US 20160380335A1

(19) **United States**

(12) **Patent Application Publication**

JEONG et al.

(10) **Pub. No.: US 2016/0380335 A1**

(43) **Pub. Date: Dec. 29, 2016**

(54) **PORTABLE ELECTRONIC DEVICE COVER**

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

(72) Inventors: **Wonseok JEONG**, Gyeonggi-do (KR); **Donghwan KIM**, Gyeonggi-do (KR); **Bumjin CHO**, Gyeonggi-do (KR); **Donguk CHOI**, Gyeonggi-do (KR); **Sangmin HAN**, Gyeonggi-do (KR)

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

(21) Appl. No.: **15/038,848**

(22) PCT Filed: **Nov. 27, 2014**

(86) PCT No.: **PCT/KR2014/011457**

§ 371 (c)(1),
(2) Date: **May 24, 2016**

(30) **Foreign Application Priority Data**

Nov. 27, 2013 (KR) 10-2013-0145604

Publication Classification

(51) **Int. Cl.**

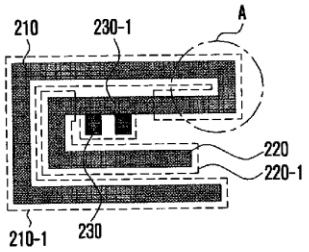
H01Q 1/24 (2006.01)
H01Q 1/50 (2006.01)
H01Q 9/04 (2006.01)

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

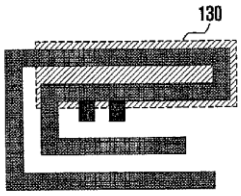
CPC ***H01Q 1/243*** (2013.01); ***H01Q 9/0414*** (2013.01); ***H01Q 1/50*** (2013.01); *H04M 1/026* (2013.01)

(57) **ABSTRACT**

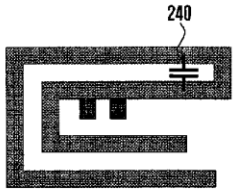
A portable electronic device cover, according to the present invention, comprises a conductive plate which is spaced at a predetermined distance from an antenna mounted in a portable electronic device and is arranged at a position overlapped with at least a part of the antenna when the portable electronic device is mounted in the portable electronic device cover.



[201]



[203]



[205]

US 20160380336A1

(19) **United States**

(12) **Patent Application Publication**

WU et al.

(10) **Pub. No.: US 2016/0380336 A1**

(43) **Pub. Date: Dec. 29, 2016**

(54) **WIRELESS COMMUNICATION APPARATUS AND ANTENNA MODULE THEREOF**

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

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

(21) Appl. No.: **15/182,617**

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

(30) **Foreign Application Priority Data**

Jun. 26, 2015 (TW) 104120770

Publication Classification

(51) **Int. Cl.**

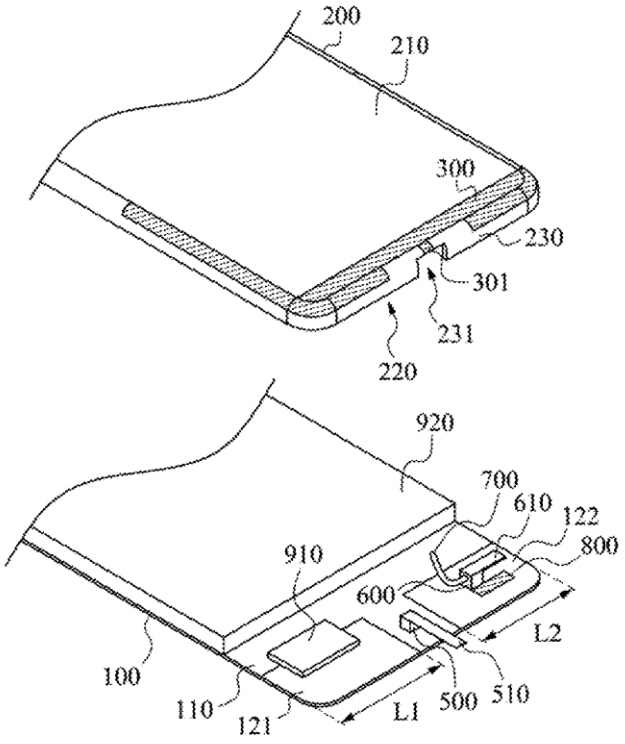
H01Q 1/24	(2006.01)
H01Q 1/50	(2006.01)
H01Q 1/48	(2006.01)

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

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

(57) **ABSTRACT**

A wireless communication apparatus includes a substrate, an electrical insulation cover, a first antenna and a second antenna. The substrate has a ground surface. The electrical insulation cover covers the substrate. The electrical insulation cover has first and second surfaces. The first antenna is disposed on the first surface and is electrically connected to the ground surface. The second antenna is disposed on the second surface and includes first and second capacitive coupling portions, a signal feeding portion and a first slit. The signal feeding portion connects the first and second capacitive coupling portions. The first slit is located between the first and second capacitive coupling portions. The first antenna can generate first and second resonant modes with the first and second capacitive coupling portions in a manner of capacitive coupling, respectively. The first and second resonant modes have different frequency bands.



US 20160380341A1

(19) **United States**

(12) **Patent Application Publication**

HAN et al.

(10) **Pub. No.: US 2016/0380341 A1**

(43) **Pub. Date: Dec. 29, 2016**

(54) **WIRELESS COMMUNICATION DEVICE WITH AN ANTENNA ADJACENT TO AN EDGE OF THE DEVICE**

(71) Applicant: **Futurewei Technologies, Inc.**, Plano, TX (US)

(72) Inventors: **Chul Min HAN**, San Diego, CA (US); **Jorge Fabrega SANCHEZ**, San Diego, CA (US)

(73) Assignee: **Futurewei Technologies, Inc.**, Plano, TX (US)

(21) Appl. No.: **15/263,559**

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

Related U.S. Application Data

(63) Continuation of application No. 15/059,588, filed on Mar. 3, 2016, now Pat. No. 9,462,096, which is a continuation of application No. 13/278,836, filed on Oct. 21, 2011, now Pat. No. 9,300,033.

Publication Classification

(51) **Int. Cl.**

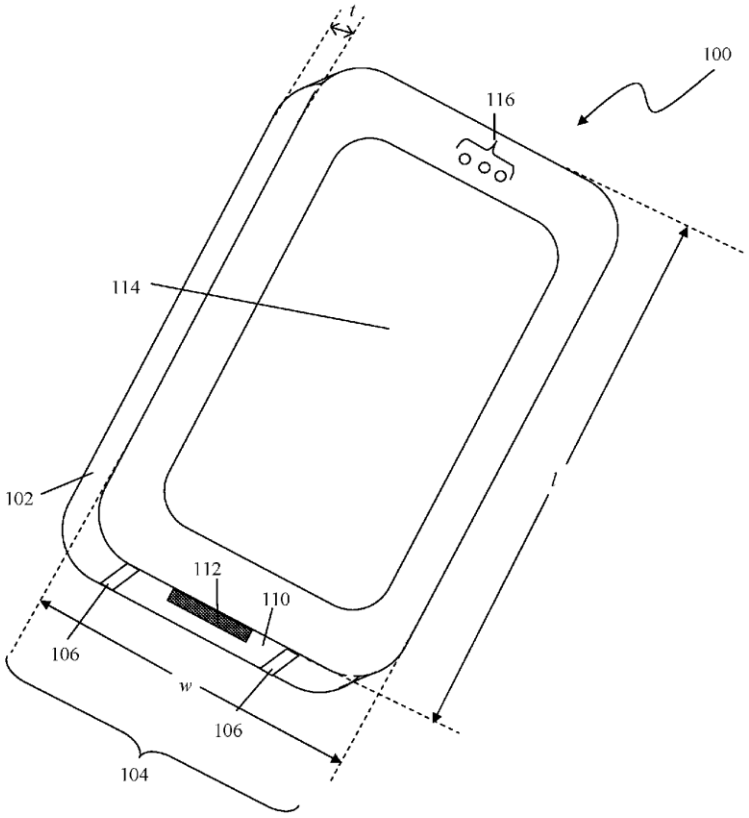
H01Q 1/24	(2006.01)
H01Q 13/10	(2006.01)
H01Q 21/29	(2006.01)
H01Q 1/50	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/50*** (2013.01); ***H01Q 13/10*** (2013.01); ***H01Q 21/293*** (2013.01)

(57) **ABSTRACT**

A wireless communication device comprising a housing comprising a plurality of edges and configured to serve as an external surface for the wireless communication device, and an antenna adjacent to at least a first edge of the housing, wherein the antenna comprises at least a conductive strip and at least one slot and wherein the antenna is configured to receive and transmit wireless signals, wherein the first edge of the housing is one of an edge of the housing nearest an ear piece and an edge of the housing that is opposite the edge of the housing nearest the ear piece, and wherein the conductive strip and the slot are adjacent to at least the first edge of the housing.



US 20170005393A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0005393 A1**

Wu (43) **Pub. Date: Jan. 5, 2017**

(54) **ANTENNA MODULE AND MOBILE DEVICE USING SAME**

(71) Applicant: **Jing Wu**, Shenzhen (CN)

(72) Inventor: **Jing Wu**, Shenzhen (CN)

(73) Assignee: **AAC Technologies Pte. Ltd.**, Singapore city (SG)

(21) Appl. No.: **15/008,583**

(22) Filed: **Jan. 28, 2016**

(30) **Foreign Application Priority Data**

Jul. 2, 2015 (CN) 201520469050.4

Publication Classification

(51) **Int. Cl.**

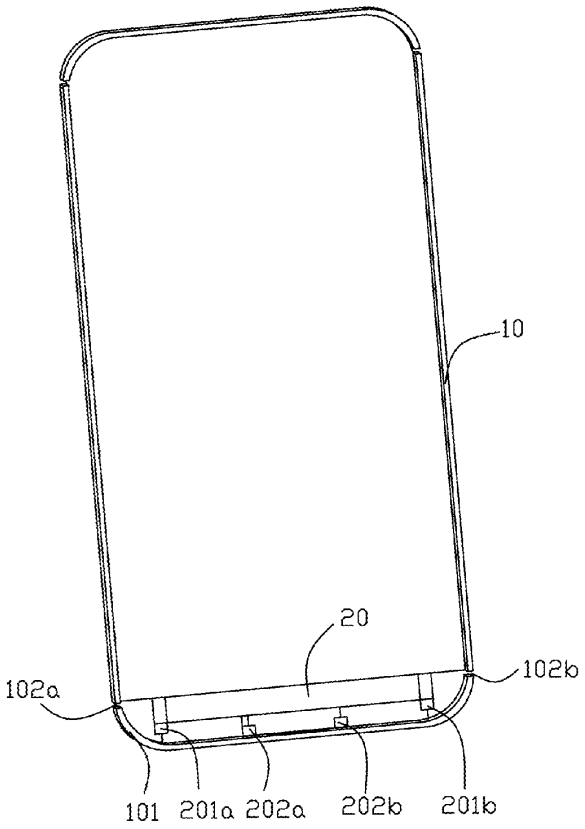
H01Q 1/24	(2006.01)
H01Q 23/00	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 9/04*** (2013.01); ***H01Q 23/00*** (2013.01)

(57) **ABSTRACT**

An antenna module is provided in the present disclosure. The antenna module includes a printed circuit board and a metal frame surrounding the printed circuit board. The metal frame includes a metal radiating portion, and a first feed point, a second feed point, a first ground point and a second ground point are disposed on the printed circuit board and electrically connected to the metal radiating portion. The first feed point and the second feed point are symmetrically disposed at two opposite sides of a central axis of the printed circuit board; the first ground point and the second ground point are respectively disposed corresponding to the first feed point and the second feed point. The present disclosure also provides a mobile device using the antenna module.



US 20170005394A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0005394 A1**

Wang et al. (43) **Pub. Date: Jan. 5, 2017**

(54) **ANTENNA WITH SLITLESS CLOSED FRAME AND WIRELESS COMMUNICATIONS DEVICE**

(71) Applicant: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen (CN)

(72) Inventors: **Jiaming Wang**, Shanghai (CN); **Rui Zhang**, Shanghai (CN); **Xiaoli Yang**, Shanghai (CN); **Meng Hou**, Shanghai (CN); **Xuefei Zhang**, Shenzhen (CN)

(21) Appl. No.: **15/118,276**

(22) PCT Filed: **Jun. 30, 2014**

(86) PCT No.: **PCT/CN2014/081224**

§ 371 (c)(1),
(2) Date: **Aug. 11, 2016**

Publication Classification

(51) **Int. Cl.**

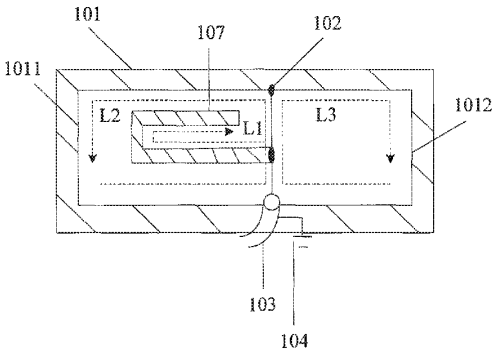
H01Q 1/24	(2006.01)
H01Q 7/00	(2006.01)
H01Q 1/48	(2006.01)

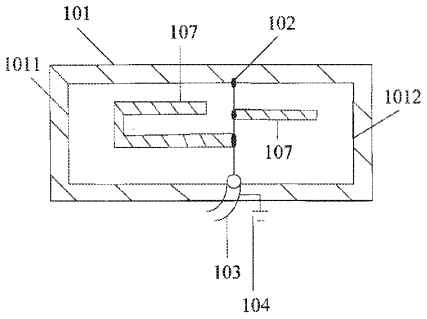
(52) **U.S. Cl.**

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 7/00*** (2013.01)

(57) **ABSTRACT**

An antenna apparatus and a wireless communications device, where the antenna apparatus includes a feeding part, a grounding part, and a closed frame, where the closed frame encircles a main body of the wireless communications device. The feeding part and the grounding part are electrically connected to the closed frame, and the closed frame, the feeding part, and the grounding part form a first current loop and a second current loop, where resonance is generated between the first current loop and the second current loop. There is no need to dispose a slit on the closed frame of the wireless communications device that uses a metal appearance, and a position of the feeding part of a radio frequency feeder is used, to mitigate impact, of a closed environment caused by not disposing the slit on the closed frame, on antenna radiation performance, thereby improving antenna performance and user experience.





US 20170005397A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0005397 A1**

Jiang et al. (43) **Pub. Date: Jan. 5, 2017**

(54) **TUNABLE MULTIBAND ANTENNA WITH PASSIVE AND ACTIVE CIRCUITRY**

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

(72) Inventors: **Yi Jiang**, Sunnyvale, CA (US); **Siwen Yong**, Santa Clara, CA (US); **Gordon Coutts**, Santa Clara, CA (US); **Lijun Zhang**, Cupertino, CA (US); **Qingxiang Li**, Mountain View, CA (US); **Robert W. Schlub**, Cupertino, CA (US)

(21) Appl. No.: **15/264,500**

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

Related U.S. Application Data

(63) Continuation of application No. 13/864,968, filed on Apr. 17, 2013, now Pat. No. 9,496,608.

Publication Classification

(51) **Int. Cl.**

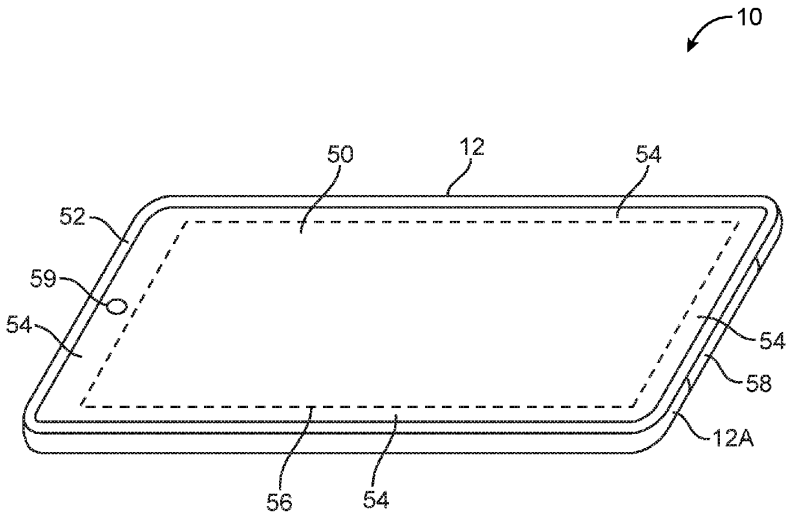
H01Q 1/24	(2006.01)
H01Q 1/48	(2006.01)
H01Q 5/392	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 5/392*** (2015.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An electronic device may have an antenna for providing coverage in wireless communications bands of interest such as a low frequency communications band and a high frequency communications band. The antenna may have an antenna ground and an antenna resonating element. The antenna resonating element may have a high band arm that contributes to a first high band resonance in the high band and may have a low band arm that exhibits a low band resonance in the low band. A passive filter that is coupled between first and second portions of the antenna resonating element may be configured to exhibit a short circuit impedance associated with a bypass path that allows the antenna resonating element to contribute to a second high band resonance in the high band. A tunable inductor coupled to the antenna resonating element may be used to tune the low band resonance.



US 20170005413A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0005413 A1**

Tai (43) **Pub. Date: Jan. 5, 2017**

(54) **TUNABLE ANTENNA MODULE USING FREQUENCY-DIVISION CIRCUIT FOR MOBILE DEVICE WITH METAL COVER**

(71) Applicant: **MEDIATEK INC.**, Hsin-Chu (TW)

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

(21) Appl. No.: **14/965,819**

(22) Filed: **Dec. 10, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/188,130, filed on Jul. 2, 2015.

Publication Classification

(51) **Int. Cl.**

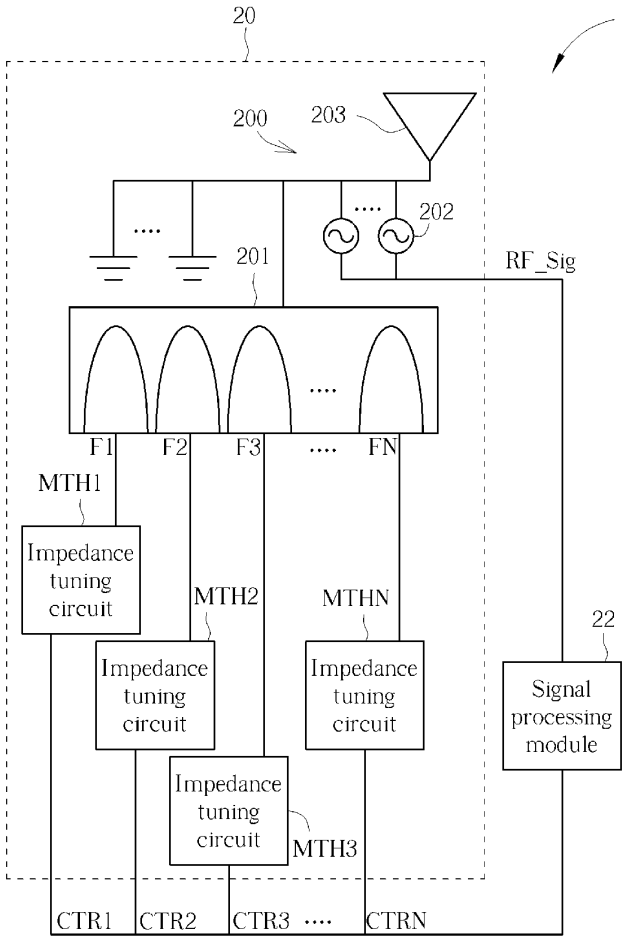
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)

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

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

(57) **ABSTRACT**

A tunable antenna module for a mobile device includes an antenna, a frequency-division circuit and one or more impedance-tuning circuits. The frequency-division circuit is coupled to a radiator of the antenna for forming one or more signal paths for one or more of component frequencies of a radio-frequency signal of the antenna. One or more the impedance-tuning circuits are coupled to the frequency-division circuit for tuning an impedance of the antenna at one or more of the component frequencies of the radio-frequency signal.



US 20170005414A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0005414 A1**

YANG (43) **Pub. Date: Jan. 5, 2017**

(54) **MOBILE DEVICE**

(71) Applicant: **Acer Incorporated**, New Taipei City (TW)

(72) Inventor: **Chung-Wen YANG**, New Taipei City (TW)

(21) Appl. No.: **15/019,045**

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

(30) **Foreign Application Priority Data**

Jul. 3, 2015 (TW) 104121616

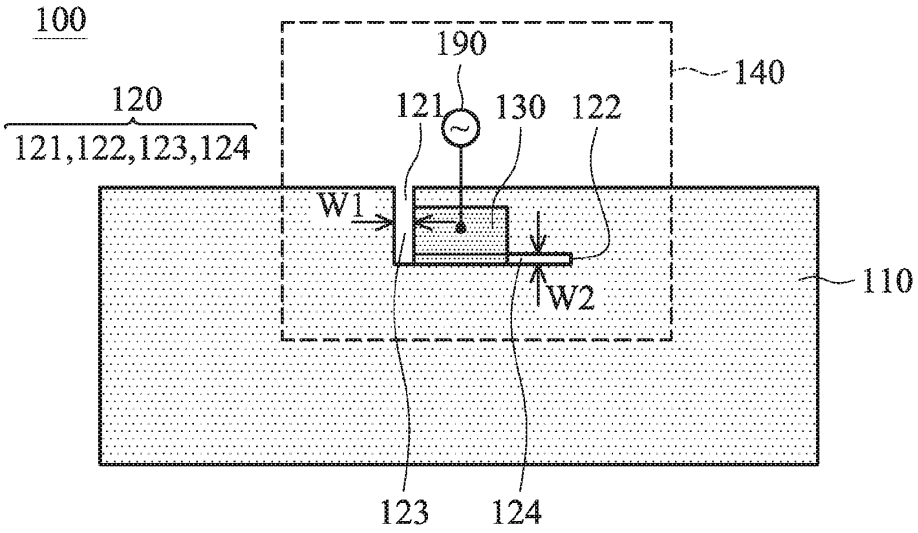
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 13/10*** (2013.01); ***H01Q 1/241*** (2013.01)

(57) **ABSTRACT**

A mobile device includes a metal back cover and a feeding antenna element. The metal back cover has a slot. The slot has an open end and a closed end. The feeding antenna element is coupled to a signal source, and extends across the slot. An antenna structure is formed by the metal back cover, the slot, and the feeding antenna element.



US 20170012341A1

(19) **United States**

(12) **Patent Application Publication**

Mai et al.

(10) **Pub. No.: US 2017/0012341 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA SYSTEM**

(71) Applicants: **Jianchun Mai**, Shenzhen (CN); **Chao Wang**, Shenzhen (CN)

(72) Inventors: **Jianchun Mai**, Shenzhen (CN); **Chao Wang**, Shenzhen (CN)

(73) Assignee: **AAC Technologies Pte. Ltd.,,** Singapore City (SG)

(21) Appl. No.: **15/011,458**

(22) Filed: **Jan. 29, 2016**

(30) **Foreign Application Priority Data**

Jul. 9, 2015 (CN) 201520493051.2

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

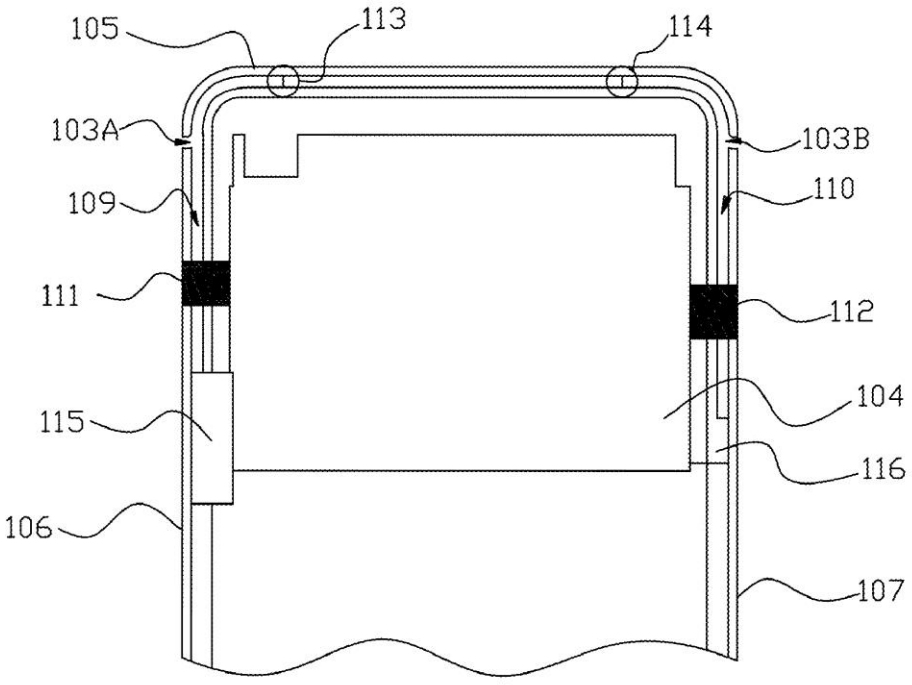
H01Q 5/50 (2006.01)

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

CPC ***H01Q 1/242*** (2013.01); ***H01Q 5/50*** (2015.01)

(57) **ABSTRACT**

An antenna system applicable to a mobile communication device is provided in the present disclosure. The antenna system includes a metal shell with a metal frame and a metal back cover, a printed circuit board (PCB) housed in the metal shell, and an antenna part with a first feed point and a second feed point. A first break point and a second break point are formed at two opposite sides of the metal frame; a first gap and a second gap are respectively formed at two opposite sides of the metal back cover for defining a first clearance area and a second clearance area. The first feed point is located in the first clearance area and contacts a left frame portion of the metal frame; the second feed point is located in the second clearance area and contacts a right frame portion of the metal frame.



US 20170012342A1

(19) **United States**

(12) **Patent Application Publication**

LAI et al.

(10) **Pub. No.: US 2017/0012342 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **TRANSFORMABLE MOBILE DEVICE**

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

(72) Inventors: **Chun-Nan LAI**, Taoyuan City (TW); **Chun-I LIN**, Taoyuan City (TW); **Hui LIN**, Taoyuan City (TW)

(21) Appl. No.: **14/838,765**

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

(30) **Foreign Application Priority Data**

Jul. 9, 2015 (TW) 104122257

Publication Classification

(51) **Int. Cl.**

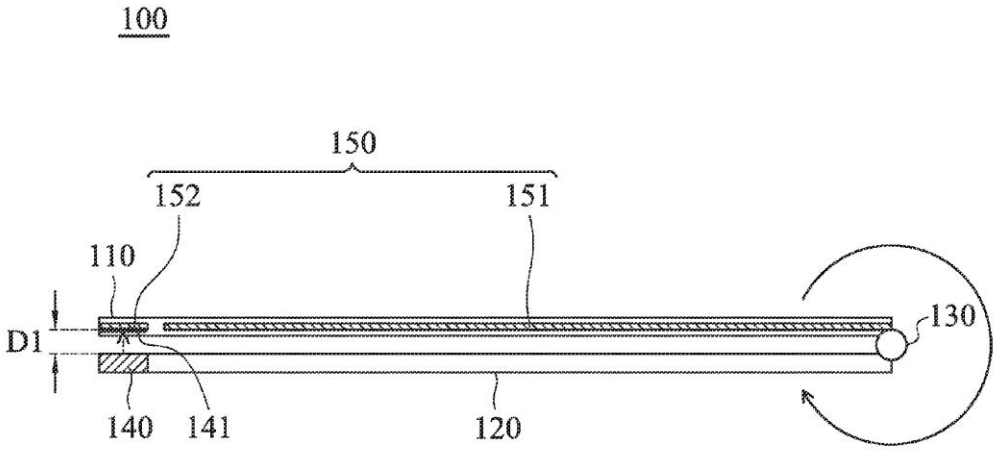
H01Q 1/24 (2006.01)
H01Q 1/22 (2006.01)
H01Q 1/48 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/2266*** (2013.01)

(57) **ABSTRACT**

A transformable mobile device operating in a notebook mode or a tablet mode is provided. The transformable mobile device includes a base, an upper cover, a hinge, a main antenna, and a ground metal plane. The hinge is connected between the base and the upper cover. The main antenna is disposed in the upper cover. The ground metal plane is disposed in the base, or on an outer surface of the base. The ground metal plane includes a main portion and a float portion. The float portion is completely separate from the main portion.



US 20170012344A1

(19) **United States**

(12) **Patent Application Publication**

Wu et al.

(10) **Pub. No.: US 2017/0012344 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA SYSTEM**

(71) Applicants: **Xiaopu Wu**, Shenzhen (CN); **Yongli Chen**, Shenzhen (CN)

(72) Inventors: **Xiaopu Wu**, Shenzhen (CN); **Yongli Chen**, Shenzhen (CN)

(73) Assignee: **AAC Technologies Pte. Ltd.**, Singapore city (SG)

(21) Appl. No.: **15/082,102**

(22) Filed: **Mar. 28, 2016**

(30) **Foreign Application Priority Data**

Jul. 10, 2015 (CN) 201520500898.9

Publication Classification

(51) **Int. Cl.**

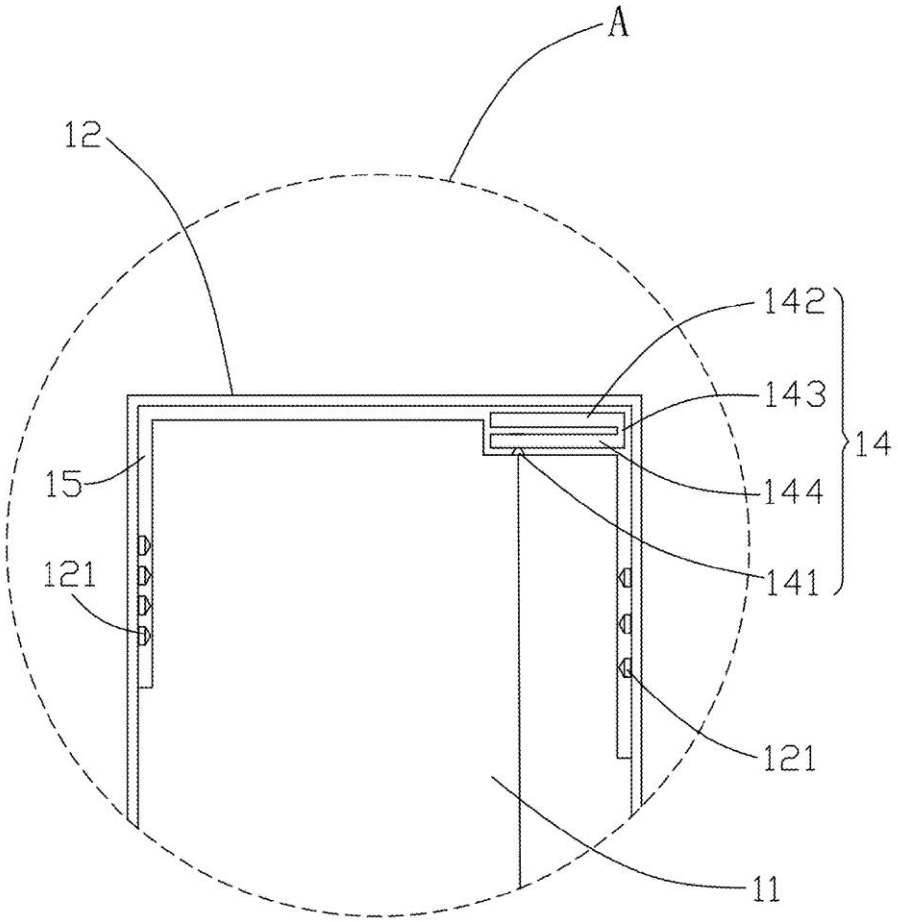
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/0414*** (2013.01)

(57) **ABSTRACT**

An antenna system applicable to a mobile communication device is provided in the present disclosure. The antenna system includes a metal frame; a grounding unit surrounded by the metal frame, and an internal antenna. One end of the grounding unit cooperates with the metal frame to form a clearance area, and the internal antenna is located in the clearance area. The internal antenna includes a feeding portion and a radiating portion; the radiating portion is spaced from the metal frame and is coupled to the metal frame. The feeding portion is connected to a feed source via a feed line.



US 20170012345A1

(19) **United States**

(12) **Patent Application Publication**

ZHANG et al.

(10) **Pub. No.: US 2017/0012345 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA UNIT AND TERMINAL**

(71) Applicant: **ZTE CORPORATION**, Shenzhen , Guangdong (CN)

(72) Inventors: **Lu ZHANG**, Shenzhen City, Guangdong Province (CN); **Wei LI**, Shenzhen City, Guangdong Province (CN)

(21) Appl. No.: **15/113,224**

(22) PCT Filed: **May 26, 2014**

(86) PCT No.: **PCT/CN2014/078464**

§ 371 (c)(1),
(2) Date: **Jul. 21, 2016**

(30) **Foreign Application Priority Data**

Jan. 24, 2014 (CN) 201410035207.2

Publication Classification

(51) **Int. Cl.**

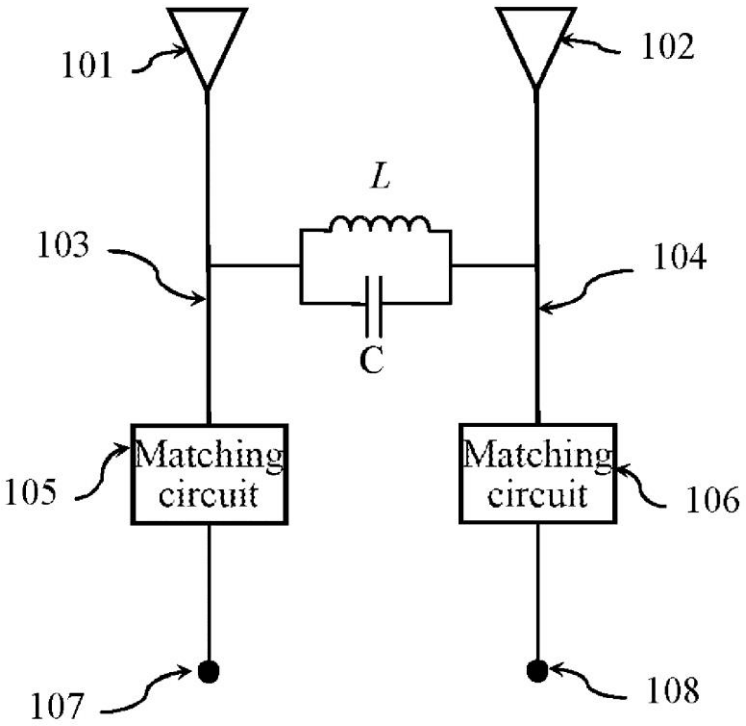
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/42 (2006.01)
H01Q 1/52 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/521*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 9/42*** (2013.01)

(57) **ABSTRACT**

The present document discloses an antenna unit and a terminal. The antenna unit disclosed by the present document includes an antenna circuit board, at least two neighboring antennas and an electromagnetic coupling module used for isolating coupling signal transmission between two neighboring antennas, wherein the electromagnetic coupling module is connected in series between the two neighboring antennas. The present document uses the electromagnetic coupling module to isolate signal transmission between the two neighboring antennas, i.e., electric signals in the two antennas are unable to be transmitted to opposite end, thereby reducing signal coupling between the neighboring antennas and improving the isolation between the two neighboring antennas.



US 20170012347A1

(19) **United States**

(12) **Patent Application Publication**

OHGUCHI et al.

(10) **Pub. No.: US 2017/0012347 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **WIRELESS DEVICE**

(71) Applicant: **SHARP KABUSHIKI KAISHA**, Sakai City (JP)

(72) Inventors: **Shuhei OHGUCHI**, Sakai-shi (JP); **Hiroyuki TAKEBE**, Sakai-shi (JP)

(21) Appl. No.: **15/119,137**

(22) PCT Filed: **Dec. 10, 2014**

(86) PCT No.: **PCT/JP2014/082672**

§ 371 (c)(1),
(2) Date: **Aug. 16, 2016**

(30) **Foreign Application Priority Data**

Feb. 19, 2014 (JP) 2014-030048

Publication Classification

(51) **Int. Cl.**

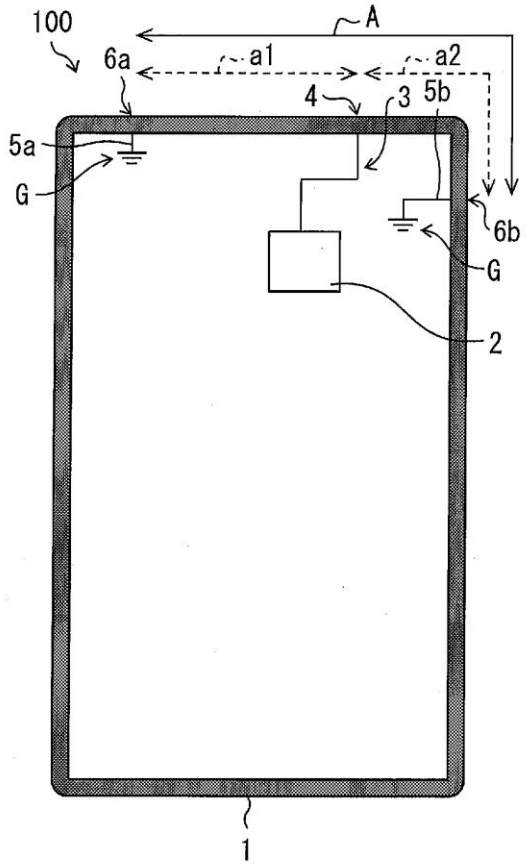
H01Q 1/24 (2006.01)
H01Q 9/42 (2006.01)
H01Q 1/50 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/50*** (2013.01); ***H01Q 9/42*** (2013.01)

(57) **ABSTRACT**

A degree of freedom in design of a frame member that serves as an antenna is improved without causing a decrease in antenna characteristics. A frame member (**1**) has a first reference electric potential connection point (**6***a*) and a second reference electric potential connection point (**6***b*), each of which is connected to a reference electric potential (G) of a housing. A wireless circuit (**2**) is connected to a feed connection point (**4**) located between the first and second reference electric potential connection points (**6***a* and **6***b*) of the frame member (**1**).



US 20170012348A1

(19) **United States**

(12) **Patent Application Publication**

ZHOU et al.

(10) **Pub. No.: US 2017/0012348 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA STRUCTURE FOR MOBILE PHONE**

(71) Applicant: **Luxshare Precision Industry Co., Ltd.**, Shenzhen City (CN)

(72) Inventors: **CHUN-LONG ZHOU**, Kunshan City (CN); **FANG-FANG ZHANG**, Kunshan City (CN)

(21) Appl. No.: **15/201,627**

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

(30) **Foreign Application Priority Data**

Jul. 6, 2015 (CN) 201510388105.3

Publication Classification

(51) **Int. Cl.**

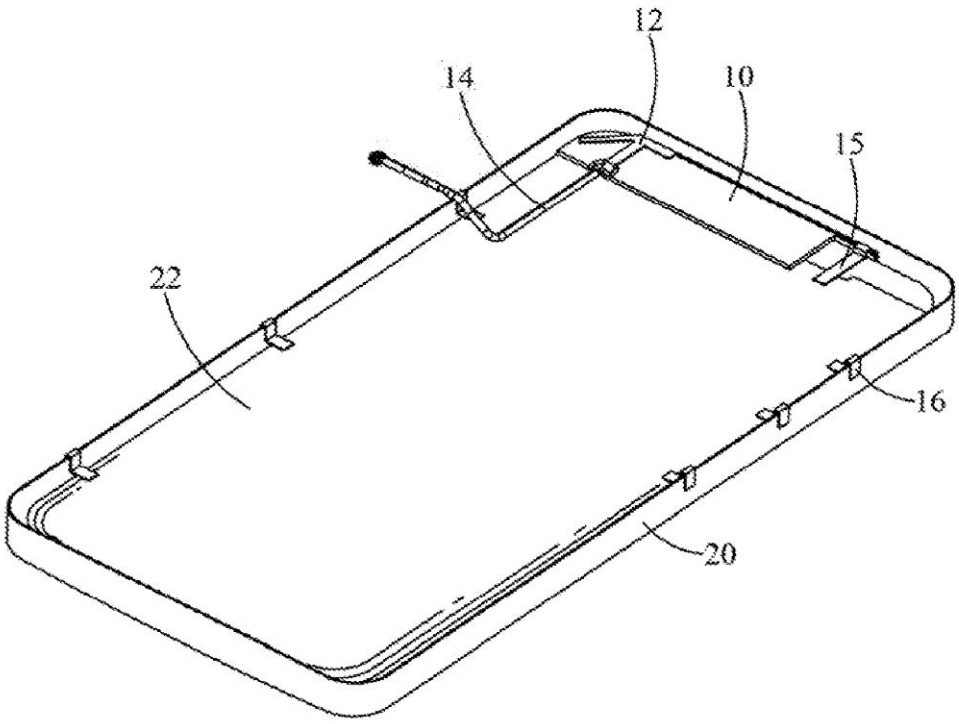
H01Q 1/24	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/50	(2006.01)

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

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

(57) **ABSTRACT**

An antenna structure for mobile phone includes a branch antenna acting with a metal shell of the mobile phone, an insulating body located in the metal shell, a main antenna disposed on the insulating body to be coupled to the metal shell and having a feed portion, and a feed-line including a conductive portion welded with the feed portion. The metal shell has a back cover and a ring-shaped metal frame integrated with the back cover. A circuit board is located in the metal shell. The main antenna has a ground portion connected to a ground circuit of the circuit board, and the feed-line includes a braid portion connected with the ground circuit. The metal frame is formed into a continuous metallic loop configuration to ensure integrality and beauty of the metal shell for the mobile phone.



US 20170012349A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2017/0012349 A1**

(43) **Pub. Date: Jan. 12, 2017**

LEE et al.

(54) **METHOD AND APPARATUS FOR CALIBRATION IN RADIO FREQUENCY MODULE**

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

(72) Inventors: **Dae-Young LEE**, Seongnam-si (KR); **Chul-Woo BYEON**, Suwon-si (KR); **Ju-Ho SON**, Seoul (KR); **Jeong-Ho LEE**, Suwon-si (KR); **Mee-Ran KIM**, Ansan-si (KR)

(21) Appl. No.: **15/206,720**

(22) Filed: **Jul. 11, 2016**

(30) **Foreign Application Priority Data**

Jul. 9, 2015 (KR) 10-2015-0097571

Publication Classification

(51) **Int. Cl.**

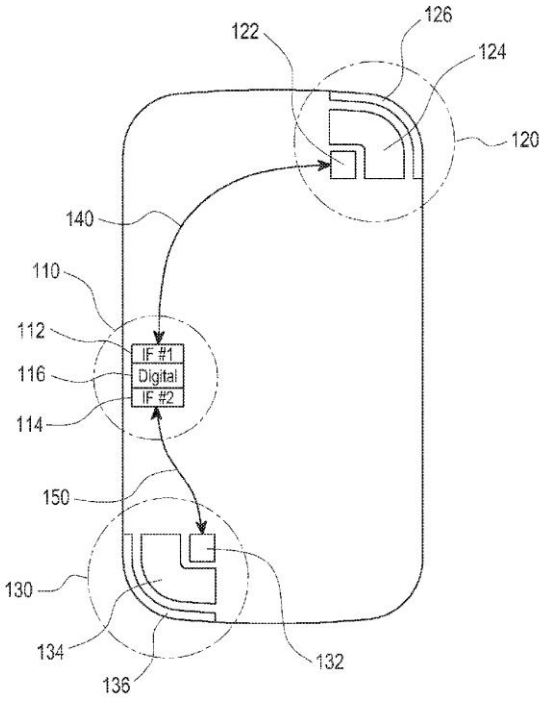
H01Q 1/24 (2006.01)
H01Q 21/22 (2006.01)
H01Q 3/30 (2006.01)
H01Q 1/50 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/50*** (2013.01); ***H01Q 21/22*** (2013.01); ***H01Q 3/30*** (2013.01)

(57) **ABSTRACT**

An apparatus and a method for phase calibration in an radio frequency (RF) module that constitutes a wireless communication device are provided. The apparatus and method include a test signal is emitted by a forward transmission antenna array of a first antenna array, and the emitted test signal, which is transferred by a member that covers the first and second antenna arrays, is received through a forward reception antenna array of the second antenna array. On the basis of the received test signal, a phase value is calibrated with regard to each of chain combinations formed by the first and second antenna arrays. Forward chain combinations that constitute the chain combination may be determined by a combination of forward transmission chains, which correspond to respective transmission antennas that constitute the forward transmission antenna array, and forward reception chains, which correspond to respective reception antennas that constitute the forward reception antenna array.



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(19) **United States**

(12) **Patent Application Publication**

NAKANO et al.

(10) **Pub. No.: US 2017/0012350 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA DEVICE, FEED ELEMENT, AND COMMUNICATION TERMINAL DEVICE**

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

(72) Inventors: **Shinichi NAKANO**, Nagaokakyo-shi (JP); **Kuniaki YOSUI**, Nagaokakyo-shi (JP); **Noboru KATO**, Nagaokakyo-shi (JP)

(21) Appl. No.: **15/272,684**

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

Related U.S. Application Data

(63) Continuation of application No. 14/221,437, filed on Mar. 21, 2014, which is a continuation of application No. PCT/JP2013/067805, filed on Jun. 28, 2013.

(30) **Foreign Application Priority Data**

Jun. 28, 2012	(JP)	2012-144968
Sep. 14, 2012	(JP)	2012-202755
Oct. 12, 2012	(JP)	2012-226975

Publication Classification

(51) **Int. Cl.**

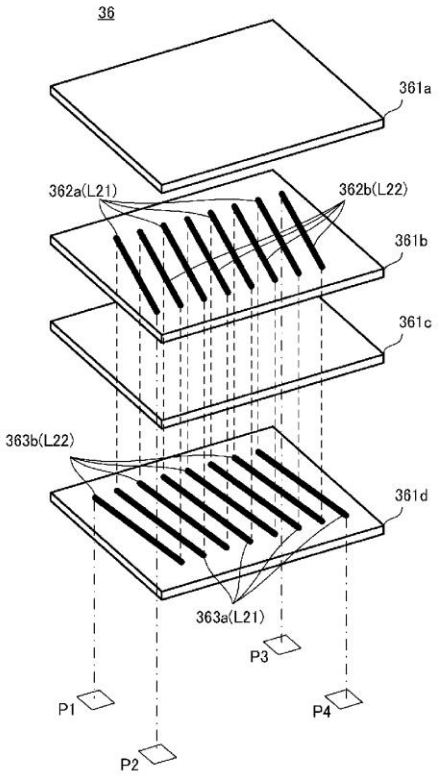
H01Q 1/24	(2006.01)
H01Q 1/48	(2006.01)
H01Q 7/06	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 7/06*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna device includes a conductor surface in which an opening having an open edge portion in communication with the outside is provided, a feed element including a first coil connected to the feed element and a second coil magnetically coupled to the first coil, a first mounting portion disposed in the open edge portion and connected to a first end of the second coil, and a second mounting portion disposed in the open edge portion in a state isolated from the first mounting portion and connected to a second end of the second coil. The first mounting portion and the conductor surface are directly or indirectly conducted to each other, and the second mounting portion and the conductor surface are directly or indirectly conducted to each other. A loop is defined around the opening through the first mounting portion, the second mounting portion, and the second coil.



US 20170012351A1

(19) **United States**

(12) **Patent Application Publication**

Werner et al.

(10) **Pub. No.: US 2017/0012351 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA APPARATUS AND COMMUNICATION SYSTEM**

(71) Applicant: **THE PENN STATE RESEARCH FOUNDATION**, University Park, PA (US)

(72) Inventors: **Douglas H. Werner**, State College, PA (US); **Zhihao Jiang**, State College, PA (US)

(21) Appl. No.: **15/273,790**

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

Related U.S. Application Data

(63) Continuation of application No. 14/462,780, filed on Aug. 19, 2014, now Pat. No. 9,478,852.

(60) Provisional application No. 61/868,836, filed on Aug. 22, 2013.

Publication Classification

(51) **Int. Cl.**

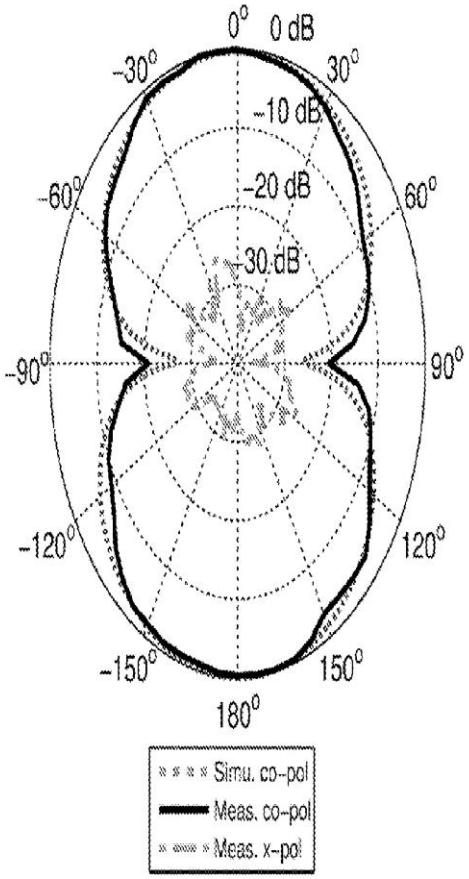
H01Q 1/27	(2006.01)
H01Q 1/52	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 1/273*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/52*** (2013.01); ***H01Q 1/241*** (2013.01)

(57) **ABSTRACT**

An antenna includes a first body having an array of resonators; a spacer adjacent to the first body, and a second body adjacent to the spacer such that the spacer is between the first and second bodies. The first body can be configured as an artificial metasurface ground plane and the second body can be configured as a monopole.



US 20170012352A1

(19) **United States**

(12) **Patent Application Publication**

HSU et al.

(10) **Pub. No.: US 2017/0012352 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **COMMUNICATION DEVICE**

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

(72) Inventors: **Hung-Ren HSU**, Taoyuan City (TW); **Chun-I LIN**, Taoyuan City (TW); **Huei LIN**, Taoyuan City (TW)

(21) Appl. No.: **14/818,575**

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

(30) **Foreign Application Priority Data**

Jul. 9, 2015 (TW) 104122256

Publication Classification

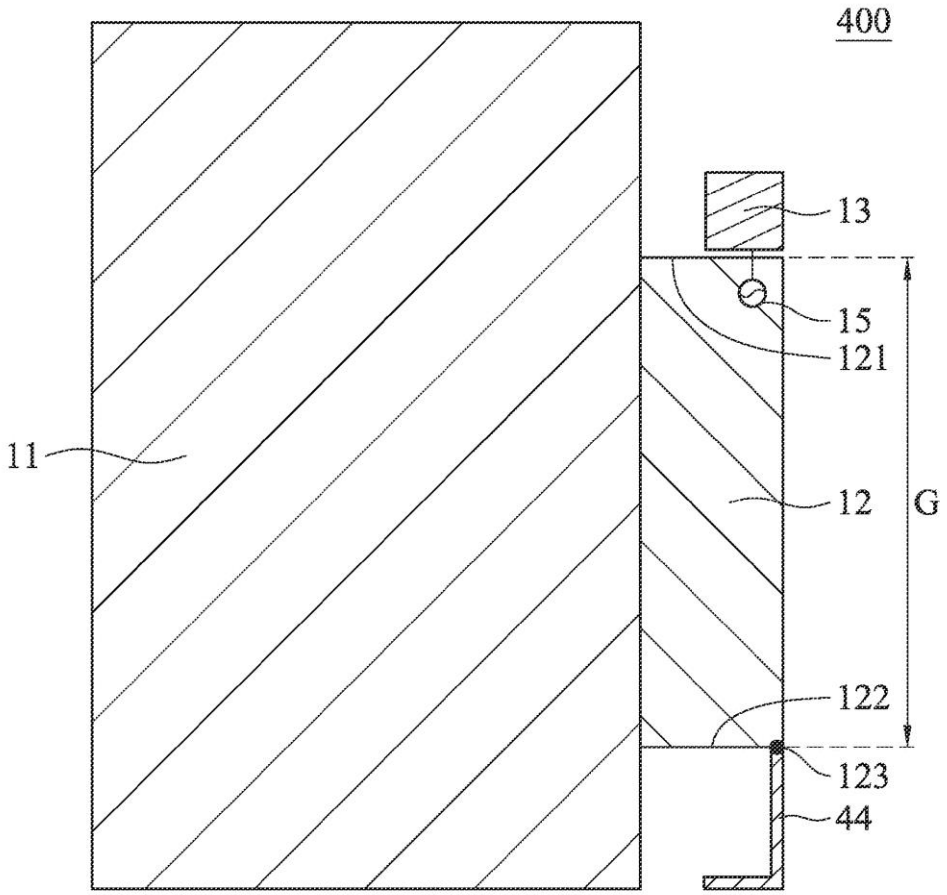
(51) **Int. Cl.**
H01Q 1/48 (2006.01)

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

(57) **ABSTRACT**

A communication device includes a system ground plane, a ground element, an antenna element, and a metal guide line. The ground element is coupled to the system ground plane. The ground element has a first edge, a second edge, and a connection point.

The first edge and the second edge are opposite to each other. The connection point is positioned at the second edge. The antenna element is disposed adjacent to, or at, the first edge. One end of the metal guide line is coupled to the connection point, and another end of the metal guide line is open.



US 20170012353A1

(19) **United States**

(12) **Patent Application Publication**

Chen et al.

(10) **Pub. No.: US 2017/0012353 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA SYSTEM AND A COMMUNICATION DEVICE**

(71) Applicant: **Climax Technology Co., LTD.**, Taipei (TW)

(72) Inventors: **Cheng-Wei Chen**, Taipei (TW); **Meng-Chih Lin**, Taipei (TW); **Dau-Chyrh Chang**, Taipei (TW)

(21) Appl. No.: **14/825,955**

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

(30) **Foreign Application Priority Data**

Jul. 8, 2015 (TW) 104122174

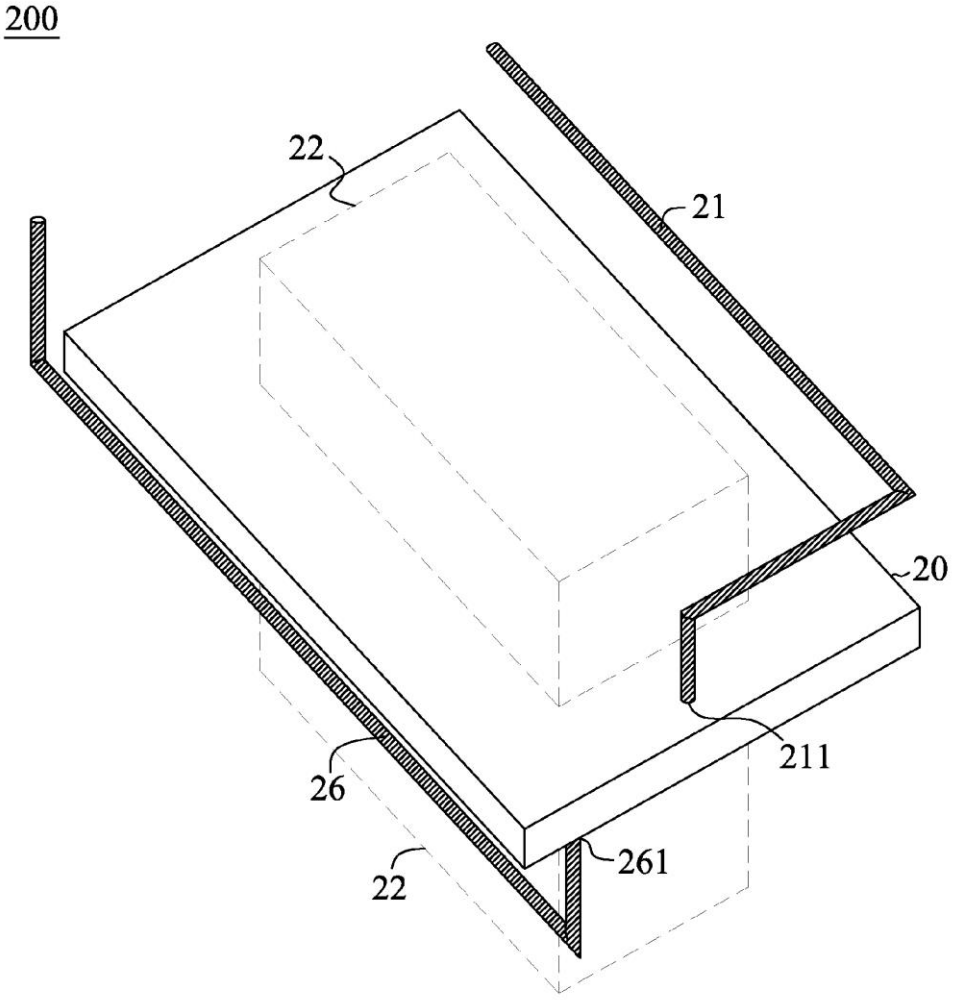
Publication Classification

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

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

(57) **ABSTRACT**

An antenna system includes a monopole antenna with a first end connected to a feed point on a printed circuit board (PCB) and a second end being electrically floating; and a matching conductive stub with a first end connected to a ground point on the PCB and a second end being electrically floating.



US 20170012354A1

(19) **United States**

(12) **Patent Application Publication**

Wang et al.

(10) **Pub. No.: US 2017/0012354 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA MODULE**

(71) Applicants: **Chao Wang**, Shenzhen (CN); **Jianchun Mai**, Shenzhen (CN)

(72) Inventors: **Chao Wang**, Shenzhen (CN); **Jianchun Mai**, Shenzhen (CN)

(73) Assignee: **AAC Technologies Pte. Ltd.,**, Singapore city (SG)

(21) Appl. No.: **15/008,641**

(22) Filed: **Jan. 28, 2016**

(30) **Foreign Application Priority Data**

Jul. 8, 2015 (CN) 201520490777.0

Publication Classification

(51) **Int. Cl.**

H01Q 5/10 (2006.01)

H01Q 1/38 (2006.01)

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

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

(57) **ABSTRACT**

An antenna module applicable to a mobile device is provided in the present disclosure. The antenna module includes a metal frame, a circuit board surrounded by the metal frame, and an antenna portion on the circuit board. The circuit board includes a main board and a ground board placed on the main board. The antenna portion includes at least one low frequency (LF) ground point and at least one high frequency (HF) ground point arranged on the ground board, and a feed point arranged on the main board. The at least one LF ground point and the at least one HF ground point contact the metal frame; a first current path length between the feed point and the at least one LF ground point is greater than a second current path length between the feed point and the at least one HF ground point.

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(19) **United States**

(12) **Patent Application Publication**

Zhang et al.

(10) **Pub. No.: US 2017/0012357 A1**

(43) **Pub. Date: Jan. 12, 2017**

(54) **ANTENNA SYSTEM AND TERMINAL**

(71) Applicant: **HUAWEI DEVICE CO., LTD.**, Shanzhen, Guangdong (CN)

(72) Inventors: **Xuefei Zhang**, Shenzhen (CN); **Lei Wang**, Shanghai (CN); **Kun Feng**, Shanghai (CN); **Chi Liu**, Xi'an (CN)

(21) Appl. No.: **15/113,407**

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

(86) PCT No.: **PCT/CN2015/070283**

§ 371 (c)(1),
(2) Date: **Jul. 21, 2016**

(30) **Foreign Application Priority Data**

Jan. 23, 2014 (CN) 201410030800.8

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0421*** (2013.01); ***H01Q 1/241*** (2013.01); ***H01Q 9/0442*** (2013.01)

(57) **ABSTRACT**

An antenna system includes an antenna body, a tunable component, and at least one of a first filter and a second filter. The antenna body is connected to the tunable component. The first filter is connected in parallel to the tunable component, and the first filter presents a high impedance characteristic in a low frequency band, and presents a low impedance characteristic in a high frequency band. The second filter is connected in series between the antenna body and the tunable component, a first end of the second filter is connected to the antenna body, and a second end of the second filter is connected to the tunable component. The second filter presents a low impedance characteristic in a low frequency band, and presents a high impedance characteristic in a high frequency band.

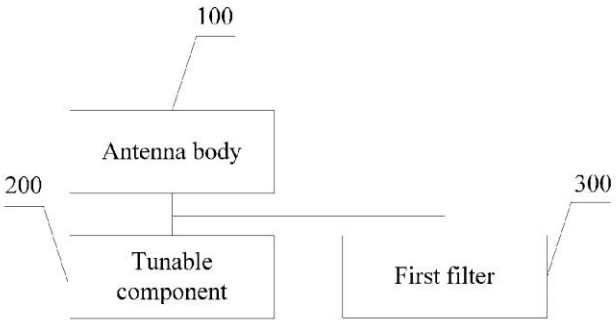

FIG. 1