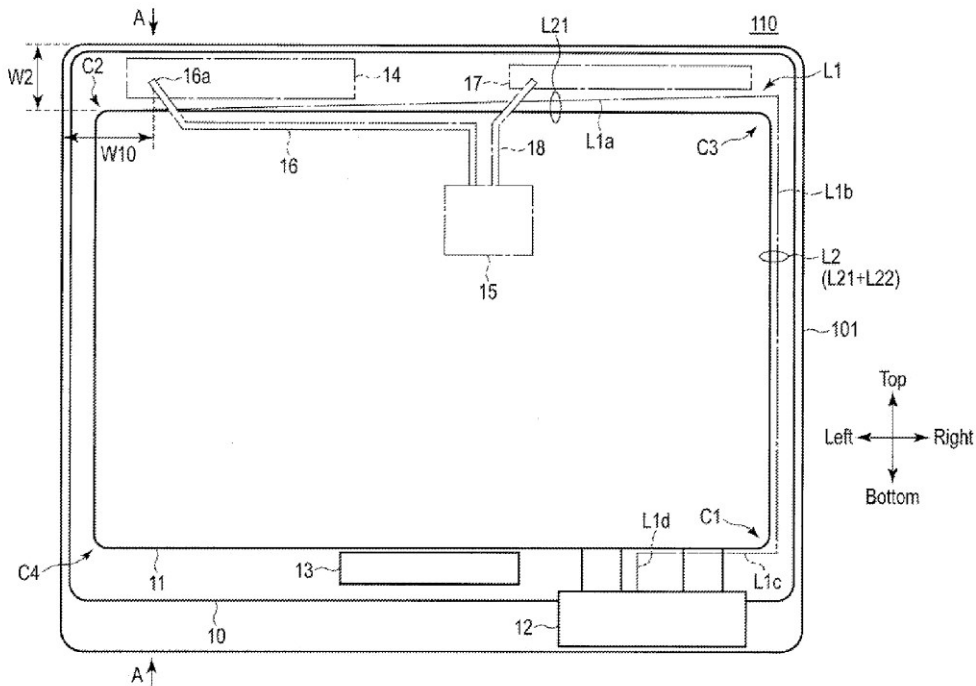
(21) Appl. No.: **14/858,679**

According to one embodiment, a communication device includes a touchpanel including a rectangular area on which electrodes are arranged, a first corner, a second corner opposite to the first corner, a third corner, and a fourth corner opposite to the third corner, a plurality of control lines connected to the respective electrodes and arranged to circumvent the area, a controller provided in a position closest to the first corner among the first, second, third and fourth corners, and configured to receive input to the electrodes via the plurality of control lines, and an antenna provided in a position closest to the second corner among the first, second, third and fourth corners.

(22) Filed: **Sep. 18, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/085,398, filed on Nov. 28, 2014.





US 20160161921A1

(19) **United States**

(12) **Patent Application Publication**
MASAKI

(10) **Pub. No.: US 2016/0161921 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ELECTRONIC TIMEPIECE**

Publication Classification

(71) Applicant: **Seiko Epson Corporation**, Tokyo (JP)

(51) **Int. Cl.**
G04G 17/08 (2006.01)

(72) Inventor: **Takaya MASAKI**, Matsumoto (JP)

G04R 20/02 (2006.01)
G04G 17/04 (2006.01)

(21) Appl. No.: **14/940,601**

(52) **U.S. Cl.**
CPC **G04G 17/08** (2013.01); **G04G 17/04**
(2013.01); **G04R 20/02** (2013.01)

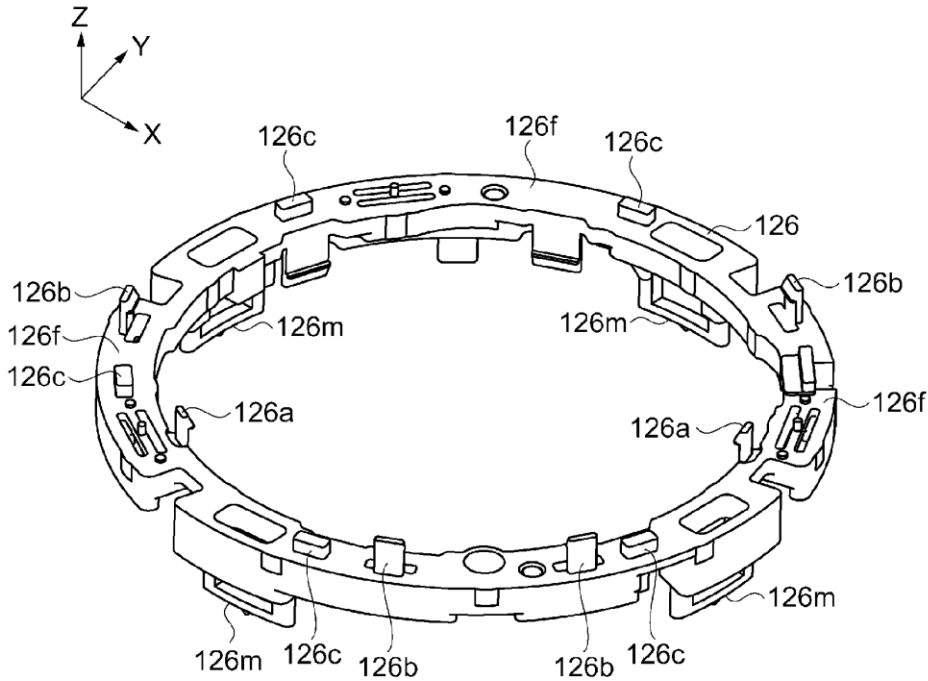
(22) Filed: **Nov. 13, 2015**

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Dec. 5, 2014 (JP) 2014-246578

An electronic timepiece has a base plate and a base plate bridge ring. The base plate bridge ring secures a ring-shaped antenna, contacts an outside case member, and supports the base plate. The base plate is configured to not contact the outside case member.





US 20160161924A1

(19) **United States**

(12) **Patent Application Publication**
Fujisawa

(10) **Pub. No.: US 2016/0161924 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **TIMEPIECE WITH INTERNAL ANTENNA**

(30) **Foreign Application Priority Data**

(71) Applicant: **Seiko Epson Corporation**, Tokyo (JP)

Sep. 1, 2009 (JP) 2009-201557

Jun. 24, 2010 (JP) 2010-143886

(72) Inventor: **Teruhiko Fujisawa**, Shiojiri-shi (JP)

Publication Classification

(21) Appl. No.: **15/019,080**

(51) **Int. Cl.**

G04R 60/10 (2006.01)

G04C 9/08 (2006.01)

H01Q 1/27 (2006.01)

G04R 20/02 (2006.01)

(22) Filed: **Feb. 9, 2016**

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

CPC **G04R 60/10** (2013.01); **G04R 20/02**

(2013.01); **G04C 9/08** (2013.01); **H01Q 1/273**

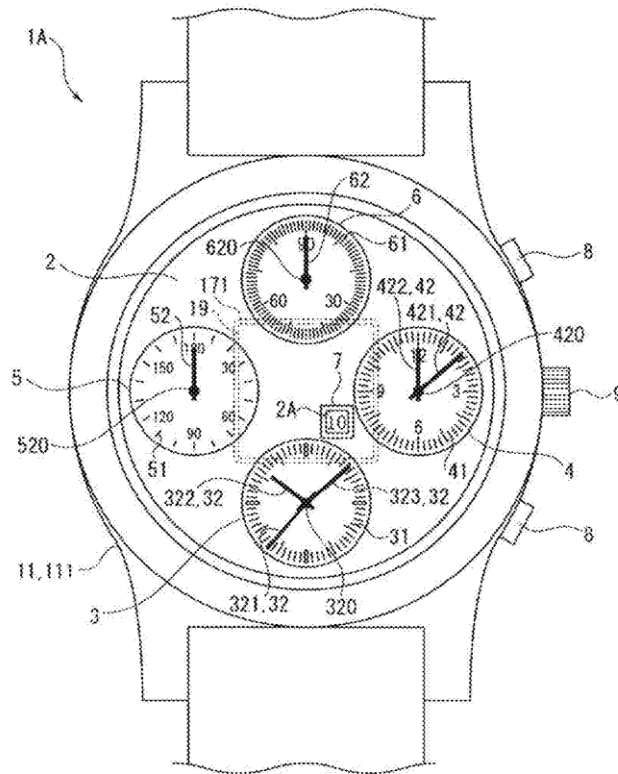
(2013.01)

Related U.S. Application Data

(63) Continuation of application No. 14/801,912, filed on Jul. 17, 2015, now Pat. No. 9,285,781, which is a continuation of application No. 14/565,457, filed on Dec. 10, 2014, now Pat. No. 9,116,512, which is a continuation of application No. 14/263,434, filed on Apr. 28, 2014, now Pat. No. 8,942,068, which is a continuation of application No. 14/033,780, filed on Sep. 23, 2013, now Pat. No. 8,755,253, which is a continuation of application No. 13/875,520, filed on May 2, 2013, now Pat. No. 8,570,840, which is a continuation of application No. 12/871,483, filed on Aug. 30, 2010, now Pat. No. 8,467,272.

(57) **ABSTRACT**

A timepiece includes a case; a movement that is housed in the case and has multiple motors that drive respective staffs disposed at different locations; a patch antenna that is disposed inside the case and at the back side of the dial; and a battery that supplies power to the motors and is disposed at a position in the case that does not overlap the patch antenna in plan view. The position at which the battery is disposed overlaps at least one of the motors in plan view.





US 20160164165A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164165 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ELECTRONIC DEVICE WITH DISPLAY
FRAME ANTENNA**

(52) **U.S. Cl.**
CPC **H01Q 1/24** (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Kelvin Kwong**, Cupertino, CA (US);
Lee E. Hooton, Cupertino, CA (US)

An electronic device has a display mounted in a housing using a plastic display frame. The display has an active area and an inactive area. A display cover layer may have polymer coating layers in the inactive area. The display frame may lie under the inactive area. A patterned metal coating layer may be formed on the display frame. The patterned metal coating layer may have portions that form adhesion promotion structures for promoting adhesion between the frame and the adhesive. The patterned metal coating layer may also have portions that form antenna structures. The antenna structures may be used to transmit and receive radio-frequency signals and may be used as adhesion promotion structures. Adhesive may be interposed between the polymer coating layers and the metal coating layer on the display frame to attach the display cover layer and the display to the display frame.

(21) Appl. No.: **15/044,763**

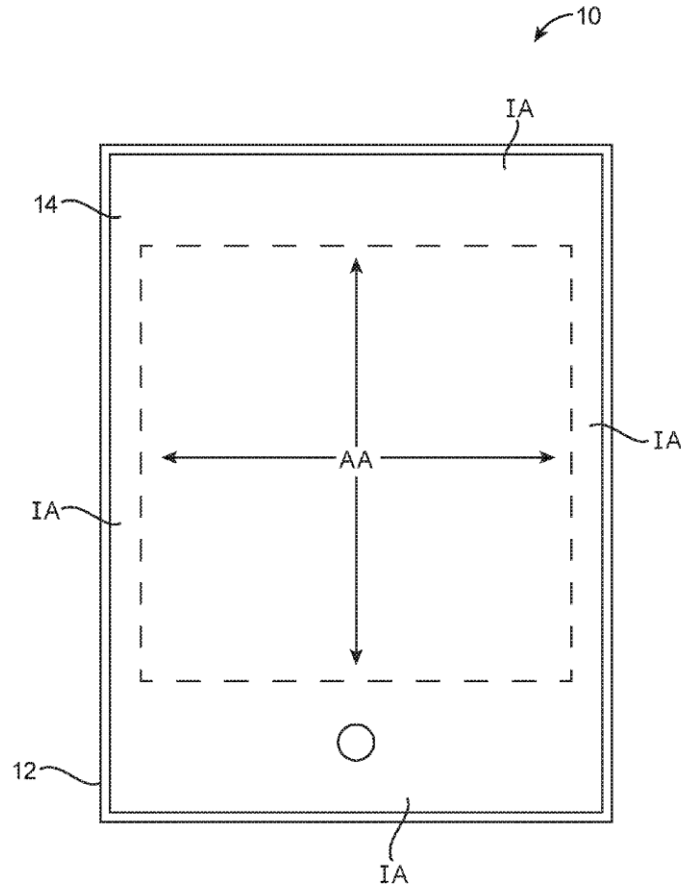
(22) Filed: **Feb. 16, 2016**

Related U.S. Application Data

(63) Continuation of application No. 14/201,501, filed on Mar. 7, 2014, now Pat. No. 9,293,806.

Publication Classification

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





US 20160164166A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164166 A1**
(43) **Pub. Date: Jun. 9, 2016**

(54) **WIRELESS COMMUNICATION DEVICE**

H01Q 5/314 (2006.01)

(71) Applicant: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)

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

H01Q 1/48 (2006.01)

(72) Inventors: **CHENG-HAN LEE**, New Taipei (TW);
WEI-XUAN YE, New Taipei (TW)

CPC *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/307* (2015.01); *H01Q 5/314* (2015.01)

(21) Appl. No.: **14/591,553**

(57) **ABSTRACT**

(22) Filed: **Jan. 7, 2015**

A wireless communication device includes a metal housing and a printed circuit board. The metal housing serves as an antenna and includes a slit separating the metal housing into a radiating body and a grounding body. The slit completely separates the radiating body from the grounding body. The printed circuit board includes a system grounding point and a radio frequency circuit. The system grounding point is electronically coupled to the grounding body. The radiating body has a first grounding point, a second grounding point and a feeding point located between the first and second points. The feeding point is electronically coupled to the radio frequency circuit. The first and second grounding points are electronically coupled to the system grounding point.

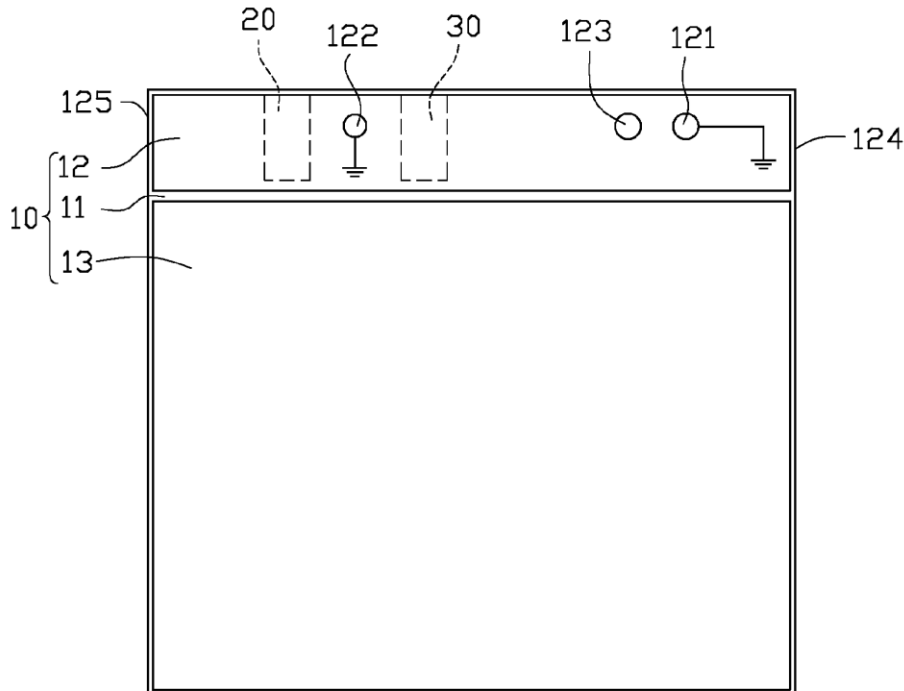
(30) **Foreign Application Priority Data**

Dec. 3, 2014 (CN) 201410721710.3

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/307 (2006.01)

100





US 20160164167A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164167 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ANTENNA MODULE AND MOBILE
TERMINAL USING THE SAME**

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

CPC **H01Q 1/24** (2013.01); **H01Q 7/00**
(2013.01); **H01Q 1/50** (2013.01)

(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)

(72) Inventors: **Hyengcheul CHOI**, Seoul (KR);
Jaehyun CHOI, Seoul (KR); **Chisang
YOU**, Seoul (KR)

(57)

ABSTRACT

(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)

(21) Appl. No.: **14/702,512**

(22) Filed: **May 1, 2015**

(30) **Foreign Application Priority Data**

Dec. 9, 2014 (KR) 10-2014-0176142

Publication Classification

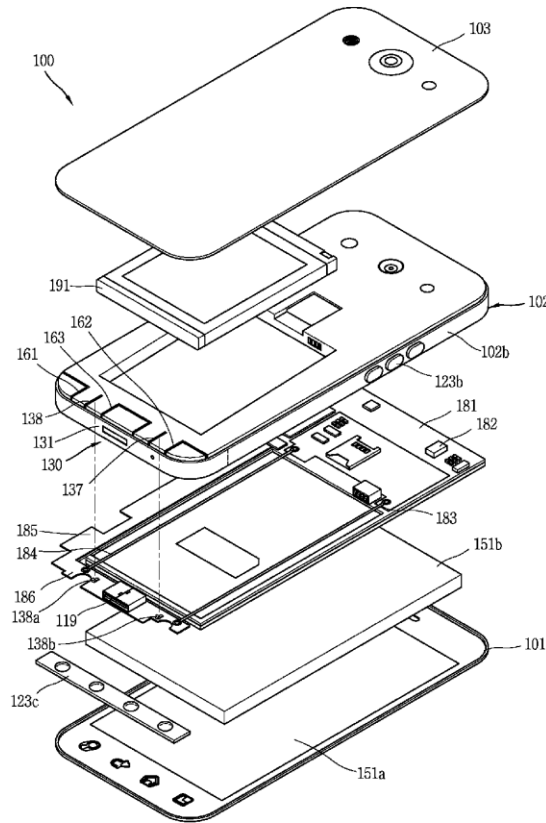
(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/50 (2006.01)

H01Q 7/00 (2006.01)

The present disclosure relates to an antenna module and a mobile terminal having the same, and the antenna module may include a conductive member, a first conductive arm formed at one side of the conductive member to form a first loop along with the conductive member so as to implement a first resonant frequency, a second conductive arm formed at the other side of the conductive member to form a second loop along with the conductive member so as to implement a second resonant frequency different from the first resonant frequency, a first feeding portion formed adjacent to the first conductive arm to feed the first conductive arm and conductive member, and a second feeding portion formed adjacent to the second conductive arm to feed the second conductive arm and conductive member.





US 20160164168A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164168 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ANTENNA MODULE AND MOBILE
TERMINAL USING THE SAME**

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

CPC *H01Q 1/243* (2013.01); *H01Q 1/50*
(2013.01); *H01Q 1/48* (2013.01)

(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)

(72) Inventors: **Jaehyun CHOI**, Seoul (KR);
Hyengcheul CHOI, Seoul (KR);
Chisang YOU, Seoul (KR)

(57)

ABSTRACT

(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)

(21) Appl. No.: **14/702,524**

(22) Filed: **May 1, 2015**

(30) **Foreign Application Priority Data**

Dec. 4, 2014 (KR) 10-2014-0173074

Publication Classification

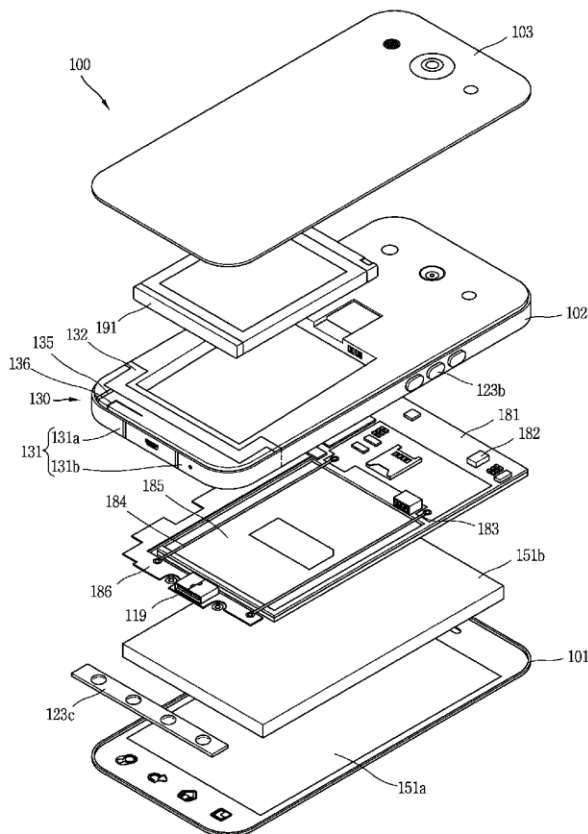
(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

H01Q 1/50 (2006.01)

The present disclosure relates to an antenna module and a mobile terminal having the same, and the antenna module may include a first conductive member connected to a feeding portion and a grounding portion, a second conductive member disposed to be separated from the first conductive member, a first connecting member configured to connect the first conductive member to the second conductive member at a position adjacent to the feeding portion, and a second connecting member configured to connect the first conductive member to the second conductive member at a position adjacent to the grounding portion, wherein a slit is formed on the first conductive member, and the slit is formed between the feeding portion and the grounding portion.





US 20160164176A1

(19) **United States**

(12) **Patent Application Publication**
Shimura

(10) **Pub. No.: US 2016/0164176 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **MULTI-BAND ANTENNA**

Publication Classification

(71) Applicant: **CANON KABUSHIKI KAISHA,**
Tokyo (JP)

(51) **Int. Cl.**
H01Q 5/10 (2006.01)
H01Q 1/12 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventor: **Hajime Shimura,** Tokyo (JP)

(52) **U.S. Cl.**
CPC . *H01Q 5/10* (2015.01); *H01Q 9/04* (2013.01);
H01Q 1/12 (2013.01)

(21) Appl. No.: **15/045,915**

(57) **ABSTRACT**

(22) Filed: **Feb. 17, 2016**

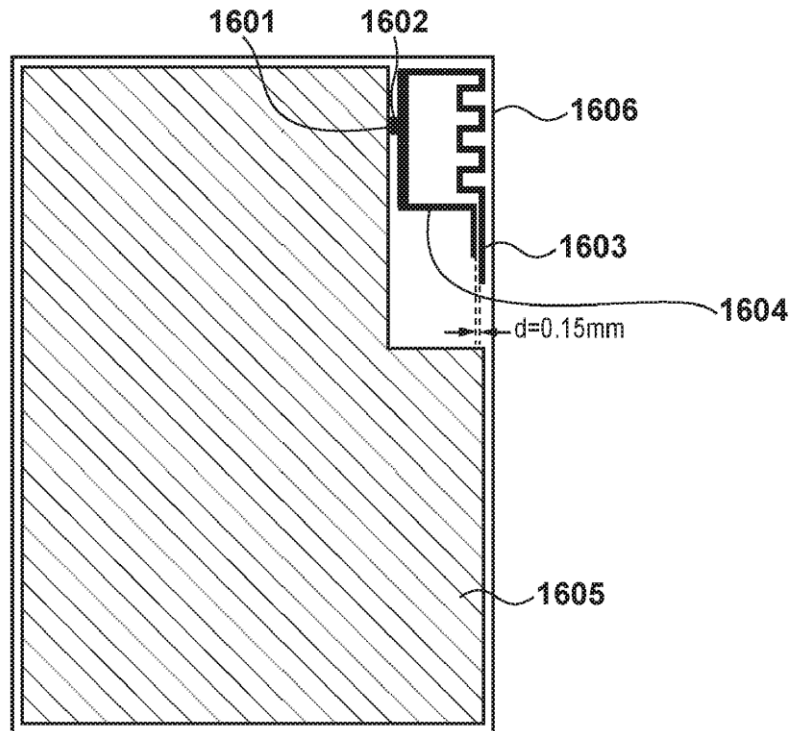
An antenna which operates in a plurality of frequency bands includes a feeding point, a first conductor which is connected to the feeding point, and at least two second conductors which are branched from the first conductor, have a linear shape, and include open ends as ends on a side opposite to the first conductor. The open ends of the two second conductors face in almost the same direction substantially parallel to a side closest to the feeding point out of the sides of an antenna region. The two second conductors include a part at which the distance between the two conductors at a portion parallel to the side is a first distance, and another part at which the distance is a second distance shorter than the first distance, and are electromagnetically coupled at, at least the other part.

Related U.S. Application Data

(63) Continuation of application No. 13/951,815, filed on Jul. 26, 2013, now Pat. No. 9,287,621.

(30) **Foreign Application Priority Data**

Aug. 8, 2012 (JP) 2012-176372
May 17, 2013 (JP) 2013-105627





US 20160164177A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164177 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **WIDEBAND ANTENNA**

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

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

CPC **H01Q 5/378** (2015.01); **H01Q 9/045** (2013.01)

(72) Inventors: **Chung-Hsuan Chen**, Hsinchu (TW);
Kuan-Chung Chen, Hsinchu (TW);
Yung-Jen Cheng, Hsinchu (TW)

(57) **ABSTRACT**

(21) Appl. No.: **14/874,484**

(22) Filed: **Oct. 5, 2015**

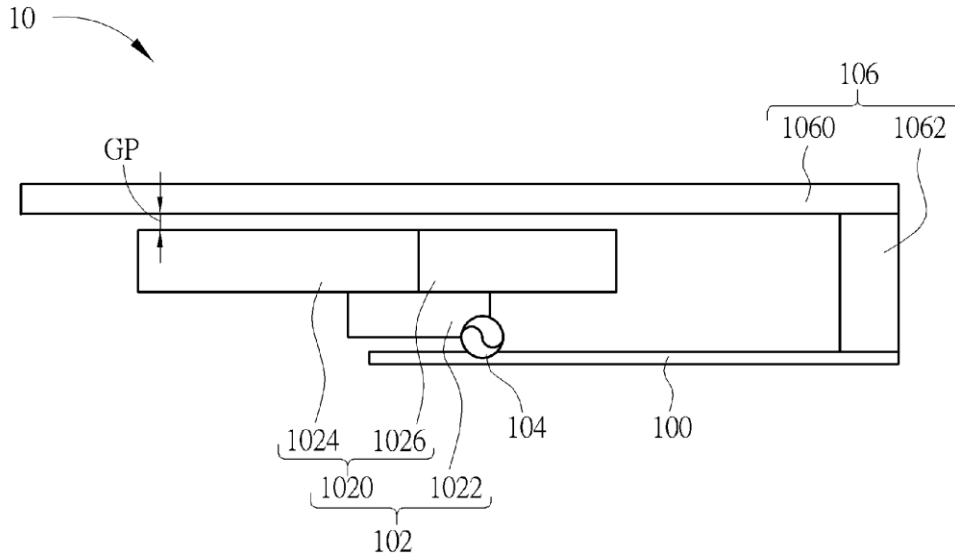
(30) **Foreign Application Priority Data**

Dec. 4, 2014 (TW) 103221506

Publication Classification

(51) **Int. Cl.**
H01Q 5/378 (2006.01)
H01Q 9/04 (2006.01)

A wideband antenna includes a grounding terminal, a first radiator disposed on a first plane, a feeding terminal formed on the first radiator, where the feeding terminal is to transmit and receive radio signals via the first radiator, and a second radiator disposed on the first plane, electrically connected to the grounding terminal, and including a part parallel to a side of the first radiator, wherein a minimum gap between the second radiator and the first radiator allows the second radiator and the first radiator to generate a coupling effect therebetween, so as to exchange radio signals between the second radiator and the first radiator.





US 20160164179A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164179 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ANTENNA GROUND PLANE EXTENSION OR ANTENNA EXTENSION ON LANYARD**

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

CPC . **H01Q 9/04** (2013.01); **H01Q 1/12** (2013.01); **H01Q 1/48** (2013.01)

(71) Applicants: **Ken Margon**, Oakland, CA (US);
Pragash Sangaran, Oakland, CA (US)

(57)

ABSTRACT

(72) Inventors: **Ken Margon**, Oakland, CA (US);
Pragash Sangaran, Oakland, CA (US)

The present invention provides a technique to optimize and/or extend the length of an antenna arm or antenna ground plane for communications components contained in a printed circuit board (PCB) within a communications device. In an embodiment of the invention, an antenna arm or ground plane extension is provided as part of a lanyard for holding the communications device. For example, the lanyard comprises a cord passed around the neck, shoulder, or wrist. The cord comprises an electrical conductor coupled to the communications components. The electrical conductor serves as the antenna arm or ground plane. The length of the PCB need not to be extended to improve antenna efficiency and gain. Ideally, the lanyard antenna extension is ideally coplanar with the PCB. Careful lanyard material selection determines the most efficient and practical wavelength or resonance length of the antenna.

(21) Appl. No.: **14/860,699**

(22) Filed: **Sep. 21, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/052,823, filed on Sep. 19, 2014.

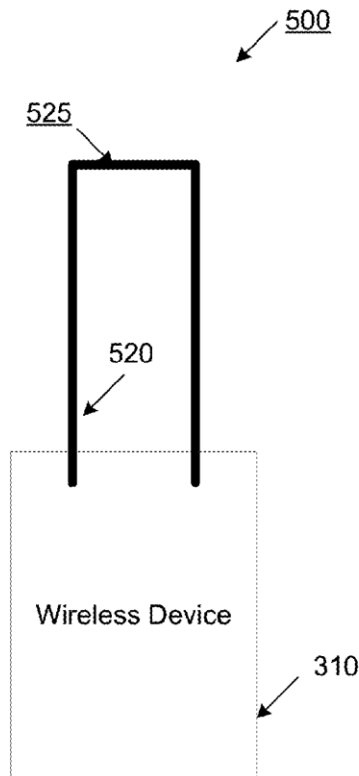
Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 1/48 (2006.01)

H01Q 1/12 (2006.01)





US 20160164180A1

(19) **United States**

(12) **Patent Application Publication**
SUH

(10) **Pub. No.: US 2016/0164180 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ELECTRONIC DEVICE WITH PIFA TYPE ANTENNA AND WIRELESS SIGNAL TRANSMITTING/RECEIVING DEVICE THEREOF**

(52) **U.S. Cl.**
CPC *H01Q 9/0407* (2013.01); *H04B 1/44* (2013.01); *H01Q 1/48* (2013.01)

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si, Gyeonggi-do (KR)

(57) **ABSTRACT**

(72) Inventor: **Younghoon SUH**, Yongin-si (KR)

(21) Appl. No.: **14/908,406**

(22) PCT Filed: **Sep. 26, 2014**

(86) PCT No.: **PCT/KR2014/008998**

§ 371 (c)(1),

(2) Date: **Jan. 28, 2016**

(30) **Foreign Application Priority Data**

Sep. 30, 2013 (KR) 10-2013-0116971

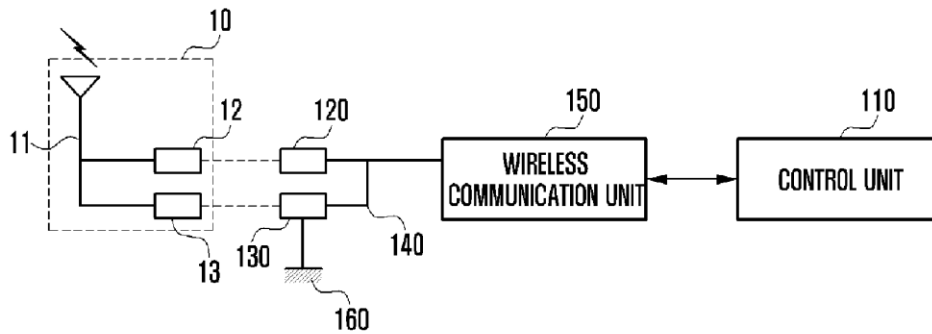
Oct. 14, 2013 (KR) 10-2013-0122254

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)
H04B 1/44 (2006.01)

Various exemplary embodiments of the present disclosure relate to an electronic device with a Planar Inverted-F Antenna (PIFA) type antenna and a wireless signal transmitting/receiving device of the electronic device. The electronic device may include: a PIFA (Planar Inverted-F Antenna) type antenna which is transmitting or receiving a wireless signal; a wireless communication unit which is processing the transmitted or received wireless signal; a printed circuit board which is mounted with the wireless communication unit and includes a ground area; a power feeding pad which is electrically connected with a signal transmitting/receiving terminal of the wireless communication unit, and connected with a power feeding section of the PIFA type antenna when the PIFA type antenna is equipped in the electronic device; a ground pad which is electrically connected with the ground area, and connected with a ground section of the PIFA type antenna when the PIFA type antenna is equipped in the electronic device; and a connection section which forms an electric route between the power feeding pad and the ground pad. Meanwhile, various exemplary embodiments may be made based on a technical idea of the present disclosure.

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US 20160164181A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0164181 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **MULTI-BAND ANTENNA**

Publication Classification

(71) Applicant: **PEGATRON CORPORATION,**
TAIPEI CITY (TW)

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/38 (2006.01)

(72) Inventors: **Chin-Ting Huang,** TAIPEI CITY (TW);
Hsiao-Wen Wu, TAIPEI CITY (TW)

(52) **U.S. Cl.**
CPC **H01Q 9/0407** (2013.01); **H01Q 1/38**
(2013.01)

(21) Appl. No.: **14/958,618**

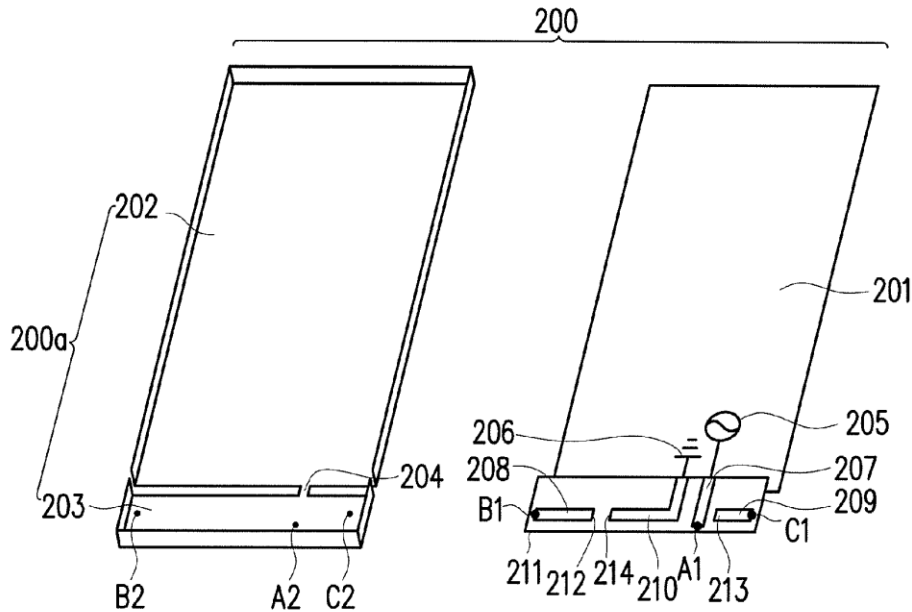
(57) **ABSTRACT**

A multi-band antenna includes a conductive cap, a ground plane element, a supporting frame, a first radiating conductive element, a second radiating conductive element, a third radiating conductive element, and a plurality of conductive pieces. The multi-band antenna of the disclosure makes the radiating conductive element contact with the conductive cap physically via the conductive piece. Therefore, although a gap similar to a slot is formed, the resonant mode of the multi-band antenna is not excited via the slot.

(22) Filed: **Dec. 3, 2015**

(30) **Foreign Application Priority Data**

Dec. 9, 2014 (TW) 103142817





US 20160164183A1

(19) **United States**

(12) **Patent Application Publication**
Azad

(10) **Pub. No.: US 2016/0164183 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **WIDE BAND ANTENNA**

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

CPC . *H01Q 9/30* (2013.01); *H01Q 1/24* (2013.01)

(71) Applicant: **Wistron Corporation**, New Taipei City (TW)

(57)

ABSTRACT

(72) Inventor: **Mohammed Ziaul Azad**, Rolling Meadows, IL (US)

A wide band antenna for interfacing an electronic device with a plurality of radio access technologies is provided. The antenna includes a first resonator and a second resonator. Both the first resonator and the second resonator are attached to an antenna feed structure. The length of the first resonator provides one mode of operation of the antenna, and the length of the second resonator provides a second mode of operation of the antenna. And a third mode of operation of the antenna is provided by mutual coupling and current flow between both the first resonator and the second resonator.

(21) Appl. No.: **14/560,677**

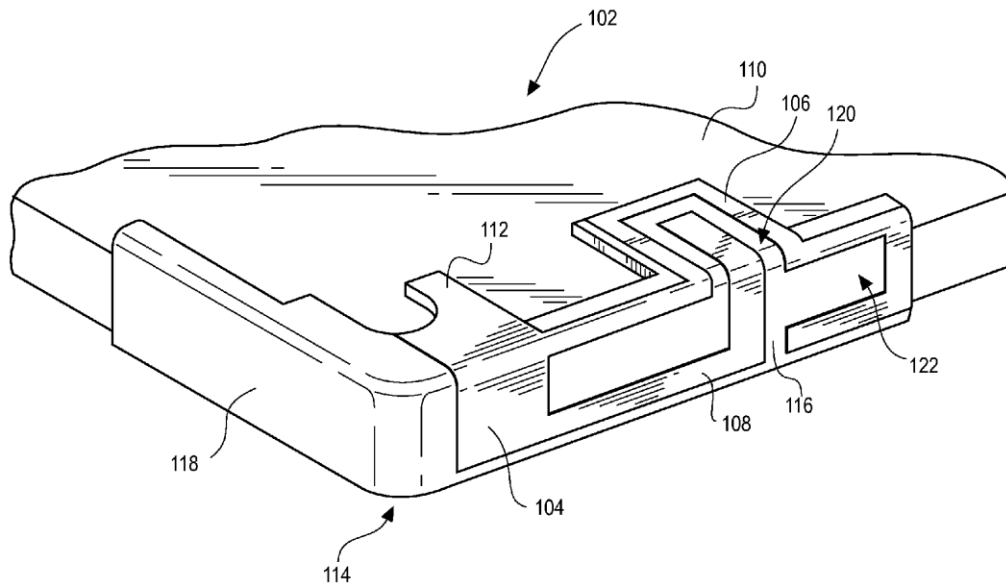
(22) Filed: **Dec. 4, 2014**

Publication Classification

(51) **Int. Cl.**

H01Q 9/30 (2006.01)

H01Q 1/24 (2006.01)





US 20160164192A1

(19) **United States**

(12) **Patent Application Publication**
LIN

(10) **Pub. No.: US 2016/0164192 A1**

(43) **Pub. Date: Jun. 9, 2016**

(54) **ANTENNA ASSEMBLY AND WIRELESS COMMUNICATION DEVICE EMPLOYING SAME**

(52) **U.S. Cl.**
CPC *H01Q 21/30* (2013.01); *H01Q 5/314* (2015.01); *H01Q 1/38* (2013.01)

(71) Applicant: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)

(57) **ABSTRACT**

(72) Inventor: **YEN-HUI LIN**, New Taipei (TW)

(21) Appl. No.: **14/677,748**

(22) Filed: **Apr. 2, 2015**

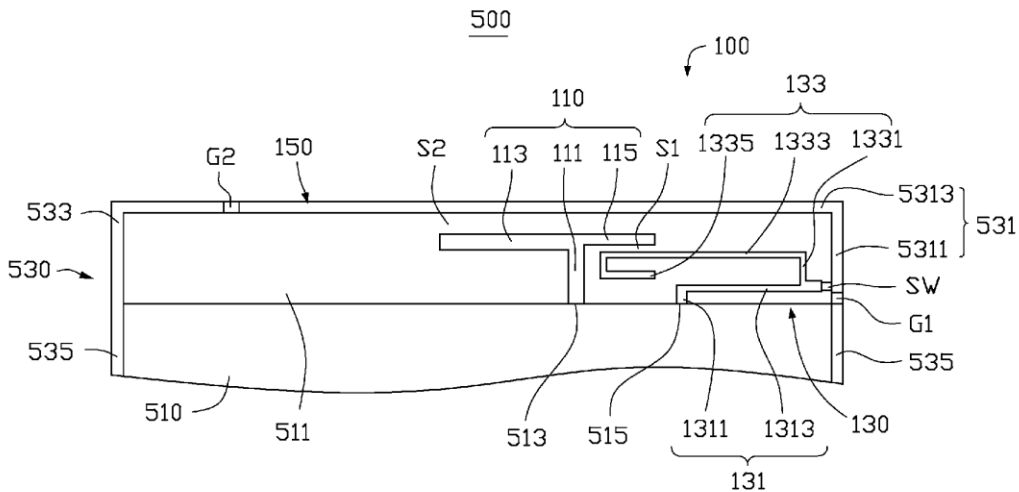
(30) **Foreign Application Priority Data**

Dec. 5, 2014 (CN) 201410730629.1

Publication Classification

(51) **Int. Cl.**
H01Q 21/30 (2006.01)
H01Q 1/38 (2006.01)
H01Q 5/314 (2006.01)

An antenna assembly includes a first radiating portion, a second radiating portion, a third radiating portion, and a switch circuit. The switch circuit is electrically connected between the second radiating portion and the third radiating portion. The switch circuit includes a plurality of branch circuit with different impedances. The first radiating portion and the second radiating portion are electrically coupled and configured to operate at a first frequency band; the first radiating portion, the third radiating portion, the switch circuit, and the second radiating portion are electrically coupled and configured to operate at a second frequency band; the switch circuit is configured to adjust a resonance mode of the antenna assembly by switching to different impedances. A wireless communication device employing the antenna assembly is also provided.





US 20160172749A1

(19) **United States**

(12) **Patent Application Publication**
Heng

(10) **Pub. No.: US 2016/0172749 A1**

(43) **Pub. Date: Jun. 16, 2016**

(54) **HYBRID ANTENNA AND INTEGRATED PROXIMITY SENSOR USING A SHARED CONDUCTIVE STRUCTURE**

Publication Classification

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/24 (2006.01)
(52) **U.S. Cl.**
CPC ... *H01Q 1/52* (2013.01); *H01Q 1/24* (2013.01)

(71) Applicant: **Ethertronics, Inc.**, San Diego, CA (US)

(72) Inventor: **Chew Chwee Heng**, Singapore (SG)

(73) Assignee: **Ethertronics, Inc.**, San Diego, CA (US)

(21) Appl. No.: **14/968,893**

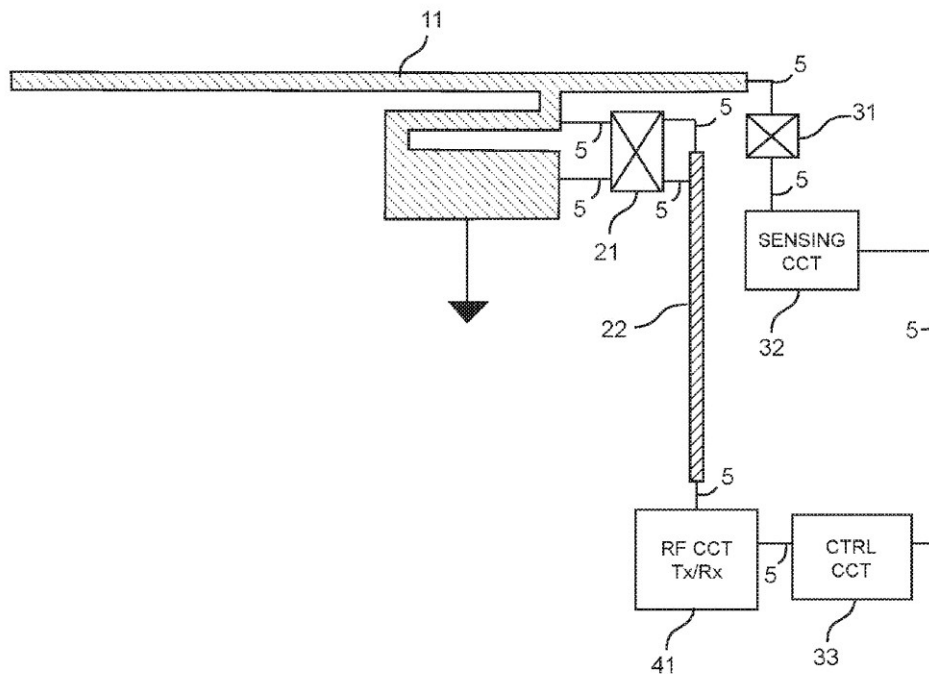
(57) **ABSTRACT**

(22) Filed: **Dec. 14, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/090,887, filed on Dec. 12, 2014.

A hybrid antenna and integrated proximity sensor is described wherein a commonly shared conductive structure is used for both antenna functions as well as a proximity sensor functions.





US 20160172753A1

(19) **United States**

(12) **Patent Application Publication**
Tai

(10) **Pub. No.: US 2016/0172753 A1**

(43) **Pub. Date: Jun. 16, 2016**

(54) **ANTENNA GROUND AND FEED SWAPPING IN HANDHELD APPLICATIONS**

(52) **U.S. CL.**

CPC **H01Q 3/24** (2013.01)

(71) Applicant: **MediaTek Inc.**, Hsinchu (TW)

(57) **ABSTRACT**

(72) Inventor: **Chen-Fang Tai**, New Taipei (TW)

Examples of techniques for antenna ground and feed swapping in handheld applications are described. A condition with respect to wireless communication of a handheld apparatus having one or more antennas may be detected in determining whether to operate the handheld apparatus in a first mode or a second mode of wireless communication. In response to a determination to operate the handheld apparatus in the first mode, a first feeding port and one or more first shorting ports may be electrically connected to at least one antenna of the one or more antennas each disposed adjacent a first distal end of the handheld apparatus. Alternatively, in response to a determination to operate the handheld apparatus in the second mode, a second feeding port and one or more second shorting ports may be electrically connected to at least one antenna or another antenna of the one or more antennas.

(21) Appl. No.: **15/051,880**

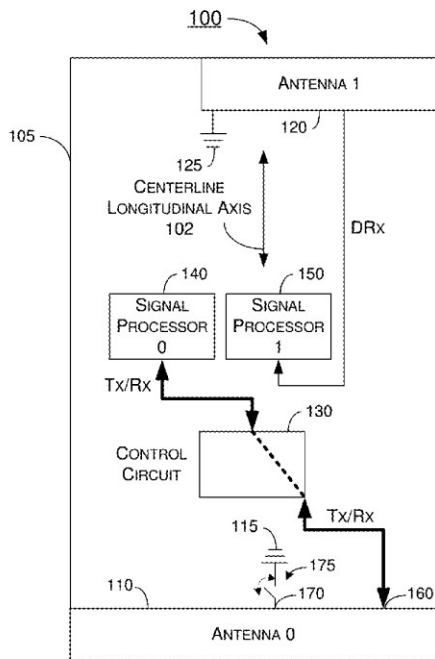
(22) Filed: **Feb. 24, 2016**

Related U.S. Application Data

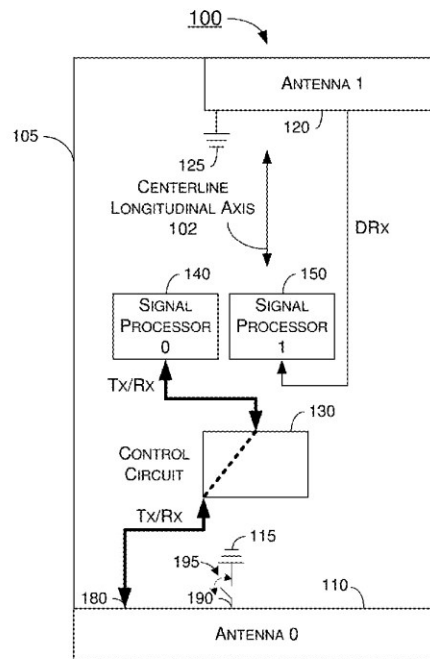
(60) Provisional application No. 62/130,814, filed on Mar. 10, 2015.

Publication Classification

(51) **Int. Cl.**
H01Q 3/24 (2006.01)



(A)



(B)



US 20160172758A1

(19) **United States**

(12) **Patent Application Publication**
PUENTE BALIARDA et al.

(10) **Pub. No.: US 2016/0172758 A1**

(43) **Pub. Date: Jun. 16, 2016**

(54) **COUPLED MULTIBAND ANTENNAS**

Publication Classification

(71) Applicant: **Fractus, S.A.**, Barcelona (ES)

(51) **Int. Cl.**
H01Q 5/10 (2006.01)

(72) Inventors: **Carles PUENTE BALIARDA**, Sant Cugat del Valles (Barcelona) (ES);
Jaume ANGUERA PROS, Vinaros (Castellon) (ES); **Jordi SOLER CASTANY**, Mataro (Barcelona) (ES);
Antonio CONDES MARTINEZ, Esplugues de Llobregat (Barcelona) (ES)

H01Q 9/30 (2006.01)

(52) **U.S. Cl.**
CPC ... **H01Q 5/10** (2015.01); **H01Q 9/30** (2013.01)

(57) **ABSTRACT**

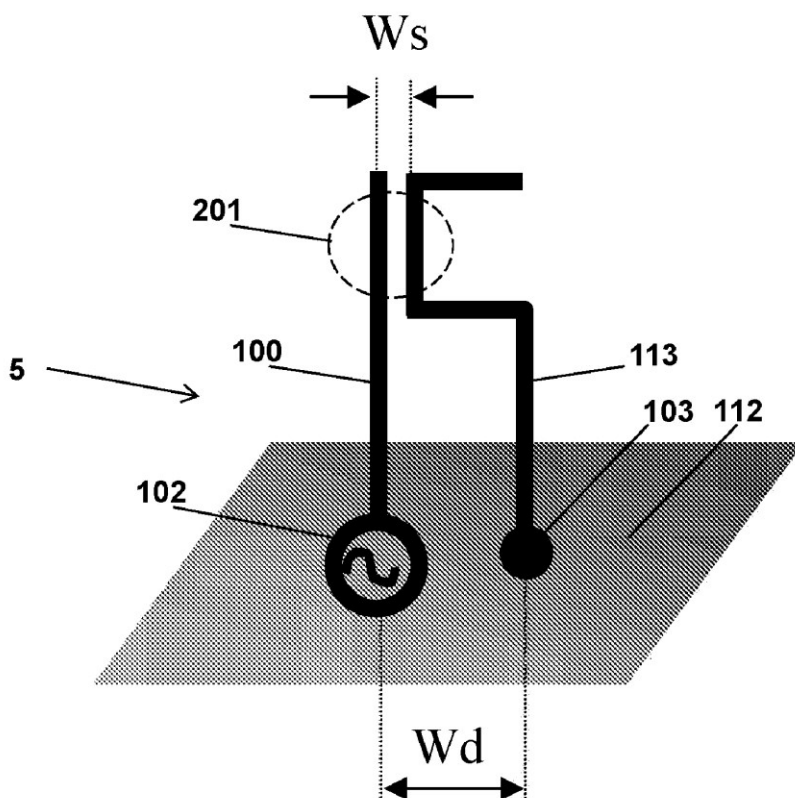
(21) Appl. No.: **15/050,037**

An antenna includes at least two radiating arm structures made of or limited by a conductor, superconductor or semiconductor material. The two arms are coupled through a region on first and second superconducting arms such that the combined structure forms a small antenna with broadband behavior, multiband behavior or a combination thereof. The coupling between the two radiating arms is obtained via the shape and spatial arrangement thereof, in which at least one portion on each arm is placed in close proximity to each other (e.g., at a distance smaller than $1/10$ of the longest free-space operating wavelength) to allow electromagnetic fields in one arm to be transferred to the other through close proximity regions. The proximity regions are spaced from the feeding port of the antenna (e.g., greater than $1/40$ of the free-space longest operating wavelength) and specifically exclude the feeding port of the antenna.

(22) Filed: **Feb. 22, 2016**

Related U.S. Application Data

(60) Division of application No. 14/627,785, filed on Feb. 20, 2015, which is a continuation of application No. 11/950,835, filed on Dec. 5, 2007, now Pat. No. 8,994,604, which is a continuation of application No. 11/075,980, filed on Mar. 9, 2005, now Pat. No. 7,315,289, which is a continuation of application No. PCT/EP02/11355, filed on Sep. 10, 2002.





US 20160172768A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0172768 A1**

(43) **Pub. Date: Jun. 16, 2016**

(54) **METHOD FOR CLOSED-LOOP TUNER IN A RECEIVER ANTENNA**

Publication Classification

(71) Applicants: **Saku Lahti**, Tampere (FI); **Jukka Leppanen**, Pirkkala (FI); **Mikko S. Komulainen**, Tampere (FI)

(51) **Int. Cl.**
H01Q 23/00 (2006.01)
H04B 17/21 (2006.01)

(72) Inventors: **Saku Lahti**, Tampere (FI); **Jukka Leppanen**, Pirkkala (FI); **Mikko S. Komulainen**, Tampere (FI)

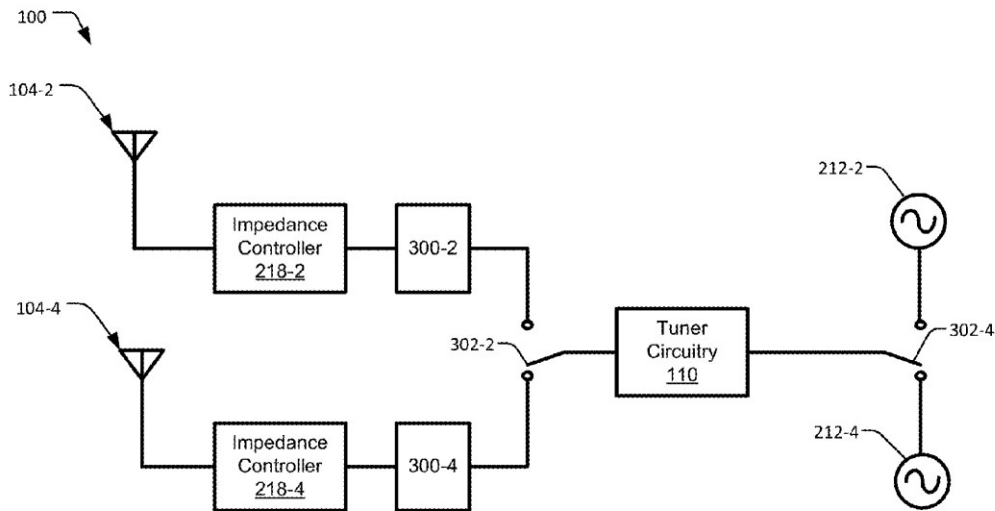
(52) **U.S. Cl.**
CPC **H01Q 23/00** (2013.01); **H04B 17/21** (2015.01)

(21) Appl. No.: **14/569,116**

(57) **ABSTRACT**

Described herein are architectures, platforms and methods for implementing a closed-loop tuner in a receiver circuitry of a portable device. For example, the closed-loop tuner is based upon a configured or an inherent local oscillator (LO) leakage power in the receiver circuitry of the portable device.

(22) Filed: **Dec. 12, 2014**





US 20160173172A1

(19) **United States**

(12) **Patent Application Publication**
Greene

(10) **Pub. No.: US 2016/0173172 A1**

(43) **Pub. Date: Jun. 16, 2016**

(54) **METHOD AND APPARATUS FOR ANTENNA SELECTION**

(71) Applicant: **BlackBerry Limited**, Waterloo (CA)

(72) Inventor: **Matthew Russell Greene**, Crystal Lake, IL (US)

(21) Appl. No.: **14/571,928**

(22) Filed: **Dec. 16, 2014**

(52) **U.S. CL.**

CPC **H04B 7/0404** (2013.01); **H01Q 21/0006** (2013.01); **H03H 7/40** (2013.01); **H04W 24/10** (2013.01); **H04B 7/0608** (2013.01); **H04B 7/0802** (2013.01)

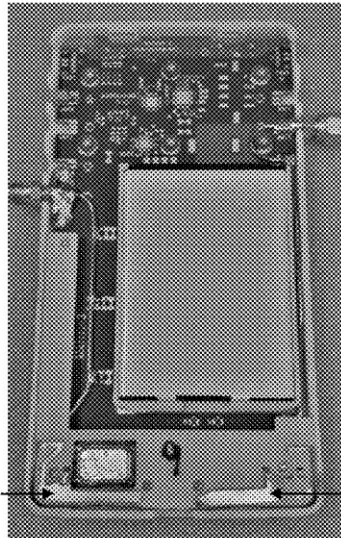
(57) **ABSTRACT**

A system that incorporates teachings of the subject disclosure may include, for example, an antenna system coupled with the transceiver that includes a first antenna and a second antenna where one of the first or second antennas is operating as a primary antenna and the other of the first or second antennas is operating as a diversity antenna. The system can include an RF switch connected with the antenna system, where the RF switch has a first position in which the first antenna is the primary antenna and the second antenna is the diversity antenna, and wherein the RF switch has a second position in which the second antenna is the primary antenna and the first antenna is the diversity antenna. The system can include a controller coupled with the matching network and with the RF switch, where the controller receives first reflection measurements associated with the antenna system, and where the controller adjusts the RF switch to select between the first and second positions according to the first reflection measurements.

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Diversity Antenna

Main Antenna



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(54) **USER DEVICE AND OPERATING METHOD THEREFOR**

Publication Classification

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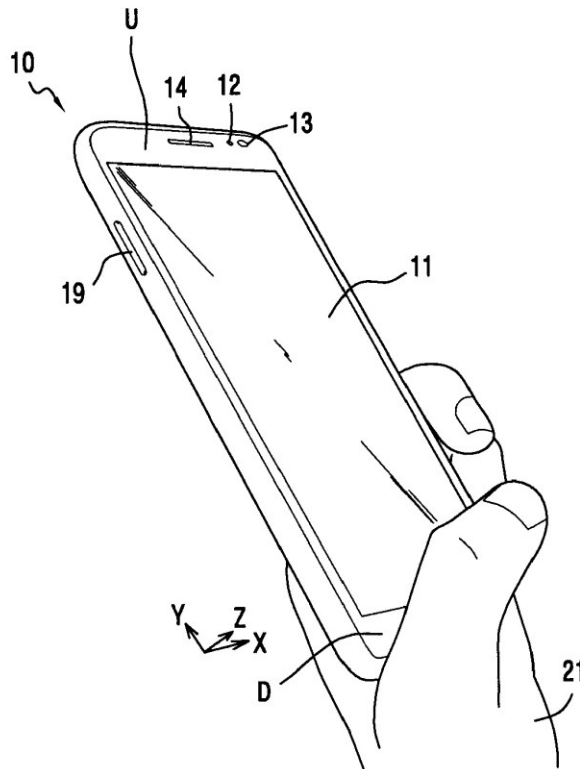
(2) Date: **Jan. 25, 2016**

(57) **ABSTRACT**

An electronic device according to one embodiment of the present disclosure may include a plurality of antennas for transmitting and receiving radio waves, at least one sensor for sensing a physical quantity or physical changes, a sensor hub for outputting a control signal in response to an output from the at least one sensor, and a communication module for controlling wireless communication using the plurality of antennas in response to the control signal. Various other exemplary embodiments are possible.

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(54) **HYBRID ANTENNA FOR PORTABLE RADIO COMMUNICATION DEVICES**

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(57)

ABSTRACT

A hybrid antenna structure allows the antenna to be used internally or mostly internally in a portable radio communication device operating in the VHF range. The hybrid antenna structure includes a switching circuit that connects an RF circuit to one of several points along the length of a wrapped conductor element, depending on the selected operating frequency. An inductive matching tail element is adjustably tuned to match the selected tap point on the wrapped conductor for the selected operating frequency.

(21) Appl. No.: **14/570,271**

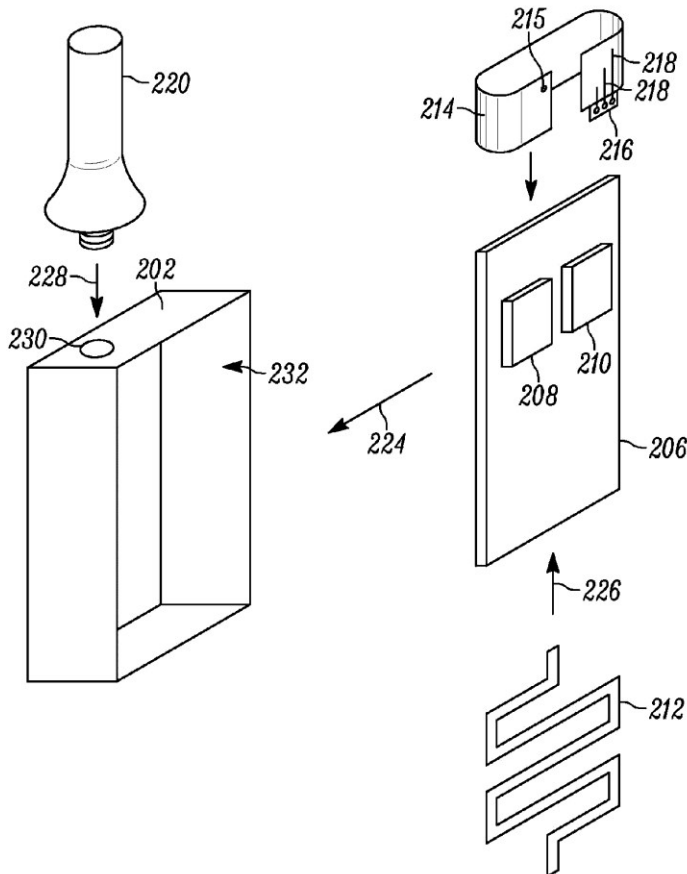
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