

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

(43) **Pub. Date:** **May 18, 2017**

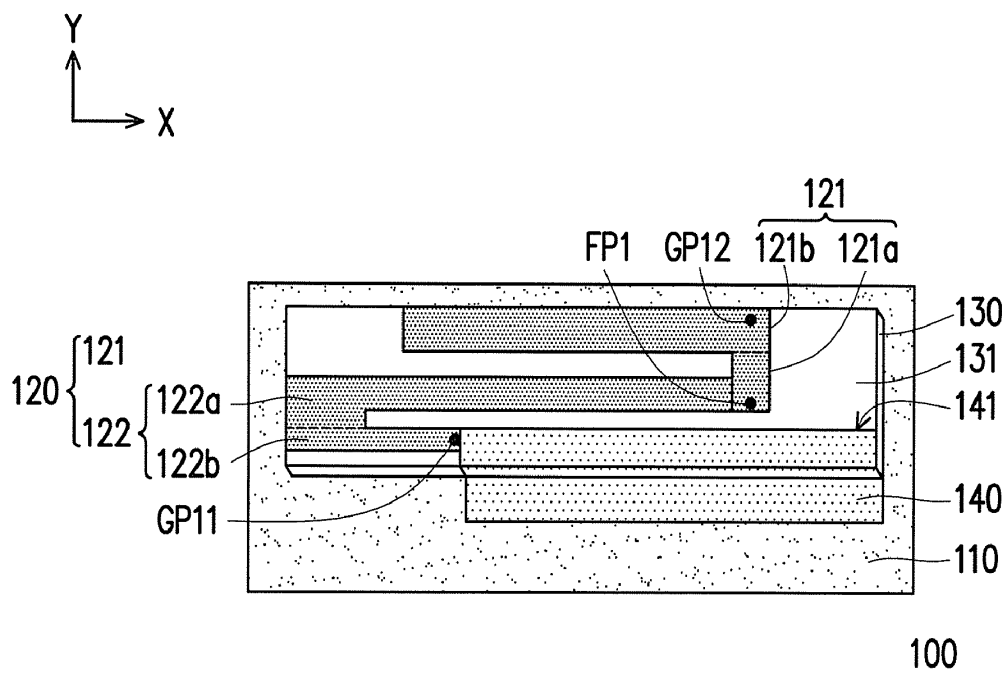
CPC *H01Q 1/22* (2013.01); *H01Q 9/0421*
(2013.01); *H01Q 1/528* (2013.01); *H01Q*
9/0414 (2013.01)

(57) **ABSTRACT**

Nov. 13, 2015 (TW) 104137449

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/52 (2006.01)
H01Q 9/04 (2006.01)

An electronic device including a metal element and an antenna element is provided. The antenna element is disposed on a substrate and includes a radiation portion and a connection portion. A first end of the radiation portion has a feeding point for receiving a feeding signal, and a second end of the radiation portion is an open end. A first end of the connection portion is electrically connected to the first end of the radiation portion. A second end of the connecting portion has a first ground point to be electrically connected the metal element. An orthogonal projection of the metal element on the substrate and an orthogonal projection of the antenna element on the substrate are overlapped with each other. The radiation portion is electrically connected the metal element through a second ground point.





US 20170141458A1

(19) **United States**

(12) **Patent Application Publication**
KWON

(10) **Pub. No.: US 2017/0141458 A1**

(43) **Pub. Date: May 18, 2017**

(54) **ANTENNA, MANUFACTURING PROCESS
THEREOF AND ELECTRONIC DEVICE
USING THE ANTENNA**

1/1637 (2013.01); *H01Q 7/00* (2013.01);
H02J 7/025 (2013.01); *H04W 88/06* (2013.01)

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

(57) **ABSTRACT**

(72) Inventor: **Chunbae KWON**, Gyeonggi-do (KR)

(21) Appl. No.: **15/353,918**

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

(30) **Foreign Application Priority Data**

Nov. 17, 2015 (KR) 10-2015-0161353

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 7/00 (2006.01)

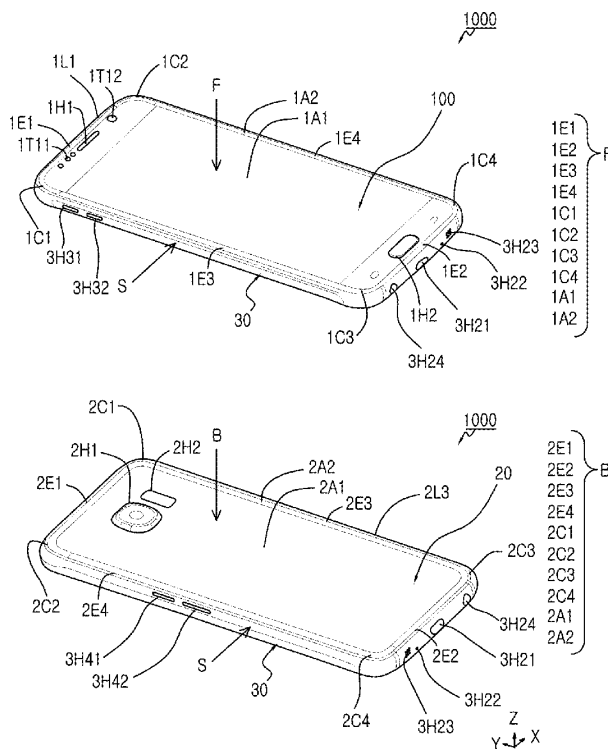
H02J 7/02 (2006.01)

G06F 1/16 (2006.01)

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

CPC *H01Q 1/241* (2013.01); *G06F 1/1626*
(2013.01); *G06F 1/1635* (2013.01); *G06F*

According to an exemplary embodiment of the present disclosure, an electronic device may include a housing having a first side facing a first direction, and a second side facing a second direction opposite to the first direction, a communication circuit disposed inside the housing, a display exposed through the first side of the housing, a conductive plate formed adjacent to the second side of the housing, a conductive coil formed inside the conductive plate when viewed from a top of the second side, and having a plurality of turns electrically connected to the communication circuit, a first non-conductive material formed inside the conductive plate when viewed from the top of the second side, and disposed at least partially between the conductive plate and the conductive coil and/or between the plurality of turns of the conductive coil, and a second non-conductive material for forming at least one part of the second side, and covering the conductive plate, the conductive coil, and the first non-conductive material. Various other exemplary embodiments are also possible.





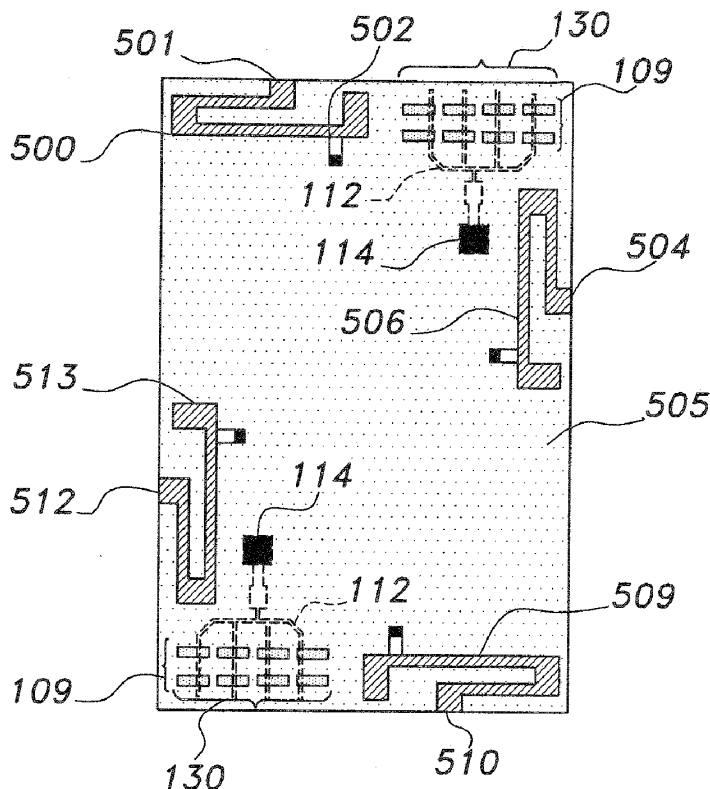
US 20170141465A1

(19) **United States**(12) **Patent Application Publication**
SHARAWI(10) **Pub. No.: US 2017/0141465 A1**(43) **Pub. Date: May 18, 2017**(54) **INTEGRATED MICROWAVE-MILLIMETER
WAVE ANTENNA SYSTEM WITH
ISOLATION ENHANCEMENT MECHANISM**(71) Applicant: **KING FAHD UNIVERSITY OF
PETROLEUM AND MINERALS,**
DHAHRAN (SA)(72) Inventor: **MOHAMMAD S. SHARAWI,**
DHAHRAN (SA)(21) Appl. No.: **14/940,105**(22) Filed: **Nov. 12, 2015****Publication Classification**(51) **Int. Cl.**
H01Q 5/20 (2006.01)
H01Q 1/48 (2006.01)
H01Q 21/30 (2006.01)
H01Q 5/50 (2006.01)
H01Q 9/04 (2006.01)
H01Q 13/10 (2006.01)
H01Q 1/12 (2006.01)
H01Q 1/50 (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/20** (2015.01); **H01Q 1/12**
(2013.01); **H01Q 1/48** (2013.01); **H01Q 1/50**
(2013.01); **H01Q 5/50** (2015.01); **H01Q 9/04**
(2013.01); **H01Q 13/10** (2013.01); **H01Q**
21/30 (2013.01)

(57)

ABSTRACT

The integrated microwave-millimeter wave antenna system with isolation enhancement mechanism is a planar, compact, multi-band microwave multiple-input-multiple-output (MIMO) antenna system integrated with a millimeter wave antenna array. The microwave MIMO antenna system covers multiple standards between (700-6000) MHz, while the millimeter wave array covers a wider bandwidth of at least 1 GHz with a center frequency ranging from 28-38 GHz. The millimeter wave antenna array is based on slot antenna elements and acts as an isolation enhancement structure to the microwave MIMO antenna system. It acts as a defected ground structure that improves port isolation of the MIMO antenna system. This dual functionality within a small form factor wireless device is highly desirable, as space is very limited. The system is for beyond 4G wireless standards.





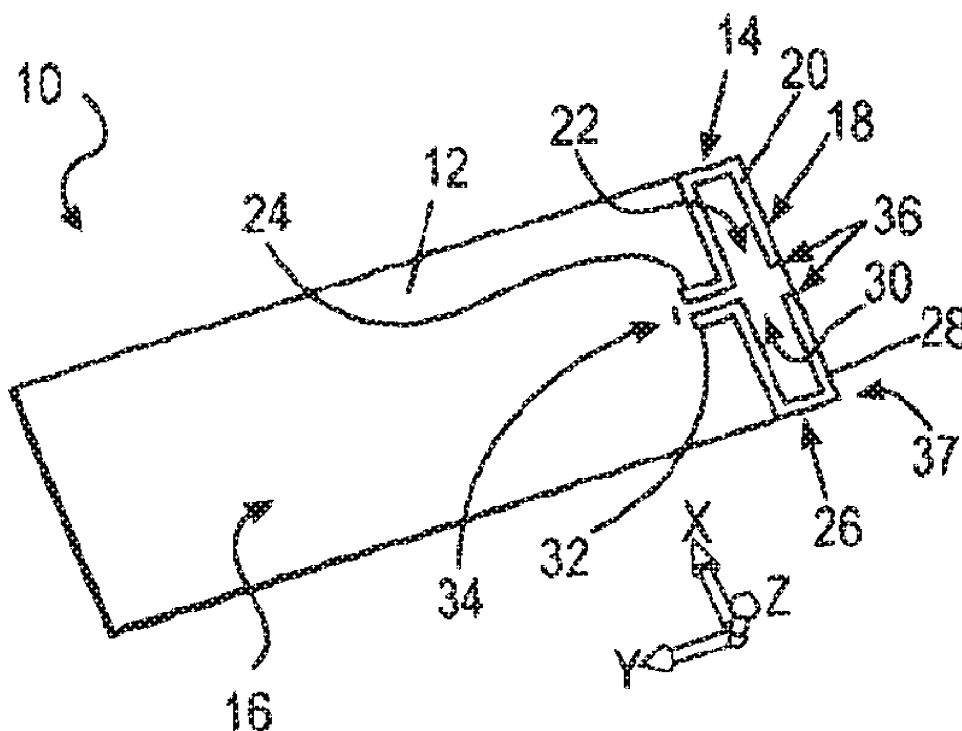
US 20170141468A1

(19) **United States**(12) **Patent Application Publication****Hu et al.**(10) **Pub. No.: US 2017/0141468 A1**(43) **Pub. Date: May 18, 2017**(54) **BALANCED ANTENNA SYSTEM****Publication Classification**(71) Applicant: **SMART ANTENNA TECHNOLOGIES LTD**, Birmingham (GB)(51) **Int. Cl.**
H01Q 5/335 (2006.01)
H01Q 21/28 (2006.01)
H01Q 21/00 (2006.01)(72) Inventors: **Zhen Hua Sampson Hu**, Heshan City (CN); **Peter Hall**, Birmingham (GB)(52) **U.S. Cl.**
CPC **H01Q 5/335** (2015.01); **H01Q 21/0006** (2013.01); **H01Q 21/28** (2013.01)(21) Appl. No.: **15/366,170**(57) **ABSTRACT**(22) Filed: **Dec. 1, 2016****Related U.S. Application Data**

(63) Continuation of application No. 13/990,189, filed on Jul. 26, 2013, now Pat. No. 9,553,361, filed as application No. PCT/GB2011/001598 on Nov. 11, 2011.

(30) **Foreign Application Priority Data**Nov. 29, 2010 (GB) 1020202.6
May 19, 2011 (GB) 1108456.3

The invention relates to a balanced antenna system comprising a radiator connected via a matching circuit to a balun. In certain embodiments, the radiator comprises a first radiating element and a second radiating element and the matching circuit comprises a first impedance-matching circuit connected to the first radiating element and a second impedance-matching circuit connected to the second radiating element. The first and second matching circuits may be identical and are connected through the balun to a single port. To minimise the component count, the design of the matching circuit and balun is co-optimised.





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(19) **United States**

(12) **Patent Application Publication**
HUANG

(10) **Pub. No.: US 2017/0141469 A1**

(43) **Pub. Date: May 18, 2017**

(54) **MULTI-BAND ANTENNA**

H01Q 1/50 (2006.01)

H01Q 1/38 (2006.01)

(71) Applicant: **PEGATRON CORPORATION**, Taipei
City (TW)

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

CPC *H01Q 5/50* (2015.01); *H01Q 1/38*
(2013.01); *H01Q 1/243* (2013.01); *H01Q 1/50*
(2013.01)

(72) Inventor: **Chin-Ting HUANG**, TAIPEI CITY
(TW)

(21) Appl. No.: **15/331,920**

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

(57)

ABSTRACT

(30) **Foreign Application Priority Data**

Nov. 12, 2015 (TW) 104137367

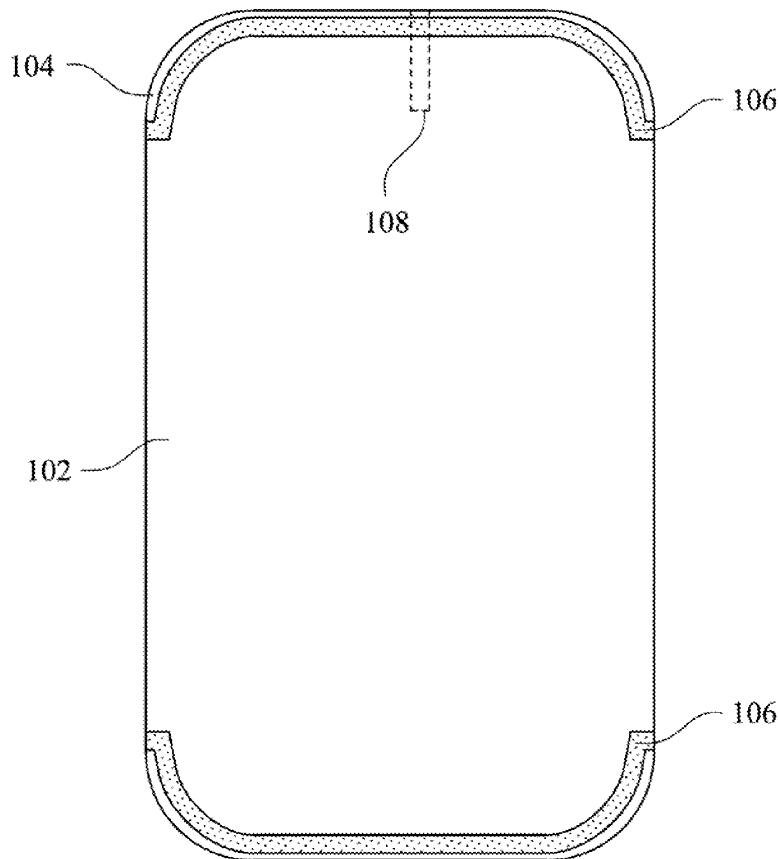
Publication Classification

(51) **Int. Cl.**

H01Q 5/50 (2006.01)

H01Q 1/24 (2006.01)

A multi-band antenna includes a metal backing plate, a radiating conductor, a non-conductor and a connector. The non-conductor is interleaved between the metal backing plate and the radiating conductor. The connector is connected to the metal backing plate and the radiating conductor, and the connector is configured to adjust a connection path between the metal backing plate and the radiating conductor to adjust an antenna operation band.





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(19) **United States**

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

(10) **Pub. No.: US 2017/0141470 A1**

(43) **Pub. Date: May 18, 2017**

(54) **ELECTRONIC DEVICE AND ANTENNA**

Publication Classification

(71) Applicant: **SONY MOBILE COMMUNICATIONS INC.**,
Shinagawa-ku (JP)

(51) **Int. Cl.**
H01Q 7/06 (2006.01)
H04B 5/00 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/22 (2006.01)

(72) Inventors: **Check Chin YONG**, Tokyo (JP);
Tatsuya Nagae, Tokyo (JP)

(52) **U.S. Cl.**
CPC **H01Q 7/06** (2013.01); **H01Q 1/2291**
(2013.01); **H04B 5/0037** (2013.01); **H04B**
5/0031 (2013.01); **H01Q 1/38** (2013.01)

(73) Assignee: **SONY MOBILE COMMUNICATIONS INC.**,
Shinagawa-ku (JP)

(57) **ABSTRACT**

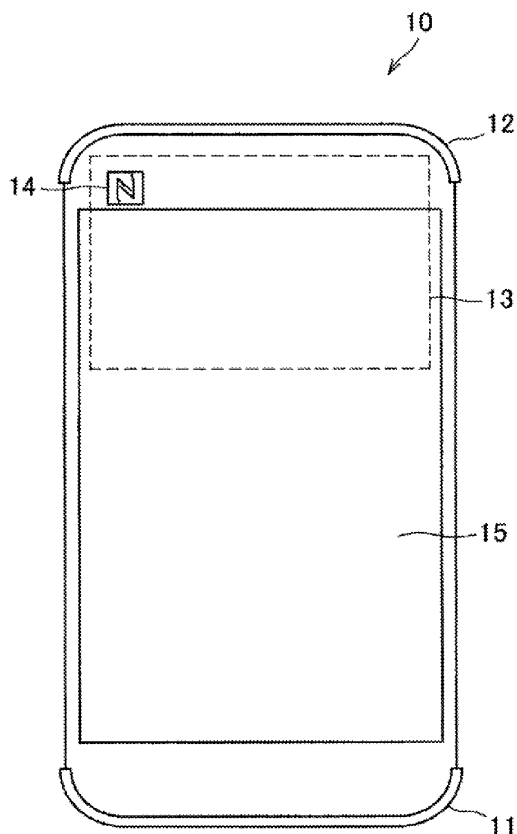
There is provided an electronic device including: a first antenna for wireless communication; a second antenna for near-field communication that forms a loop by being used together with the first antenna, at least a part of the second antenna being positioned at a back surface of a display region of a display; and a first filter that is provided in the first antenna or the second antenna, passes a signal of a frequency band used in the near-field communication to the first antenna, and blocks inflow of the signal of the frequency band used in the wireless communication into the second antenna.

(21) Appl. No.: **15/344,176**

(22) Filed: **Nov. 4, 2016**

(30) **Foreign Application Priority Data**

Nov. 13, 2015 (JP) 2015-223130





US 20170141472A1

(19) **United States**(12) **Patent Application Publication****PARK et al.**(10) **Pub. No.: US 2017/0141472 A1**(43) **Pub. Date: May 18, 2017**(54) **MILLIMETER WAVE ANTENNA FOR
DIAGONAL RADIATION**(52) **U.S. Cl.**CPC **H01Q 9/0414** (2013.01)(71) Applicant: **Korea Advanced Institute of Science
and Technology, Daejeon (KR)**

(57)

ABSTRACT(72) Inventors: **Chul-Soon PARK**, Daejeon (KR);
Tae-Hwan JANG, Daejeon (KR);
Hong-Yi KIM, Daejeon (KR);
Chae-Jun LEE, Daejeon (KR)

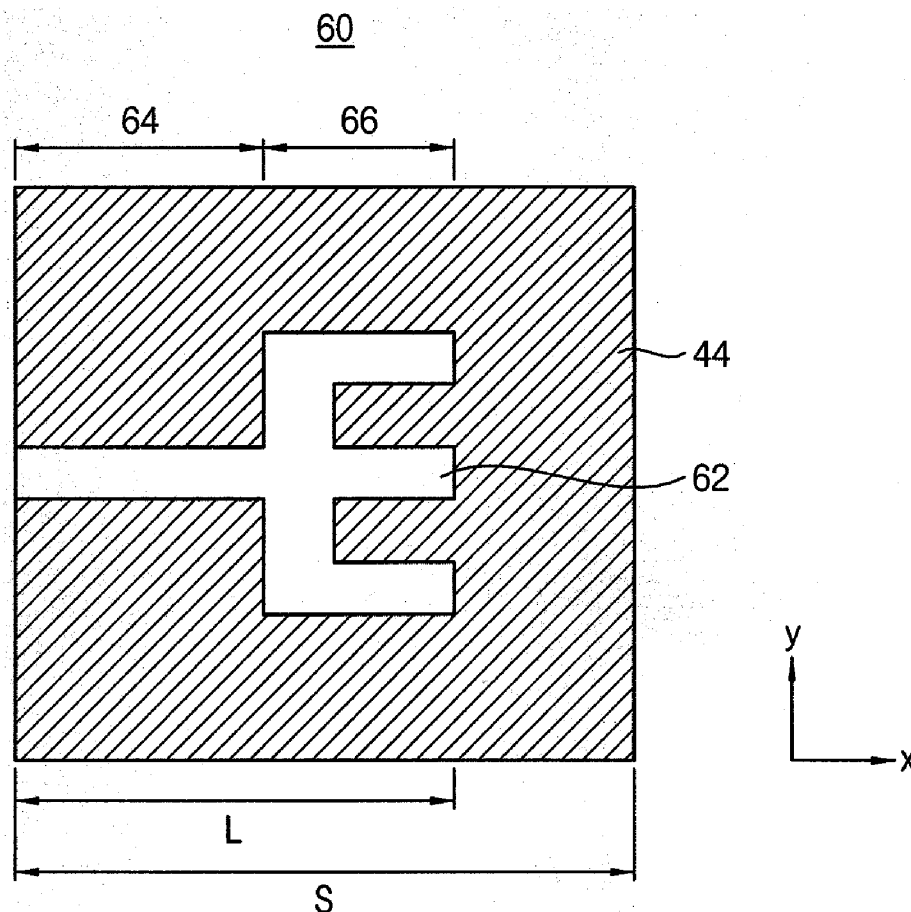
Disclosed is a millimeter wave antenna for diagonal radiation. A first metal layer and a second metal layer having a form of microstrip wire are coated on the bottom surface and at least a partial region of the top surface of a dielectric substrate, respectively. When viewed in a direction perpendicular to the top surface of the dielectric substrate, the second metal layer is covered by the first metal layer. The microstrip wire of the second metal layer may have a length of more than half of a wavelength of a RF signal. The long-wire antenna has a radiation pattern in upward diagonal direction when a signal to transmit is fed under a condition that the first metal layer is grounded. The form of the second metal layer may be a straight line, Y-shape, ψ -shape, or etc. An impedance matching metal layer may be added to the second metal layer.

(21) Appl. No.: **15/006,206**(22) Filed: **Jan. 26, 2016**(30) **Foreign Application Priority Data**

Nov. 16, 2015 (KR) 10-2015-0160190

Publication Classification(51) **Int. Cl.****H01Q 9/04**

(2006.01)





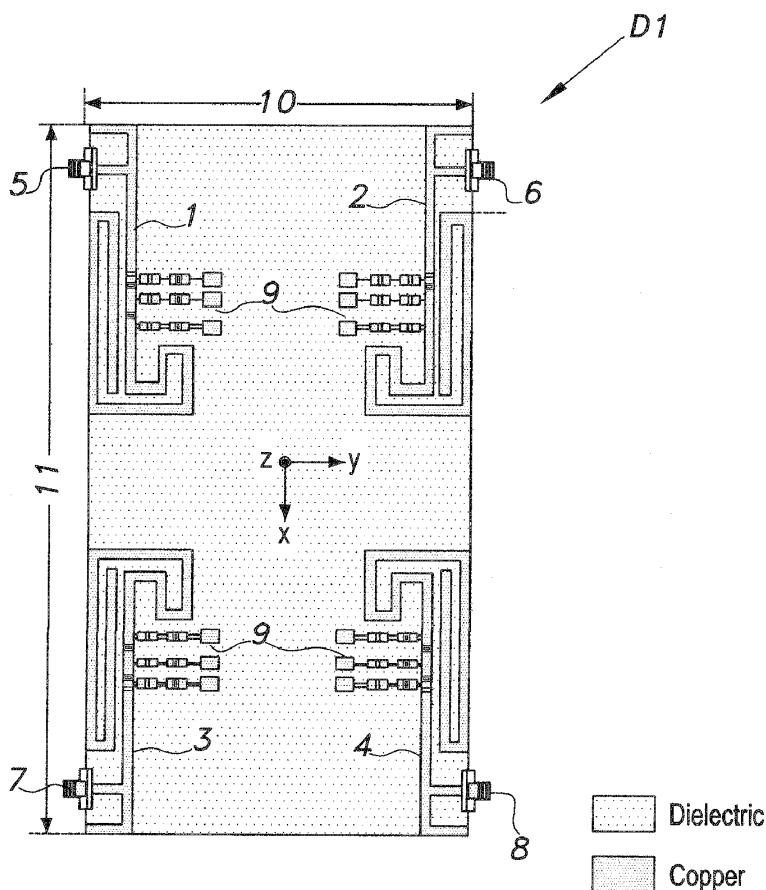
US 20170141473A1

(19) **United States**(12) **Patent Application Publication**
SHARAWI et al.(10) **Pub. No.: US 2017/0141473 A1**(43) **Pub. Date: May 18, 2017**(54) **FOUR ELEMENT RECONFIGURABLE
MIMO ANTENNA SYSTEM**(52) **U.S. Cl.**CPC **H01Q 9/0442** (2013.01); **H01Q 1/12**
(2013.01); **H01Q 1/48** (2013.01); **H01Q**
21/065 (2013.01); **H01Q 5/321** (2015.01)(71) Applicant: **KING FAHD UNIVERSITY OF
PETROLEUM AND MINERALS,**
DHAHRAN (SA)

(57)

ABSTRACT(72) Inventors: **MOHAMMAD S. SHARAWI,**
DHAHRAN (SA); **RIFAQAT**
HUSSAIN, DHAHRAN (SA)

The four element reconfigurable MIMO antenna system includes four conducting PIFA elements disposed on a top surface of a rectangular dielectric substrate. For each PIFA, an F-head portion of the PIFA defines two arms extending to a long peripheral edge of the substrate. An F-tail portion of the PIFA extends from a short peripheral edge of the substrate. A first PIFA and a second PIFA are mirror images of each other, and a third PIFA and a fourth PIFA are mirror images of each other. A meander pattern of conducting material extends from a bottom region of the F-tail portion of the PIFAs. For each PIFA, PIN/varactor diode bias circuits are disposed on the substrate's top surface, connecting to and extending away from a unique location on the F-tail portion of the PIFA, thereby creating separate radiating branches of the PIFA to achieve reconfigurability.

(21) Appl. No.: **14/940,118**(22) Filed: **Nov. 12, 2015****Publication Classification**(51) **Int. Cl.****H01Q 9/04** (2006.01)**H01Q 5/321** (2006.01)**H01Q 21/06** (2006.01)**H01Q 1/12** (2006.01)**H01Q 1/48** (2006.01)



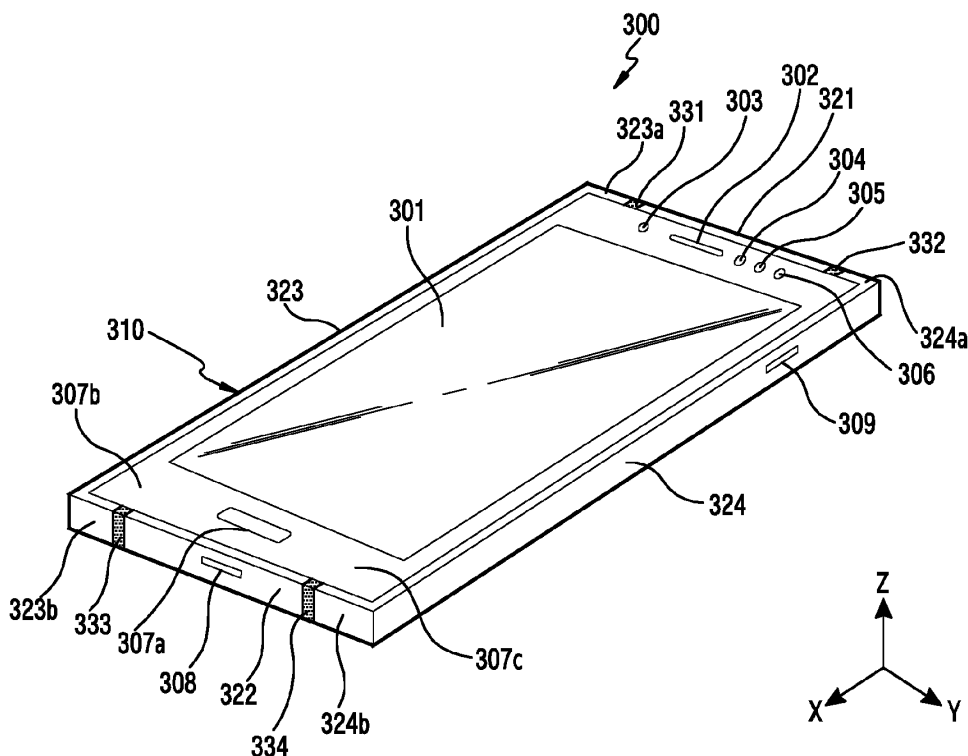
US 20170142241A1

(19) **United States**(12) **Patent Application Publication****KIM et al.**(10) **Pub. No.: US 2017/0142241 A1**(43) **Pub. Date: May 18, 2017**(54) **ELECTRONIC DEVICE WITH METAL
FRAME ANTENNA**(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(72) Inventors: **Jaehyung KIM**, Gyeonggi-do (KR);
Jinkyu Bang, Gyeonggi-do (KR); **Jinu
Kim**, Seoul (KR); **Donghwan Kim**,
Gyeonggi-do (KR); **Taegyu Kim**,
Gyeonggi-do (KR); **Kiyoung Chang**,
Seoul (KR)(21) Appl. No.: **15/351,161**(22) Filed: **Nov. 14, 2016**(30) **Foreign Application Priority Data**

Nov. 13, 2015 (KR) 10-2015-0159787

Publication Classification(51) **Int. Cl.**
H04M 1/02 (2006.01)
H01Q 1/24 (2006.01)
(52) **U.S. Cl.**
CPC **H04M 1/0218** (2013.01); **H01Q 1/243**
(2013.01)(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a housing and a connection part. The housing includes a first housing portion that includes a first side face, and a second housing portion that includes a second side face. The connection part connects the first housing portion and the second housing portion. A first conductive member extends along at least a portion of the first side face, a first non-conductive member is disposed on the first side face, a second conductive member extends along at least a portion of the second side face, a second non-conductive member is disposed on the second side face, and when the second housing portion faces the first housing portion, the first non-conductive member and the second non-conductive member are substantially aligned.





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(19) **United States**

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

(10) **Pub. No.: US 2017/0149116 A1**

(43) **Pub. Date: May 25, 2017**

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

(71) Applicant: **BYD COMPANY LIMITED**,
Shenzhen, Guangdong (CN)

(72) Inventors: **Qinyang CAI**, Shenzhen, Guangdong (CN); **Yijin WANG**, Shenzhen, Guangdong (CN); **Wensong WANG**, Shenzhen, Guangdong (CN); **Munyong CHOI**, Shenzhen, Guangdong (CN)

(73) Assignee: **BYD COMPANY LIMITED**,
Shenzhen, Guangdong (CN)

(21) Appl. No.: **15/313,015**

(22) PCT Filed: **May 26, 2016**

(86) PCT No.: **PCT/CN2015/079773**

§ 371 (c)(1),

(2) Date: **Nov. 21, 2016**

(30) **Foreign Application Priority Data**

May 26, 2014 (CN) 201420273632.0

Publication Classification

(51) **Int. Cl.**

H01Q 1/22 (2006.01)

H01Q 13/10 (2006.01)

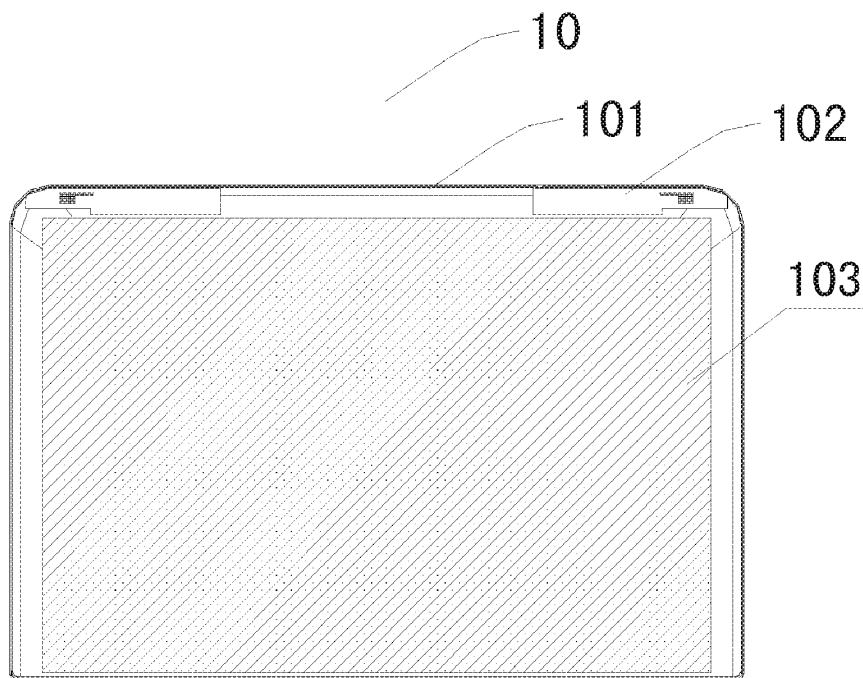
(52) **U.S. Cl.**

CPC **H01Q 1/2266** (2013.01); **H01Q 13/10** (2013.01)

(57)

ABSTRACT

An electronic device and an antenna of an electronic device are provided. The electronic device includes a metal shell, and the antenna includes: a radiating surface formed by metal shell and having a slot group penetrated therethrough in an up and down direction of the metal shell, the slot group including a plurality of slots; a medium filling layer including a body part disposed on a lower surface of the metal shell and a plurality of filling parts disposed on an upper surface of the body part and filled in the plurality of slots respectively; and an excitation sheet disposed on a lower surface of the medium filling layer.





US 20170149117A1

(19) **United States**

(12) **Patent Application Publication**
Kashiwagi

(10) **Pub. No.: US 2017/0149117 A1**

(43) **Pub. Date: May 25, 2017**

(54) **DATA COMMUNICATION DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/50 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventor: **Ippei Kashiwagi**, Ome Tokyo (JP)

(52) **U.S. Cl.**
CPC **H01Q 1/2266** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/50** (2013.01)

(21) Appl. No.: **15/359,507**

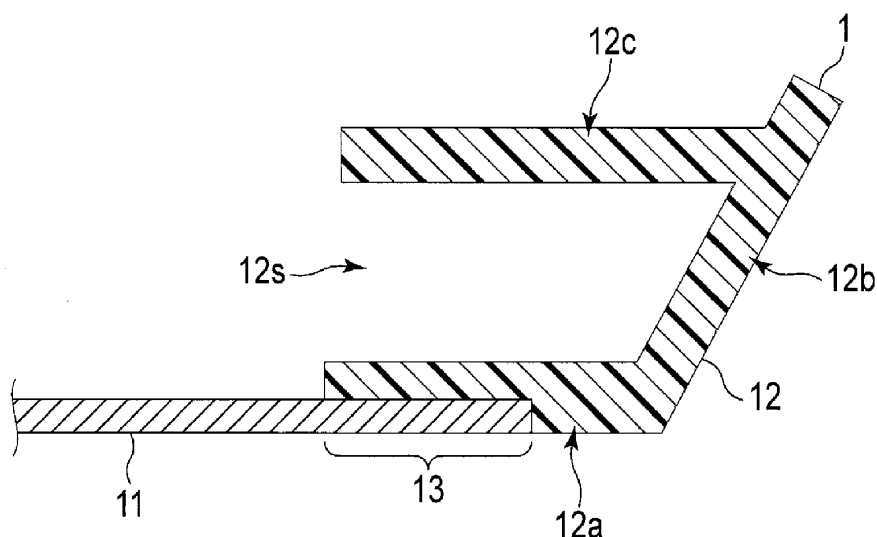
(57) **ABSTRACT**

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

According to one embodiment, a data communication device includes a housing and an antenna. The housing includes a base formed of a carbon material and circumferential edges continuous with edges of the base and formed of a resin material. The antenna is accommodated in the housing and includes a conductive portion grounded via the base and an element portion arranged further away from the base than the conductive portion.

(30) **Foreign Application Priority Data**

Nov. 24, 2015 (JP) 2015-228911





US 20170149118A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0149118 A1**

(43) **Pub. Date: May 25, 2017**

(54) **INTEGRATED STRUCTURE OF METAL HOUSING AND ANTENNA OF ELECTRONIC APPARATUS**

Publication Classification

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

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

(71) Applicant: **Huawei Device Co., Ltd.**, Shenzhen (CN)

(72) Inventors: **Hongyu Wang**, Shenzhen (CN);
Shuwen Lyu, Shanghai (CN); **Xin Zhu**,
Shanghai (CN); **Huimin Zhang**,
Shenzhen (CN)

(57) **ABSTRACT**

An integrated structure of a metal housing and an antenna of an electronic apparatus, where the electronic apparatus includes the metal housing and an antenna structure, the antenna structure includes an antenna main body, at least one micro gap set is disposed on the metal housing, the at least one micro gap set includes micro gaps, the at least one micro gap set divides the metal housing to form at least one metal region, and the at least one metal region is connected to the antenna main body to serve as a radiating body of the antenna structure.

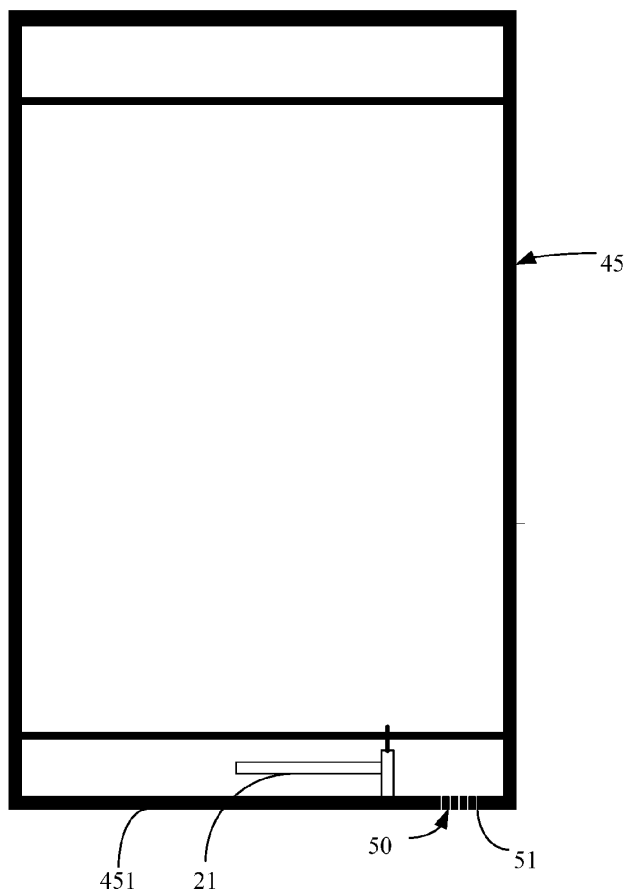
(21) Appl. No.: **15/320,836**

(22) PCT Filed: **Mar. 28, 2014**

(86) PCT No.: **PCT/CN2014/074273**

§ 371 (c)(1),

(2) Date: **Dec. 21, 2016**





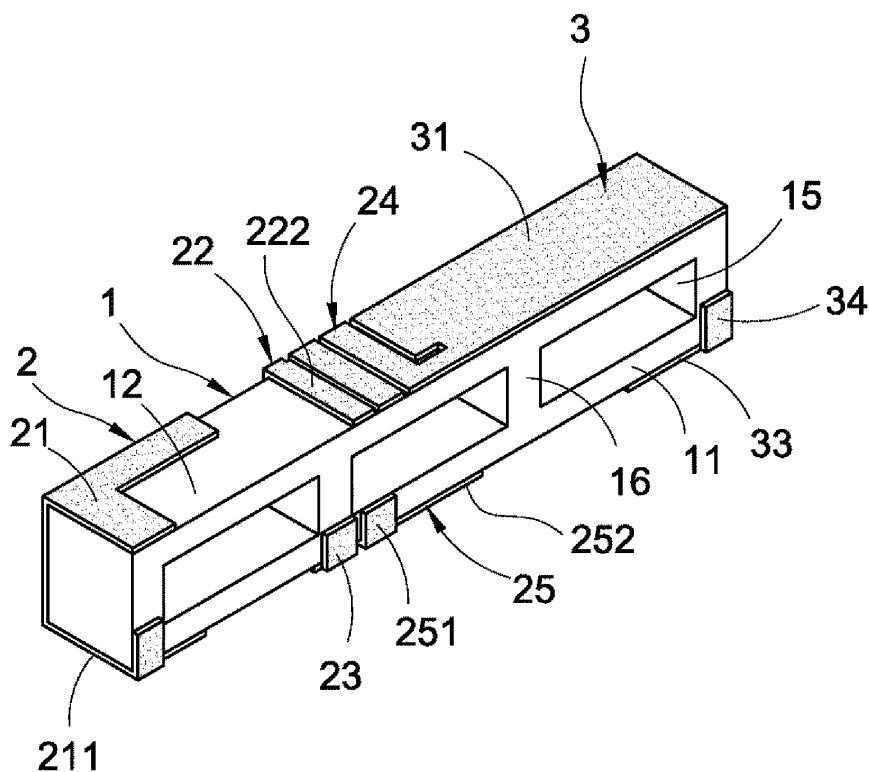
US 20170149136A1

(19) **United States**(12) **Patent Application Publication**
Quinlan(10) **Pub. No.: US 2017/0149136 A1**(43) **Pub. Date: May 25, 2017**(54) **EIGHT-FREQUENCY BAND ANTENNA**(71) Applicant: **TAOGLAS LIMITED**, Taoyuan City
(TW)(72) Inventor: **Ronan Quinlan**, Taoyuan City (TW)(21) Appl. No.: **14/948,237**(22) Filed: **Nov. 20, 2015****Publication Classification**(51) **Int. Cl.**
H01Q 5/10 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/50 (2006.01)
H01Q 1/48 (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/10** (2015.01); **H01Q 1/48**
(2013.01); **H01Q 9/04** (2013.01); **H01Q 1/50**
(2013.01)

(57)

ABSTRACT

An eight-frequency band antenna includes a carrier, a high-frequency segment, a low-frequency segment, a printed circuit board (PCB) and an inductor. The high-frequency segment is arranged on left side of the carrier and the low-frequency segment is arranged on right side of the carrier. The radiator on the bottom face of the carrier electrically connects with the micro strip of the PCB and the ground line of the ground metal when the carrier is fixed to the PCB. Moreover, the low-frequency segment is corresponding to a metal face with smaller area such that the low-frequency segment is at a free space to enhance the frequency response of the low-frequency segment and the bandwidth of the high-frequency segment. The area and the volume of blind hole on the carrier can adjust the effective dielectric constant to adjust the resonant frequency and bandwidth of the antenna.





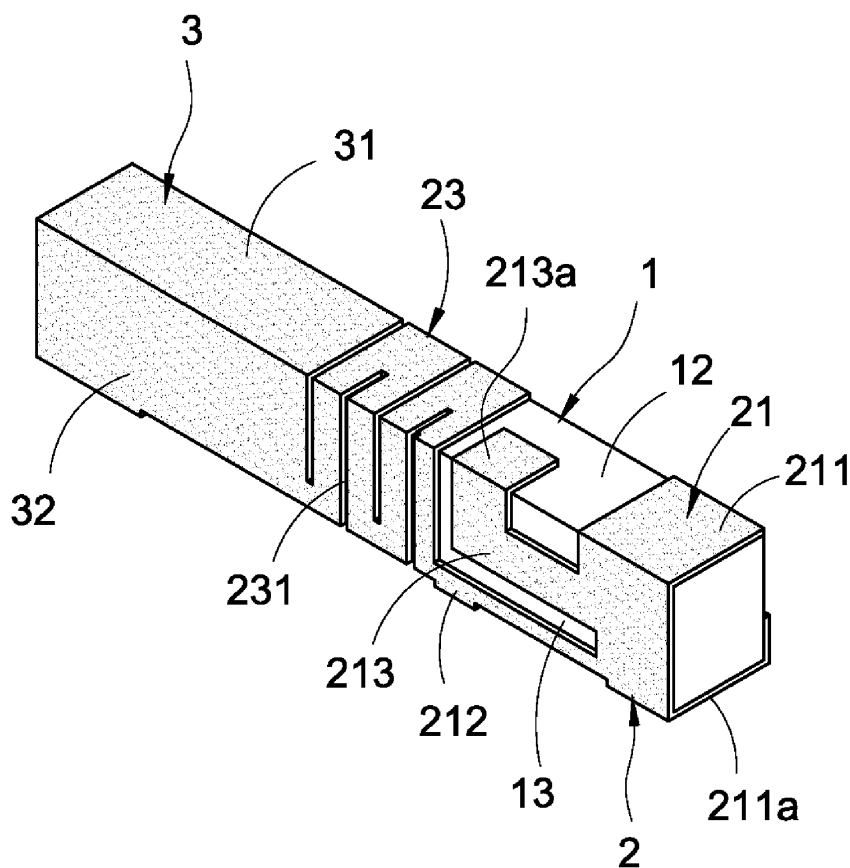
US 20170149138A1

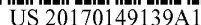
(19) **United States**(12) **Patent Application Publication**
Quinlan(10) **Pub. No.: US 2017/0149138 A1**(43) **Pub. Date: May 25, 2017**(54) **TEN-FREQUENCY BAND ANTENNA**

(57)

ABSTRACT(71) Applicant: **TAOGLAS LIMITED**, Taoyuan City
(TW)(72) Inventor: **Ronan Quinlan**, Taoyuan City (TW)(21) Appl. No.: **14/948,226**(22) Filed: **Nov. 20, 2015****Publication Classification**(51) **Int. Cl.****H01Q 9/04** (2006.01)**H01Q 1/38** (2006.01)(52) **U.S. Cl.**CPC **H01Q 9/04** (2013.01); **H01Q 1/38**
(2013.01)

A ten-frequency band antenna includes a carrier, a high-frequency segment, a low-frequency segment, a printed circuit board (PCB) and an inductor. The high-frequency segment is arranged on left side of the carrier and the low-frequency segment is arranged on right side of the carrier. The radiator on the bottom face of the carrier electrically connects with the micro strip of the PCB and the ground line of the ground metal when the carrier is fixed to the PCB. The low-frequency segment is located at an opened area and corresponding to a metal face with smaller area such that the low-frequency segment is at a free space to enhance the frequency response of the low-frequency segment and the bandwidth of the high-frequency segment. The area and the volume of blind hole on the carrier can adjust the effective dielectric constant to adjust the resonant frequency and bandwidth of the antenna.





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Wong et al.

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Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/50 (2006.01)
H01Q 1/48 (2006.01)
H01Q 7/00 (2006.01)

(52) U.S. Cl.
CPC *H01Q 9/0421* (2013.01); *H01Q 1/48*
(2013.01); *H01Q 7/00* (2013.01); *H01Q 5/50*
(2015.01); *H01Q 1/242* (2013.01)

(57) **ABSTRACT**

A communication device including a ground element and an antenna element is provided. The antenna element is disposed adjacent to an edge of the ground element, and a loop structure is formed by the antenna element and the edge of the ground element. The antenna element includes a first and a second metal portions, and a first and second switches. When the first switch is turned on and the second switch is turned off, the first metal portion, the second metal portion, a shorting metal portion and the first switch form a loop antenna with the ground element. When the second switch is turned on and the first switch is turned off, an inverted-F antenna is formed by the second metal portion.

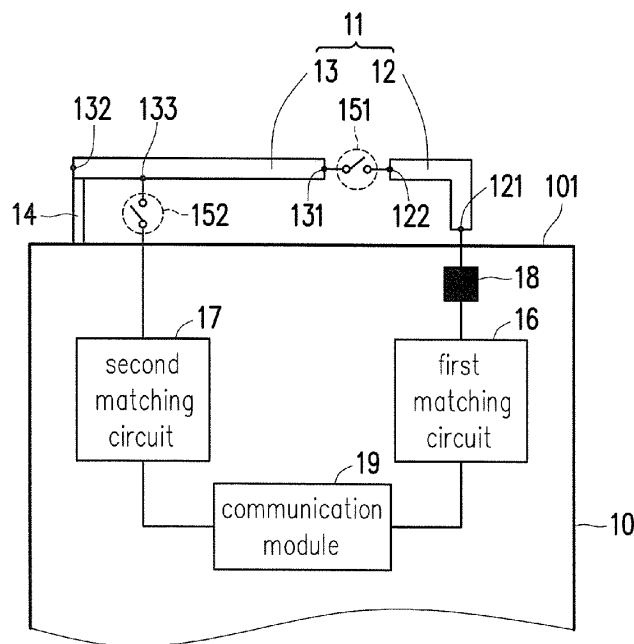
(22) Filed: **Jan. 10, 2017**

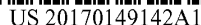
Related U.S. Application Data

(63) Continuation of application No. 14/071,660, filed on Nov. 5, 2013.

(30) **Foreign Application Priority Data**

Jun. 27, 2013 (TW) 102122988





(12) **Patent Application Publication**
CHANG

(43) **Pub. Date:** **May 25, 2017**

(52) U.S. Cl.

CPC **H01Q 13/106** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/38** (2013.01); **H01Q 5/378**
(2015.01); **H01Q 1/243** (2013.01)

(72) Inventor: **Jing-Teng CHANG**, Xinfeng Township
(TW)

(57) **ABSTRACT**

(22) Filed: **Aug. 2, 2016**

(30) **Foreign Application Priority Data**

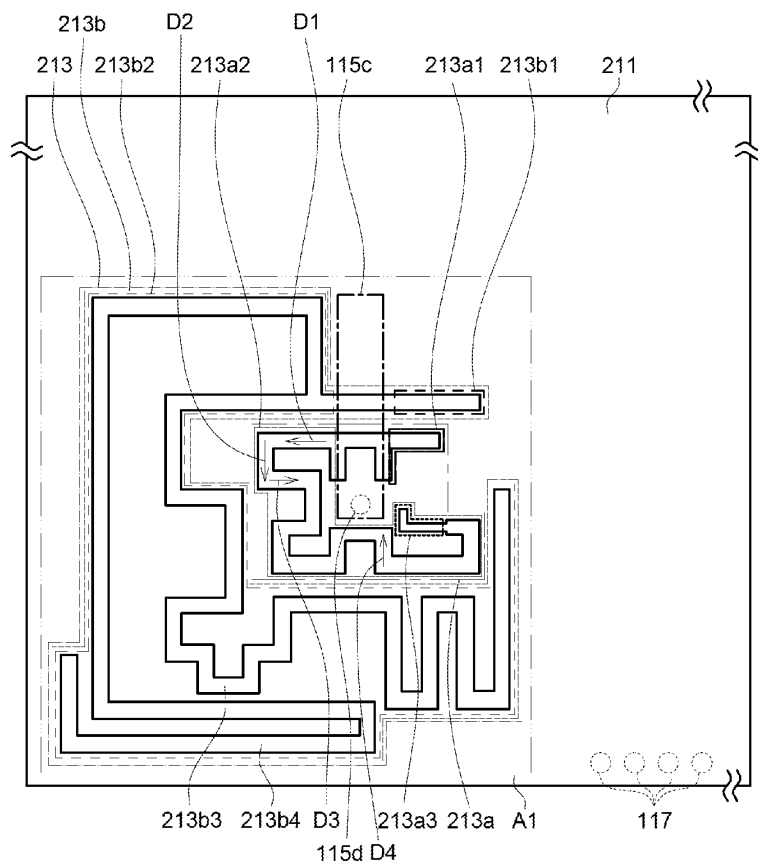
Oct. 5, 2015 (TW) 104132685

Publication Classification

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/378 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/38 (2006.01)

A multi-band antenna includes a circuit board having an insulation dielectric layer, a first ground plane and an impedance matching circuit formed on a first plane of the circuit board, and a second ground plane formed on a second plane of the circuit board. A slot antenna radiation main body, formed at a location of the second ground plane and corresponding to the exposed part of the insulation dielectric layer, includes first and second radiation main bodies. The first radiation main body includes a first impedance matching part and a first resonance part. The second radiation main body includes a second impedance matching part and a second resonance part. The first resonance part includes a plurality of first bends, a first segment, and a second segment. The second resonance part includes a plurality of second bends, a third segment, and a fourth segment.

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US 20170149146A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0149146 A1**

(43) **Pub. Date: May 25, 2017**

(54) **MULTIMODE ANTENNA STRUCTURE**

Publication Classification

(71) Applicant: **Achilles Technology Management CO II, Inc.**, Palo Alto, CA (US)

(51) **Int. Cl.**
H01Q 21/28 (2006.01)
H01Q 1/38 (2006.01)
H01Q 5/35 (2006.01)
H01Q 1/52 (2006.01)
H01Q 5/321 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventors: **MARK T. MONTGOMERY**,
MELBOURNE BEACH, FL (US);
MARK W. KISHLER, ROCKLEDGE,
FL (US); **LI CHEN**, MELBOURNE,
FL (US)

(52) **U.S. Cl.**
CPC **H01Q 21/28** (2013.01); **H01Q 1/24**
(2013.01); **H01Q 1/38** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/521** (2013.01); **H01Q**
5/321 (2015.01); **H01Q 5/35** (2015.01)

(21) Appl. No.: **15/190,870**

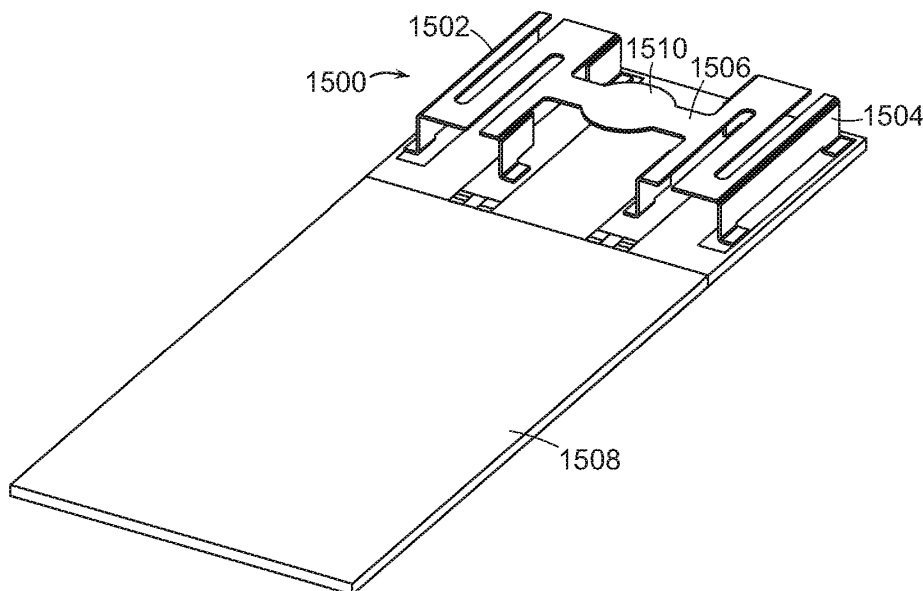
(22) Filed: **Jun. 23, 2016**

Related U.S. Application Data

- (63) Continuation of application No. 14/918,895, filed on Oct. 21, 2015, now Pat. No. 9,401,547, which is a continuation of application No. 14/450,365, filed on Aug. 4, 2014, now Pat. No. 9,190,726, which is a continuation of application No. 12/727,531, filed on Mar. 19, 2010, now Pat. No. 8,866,691, which is a continuation-in-part of application No. 12/099,320, filed on Apr. 8, 2008, now Pat. No. 7,688,273, which is a continuation-in-part of application No. 11/769,565, filed on Jun. 27, 2007, now Pat. No. 7,688,275.
- (60) Provisional application No. 61/161,669, filed on Mar. 19, 2009, provisional application No. 60/925,394, filed on Apr. 20, 2007, provisional application No. 60/916,655, filed on May 8, 2007.

(57) **ABSTRACT**

A multimode antenna structure is provided for transmitting and receiving electromagnetic signals in a communication device. The antenna structure includes a plurality of antenna ports for coupling to the circuitry; a plurality of antenna elements, each operatively coupled to a different one of the antenna ports; and a plurality of connecting elements. The connecting elements each electrically connect neighboring antenna elements such that the antenna elements and the connecting elements are arranged about the periphery of the antenna structure and form a single radiating structure. Electrical currents on one antenna element flow to connected neighboring antenna elements and generally bypass the antenna ports coupled to the neighboring antenna elements such that an antenna mode excited by one antenna port is generally electrically isolated from a mode excited by another antenna port at a given desired signal frequency range, and the antenna structure generates diverse antenna patterns.





US 20170155198A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0155198 A1**

(43) **Pub. Date: Jun. 1, 2017**

(54) **MOBILE DEVICE**

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

(72) Inventors: **Wen-Yuan LO**, Taoyuan City (TW);
Jui-Chun JAO, Taoyuan City (TW);
Lieh-Hung LIAO, Taoyuan City (TW)

(21) Appl. No.: **14/986,009**

(22) Filed: **Dec. 31, 2015**

(30) **Foreign Application Priority Data**

Dec. 1, 2015 (TW) 104140048

Publication Classification

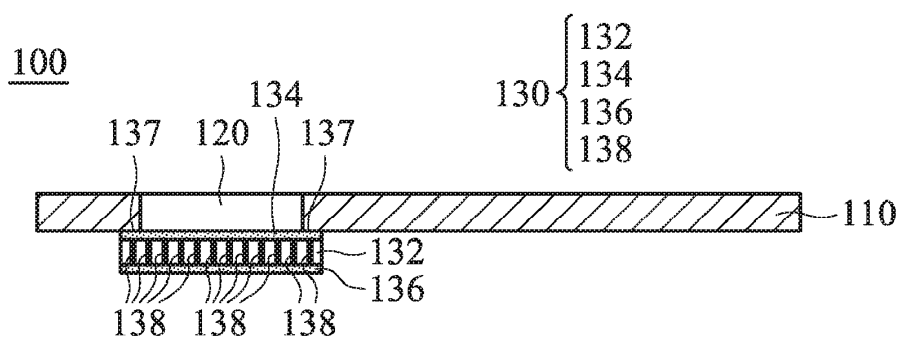
(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)

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

CPC **H01Q 13/10** (2013.01); **H01Q 1/243** (2013.01)

(57) **ABSTRACT**

A mobile device includes a metal back cover and a printed circuit board. The metal back cover has a slot. The printed circuit board includes a dielectric substrate, a first metal element, a second metal element, and via elements. The first metal element is disposed on a top surface of the dielectric substrate. The second metal element is disposed on a bottom surface of the dielectric substrate. The via elements are formed in the dielectric substrate, and are coupled between the first metal element and the second metal element. The first metal element is coupled to the metal back cover, such that a slot antenna is formed by the printed circuit board and the slot of the metal back cover. The slot antenna is excited by a signal source which is coupled to the second metal element.





US 20170162932A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0162932 A1**

(43) **Pub. Date: Jun. 8, 2017**

(54) **ANTENNA MODULE**

H01Q 13/10 (2006.01)

H01Q 1/48 (2006.01)

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

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

CPC **H01Q 1/243** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 21/00** (2013.01); **H01Q**
13/10 (2013.01)

(72) Inventors: **Chien-Yi WU**, TAIPEI CITY (TW);
Cheng-Hsiung WU, TAIPEI CITY
(TW); **Chao-Hsu WU**, TAIPEI CITY
(TW); **Shih-Keng HUANG**, TAIPEI
CITY (TW)

(57)

ABSTRACT

An antenna module includes a parasitic unit and a first antenna unit. The parasitic unit includes a first parasitic radiation portion and a second parasitic radiation portion. The second parasitic radiation portion is electrically connected to the first parasitic radiation portion. The first parasitic radiation portion and the second parasitic radiation portion surround a central area. The first antenna unit includes a feeding terminal, a ground terminal and a first radiation portion, in which the ground terminal is electrically connected to a ground portion. The feeding terminal is configured to transmit and receive a first antenna signal. The first radiation portion is configured to collaborate with the parasitic unit to generate a first resonant mode. The first resonant mode includes a central frequency, a frequency twice of the central frequency and a frequency three times of the central frequency.

(21) Appl. No.: **15/335,461**

(22) Filed: **Oct. 27, 2016**

(30) **Foreign Application Priority Data**

Dec. 3, 2015 (TW) 104140521

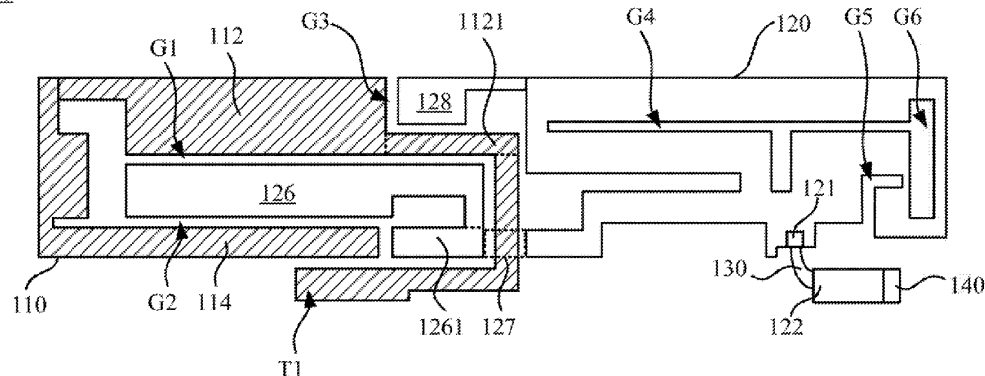
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 21/00 (2006.01)

100





US 20170162933A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0162933 A1**

(43) **Pub. Date: Jun. 8, 2017**

(54) **TERMINAL CASING AND TERMINAL**

Publication Classification

(71) Applicant: **XIAOMI INC.**, Beijing (CN)

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

H01Q 9/04 (2006.01)

H04M 1/02 (2006.01)

(72) Inventors: **Xiaofeng XIONG**, Beijing (CN);
Zonglin XUE, Beijing (CN); **Linchuan WANG**, Beijing (CN)

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

CPC **H01Q 1/243** (2013.01); **H04M 1/026**
(2013.01); **H01Q 1/48** (2013.01); **H01Q**
9/0421 (2013.01)

(73) Assignee: **XIAOMI INC.**, Beijing (CN)

(21) Appl. No.: **15/368,872**

(57)

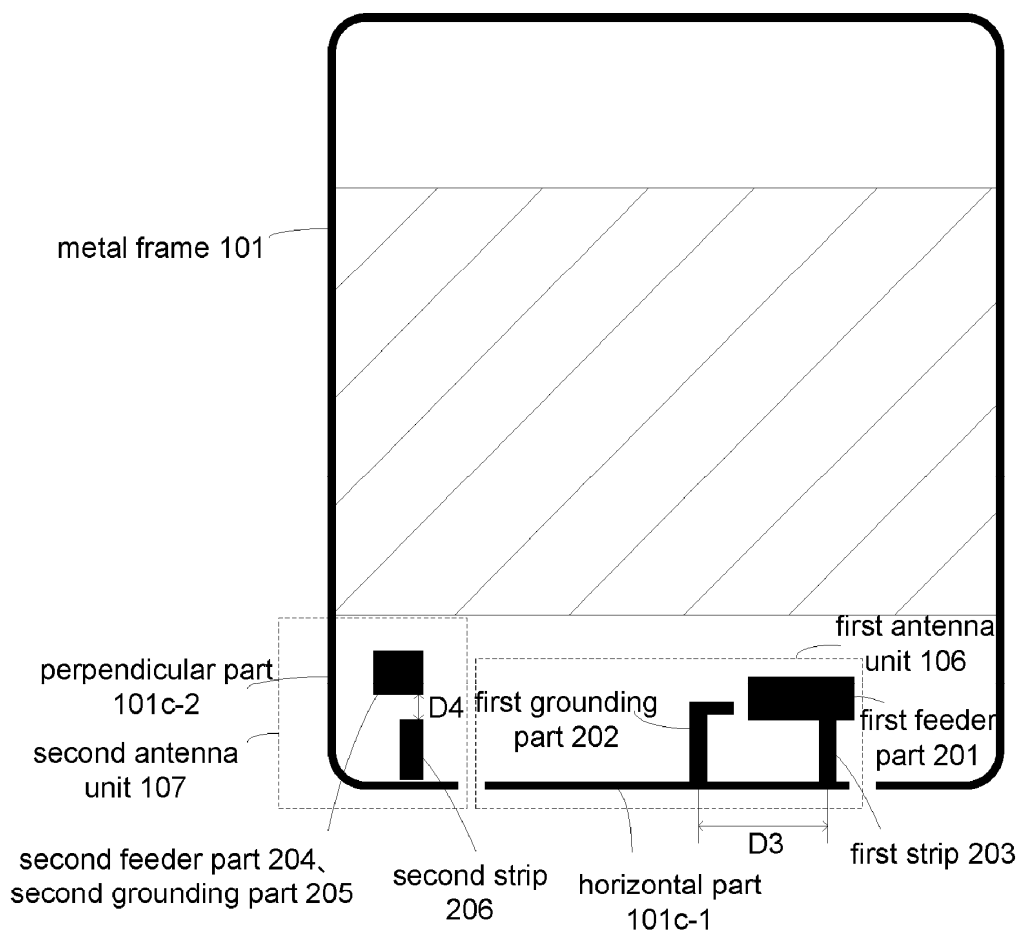
ABSTRACT

A terminal casing and a terminal are provided. A bottom frame is divided into a horizontal part and two perpendicular parts by two gaps in the bottom frame of a metal frame; and a first feeder unit and a second feeder unit are arranged in a clearance area, the first feeder unit and the horizontal part of the bottom frame form a first antenna unit, and the second feeder unit and any perpendicular part form a second antenna unit orthogonal to the first antenna unit.

(22) Filed: **Dec. 5, 2016**

(30) **Foreign Application Priority Data**

Dec. 3, 2015 (CN) 201510881118.4





US 20170162936A1

(19) **United States**

(12) **Patent Application Publication**

Huang et al.

(10) **Pub. No.: US 2017/0162936 A1**

(43) **Pub. Date: Jun. 8, 2017**

(54) **LAMINATED ANTENNA STRUCTURE**

(71) Applicant: **Industrial Technology Research Institute, Hsinchu (TW)**

(72) Inventors: **Meng-Chi Huang**, Taoyuan City (TW);
Tune-Hune Kao, Hsinchu City (TW);
Wei-Yu Li, Yilan County (TW); **Wei Chung**, Hsinchu County (TW);
Wen-Hua Zhang, Hsinchu County (TW)

(21) Appl. No.: **14/983,553**

(22) Filed: **Dec. 30, 2015**

(30) **Foreign Application Priority Data**

Dec. 4, 2015 (TW) 104140736

Publication Classification

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

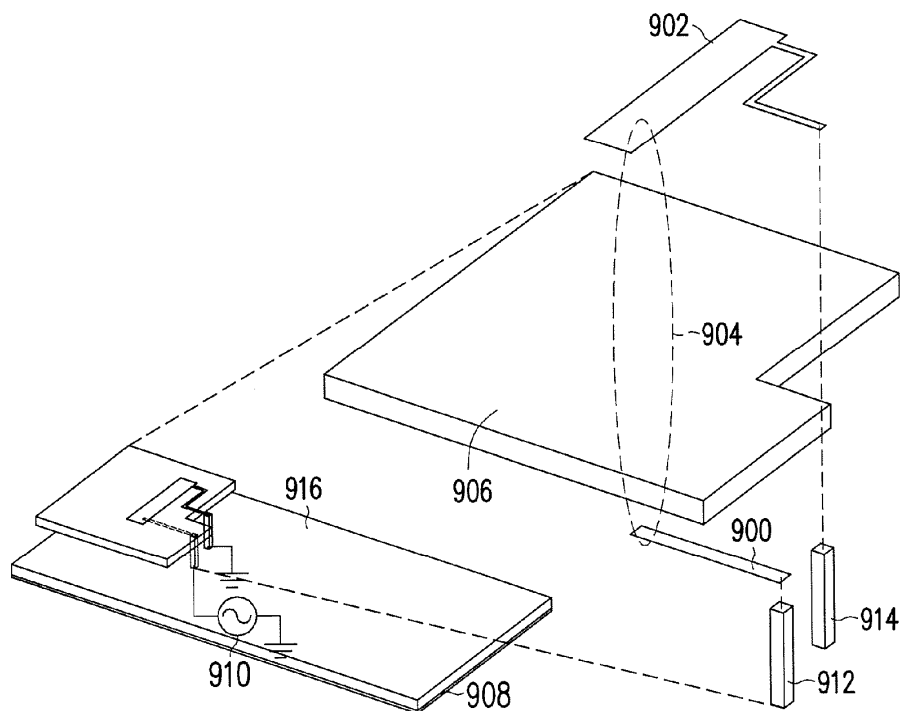
H01Q 1/36 (2006.01)

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

CPC **H01Q 1/38** (2013.01); **H01Q 1/364** (2013.01); **H01Q 1/243** (2013.01)

(57) **ABSTRACT**

A laminated antenna structure includes a substrate, a first conductive circuit layer, an insulating colloidal layer, a second conductive circuit layer and a conductive structure. The first conductive circuit layer is disposed on or above the substrate, the second conductive circuit layer is disposed above the first conductive circuit layer, and the insulating colloidal layer is disposed between the first and the second conductive circuit layers. The first conductive circuit layer, the insulating colloidal layer and the second conductive circuit layer form a laminated capacitive structure. The conductive structure is electrically connected to a signal source on the substrate, and the signal source is electrically connected to at least one of the first conductive circuit layer and the second conductive circuit layer. The insulating colloidal layer contains catalyzers.





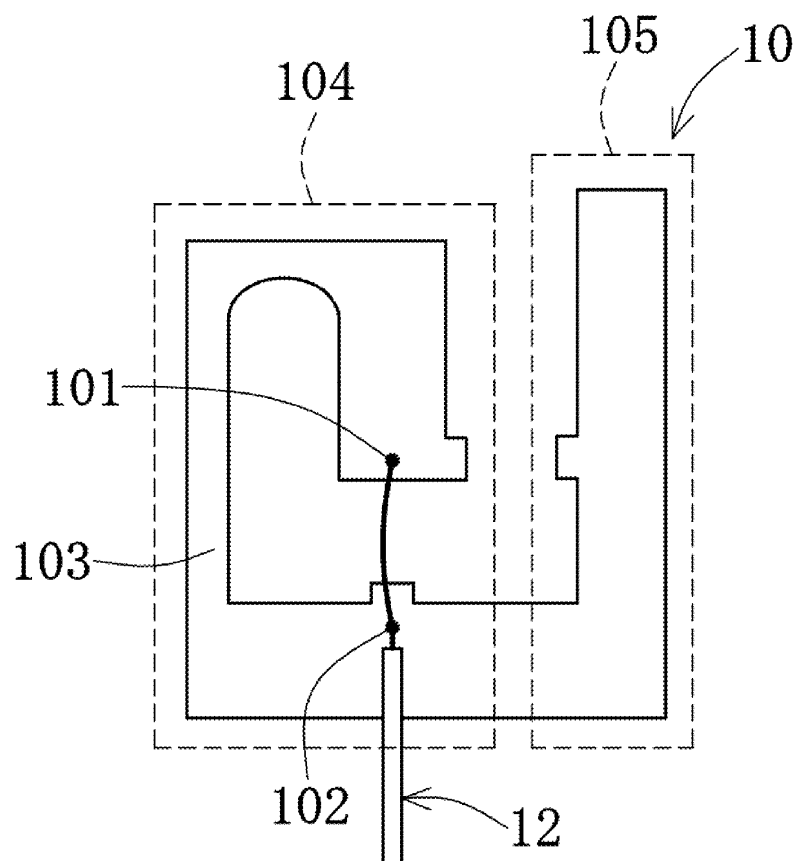
US 20170162939A1

(19) **United States**(12) **Patent Application Publication**
HUANG et al.(10) **Pub. No.: US 2017/0162939 A1**(43) **Pub. Date: Jun. 8, 2017**(54) **ANTENNA DEVICE WITH CONTINUOUS
BENDING STRUCTURE AND APPLICATION
SYSTEM USING THE SAME**(52) **U.S. CL.**
CPC **H01Q 5/10** (2015.01); **H01Q 1/38**
(2013.01)(71) Applicant: **ARCADYAN TECHNOLOGY
CORPORATION**, HSINCHU CITY
(TW)(57) **ABSTRACT**(72) Inventors: **CHIH-YUNG HUANG**, TAICHUNG
CITY (TW); **KUO-CHANG LO**,
MIAOLI COUNTY (TW)(21) Appl. No.: **15/054,635**(22) Filed: **Feb. 26, 2016**(30) **Foreign Application Priority Data**

Dec. 7, 2015 (TW) 104140931

Publication Classification(51) **Int. Cl.**
H01Q 5/10 (2006.01)
H01Q 1/38 (2006.01)

The disclosure is related to an antenna device with continuous bending structure using the antenna. The radiation body of the antenna device includes a main region having at least three L-type continuous bending structures, and a ground region having at least one L-type bending structure. Two adjacent sides of the planar structure of the antenna device render an aspect ratio of approximately one to one. A signal feeding point and a signal grounding point are formed upon the main region. The two points are connected over a wire for forming a signal-feeding direction. According to a demand, the aspect of the present invention allows for modifying the signaling direction of the antenna by adjusting the mounting angle in an electronic device so as to modify the direction of radiation field intensity of the electronic device.





US 20170162941A1

(19) **United States**

(12) **Patent Application Publication**
KROGERUS

(10) **Pub. No.: US 2017/0162941 A1**

(43) **Pub. Date: Jun. 8, 2017**

(54) **APPARATUS AND METHODS FOR
WIRELESS COMMUNICATION**

H01Q 5/35 (2006.01)

H01Q 21/28 (2006.01)

H01Q 5/321 (2006.01)

H01Q 5/40 (2006.01)

(71) Applicant: **NOKIA TECHNOLOGIES OY**,
Espoo (FI)

(72) Inventor: **Joonas KROGERUS**, Espoo (FI)

(73) Assignee: **Nokia Technologies Oy**

(21) Appl. No.: **15/325,123**

(22) PCT Filed: **Jul. 2, 2015**

(86) PCT No.: **PCT/FI2015/050481**

§ 371 (c)(1),

(2) Date: **Jan. 10, 2017**

(30) **Foreign Application Priority Data**

Jul. 10, 2014 (GB) 1412252.7

Publication Classification

(51) **Int. Cl.**

H01Q 5/364 (2006.01)

H01Q 5/307 (2006.01)

H01Q 21/06 (2006.01)

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

CPC *H01Q 5/364* (2015.01); *H01Q 5/321*

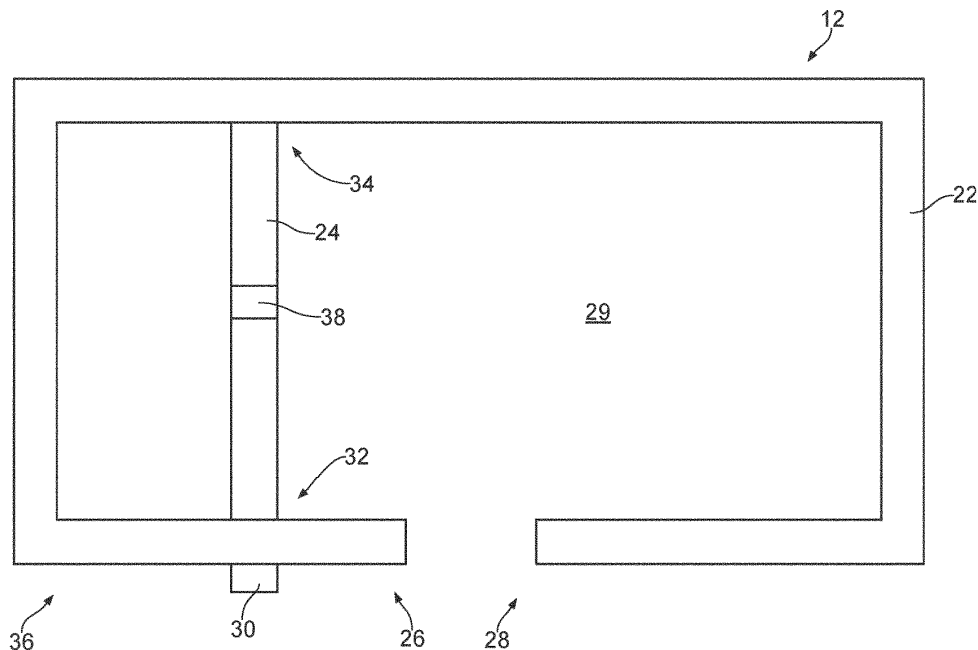
(2015.01); *H01Q 5/307* (2015.01); *H01Q 5/40*

(2015.01); *H01Q 5/35* (2015.01); *H01Q 21/28*

(2013.01); *H01Q 21/065* (2013.01)

(57) **ABSTRACT**

An apparatus comprising: a first conductive antenna track, extending between a first end and a second end and defining a loop shape, the first conductive antenna track comprising a first feed point adjacent to the first end and configured to couple to radio frequency circuitry; and a second conductive antenna track coupled to the first conductive antenna track at a first location in proximity to the first feed point, and at a second location between the first end and the second end of the first conductive antenna track, to form a first closed loop configured to resonate in a first operational frequency band.





US 20170162942A1

(19) **United States**(12) **Patent Application Publication**
WU et al.(10) **Pub. No.: US 2017/0162942 A1**(43) **Pub. Date: Jun. 8, 2017**(54) **MONOPOLE ANTENNA**(52) **U.S. CL.**CPC **H01Q 5/392** (2015.01); **H01Q 1/48**
(2013.01)(71) Applicant: **ARCADYAN TECHNOLOGY**
CORPORATION, Hsinchu City (TW)(72) Inventors: **Min-Chi WU**, Zhubei City (TW);
Kuo-Chang LO, Toufen Township
(TW)(57) **ABSTRACT**

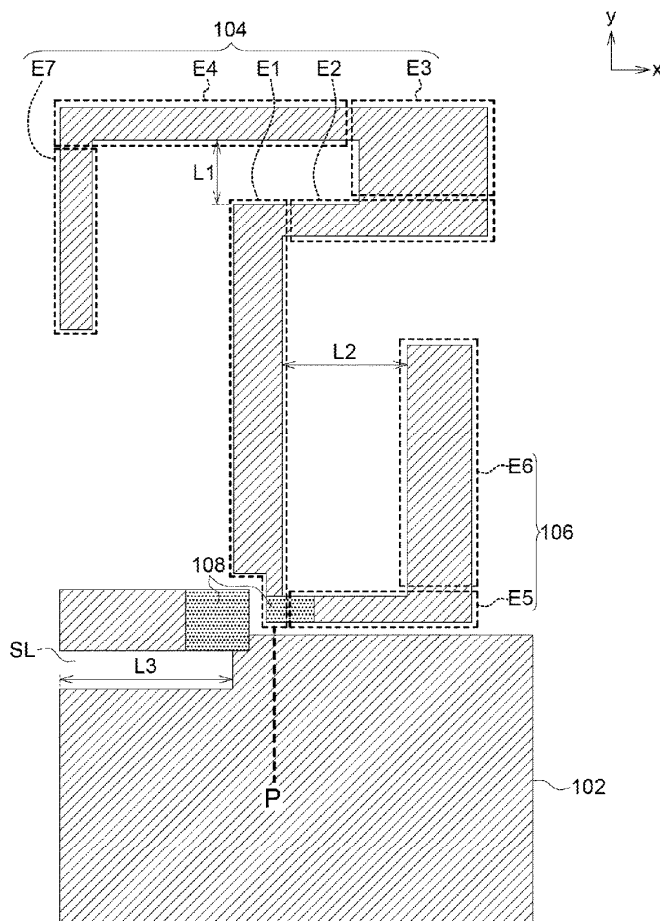
A dual-band monopole antenna includes a ground portion, a first radiator, a second radiator and a feed portion. The first radiator includes a first extension portion extended towards the ground portion, a second extension portion extended and perpendicular to the first extension portion, a third extension portion extended and perpendicular to the second extension portion, and a fourth extension portion extended and perpendicular to the third extension portion. The second radiator includes a fifth extension portion extended and parallel to the second extension portion, and a sixth extension portion parallel to the first extension portion. The feed portion has one end connected to the first extension portion and the other end corresponds to the ground portion.

(21) Appl. No.: **15/224,105**(22) Filed: **Jul. 29, 2016**(30) **Foreign Application Priority Data**

Dec. 4, 2015 (TW) 104140810

Publication Classification(51) **Int. Cl.**
H01Q 5/392 (2006.01)
H01Q 1/48 (2006.01)

100





US 20170162948A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0162948 A1**

(43) **Pub. Date: Jun. 8, 2017**

(54) **ANTENNA ARRAY**

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

CPC **H01Q 21/06** (2013.01); **H01Q 5/10**
(2015.01); **H01Q 1/38** (2013.01)

(71) Applicant: **Industrial Technology Research
Institute, Hsinchu (TW)**

(72) Inventors: **Kin-Lu WONG**, Kaohsiung City (TW);
Jun-Yu LU, Kaohsiung City (TW);
Wei-Yu LI, Yilan City (TW)

(57) **ABSTRACT**

(73) Assignee: **Industrial Technology Research
Institute, Hsinchu (TW)**

An antenna array includes a ground conductor portion, a first antenna and a second antenna. The ground conductor portion has a first edge and a second edge. The first antenna has a first no-ground radiating area and a first feeding conductor portion. The second antenna has a second no-ground radiating area and a second feeding conductor portion. The first no-ground radiating area is formed and surrounded by a first grounding conductor structure, a second grounding conductor structure, and the first edge, and the first no-ground radiating area has a first breach. The second no-ground radiating area is formed and surrounded by a third grounding conductor structure, a fourth grounding conductor structure, and the second edge, and the second no-ground radiating area has a second breach. The first and second feeding conductor portions are respectively and electrically connected to a first signal source and a second signal source.

(21) Appl. No.: **14/984,590**

(22) Filed: **Dec. 30, 2015**

(30) **Foreign Application Priority Data**

Dec. 8, 2015 (TW) 104141055

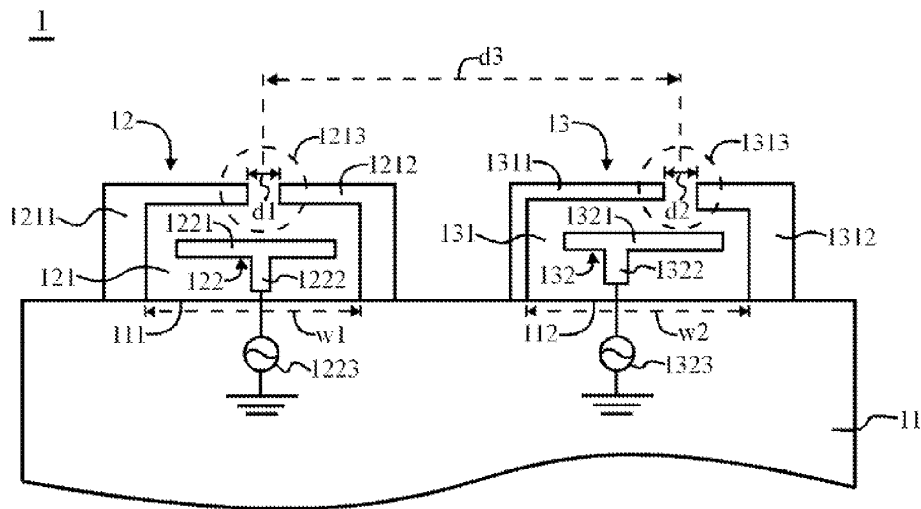
Publication Classification

(51) **Int. Cl.**

H01Q 21/06 (2006.01)

H01Q 1/38 (2006.01)

H01Q 5/10 (2006.01)





US 20170170543A1

(19) **United States**

(12) **Patent Application Publication**

Lee et al.

(10) **Pub. No.: US 2017/0170543 A1**

(43) **Pub. Date: Jun. 15, 2017**

(54) **ANTENNA AND ELECTRIC DEVICE USING THE SAME**

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

(72) Inventors: **Cheng-Tse Lee**, Taipei City (TW);
Saou-Wen Su, Taipei City (TW)

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

(21) Appl. No.: **15/376,682**

(22) Filed: **Dec. 13, 2016**

(30) **Foreign Application Priority Data**

Dec. 15, 2015 (TW) 104142046

Publication Classification

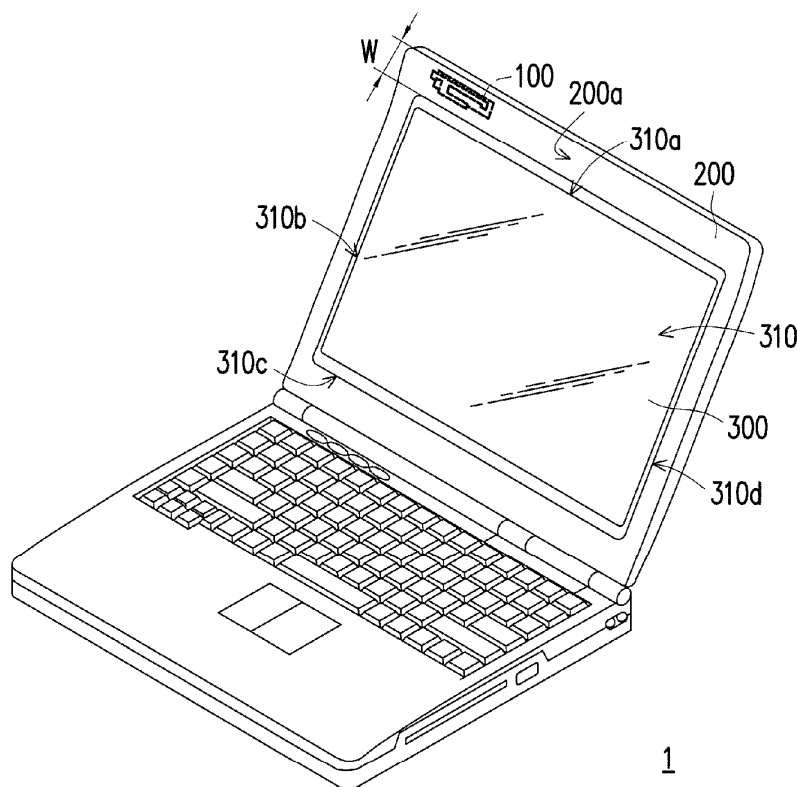
(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)

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

CPC **H01Q 1/2266** (2013.01); **H01Q 1/48** (2013.01); **H01Q 9/0421** (2013.01)

(57) **ABSTRACT**

An antenna is provided. The antenna includes: an antenna ground plane; a radiating unit parallel to the antenna ground plane, the radiating unit including: a common unit; a first branch extended from the common unit along a first direction; a second branch extended from the common unit along a second direction, wherein the first direction and the second direction are inverse; a third branch separated from the first branch and the second branch and extending outwardly from the common unit; a shorting unit located between a plane of radiating unit located and a plane of the antenna ground plane and connected to the common unit and the antenna ground plane; and a feeding unit located between a plane of the radiating unit and a plane of the antenna ground plane, wherein the feeding unit is separated from the shorting unit and connected to the third branch, and the shorting unit and the feeding unit are located on the same side.





US 20170170547A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0170547 A1**

(43) **Pub. Date: Jun. 15, 2017**

(54) **ULTRA-WIDE-BAND PARASITIC ANTENNA
AND MOBILE TERMINAL**

Publication Classification

(71) Applicants: **LE HOLDINGS (BEIJING) CO.,
LTD.**, Beijing (CN); **Lemobile
Information Technology (Beijing) Co.,
Ltd**, Beijing (CN)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/36 (2006.01)
H01Q 1/48 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/36** (2013.01)

(72) Inventors: **Lishan HUANG**, Beijing (CN);
Niantao WANG, Beijing (CN)

(57) **ABSTRACT**

(21) Appl. No.: **15/236,338**

An embodiment of the present disclosure discloses an ultra-wide-band parasitic antenna and a mobile terminal. The antenna comprises an antenna feed unit, an antenna grounding unit and an antenna radiation part which are disposed on an antenna bracket, a first parasitic antenna resonance part disposed on the antenna bracket and connected with the antenna radiation part, a second parasitic antenna resonance part disposed out of the antenna bracket, wherein the second parasitic antenna resonance part and the antenna radiation part in a coupled relationship. The ultra-wide-band parasitic antenna and the mobile terminal provided by the embodiment of the present disclosure save antenna design space for the mobile terminal, save project cost and avoid consumption.

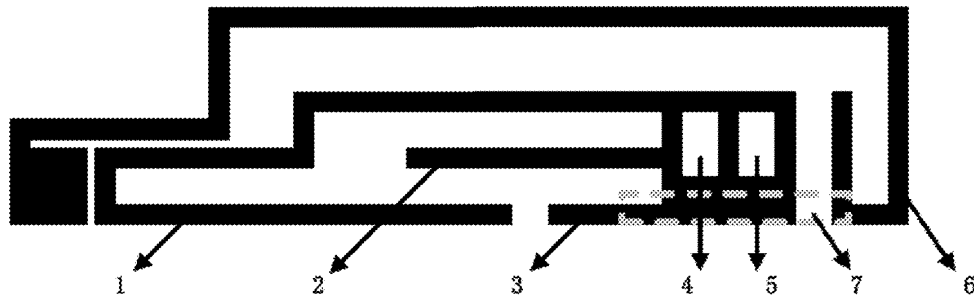
(22) Filed: **Aug. 12, 2016**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2016/088890, filed on Jul. 6, 2016.

(30) **Foreign Application Priority Data**

Dec. 15, 2015 (CN) 201510939736.X





US 20170170548A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0170548 A1**

(43) **Pub. Date: Jun. 15, 2017**

(54) **ANTENNA FOR FULL-METAL BACK
COVER AND MOBILE TERMINAL**

(71) Applicants: **LE HOLDINGS (BEIJING) CO.,
LTD.**, Beijing (CN); **Lemobile
Information Technology (Beijing) Co.,
Ltd.**, Beijing (CN)

(72) Inventors: **Lishan HUANG**, Beijing (CN); **Wei
LI**, Beijing (CN)

(21) Appl. No.: **15/236,346**

(22) Filed: **Aug. 12, 2016**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2016/
089089, filed on Jul. 7, 2016.

(30) **Foreign Application Priority Data**

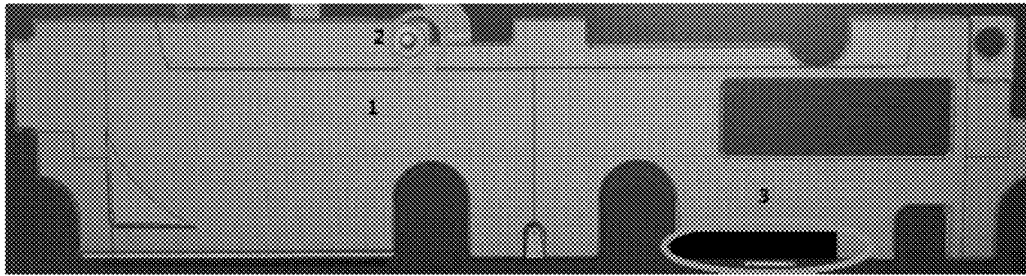
Dec. 11, 2015 (CN) 201510921115.9

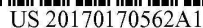
Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/50 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/50**
(2013.01)

(57) **ABSTRACT**

An embodiment of the present disclosure discloses an antenna for a full-metal back cover and a mobile terminal. The antenna for a full-metal back cover comprises a parasitic antenna resonance part disposed on an assembled part of a mobile terminal; when the mobile terminal is assembled, the parasitic antenna resonance part and an antenna body disposed on a full-metal back cover are in a position correspondence relationship; the antenna body comprises an antenna feed unit, an antenna grounding unit and an antenna radiation part; and the parasitic antenna resonance part and the antenna radiation part are in a coupled relationship. The antenna for a full-metal back cover and the mobile terminal provided by the embodiment of the present disclosure realize an effect of expanding antenna frequency band, improve antenna performance and save antenna design space and project development cost.



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

(43) **Pub. Date:** **Jun. 15, 2017**

H01Q 1/48 (2006.01)

(52) U.S. Cl.

CPC *H01Q 5/328* (2015.01); *H01Q 1/243*
(2013.01); *H01Q 1/48* (2013.01); *H01Q 3/24*
(2013.01); *H01Q 9/0421* (2013.01); *H01Q*
13/10 (2013.01)

(73) Assignee: **Samsung Electronics Co., Ltd.**

(21) Appl. No.: 15/380,479

(22) Filed: **Dec. 15, 2016**

(30) **Foreign Application Priority Data**

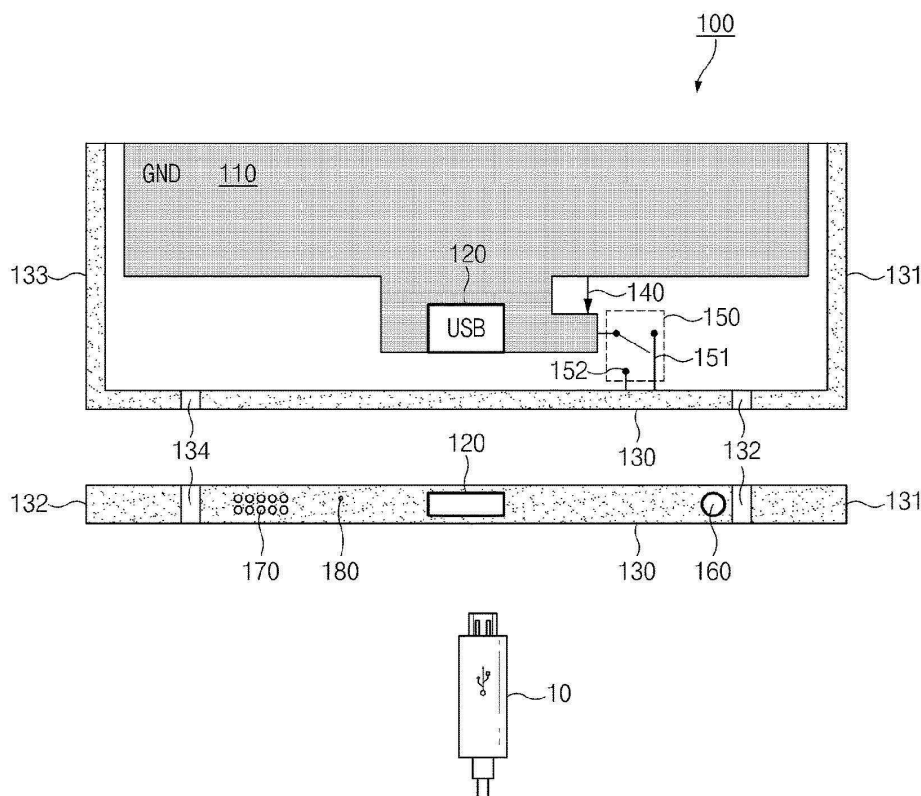
Dec. 15, 2015 (KR) 10-2015-0179242

Publication Classification

(51) **Int. Cl.**
H01Q 5/328 (2006.01)
H01Q 13/10 (2006.01)

(57) **ABSTRACT**

An electronic device including an antenna is provided. The electronic device includes a ground plane, an antenna element that is electrically connected to the ground plane through a first electrical path, a receptacle that accommodates an external connector that is electrically connected to the ground plane and comprises a conductive line, and a control circuit that is configured to: detect whether the external connector is inserted into the receptacle, and change the first electrical path to a second electrical path or add the second electrical path to the first electrical path between the antenna element and the ground plane, when the external connector is inserted into the receptacle.





US 20170170566A1

(19) **United States**(12) **Patent Application Publication**
WU et al.(10) **Pub. No.: US 2017/0170566 A1**(43) **Pub. Date: Jun. 15, 2017**(54) **SURFACE-MOUNT MULTI-BAND ANTENNA**(71) Applicant: **Cirotech Technology Corp.**, Tainan
City (TW)(72) Inventors: **Chia-Tsung WU**, Tainan City (TW);
Shin-Hui CHOU, Tainan City (TW)(21) Appl. No.: **15/160,404**(22) Filed: **May 20, 2016**(30) **Foreign Application Priority Data**

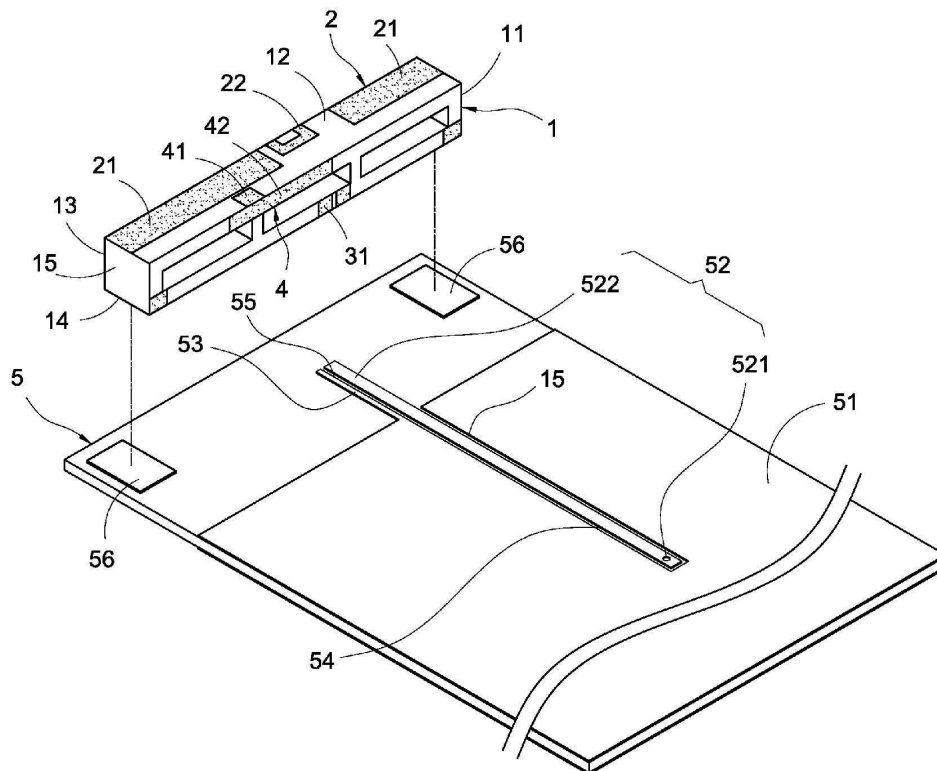
Dec. 9, 2015 (TW) 104219703

Publication Classification(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/10 (2006.01)
H01Q 1/48 (2006.01)(52) **U.S. CL.**CPC **H01Q 9/04** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/10** (2015.01)

(57)

ABSTRACT

A surface-mount multi-band antenna includes a carrier, a first radiator, a second radiator, and a third radiator. The first radiator, the second radiator and the third radiator are respectively arranged on faces of the carrier. The first radiator includes a first rectangular region and a second rectangular region arranged on the bottom face of the carrier. The second radiator includes a third rectangular region and a fourth rectangular region on the bottom face. The second rectangular region has an opened area on the surface of the bottom face to provide coupling effect to increase bandwidth. One end of the fourth rectangular region forms a ground point and has a separation of 0.75 mm with the second rectangular region to provide matching. The fourth rectangular region has a length of 9.9 mm to add one more mode.





US 20170170859A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0170859 A1**

(43) **Pub. Date: Jun. 15, 2017**

(54) **ACCESSORY CASE FOR WIRELESS
ELECTRONIC DEVICE**

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

(72) Inventors: **Basim H. Noori**, San Jose, CA (US);
Khan M. Salam, Dublin, CA (US);
Matthew A. Mow, Los Altos, CA (US);
Yi Jiang, Sunnyvale, CA (US); **Yuehui
Ouyang**, Sunnyvale, CA (US)

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

(21) Appl. No.: **14/966,421**

(22) Filed: **Dec. 11, 2015**

Publication Classification

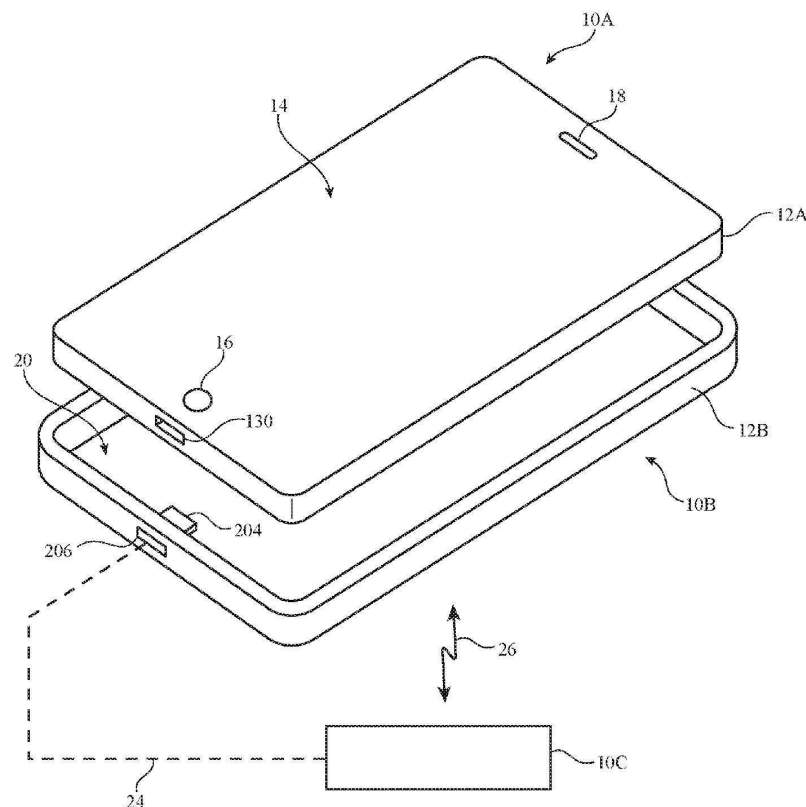
(51) **Int. Cl.**
H04B 1/3883 (2006.01)
H04B 7/06 (2006.01)
H02J 7/02 (2006.01)
H04B 1/3888 (2006.01)

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

CPC **H04B 1/3883** (2013.01); **H04B 1/3888**
(2013.01); **H04B 7/0617** (2013.01); **H02J**
7/025 (2013.01)

(57) **ABSTRACT**

A removable case may have a body that is configured to receive an electronic device. The case may be coupled to the electronic device using wired and wireless paths. The case may include circuitry that receives wireless power from external equipment. The circuitry that receives the wireless power may receive wireless power at microwave frequencies. Received power may be supplied to the electronic device through wired and wireless paths. The removable case may also include circuitry that wirelessly communicates with external equipment. An array of antennas may be used to support beam steering. The array of antennas may support wireless communications in millimeter wave communications bands such as a communications band at 60 GHz or other extremely high frequency communications bands. The case and electronic device may have respective intermediate frequency antenna structures to allow intermediate frequency signals to be wirelessly conveyed between the case and device.





US 20170179575A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0179575 A1**

(43) **Pub. Date: Jun. 22, 2017**

(54) **PORTABLE ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventors: **Chien-Ming Hsu**, Taipei City (TW);
Wang-Ta Hsieh, Taipei City (TW);
Kuei-Shun Yeh, Taipei City (TW);
Shih-Chia Chiu, Taipei City (TW);
Chuan-Chien Huang, Taipei City (TW)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/38** (2013.01)

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

(57) **ABSTRACT**

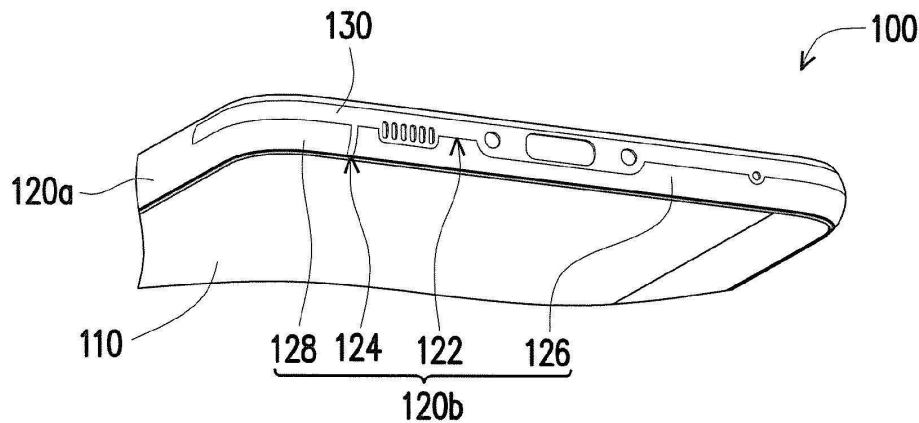
(21) Appl. No.: **15/376,677**

(22) Filed: **Dec. 13, 2016**

(30) **Foreign Application Priority Data**

Dec. 22, 2015 (CN) 201510991116.0

A portable electronic device including a front cover, a back cover and a circuit board is provided. The circuit board is located between the front cover and the back cover. The back cover is combined with the front cover and includes a back section, a plurality of side sections and a separator, at least one of the side sections adjacent to the back cover includes a groove close to the back section and a slot far away from the back section, the slot is connected through to the groove, a first antenna unit and a second antenna unit are defined at the side section by the groove and the slot. The separator is located in the groove and the slot.





US 20170179581A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0179581 A1**

(43) **Pub. Date: Jun. 22, 2017**

(54) **COUPLED ANTENNA STRUCTURE**

(71) Applicant: **Suunto Oy**, Vantaa (FI)

(72) Inventors: **Heikki Puuri**, Vantaa (FI); **Erik Lindman**, Vantaa (FI)

(21) Appl. No.: **15/386,090**

(22) Filed: **Dec. 21, 2016**

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/794,468, filed on Mar. 11, 2013.

Publication Classification

(51) **Int. Cl.**
H01Q 1/27 (2006.01)
H01Q 1/36 (2006.01)
G04R 60/02 (2006.01)
H01Q 5/385 (2006.01)

H01Q 7/00 (2006.01)

H01Q 1/38 (2006.01)

H01Q 9/04 (2006.01)

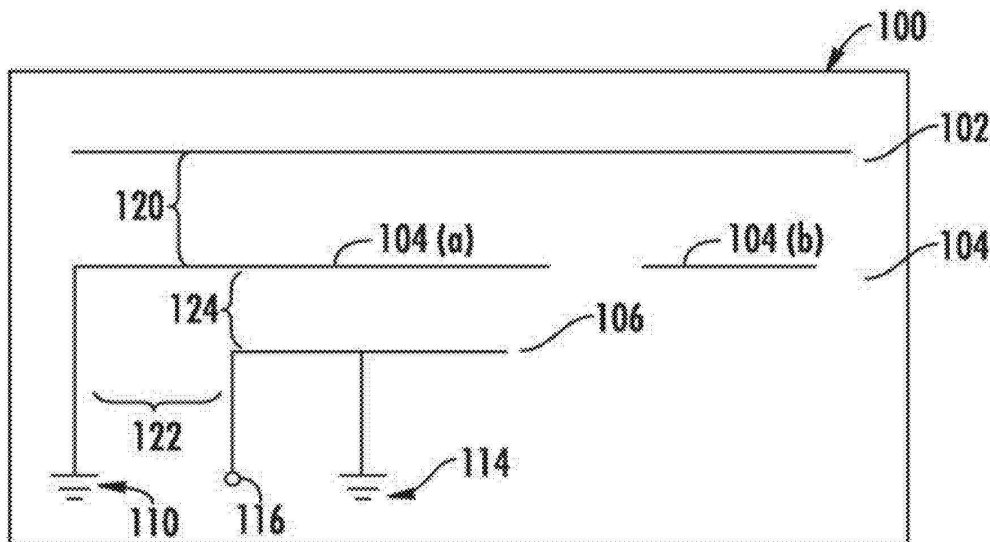
(52) **U.S. Cl.**

CPC **H01Q 1/273** (2013.01); **H01Q 1/38** (2013.01); **H01Q 1/36** (2013.01); **H01Q 9/0457** (2013.01); **H01Q 5/385** (2015.01); **H01Q 7/005** (2013.01); **G04R 60/02** (2013.01)

(57)

ABSTRACT

A coupled antenna apparatus particularly well adapted for small form factor, metal encased applications that utilize satellite wireless links, e.g. GPS. Certain examples use electromagnetic feeding that includes one or more separate feed elements that are not galvanically connected to a radiator element of the antenna. Additionally, one radiator element of the antenna can be located on an outermost surface of a bezel of an electronic device, for example a wrist-wearable device. A resonating circuit is housed within an electronic device and electrically coupled to such an outer radiator element.





US 20170179590A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0179590 A1**

(43) **Pub. Date: Jun. 22, 2017**

(54) **ANTENNA ARRANGEMENT**

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

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

(71) Applicant: **Intel Corporation**, Santa Clara, CA
(US)

(57)

ABSTRACT

(72) Inventors: **Saku Lahti**, Tampere, FL (US); **Mikko S. Komulainen**, Tampere, FL (US)

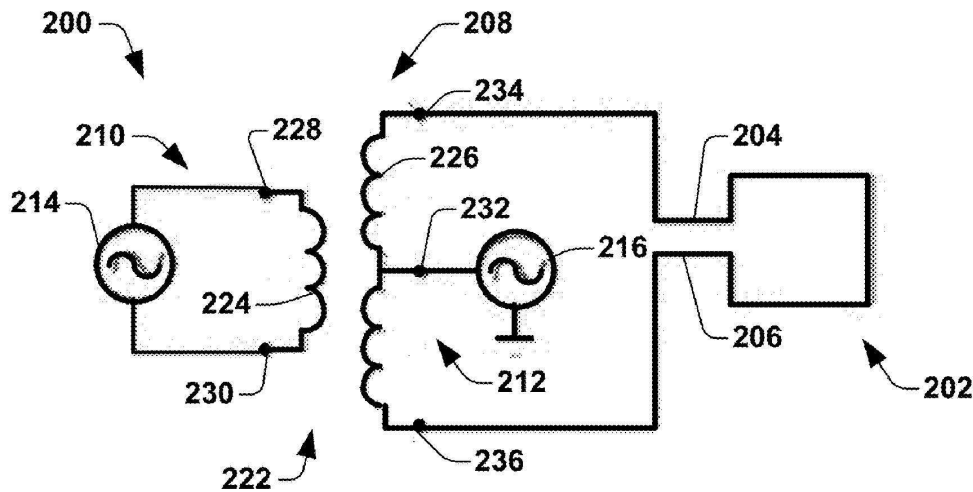
An antenna system includes an antenna having a symmetric geometry with respect to first and second antenna feed ports associated therewith, and a hybrid antenna feed circuit coupled to the first and second antenna feed ports of the antenna. The hybrid antenna feed circuit is configured to receive first and second transmit signals and feed the first transmit signal to the first and second antenna feed ports in a balanced feed mode and feed the second transmit signal to the first and second antenna feed ports in an unbalanced mode in a concurrent fashion.

(21) Appl. No.: **14/976,847**

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

Publication Classification

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





US 20170179591A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0179591 A1**

(43) **Pub. Date: Jun. 22, 2017**

(54) **ANTENNA ASSEMBLY AND ELECTRONIC DEVICE**

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

CPC **H01Q 1/528** (2013.01); **H01Q 1/48** (2013.01); **H01Q 1/243** (2013.01)

(71) Applicant: **Xiaomi Inc.**, Beijing (CN)

(72) Inventors: **Wei KUANG**, Beijing (CN); **Wendong LIU**, Beijing (CN); **Youquan SU**, Beijing (CN)

(57)

ABSTRACT

(21) Appl. No.: **15/385,851**

(22) Filed: **Dec. 20, 2016**

(30) **Foreign Application Priority Data**

Dec. 21, 2015 (CN) 201510965362.9

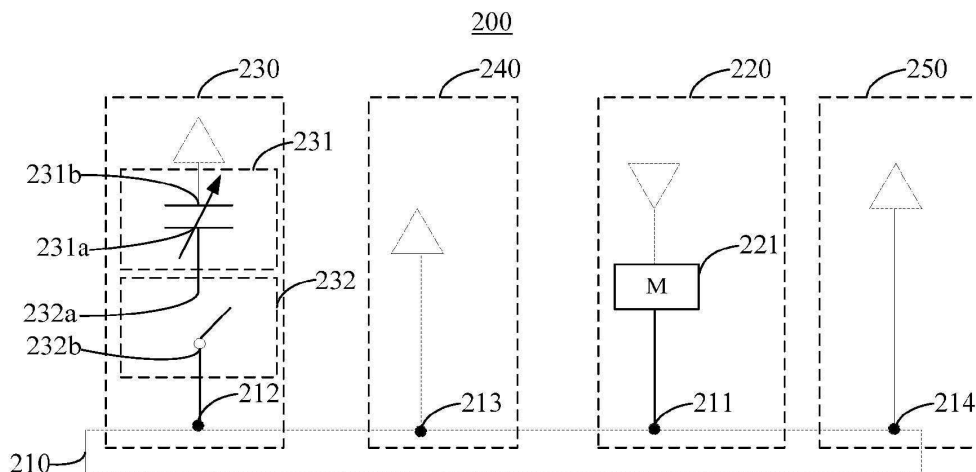
Publication Classification

(51) **Int. Cl.**

H01Q 1/52 (2006.01)

H01Q 1/48 (2006.01)

An antenna assembly and an electronic device are provided. The antenna assembly includes: an antenna body having a feed point, a first grounding point, a second grounding point, and a third grounding point; a feed circuit connected with the antenna body via the feed point; a first grounding circuit configured to provide at least two low frequency states and connected with the antenna body via the first grounding point; a second grounding circuit connected with the antenna body via the second grounding point; and a third grounding circuit connected with the antenna body via the third grounding point.





US 20170179996A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0179996 A1**

(43) **Pub. Date: Jun. 22, 2017**

(54) **INFORMATION HANDLING SYSTEM
DYNAMIC ANTENNA MANAGEMENT**

Publication Classification

(71) Applicant: **Dell Products L.P.**, Round Rock, TX
(US)

(51) **Int. Cl.**
H04B 1/40 (2006.01)
G06F 3/0488 (2006.01)
H04B 1/3827 (2006.01)

(72) Inventors: **Lawrence E. Knepper**, Leander, TX
(US); **Liam Prendergast**, Limerick
(IE); **Benny J. Bologna**, Austin, TX
(US); **Deeder M. Aurongzeb**, Austin,
TX (US)

(52) **U.S. Cl.**
CPC **H04B 1/40** (2013.01); **H04B 1/3838**
(2013.01); **G06F 3/0488** (2013.01)

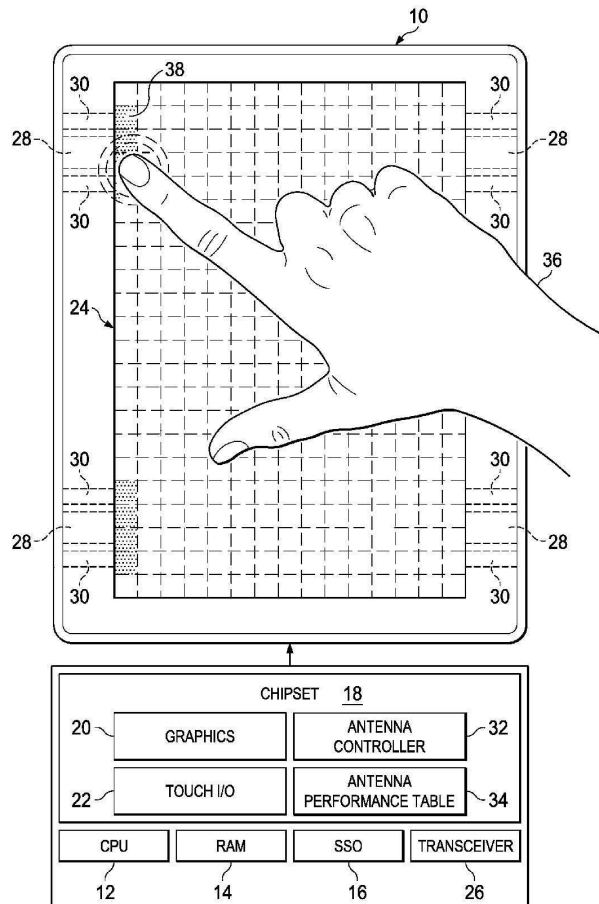
(73) Assignee: **Dell Products L.P.**, Round Rock, TX
(US)

(57) **ABSTRACT**

A portable information handling system has plural antennae integrated in a housing proximate a touchscreen display. An antenna controller interfaced with the touchscreen display alters performance settings of the plural antennae, such as impedance tuning settings and selection of one or more antenna as active and/or idle. Touchscreen display touched locations and touch area sizes are associated in a table with predetermined performance settings for lookup by the antenna controller.

(21) Appl. No.: **14/970,948**

(22) Filed: **Dec. 16, 2015**





US 20170180520A1

(19) **United States**

(12) **Patent Application Publication**
WU

(10) **Pub. No.: US 2017/0180520 A1**

(43) **Pub. Date: Jun. 22, 2017**

(54) **MOBILE TERMINAL AND EXTERNAL ANTENNA**

(71) Applicants: **LE HOLDINGS (BEIJING) CO., LTD.**, Beijing (CN); **LEMOBILE INFORMATION TECHNOLOGY (BEIJING) CO., LTD.**, Beijing (CN)

(72) Inventor: **Hao WU**, Beijing (CN)

(21) Appl. No.: **15/242,414**

(22) Filed: **Aug. 19, 2016**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2016/088673, filed on Jul. 5, 2016.

(30) **Foreign Application Priority Data**

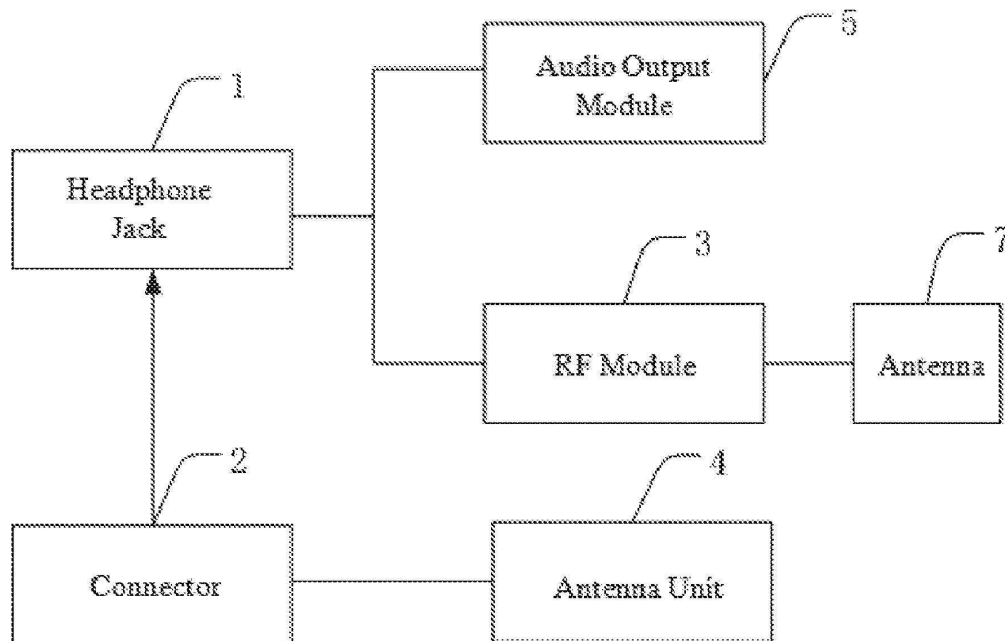
Dec. 16, 2015 (CN) 2015109446239

Publication Classification

(51) **Int. Cl.**
H04M 1/02 (2006.01)
H04M 1/60 (2006.01)
(52) **U.S. Cl.**
CPC **H04M 1/0202** (2013.01); **H04M 1/6058** (2013.01)

(57) **ABSTRACT**

Disclosed are a mobile terminal and an external antenna. The mobile terminal comprises: a headphone jack which comprises at least two connection terminals and is to be plugged by a connector of an external device and remains electrically connected to the said external device; an audio output module which comprises an audio connection port and is connected to a first connection terminal and a second connection terminal of the said headphone jack; and a radio frequency module comprising multiple antenna connection ports, wherein a first antenna connection port is connected to a first or second connection terminal of the said headphone jack; wherein the said first antenna connection port, via a capacitor, is coupled to the said first connection terminal or the said second connection terminal.





US 20170180521A1

(19) **United States**(12) **Patent Application Publication**
KITOWSKI(10) **Pub. No.: US 2017/0180521 A1**(43) **Pub. Date: Jun. 22, 2017**(54) **WIRELESS ELECTRONIC
COMMUNICATION DEVICES, IN
PARTICULAR, MOBILE PHONES**(52) **U.S. CL.**
CPC **H04M 1/026** (2013.01); **H04W 88/02**
(2013.01)(71) Applicant: **SAMADHI ENGINEERING SP. z o.**
o., Warszawa (PL)(57) **ABSTRACT**(72) Inventor: **Przemyslaw KITOWSKI**, Gdansk (PL)(73) Assignee: **SAMADHI ENGINEERING SP. z o.**
o., Warszawa (PL)(21) Appl. No.: **15/273,193**(22) Filed: **Sep. 22, 2016**(30) **Foreign Application Priority Data**

Dec. 22, 2015 (PL) P-415459

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

Embodiments of the present invention provide a wireless electronic communication device, in particular a mobile phone, including a transceiver, a display, a keyboard, an antenna to be used with GSM 2G 800/900/1800/1900 MHz radio frequencies. The antenna is mounted in a antenna socket inside a casing, wherein the antenna socket is made in the form of a notch at the back of the casing and vertical walls of the notch being spatially shaped, preferably along a wavy serrated line. The ratio of a circumferential length of the notch (L_z) to a length of the inner contour of the notch (L) satisfies the following relationship: $L_z/L > 1.4$, wherein L_z is the circumferential length of the wavy edge line and L is the length of the inner contour of the antenna socket notch.

