



US 20170117614A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0117614 A1**

(43) **Pub. Date: Apr. 27, 2017**

(54) **ANTENNA SYSTEM WITH FULL METAL BACK COVER**

H01Q 1/48 (2006.01)

H01Q 1/22 (2006.01)

H01Q 1/36 (2006.01)

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

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

CPC *H01Q 1/243* (2013.01); *H01Q 1/2291* (2013.01); *H01Q 1/36* (2013.01); *H01Q 1/48* (2013.01); *H01Q 1/38* (2013.01)

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

(57)

ABSTRACT

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

(21) Appl. No.: **15/283,530**

(22) Filed: **Oct. 3, 2016**

(30) **Foreign Application Priority Data**

Oct. 26, 2015 (CN) 201510700646.5

May 15, 2016 (JP) 2016-119329

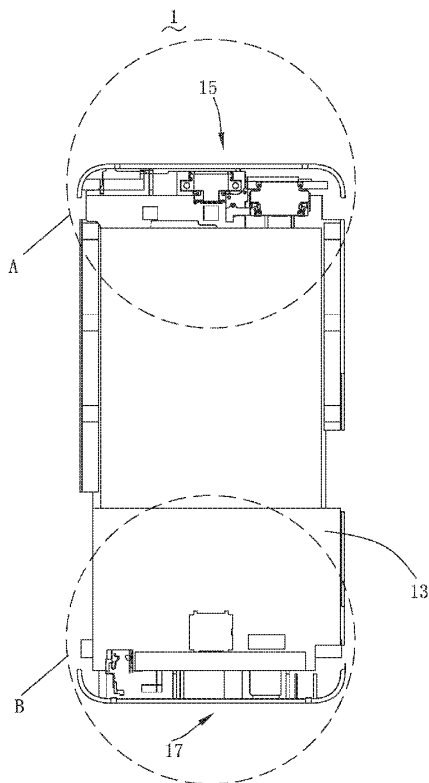
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/38 (2006.01)

An antenna system with a full metal back cover is provided in the present disclosure. The antenna system includes a metal back cover with a main body, a first sidewall and a second sidewall opposite to each other, a circuit board with a main ground point, a first antenna module and a second antenna module electrically connected to the circuit board. A first gap is formed between the first sidewall and the main body, and a second gap is formed between the second sidewall and the main body; the metal back cover is divided into a first metal portion including the first sidewall and a second metal portion including the second sidewall. The first metal portion includes a top slit penetrating through an edge of the first sidewall, and the second metal portion includes a bottom slit penetrating through an edge of the second sidewall.





US 20170117615A1

(19) **United States**(12) **Patent Application Publication**
Choon et al.(10) **Pub. No.: US 2017/0117615 A1**(43) **Pub. Date: Apr. 27, 2017**(54) **ANTENNA MODULE AND MOBILE
TERMINAL USING SAME****H01Q 7/00** (2006.01)**H01Q 1/48** (2006.01)(71) Applicants: **Tan Yew Choon**, Singapore (SG); **Ng
Guan Hong**, Singapore (SG); **Tay Yew
Siow**, Singapore (SG)(52) **U.S. Cl.**CPC **H01Q 1/243** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/38** (2013.01); **H01Q 7/005**
(2013.01)(72) Inventors: **Tan Yew Choon**, Singapore (SG); **Ng
Guan Hong**, Singapore (SG); **Tay Yew
Siow**, Singapore (SG)

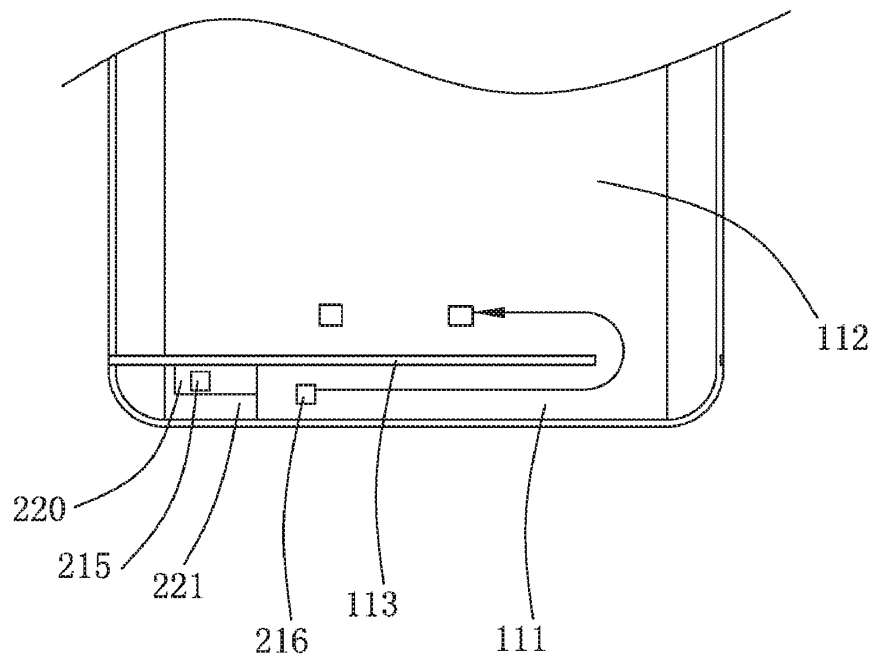
(57)

ABSTRACT(73) Assignee: **AAC Technologies Pte. Ltd.**,
Singapore city (SG)(21) Appl. No.: **15/283,539**(22) Filed: **Oct. 3, 2016**(30) **Foreign Application Priority Data**

Oct. 26, 2015 (CN) 201510700339.7

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

An antenna module is disclosed. The antenna module includes a radiator. The radiator includes a first radiation part, a second radiation part connecting with the first radiation part partially and a coupling slot arranged between the first radiation part and the second radiation part. Further, the antenna module includes a circuit board which is arranged opposite to the radiator and includes a system base, a grounding line connecting with the system base electrically, a feeder line and a tuning switch controlling ON/OFF of the grounding line, and a capacitance feed sheet facing one side of the first radiation part which faces the circuit board and connecting with the first radiation part. The capacitance feed sheet is connected with the feeder line electrically; the grounding line is connected with the first radiation part electrically; and the system base is connected with the said second radiation part electrically.





US 20170117616A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0117616 A1**

(43) **Pub. Date: Apr. 27, 2017**

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

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

(72) Inventors: **Kuo Cheng CHEN**, Suwon-si (KR);
You Chieh CHEN, Suwon-si (KR);
Yoon Jae LEE, Seoul (KR); **Soon Ho**
HWANG, Seoul (KR)

(21) Appl. No.: **15/295,365**

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

(30) **Foreign Application Priority Data**

Oct. 27, 2015 (KR) 10-2015-0149162

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/36 (2006.01)
H01Q 9/04 (2006.01)

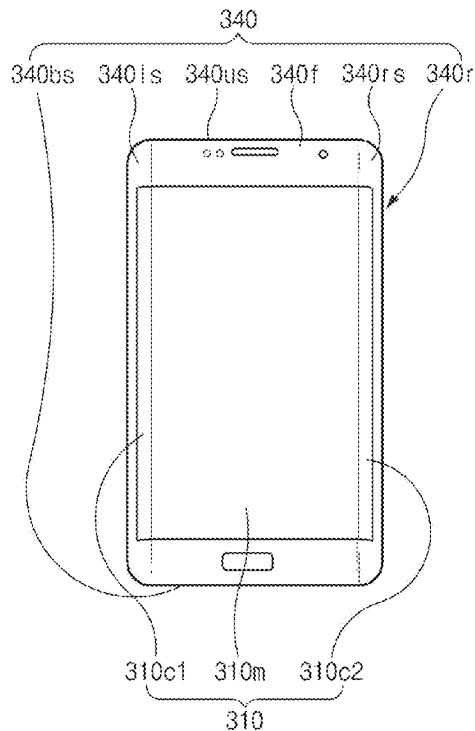
(52) **U.S. Cl.**

CPC **H01Q 1/243** (2013.01); **H01Q 9/0421**
(2013.01); **H01Q 1/36** (2013.01)

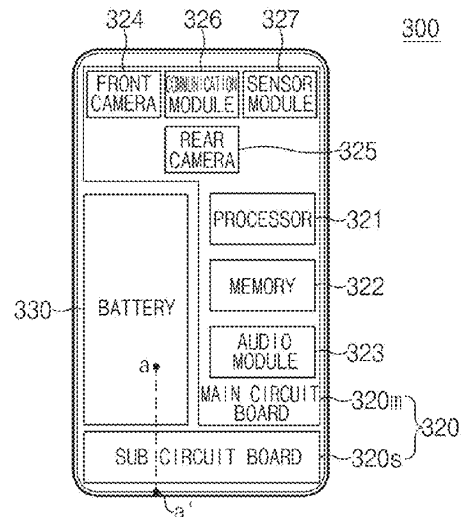
(57)

ABSTRACT

An electronic device is provided. The electronic device includes a housing and an antenna radiator disposed in the housing. An opening is formed in the housing. The opening includes a first portion configured to align with a length direction of the antenna radiator at a position corresponding to the antenna radiator and penetrate the housing in a thickness direction, and a second portion connected to the first portion, the second portion being configured to form a specified angle with respect to the length direction of the antenna radiator and penetrate the housing in a thickness direction. At least a portion of the housing, which surrounds the opening, comprises a conductive member. At least a portion of a circumference of the opening comprises an electrical open curve.



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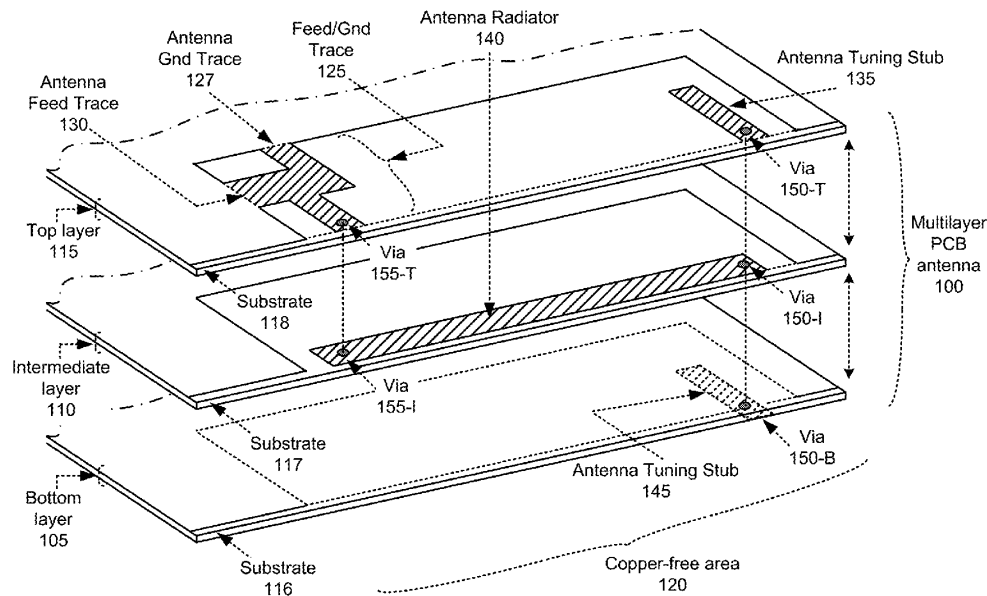




US 20170117620A1

(19) **United States**(12) **Patent Application Publication**
Lapushin(10) **Pub. No.: US 2017/0117620 A1**(43) **Pub. Date: Apr. 27, 2017**(54) **PCB EMBEDDED RADIATOR ANTENNA
WITH EXPOSED TUNING STUB**(71) Applicant: **Verizon Patent and Licensing Inc.**,
Arlington, VA (US)(72) Inventor: **Semyon Lapushin**, Tucker, GA (US)(21) Appl. No.: **14/922,598**(22) Filed: **Oct. 26, 2015****Publication Classification**(51) **Int. Cl.**
H01Q 1/38 (2006.01)(52) **U.S. Cl.**
CPC **H01Q 1/38** (2013.01)(57) **ABSTRACT**

A printed circuit board (PCB) antenna includes a main antenna radiator element embedded within substrate material of a multilayered PCB such that the main antenna radiator element is formed on, or within, a different substrate layer than other components of the PCB antenna. The PCB antenna includes a first PCB substrate, and a first conductive pattern formed on the first PCB substrate, where the first conductive pattern comprises an antenna radiator. The PCB antenna includes a second PCB substrate that is affixed to a first side of the first PCB substrate, and includes a second conductive pattern formed on the second PCB substrate, where the second conductive pattern comprises an antenna ground connection, and an antenna feed connection. The antenna ground connection and the antenna feed connect, through substrate material, to a first end of the antenna radiator of the first PCB substrate.





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(19) **United States**

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

(10) **Pub. No.: US 2017/0117623 A1**

(43) **Pub. Date: Apr. 27, 2017**

(54) **MOBILE DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/44 (2006.01)

(72) Inventors: **Ming-Che CHAN**, Taoyuan City (TW);
Chun-I LIN, Taoyuan City (TW); **Hui LIN**, Taoyuan City (TW)

(52) **U.S. Cl.**
CPC **H01Q 1/44** (2013.01)

(21) Appl. No.: **14/985,933**

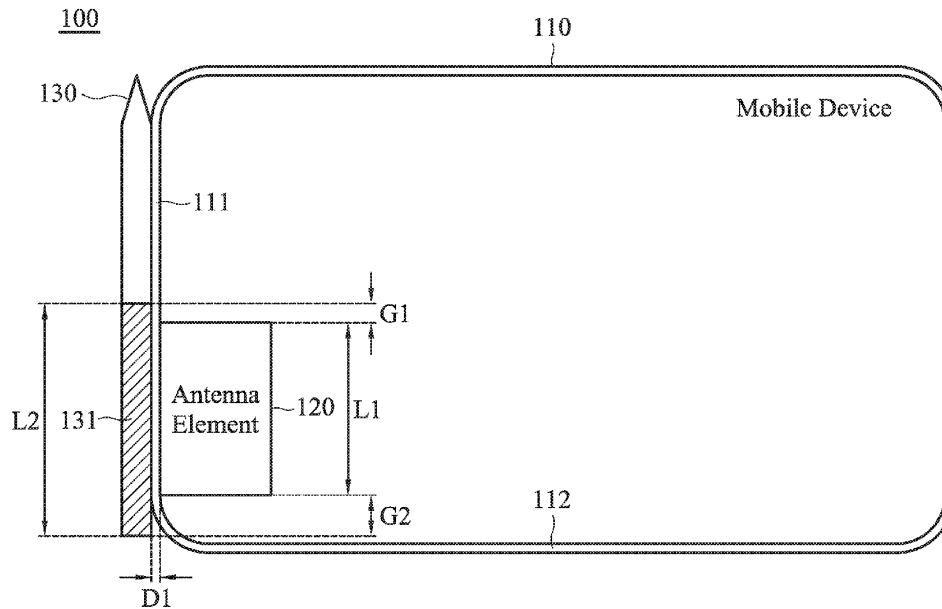
(57) **ABSTRACT**

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

A mobile device includes a housing, an antenna element, and a stylus. The stylus includes a metal portion. When the stylus is close to the antenna element, the metal portion resonates with the antenna element in an operation frequency band, so as to enhance the radiation efficiency of the antenna element.

(30) **Foreign Application Priority Data**

Oct. 22, 2015 (TW) 104134627





US 20170122618A1

(19) **United States**(12) **Patent Application Publication**
YAMAMOTO et al.(10) **Pub. No.: US 2017/0122618 A1**(43) **Pub. Date: May 4, 2017**(54) **REMOTE CONTROL DEVICE**(30) **Foreign Application Priority Data**(71) Applicant: **DAIKIN INDUSTRIES, LTD.**,
Osaka-shi, Osaka (JP)

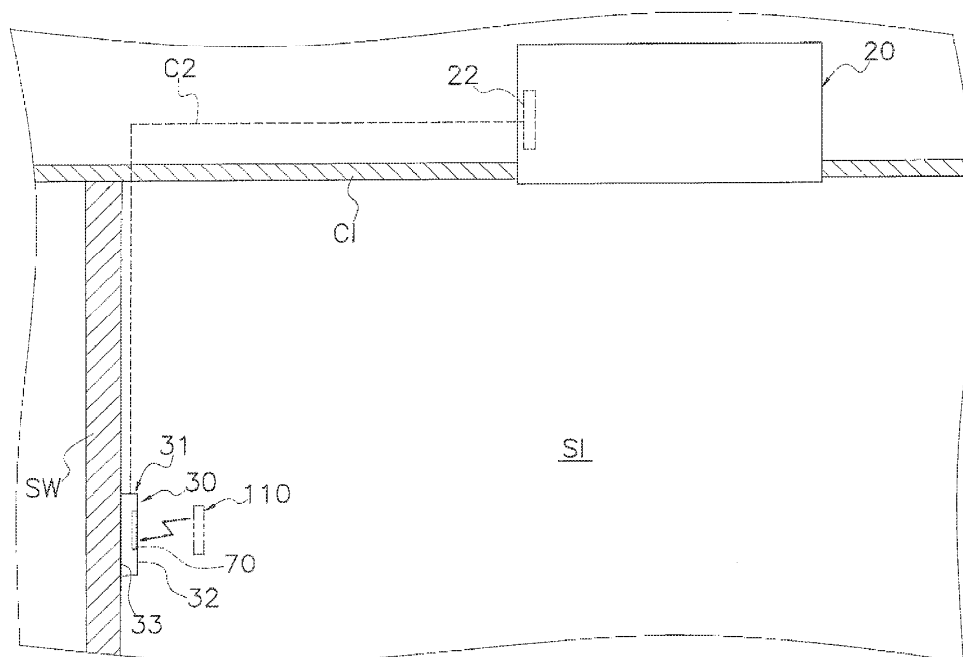
Jun. 9, 2014 (JP) 2014-118264

Publication Classification(72) Inventors: **Ryousuke YAMAMOTO**, Sakai-shi,
Osaka (JP); **Mario HAYASHI**,
Sakai-shi, Osaka (JP); **Yasuaki**
KOBAYASHI, Sakai-shi, Osaka (JP);
Tatsuya HIGUCHI, Sakai-shi, Osaka
(JP); **Ryouji INOUE**, Sakai-shi, Osaka
(JP); **Yukio INOUE**, Sakai-shi, Osaka
(JP); **Natsuko KITAGAWA**, Sakai-shi,
Osaka (JP); **Takeshi YOSHIMURA**,
Sakai-shi, Osaka (JP); **Asuka YAGI**,
Sakai-shi, Osaka (JP); **Youta KATOU**,
Sakai-shi, Osaka (JP)(51) **Int. Cl.**
F24F 11/02 (2006.01)
G08C 17/02 (2006.01)(52) **U.S. Cl.**
CPC **F24F 11/02** (2013.01); **G08C 17/02**
(2013.01); **F24F 2011/0091** (2013.01)(57) **ABSTRACT**

A remote control device configured communicate with an air conditioner or a heat pump includes a touch panel having an electrode unit, a liquid crystal display, and a casing accommodating the touch panel and the liquid crystal display. The casing has a back surface part and a front surface part. The liquid crystal display is disposed to overlap the touch panel as seen from a front surface part side. The electrode unit has a first electrode section to detect a touched position, and a second electrode section that may function as an antenna to perform wireless communication with another communication device. The first and second electrode sections are configured and arranged to be nearer to the front surface part than to the back surface part inside the casing, and to be disposed so as not to overlap with each other as seen from the front surface part side.

(21) Appl. No.: **15/316,973**(22) PCT Filed: **Jun. 3, 2015**(86) PCT No.: **PCT/JP2015/065994**

§ 371 (c)(1),

(2) Date: **Dec. 7, 2016**



US 20170125887A1

(19) **United States**(12) **Patent Application Publication**
PARK et al.(10) **Pub. No.: US 2017/0125887 A1**(43) **Pub. Date: May 4, 2017**(54) **ANTENNA STRUCTURE AND ELECTRONIC
DEVICE INCLUDING THE SAME**(52) **U.S. Cl.**CPC **H01Q 1/243** (2013.01); **H01Q 5/314**
(2015.01); **H04B 7/0413** (2013.01)(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(72) Inventors: **Gyu Bok PARK**, Gyeonggi-do (KR);
Kyung Moon SEOL, Gyeonggi-do
(KR); **Ji Ho KIM**, Gyeonggi-do (KR);
Kyi Hyun Jang, Seoul (KR); **Hyun
Seock ROH**, Gyeonggi-do (KR); **Sang
Bong SUNG**, Gyeonggi-do (KR)

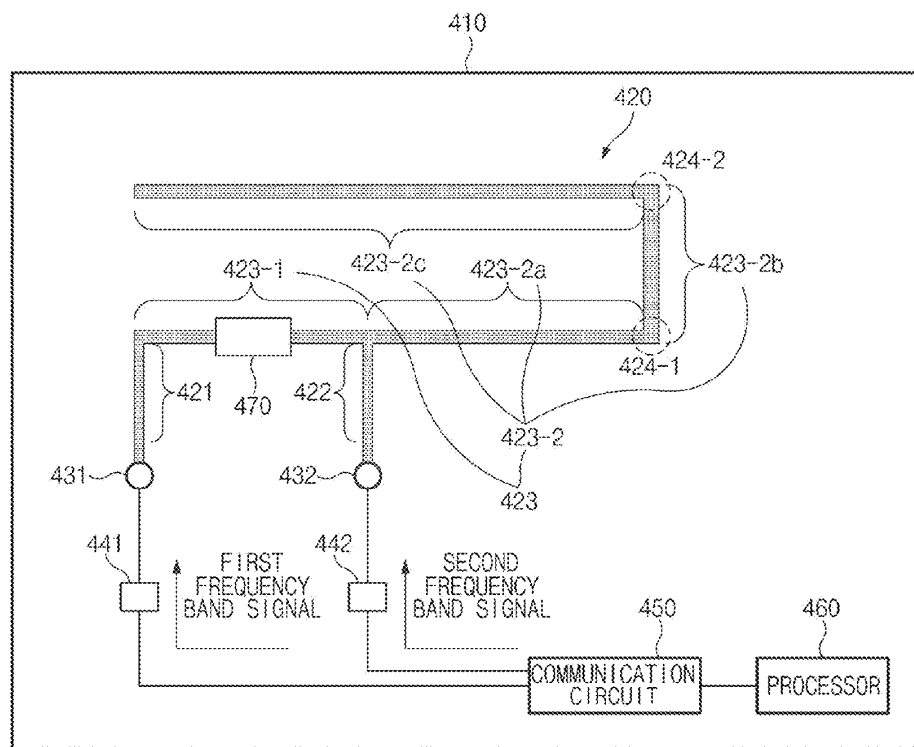
(57)

ABSTRACT

An antenna structure is provided for use in an electronic device. The antenna structure includes a first feeding part; a second feeding part; and an antenna radiator including a first connection pattern including a first end and a second end, the first end of the first connection pattern being electrically connected to the first feeding part; a second connection pattern including a first end and a second end, the first end of the second connection pattern being electrically connected to the second feeding part; a first pattern that connects the second end of the first connection pattern and the second end of the second connection pattern; and a second pattern that extends from at least one end of the first pattern. The first feeding part is configured to transmit or receive a signal of a first frequency band, and the second feeding part is configured to transmit or receive a signal of a second frequency band that at least partially overlaps the first frequency band.

(73) Assignee: **Samsung Electronics Co., Ltd.**(21) Appl. No.: **15/285,068**(22) Filed: **Oct. 4, 2016**(30) **Foreign Application Priority Data**

Nov. 2, 2015 (KR) 10-2015-0153407

Publication Classification(51) **Int. Cl.****H01Q 1/24** (2006.01)**H04B 7/04** (2006.01)**H01Q 5/314** (2006.01)



US 20170125889A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0125889 A1**

(43) **Pub. Date: May 4, 2017**

(54) **ELECTRONIC DEVICE WITH
FINGERPRINT SENSOR AND TUNABLE
HYBRID ANTENNA**

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

(72) Inventors: **Mattia Pascolini**, San Francisco, CA
(US); **Nanbo Jin**, Milpitas, CA (US)

(21) Appl. No.: **15/374,745**

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

Related U.S. Application Data

(62) Division of application No. 14/463,299, filed on Aug.
19, 2014, now Pat. No. 9,577,318.

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/22 (2006.01)
G06K 9/00 (2006.01)
H01Q 13/10 (2006.01)
H01Q 3/24 (2006.01)
H04N 5/225 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)

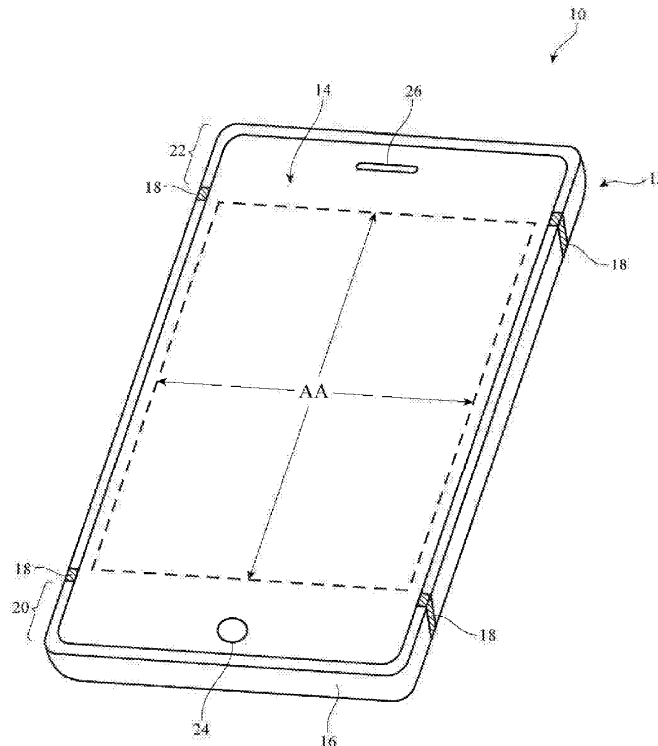
(52) **U.S. Cl.**

CPC **H01Q 1/243** (2013.01); **H01Q 9/0421**
(2013.01); **H01Q 9/0485** (2013.01); **H01Q**
1/38 (2013.01); **H01Q 1/2258** (2013.01);
H01Q 1/48 (2013.01); **H01Q 13/103**
(2013.01); **H01Q 3/247** (2013.01); **H04N**
5/2253 (2013.01); **G06K 9/0002** (2013.01);
H04M 1/026 (2013.01)

(57)

ABSTRACT

An electronic device may have wireless circuitry and components such as sensors. The electronic device may have a metal housing having first and second planar rear wall portions separated by a gap. Conductive structures may bridge the gap to electrically couple the first and second rear wall portions. The wireless circuitry may include a hybrid slot inverted-F antenna. The antenna may have an inverted-F antenna resonating element formed from peripheral housing structures that are separated from the second rear wall portion by an opening. The opening may form a C-shaped slot antenna resonating element for the antenna. The sensors may include a fingerprint sensor. The fingerprint sensor may be coupled to a button member in a button. The fingerprint sensor and other portions of the button may overlap the second planar rear wall portion to minimize interference with antenna operation.





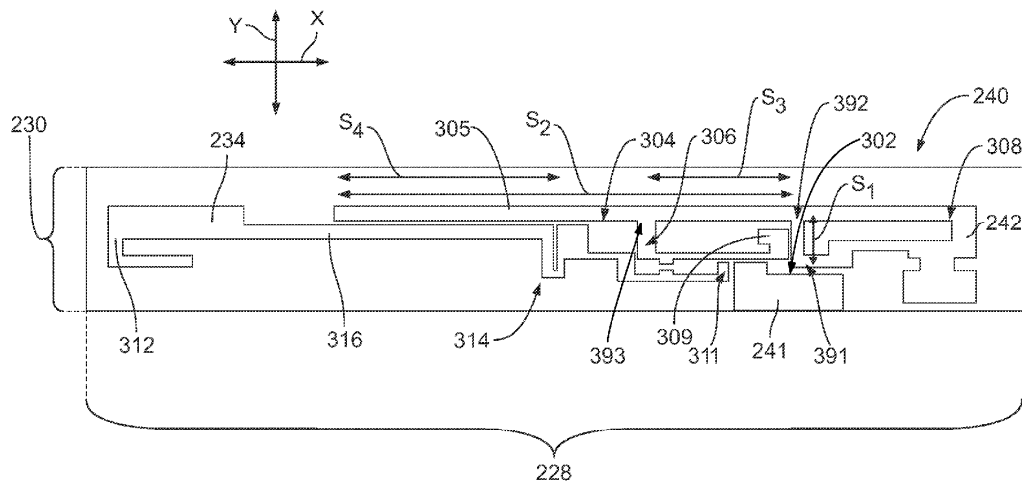
US 20170125916A1

(19) **United States**(12) **Patent Application Publication**
Camacho et al.(10) **Pub. No.: US 2017/0125916 A1**(43) **Pub. Date: May 4, 2017**(54) **ANTENNA APPARATUS CONFIGURED TO
REDUCE RADIO-FREQUENCY EXPOSURE****H01Q 1/22** (2006.01)**H01Q 19/10** (2006.01)(71) Applicant: **TYCO ELECTRONICS
CORPORATION**, Berwyn, PA (US)(52) **U.S. Cl.**CPC **H01Q 19/005** (2013.01); **H01Q 1/2266**
(2013.01); **H01Q 19/10** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/371** (2015.01); **H01Q**
5/378 (2015.01)(72) Inventors: **Eduardo Lopez Camacho**,
Watsonville, CA (US); **Bruce Foster**
Bishop, Aptos, CA (US)(21) Appl. No.: **14/928,216**(22) Filed: **Oct. 30, 2015****Publication Classification**(51) **Int. Cl.****H01Q 19/00** (2006.01)**H01Q 5/378** (2006.01)**H01Q 1/48** (2006.01)**H01Q 5/371** (2006.01)

(57)

ABSTRACT

Antenna apparatus includes a system ground and an antenna sub-assembly including a feed pad and a ground pad that are configured to have a cable terminated thereto. The ground pad is electrically coupled to the system ground. The antenna sub-assembly includes a first level having a radiating trace that is electrically coupled to the feed pad. The radiating trace is configured for communication within a designated radio frequency (RF) band. The antenna sub-assembly also includes a second level that is stacked with respect to the first level and has a reflector. The reflector is vertically aligned with a portion of the radiating trace to block RF emissions therefrom.





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(19) **United States**

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

(10) **Pub. No.: US 2017/0133743 A1**

(43) **Pub. Date: May 11, 2017**

(54) **INTERFACE UNIT AND COMPUTER**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/38 (2006.01)
H01Q 7/00 (2006.01)
H04B 5/00 (2006.01)
H01Q 1/52 (2006.01)

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

(52) **U.S. Cl.**
CPC **H01Q 1/2266** (2013.01); **H04B 5/005**
(2013.01); **H01Q 1/526** (2013.01); **H01Q 7/00**
(2013.01); **H01Q 1/38** (2013.01); **H01Q**
1/2291 (2013.01); **H01Q 1/2283** (2013.01)

(21) Appl. No.: **15/410,923**

(22) Filed: **Jan. 20, 2017**

Related U.S. Application Data

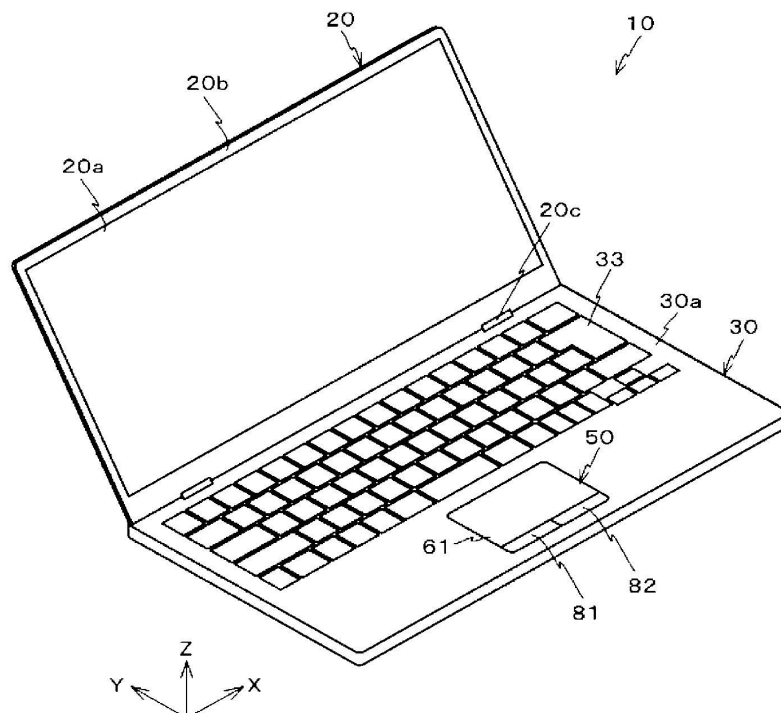
(63) Continuation of application No. 14/340,602, filed on Jul. 25, 2014, now Pat. No. 9,590,700, which is a continuation of application No. PCT/JP2013/083398, filed on Dec. 12, 2013.

Foreign Application Priority Data

(30) Dec. 21, 2012 (JP) 2012-280323

(57) **ABSTRACT**

In an interface unit, a shield layer includes an aperture through which magnetic flux generated by a power feeding coil of an antenna passes. Since the antenna is smaller than the shield layer, the aperture is much smaller than the shield layer. Thus, noise constituted by electromagnetic waves that travel from inside to outside of a computer via an aperture provided in an upper surface cover is blocked. During communication, the antenna and the shield layer are electromagnetically coupled to each other, and the shield layer defines and functions as an antenna. This allows proper communication with a communication target.





US 20170133745A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0133745 A1**

(43) **Pub. Date: May 11, 2017**

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

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

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

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

(72) Inventors: **JIN-BO CHEN**, New Taipei (TW);
CHENG-AN CHEN, New Taipei
(TW); **CHIH-WEI LIAO**, New Taipei
(TW)

(57)

ABSTRACT

(21) Appl. No.: **15/083,434**

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

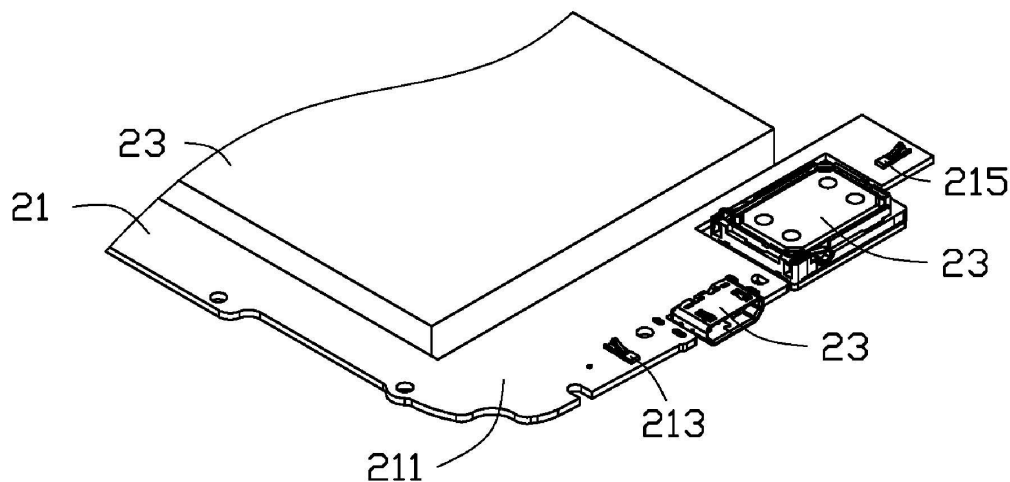
(30) **Foreign Application Priority Data**

Nov. 11, 2015 (CN) 201510761916.3

Publication Classification

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

An antenna module includes a holder, a first feed portion, a second feed portion, a first antenna unit, and a second antenna unit. The holder includes a top surface, an end surface, and a side surface. The first feed portion is positioned on the top surface. The second feed portion is positioned on the top surface and is spaced from the first feed portion. The first antenna unit is positioned on the top surface and the end surface, and is electrically connected to the first feed portion. The second antenna unit is spaced from the first antenna unit and is positioned on the top surface and the side surface. The second antenna unit is electrically connected to the second feed portion. The first feed portion and the second feed portion respectively feed current to the first antenna unit and the second antenna unit.





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(19) **United States**

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

(10) **Pub. No.: US 2017/0133747 A1**

(43) **Pub. Date: May 11, 2017**

(54) **ANTENNA MANUFACTURING METHOD
AND ANTENNA SYSTEM**

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 1/38 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/38**
(2013.01)

(72) Inventors: **Bo CHENG**, Beijing (CN); **Jia HE**,
Beijing (CN)

(57) **ABSTRACT**

(21) Appl. No.: **15/237,437**

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

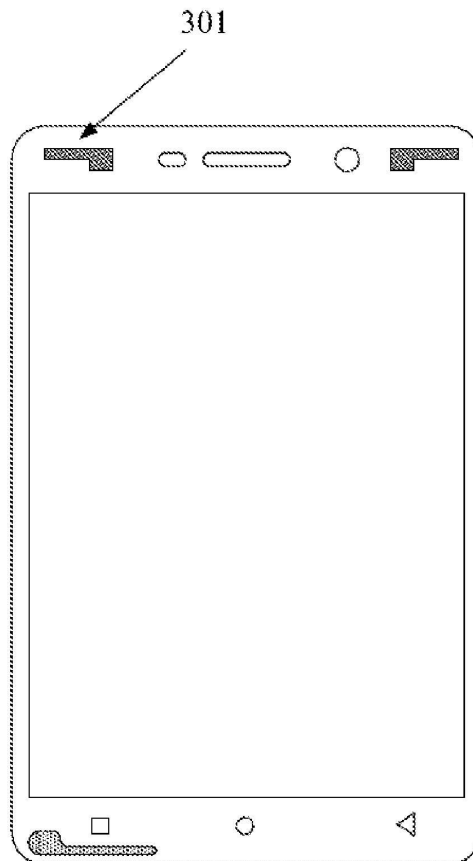
Related U.S. Application Data

(63) Continuation of application No. PCT/CN2016/
088439, filed on Jul. 4, 2016.

(30) **Foreign Application Priority Data**

Nov. 6, 2015 (CN) 201510758256.3

An embodiment of the present disclosure discloses an antenna manufacturing method and an antenna system. The method specifically comprises: spraying a conductive layer on the back of a screen of a mobile terminal to form an antenna body, wherein, the size of the antenna body is matched with the frequency band of an antenna system. The antenna manufacturing method and the antenna system according to the embodiment of the present disclosure may improve the irradiation efficiency of the electromagnetic wave of the antenna system, and widen the bandwidth of the antenna system.





US 20170133748A1

(19) **United States**

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

(10) **Pub. No.: US 2017/0133748 A1**

(43) **Pub. Date: May 11, 2017**

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

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

(72) Inventors: **Kyung Bin KIM**, Hwaseong-si (KR);
Jinu KIM, Seoul (KR); **Byeonghwan
YOUM**, Suwon-si (KR); **Gi-Uk
GANG**, Suwon-si (KR); **Nak-Chung
CHOI**, Seoul (KR)

(21) Appl. No.: **15/256,926**

(22) Filed: **Sep. 6, 2016**

(30) **Foreign Application Priority Data**

Nov. 6, 2015 (KR) 10-2015-0155861

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H05K 5/00 (2006.01)
H05K 5/03 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H05K 5/03**
(2013.01); **H05K 5/0017** (2013.01); **H05K**
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(57) **ABSTRACT**

Various embodiments of the present disclosure may provide an electronic device that includes: a first cover configured to form a first surface of the electronic device; a second cover configured to form a second surface of the electronic device, the second cover being opposite to the first surface; a conductive sidewall configured to surround at least a part of a space formed between the first cover and the second cover; a conductive member located in the space and configured to integrally extend from the conductive sidewall, the conductive member including a first surface directed toward the first cover and a second surface directed toward the second cover; a non-conductive member located in the space to make contact with the conductive member, the non-conductive member including a first surface directed toward the first cover and a second surface directed toward the second cover; a conductive pattern disposed on the second surface of the non-conductive member and electrically connected to the conductive member; and a conductive structure disposed between the conductive pattern and the conductive member to electrically connect the conductive pattern to the conductive member. The non-conductive member may include a via hole that at least partially passes through the area between the first surface and the second surface thereof, and the conductive structure may include a first part having a first cross-sectional area and a second part having a second cross-sectional area that is larger than the first cross-sectional area, wherein at least a part of the conductive structure may be disposed within a through-hole of the non-conductive member, and the second part may be disposed closer to the second surface of the non-conductive member than the first part. Various other embodiments are possible.

