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(19) **United States**

(12) **Patent Application Publication**

Sung et al.

(10) **Pub. No.: US 2019/0221920 A1**

(43) **Pub. Date: Jul. 18, 2019**

(54) **ANTENNA DEVICE OF MOBILE TERMINAL**

Publication Classification

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

(72) Inventors: **Sang Bong Sung**, Gyeongsangbuk-do
(KR); **In Jin Hwang**,
Gyeongsangbuk-do (KR); **Seung Hwan
Kim**, Gyeonggi-do (KR); **Jae Ho Lee**,
Gyeonggi-do (KR)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/42 (2006.01)
H01Q 1/48 (2006.01)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H04M 1/0262*
(2013.01); *H01Q 9/0421* (2013.01); *H04M*
1/026 (2013.01); *H01Q 9/42* (2013.01); *H01Q*
1/48 (2013.01); *H01Q 1/24* (2013.01); *H01Q*
1/38 (2013.01)

(21) Appl. No.: **16/359,268**

(22) Filed: **Mar. 20, 2019**

Related U.S. Application Data

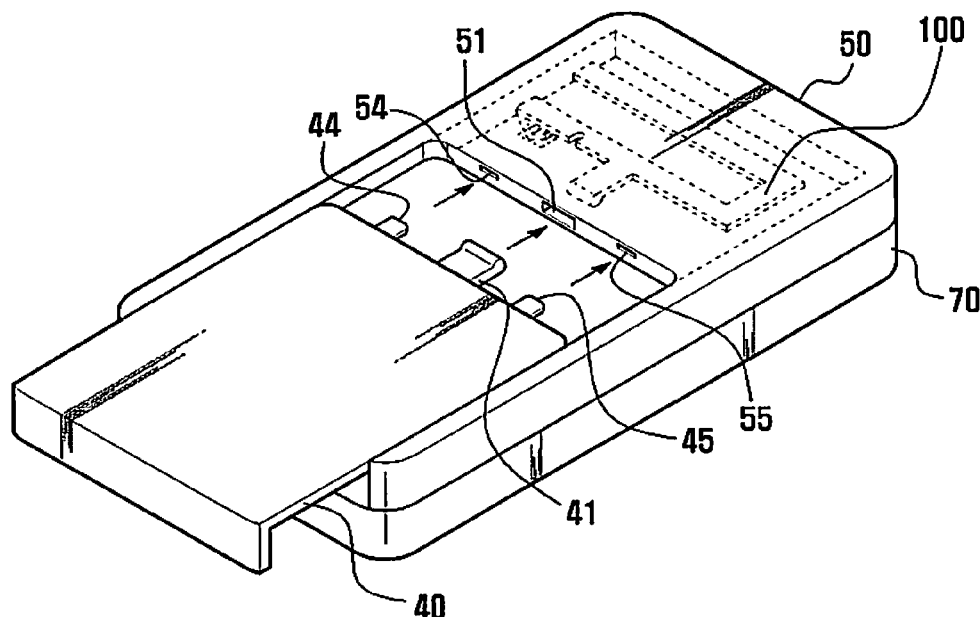
(63) Continuation of application No. 15/337,961, filed on Oct. 28, 2016, now Pat. No. 10,270,157, which is a continuation of application No. 14/731,801, filed on Jun. 5, 2015, now Pat. No. 9,484,623, which is a continuation of application No. 13/962,483, filed on Aug. 8, 2013, now Pat. No. 9,054,419, which is a continuation of application No. 13/458,453, filed on Apr. 27, 2012, now Pat. No. 8,531,342, which is a continuation of application No. 12/489,044, filed on Jun. 22, 2009, now Pat. No. 8,188,930.

Foreign Application Priority Data

Jun. 20, 2008 (KR) 10-2008-0058619

(57) **ABSTRACT**

An apparatus is provided that includes an outer front side having a display disposed therein, and an outer rear side including a conductive part and a non-conductive part. The apparatus also includes a battery disposed between the outer front side and the outer rear side, a circuit board, and an antenna. The antenna includes a radiation unit capable of receiving a signal, at least a portion of the radiation unit being disposed between the outer front side and the non-conductive part of the outer rear side. The antenna also includes a feeding unit which electrically connects the radiation unit to the circuit board. The antenna further includes a ground part which electrically connects the radiation unit to the conductive part of the outer rear side. The ground part is connected to the conductive part at a connection point spaced apart from a ground point connecting the circuit board with the conductive part





(19) **United States**

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

(10) **Pub. No.: US 2019/0221933 A1**

(43) **Pub. Date: Jul. 18, 2019**

(54) **LIQUID CRYSTAL CELL AND SCANNING ANTENNA**

(52) **U.S. Cl.**
CPC **H01Q 3/34** (2013.01)

(71) Applicant: **SHARP KABUSHIKI KAISHA,**
Osaka (JP)

(57) **ABSTRACT**

(72) Inventors: **HIROAKI ASAGI,** Sakai City (JP);
ISAMU MIYAKE, Sakai City (JP)

A liquid crystal cell including multiple antenna units includes a TFT board that includes a first dielectric substrate, TFTs on the first dielectric substrate, and patch electrodes electrically connected to the TFTs, a slot board that includes a second dielectric substrate and a slot electrode having slots on the second dielectric substrate, a conductive alignment film having conductivity on at least one of the patch electrodes and the slot electrode, and a liquid crystal layer disposed between the TFT board and the slot board with the patch electrodes and the slot electrode facing each other. The liquid crystal layer includes liquid crystal molecules that are horizontally aligned with respect to the TFT board and the slot board while no voltage is being applied across the patch electrodes and the slot electrode.

(21) Appl. No.: **16/246,835**

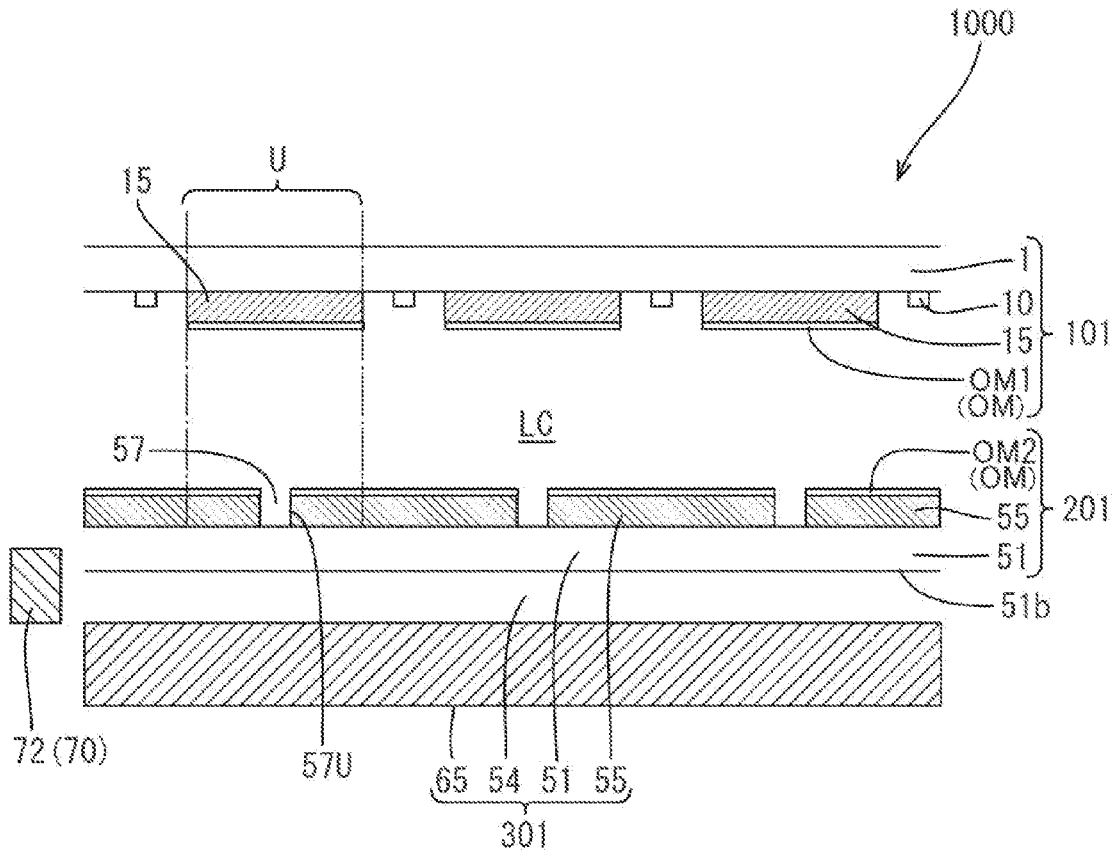
(22) Filed: **Jan. 14, 2019**

(30) **Foreign Application Priority Data**

Jan. 16, 2018 (JP) 2018-004984

Publication Classification

(51) **Int. Cl.**
H01Q 3/34 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2019/0221942 A1**

(43) **Pub. Date: Jul. 18, 2019**

(54) **ANTENNA DEVICE**

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

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

CPC **H01Q 9/42** (2013.01); **H01Q 1/48** (2013.01); **H01Q 9/0421** (2013.01)

(72) Inventors: **Chin-Ting Huang**, Taipei City (TW);
Sony Chayadi, Taipei City (TW);
Yan-Hua Chen, Taipei City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **16/244,253**

An antenna device is disclosed. The antenna device includes a first metal ground plate, a first field adjustment plate, a second field adjustment plate, a first antenna unit, and a first signal feed source. The first field adjustment plate is connected to a first side of the first metal ground plate, in which the first field adjustment plate and the first metal ground plate form a first angle. The second field adjustment plate is connected to a second side of the first metal ground plate, in which the second field adjustment plate and the first metal ground plate form a second angle. The first antenna unit is connected to the first metal ground plate. The first signal feed source is configured to input a first signal to the first antenna unit.

(22) Filed: **Jan. 10, 2019**

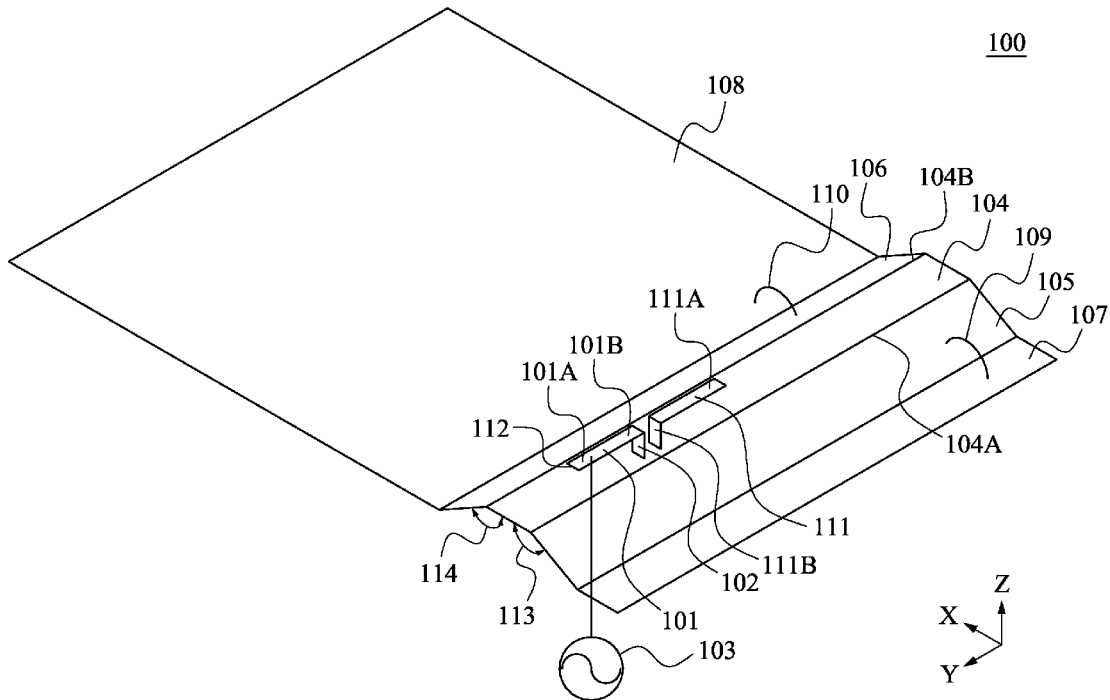
(30) **Foreign Application Priority Data**

Jan. 15, 2018 (TW) 107101445

Publication Classification

(51) **Int. Cl.**

H01Q 9/42 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)





(19) **United States**

(12) **Patent Application Publication**

WU et al.

(10) **Pub. No.: US 2019/0221943 A1**

(43) **Pub. Date: Jul. 18, 2019**

(54) **COMMUNICATION DEVICE**

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

(71) Applicant: **Wistron NeWeb Corp.**, Hsinchu (TW)

CPC **H01Q 13/103** (2013.01); **H01Q 13/106** (2013.01); **H01Q 1/243** (2013.01); **H01Q 1/38** (2013.01); **H01Q 13/16** (2013.01)

(72) Inventors: **Yan-Ting WU**, Hsinchu (TW);
Cheng-Da YANG, Hsinchu (TW);
Yu-Yu CHIANG, Hsinchu (TW)

(57) **ABSTRACT**

(21) Appl. No.: **16/035,849**

(22) Filed: **Jul. 16, 2018**

Related U.S. Application Data

(60) Provisional application No. 62/617,292, filed on Jan. 14, 2018.

Foreign Application Priority Data

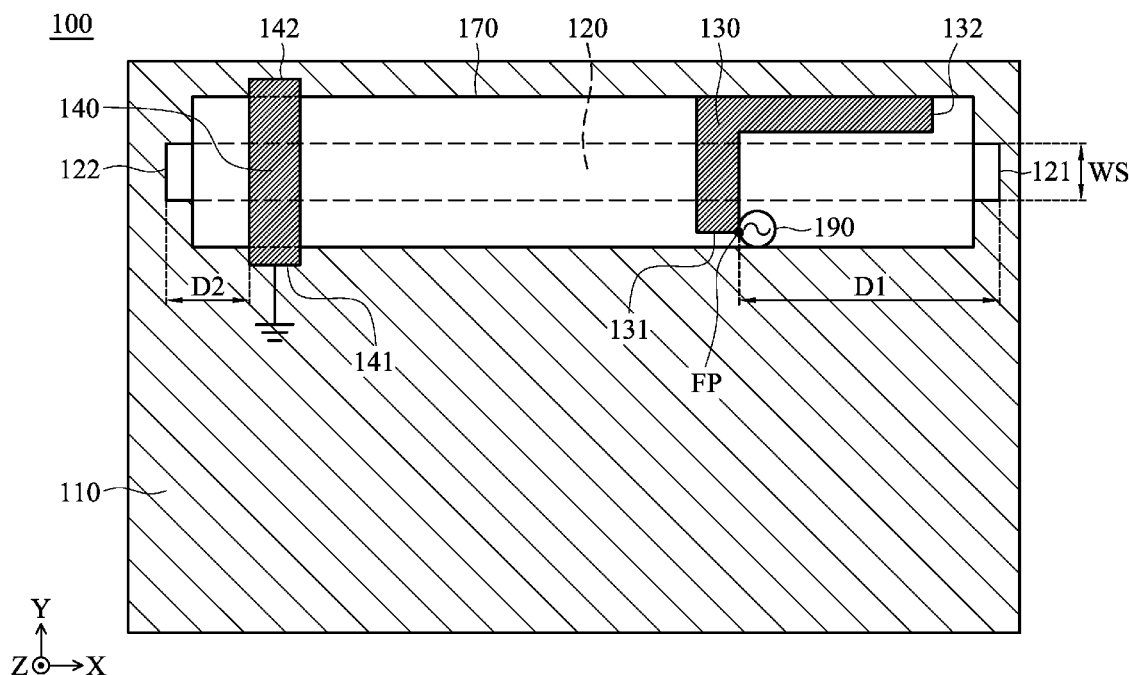
Mar. 28, 2018 (TW) 107110710

Publication Classification

(51) **Int. Cl.**

H01Q 13/10 (2006.01)
H01Q 13/16 (2006.01)
H01Q 1/38 (2006.01)

A communication device includes a metal mechanism element, a feeding radiation element, a tuning radiation element, and a dielectric substrate. The metal mechanism element has a closed slot. The feeding radiation element extends across the closed slot. The feeding radiation element has a feeding point. The tuning radiation element extends across the closed slot. The first end of the tuning radiation element is coupled to the metal mechanism element. The second end of the tuning radiation element is adjacent to the metal mechanism element or is coupled to the metal mechanism element. The dielectric substrate is adjacent to the metal mechanism element. The feeding radiation element and the tuning radiation element are both disposed on the dielectric substrate. An antenna structure is formed by the feeding radiation element, the tuning radiation element, and the closed slot of the metal mechanism element.





US 20190222063A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0222063 A1**

(43) **Pub. Date: Jul. 18, 2019**

(54) **PORTABLE TERMINAL HAVING A WIRELESS CHARGER COIL AND AN ANTENNA ELEMENT ON THE SAME PLANE**

Publication Classification

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

- (51) **Int. Cl.**
- H02J 50/10* (2006.01)
- H02J 7/02* (2006.01)
- H04B 5/00* (2006.01)
- H02J 7/04* (2006.01)
- H04W 88/02* (2006.01)
- H02J 7/00* (2006.01)
- H01F 38/14* (2006.01)
- H04M 1/02* (2006.01)

(72) Inventors: **Jin-Hyoung PARK**, Wonju-si (KR); **Ki-Hyun KIM**, Suwon-si (KR); **Kil-Soo KO**, Suwon-si (KR); **Se-Ho PARK**, Suwon-si (KR); **Sung-Kweon PARK**, Seongnam-si (KR)

- (52) **U.S. Cl.**
- CPC *H02J 50/10* (2016.02); *H02J 7/025* (2013.01); *H04B 5/0087* (2013.01); *H04B 5/0075* (2013.01); *H04B 5/00* (2013.01); *H02J 7/04* (2013.01); *H04M 2250/04* (2013.01); *H02J 7/00* (2013.01); *H01F 38/14* (2013.01); *H04B 5/0037* (2013.01); *H04M 1/0262* (2013.01); *H02J 7/0044* (2013.01); *H04B 5/0081* (2013.01); *H04W 88/02* (2013.01)

(21) Appl. No.: **16/363,932**

(22) Filed: **Mar. 25, 2019**

Related U.S. Application Data

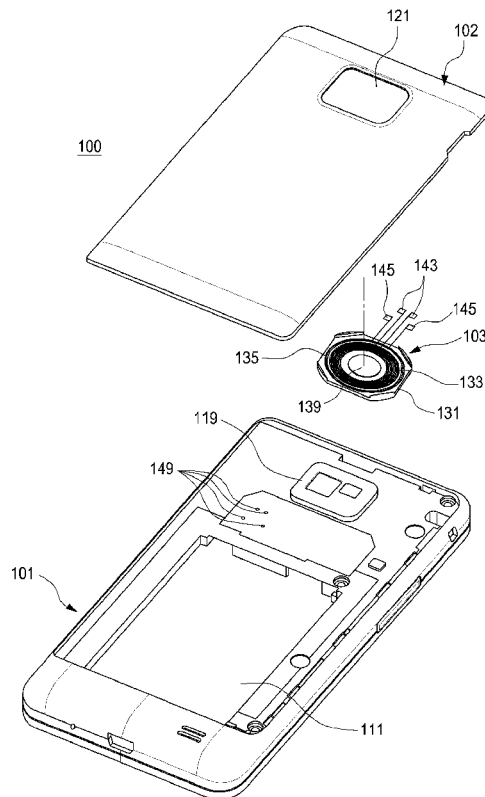
(63) Continuation of application No. 15/940,616, filed on Mar. 29, 2018, now Pat. No. 10,243,402, which is a continuation of application No. 15/004,287, filed on Jan. 22, 2016, now Pat. No. 9,985,478, which is a continuation of application No. 14/561,939, filed on Dec. 5, 2014, now Pat. No. 9,246,352, which is a continuation of application No. 13/312,359, filed on Dec. 6, 2011, now Pat. No. 8,922,162.

Foreign Application Priority Data

Aug. 8, 2011 (KR) 10-2011-0078611

(57) **ABSTRACT**

A portable terminal is provided. The portable terminal includes a shielding member attached to an inner surface of an external part, a shielding wall formed on the shielding member, a first coil attached to a surface of the shielding member that faces the inner surface of the external part, and a second coil attached to the surface of the shielding member, with the second coil surrounds the first coil on a same plane and the shielding wall being disposed between the first and second coil.





(19) **United States**

(12) **Patent Application Publication**
JANG

(10) **Pub. No.: US 2019/0235571 A1**

(43) **Pub. Date: Aug. 1, 2019**

(54) **ELECTRONIC DEVICE FOR REDUCING NOISE**

H05K 1/18 (2006.01)
H01Q 1/24 (2006.01)

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

(52) **U.S. Cl.**
CPC *G06F 1/1626* (2013.01); *H05K 5/0069*
(2013.01); *H01Q 1/243* (2013.01); *H05K 1/189* (2013.01); *G06F 1/1698* (2013.01)

(72) Inventor: **Seokmin JANG**, Gyeonggi-do (KR)

(21) Appl. No.: **16/254,685**

(57) **ABSTRACT**

(22) Filed: **Jan. 23, 2019**

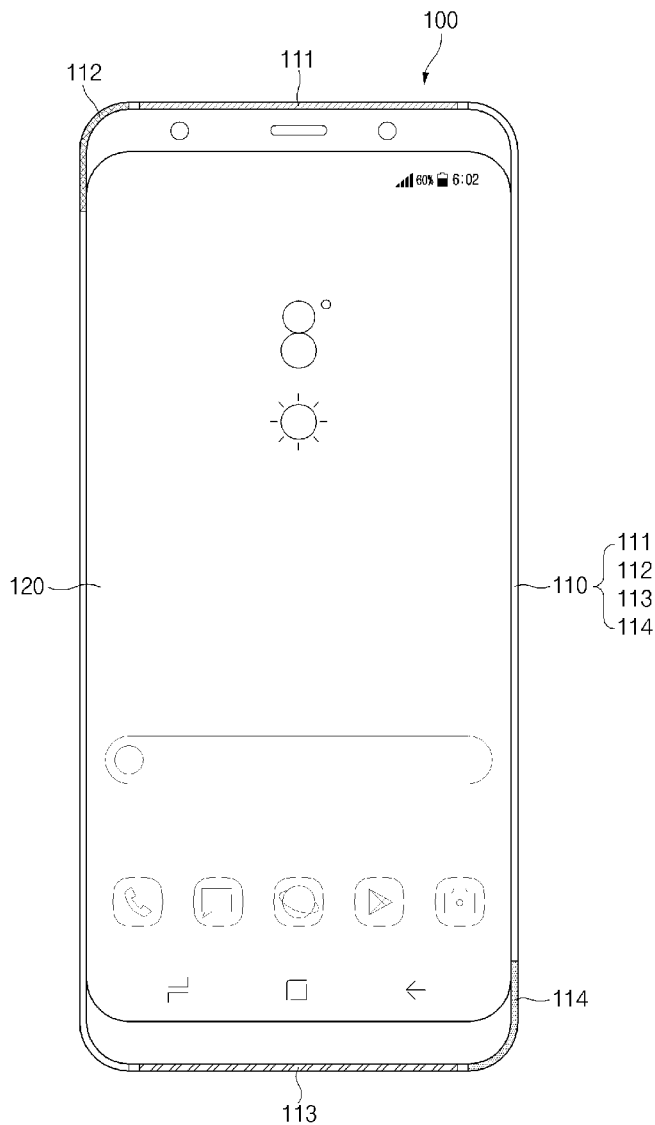
(30) **Foreign Application Priority Data**

Jan. 30, 2018 (KR) 10-2018-0011124

Publication Classification

(51) **Int. Cl.**
G06F 1/16 (2006.01)
H05K 5/00 (2006.01)

An electronic device includes an antenna, a display, a housing forming at least a portion of an exterior of the electronic device, a printed circuit board disposed within the housing, a connector disposed on the printed circuit board, a wire electrically connecting the connector and the display, a plurality of filters disposed on the printed circuit board, a switch selectively connecting the connector to one or more of the plurality of filters, and at least one processor electrically connected with the antenna, the display, and the switch.





(19) **United States**

(12) **Patent Application Publication**
Gu

(10) **Pub. No.: US 2019/0237851 A1**

(43) **Pub. Date: Aug. 1, 2019**

(54) **ANTENNA DEVICE AND MIMO ANTENNA ARRAYS FOR ELECTRONIC DEVICE**

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

CPC **H01Q 1/243** (2013.01); **H01Q 5/35** (2015.01); **H01Q 5/10** (2015.01); **H01Q 9/0435** (2013.01)

(71) Applicant: **Huanhuan Gu**, Waterloo (CA)

(72) Inventor: **Huanhuan Gu**, Waterloo (CA)

(57)

ABSTRACT

Radio Frequency (RF) signal antenna devices and MIMO antenna portion arrays including the RF signal antenna devices are described. An antenna device includes a radiator that functions both as a first antenna and as a second antenna, a ground terminal directly connected to the radiator between a first end and a second end of the radiator, a first feed terminal for the first antenna, directly connected to the radiator at a first feed point between the first end of the radiator and the ground terminal; and a second feed terminal for the second antenna, directly connected to the radiator at a second feed point between the second end of the radiator and the ground terminal.

(21) Appl. No.: **15/881,343**

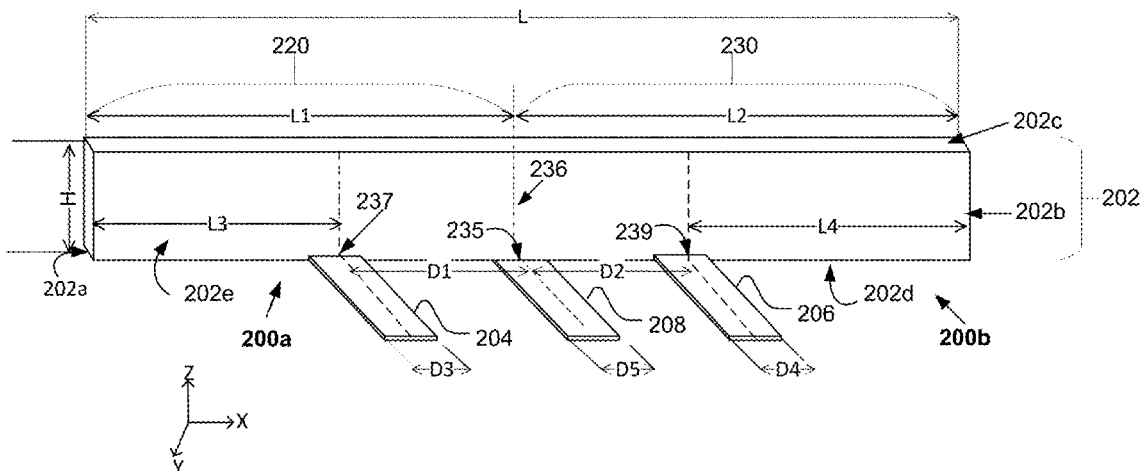
(22) Filed: **Jan. 26, 2018**

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
H01Q 5/10 (2015.01)
H01Q 5/35 (2015.01)

200





US 20190237852A1

(19) **United States**

(12) **Patent Application Publication**
TSOU

(10) **Pub. No.: US 2019/0237852 A1**

(43) **Pub. Date: Aug. 1, 2019**

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

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/2266* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/35* (2015.01)

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

(57) **ABSTRACT**

(72) Inventor: **TUN-YUAN TSOU**, New Taipei (TW)

An antenna structure utilizing metallic frame of electronic device to simultaneously send and receive radio waves on multiple frequencies includes first and second feeding sources and the metallic frame. A notch in the metallic frame creates first and second radiating portions. The first feeding source feeds the first radiating portion, and a first mode and a second mode can be activated simultaneously to generate radiation signals in a first frequency band and a second frequency band. The second feeding source feeds the second radiating portion and a third mode and a fourth mode can be simultaneously activated to generate radiation signals in a third frequency band and a fourth frequency band. A wireless communication device is also provided. The wireless communication device includes a motherboard and the antenna structure.

(21) Appl. No.: **16/243,596**

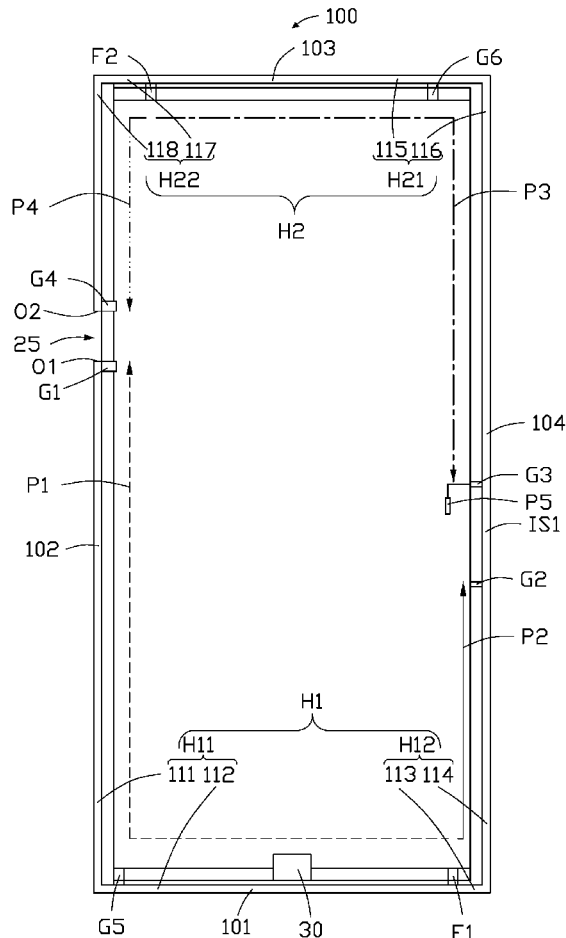
(22) Filed: **Jan. 9, 2019**

(30) **Foreign Application Priority Data**

Jan. 11, 2018 (CN) 201810026892.0

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/35 (2006.01)
H01Q 1/48 (2006.01)





US 20190237853A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0237853 A1**

(43) **Pub. Date: Aug. 1, 2019**

(54) **RECONFIGURABLE ANTENNA DEVICE
SUITABLE FOR THREE-SEGMENT TYPE
METAL BACK COVER**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/307 (2006.01)
H01Q 1/50 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/50*
(2013.01); *H01Q 5/307* (2015.01)

(71) Applicant: **JRD COMMUNICATION
(SHENZHEN) LTD**, Shenzhen (CN)

(72) Inventors: **Wei HU**, Shenzhen (CN); **Chaoyu
TIAN**, Shenzhen (CN)

(57) **ABSTRACT**

A reconfigurable antenna device suitable for a three-segment metal back cover is provided. The antenna device may include an antenna radiation body, a first matching module, a second matching module, a switch module and a feeding end. The antenna radiation body can be parallel to and above a first metal body and a second metal body of the metal back cover. The antenna radiation body can be grounded after being connected to the first matching module. The antenna radiation body is further connected to the second matching module, and the second matching module is connected to the feeding end and a switch module, respectively. A multi-band reconfigurable antenna can be achieved by adjusting the position of the switch module.

(21) Appl. No.: **16/344,775**

(22) PCT Filed: **Sep. 1, 2017**

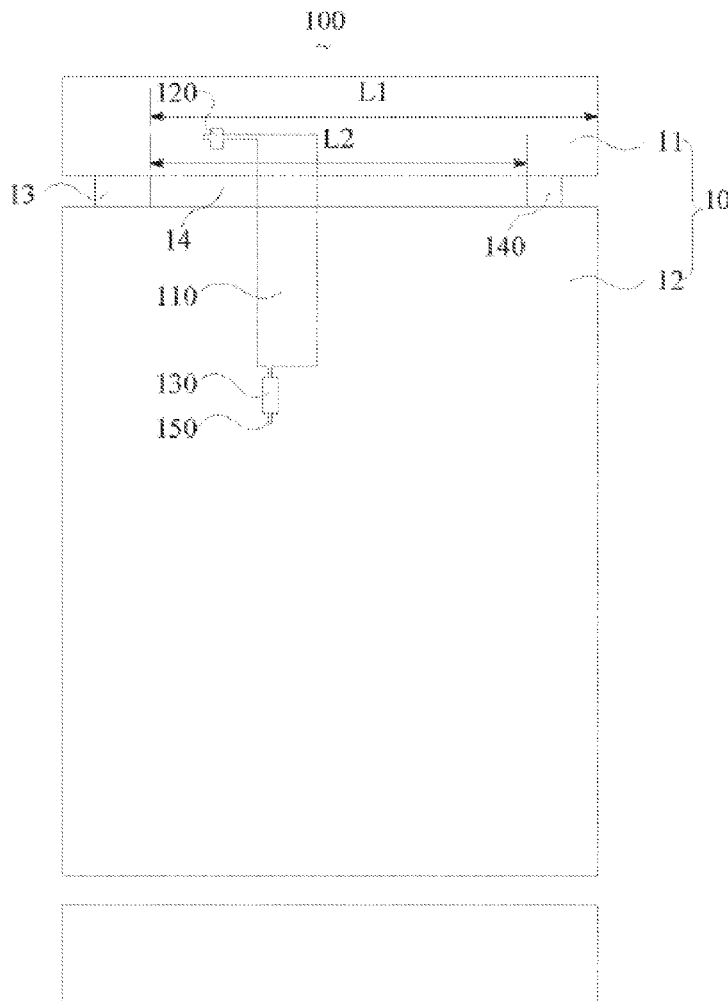
(86) PCT No.: **PCT/CN2017/100265**

§ 371 (c)(1),

(2) Date: **Apr. 24, 2019**

(30) **Foreign Application Priority Data**

Oct. 26, 2016 (CN) 201610942722.8





(19) **United States**

(12) **Patent Application Publication**

LEE et al.

(10) **Pub. No.: US 2019/0237855 A1**

(43) **Pub. Date: Aug. 1, 2019**

(54) **MOBILE TERMINAL**

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

(72) Inventors: **Youngjoon LEE**, Seoul (KR); **Taemin KWON**, Seoul (KR); **Sangmo KIM**, Seoul (KR); **Soocho BANG**, Seoul (KR); **Geunsu LEE**, Seoul (KR); **Kyujin CHOI**, Seoul (KR); **Baekbong PYO**, Seoul (KR); **Changho HONG**, Seoul (KR)

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

(21) Appl. No.: **16/383,278**

(22) Filed: **Apr. 12, 2019**

Related U.S. Application Data

(63) Continuation of application No. 15/865,380, filed on Jan. 9, 2018, now Pat. No. 10,297,906.

Foreign Application Priority Data

May 2, 2017 (KR) 10-2017-0056485

Publication Classification

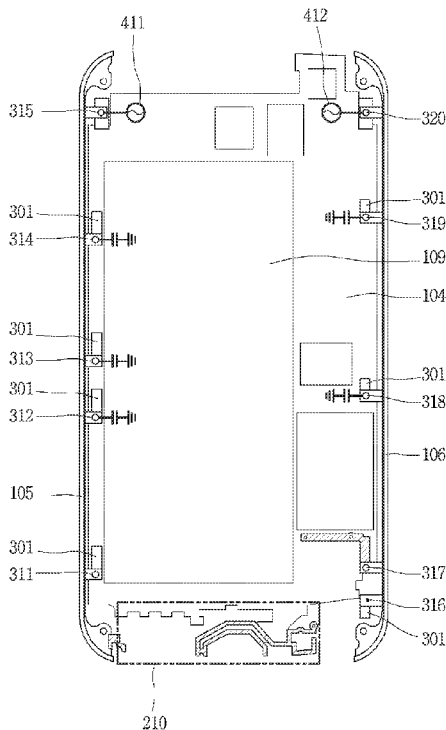
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)

H01Q 1/38 (2006.01)
H01Q 5/371 (2006.01)
H01Q 9/42 (2006.01)
H01Q 9/14 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/22 (2006.01)
H01Q 21/28 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H04M 1/0266** (2013.01); **H01Q 1/38** (2013.01); **H04M 1/02** (2013.01); **H01Q 1/24** (2013.01); **H01Q 5/371** (2015.01); **H01Q 21/28** (2013.01); **H01Q 9/42** (2013.01); **H01Q 9/145** (2013.01); **H01Q 1/48** (2013.01); **H01Q 1/245** (2013.01); **H01Q 1/2291** (2013.01); **H04M 1/026** (2013.01)

(57) **ABSTRACT**

A mobile terminal can include a terminal body having a display unit disposed on one surface thereof; a frame supporting the display unit; a metal member spaced apart from the frame and exposed to an outside of the mobile terminal; a plurality of connecting members connecting the metal member to the frame and grounding the metal member; and an antenna unit disposed adjacent to the frame and including a radiator configured to radiate wireless signals in a first frequency band, in which the metal member is divided into specific areas by the plurality of connecting members, and one area located adjacent to the radiator, is configured to generate a parasitic resonance at a second frequency band different from the first frequency band, and the plurality of connecting members connected to the metal member are spaced apart from one another at different intervals.





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(19) **United States**

(12) **Patent Application Publication**

Xia et al.

(10) **Pub. No.: US 2019/0245262 A1**

(43) **Pub. Date: Aug. 8, 2019**

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

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

CPC *H01Q 1/243* (2013.01); *H01Q 21/22* (2013.01); *H01Q 3/38* (2013.01); *H04M 1/0266* (2013.01); *H04M 1/0277* (2013.01)

(71) Applicant: **AAC Technologies Pte. Ltd.**,
Singapore city (SG)

(72) Inventors: **Xiaoyue Xia**, Shenzhen (CN); **Chao Wang**, Shenzhen (CN)

(57) **ABSTRACT**

The present disclosure discloses an antenna system and a mobile terminal. The antenna system is applied to the mobile terminal and includes a first feeding point, a first millimeter-wave array antenna electrically connected to the first feeding point, a second feeding point, a second millimeter-wave array antenna electrically connected to the second feeding point, a third feeding point, a third millimeter-wave array antenna electrically connected to the third feeding point, a fourth feeding point, and a fourth millimeter-wave array antenna electrically connected to the fourth feeding point, which are all disposed on the circuit board; beams of the first millimeter-wave array antenna cover a space of $Z>0$; beams of the second millimeter-wave array antenna cover a space of $Z<0$; beams of the third millimeter-wave array antenna cover a space of $Y>0$; and beams of the fourth millimeter-wave array antenna cover a space of $Y<0$.

(21) Appl. No.: **16/057,960**

(22) Filed: **Aug. 8, 2018**

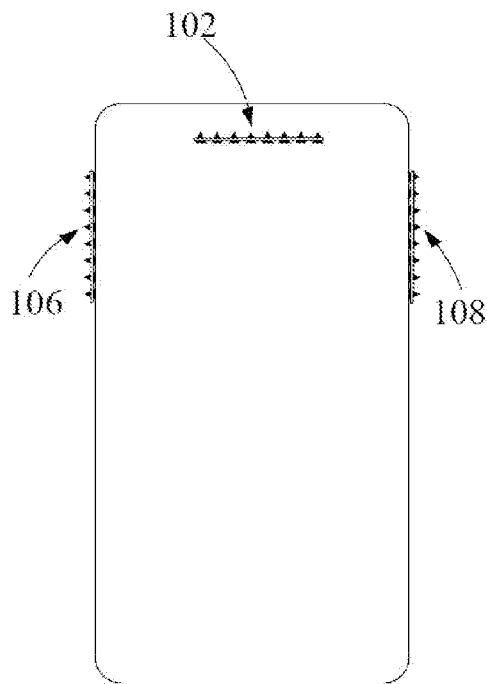
(30) **Foreign Application Priority Data**

Dec. 13, 2017 (CN) 201711326170.9

Publication Classification

(51) **Int. Cl.**

<i>H01Q 1/24</i>	(2006.01)
<i>H01Q 21/22</i>	(2006.01)
<i>H04M 1/02</i>	(2006.01)
<i>H01Q 3/38</i>	(2006.01)





US 20190245953A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0245953 A1**

(43) **Pub. Date: Aug. 8, 2019**

(54) **ELECTRONIC DEVICE AND STRUCTURE OF HOUSING FOR SAME**

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

(72) Inventors: **Hyunjin KIM**, Suwon-si (KR);
Seungtae KO, Suwon-si (KR); **Junsig KUM**,
Suwon-si (KR); **Yoongeon KIM**, Suwon-si (KR);
Youngju LEE, Suwon-si (KR)

(21) Appl. No.: **16/265,014**

(22) Filed: **Feb. 1, 2019**

(30) **Foreign Application Priority Data**

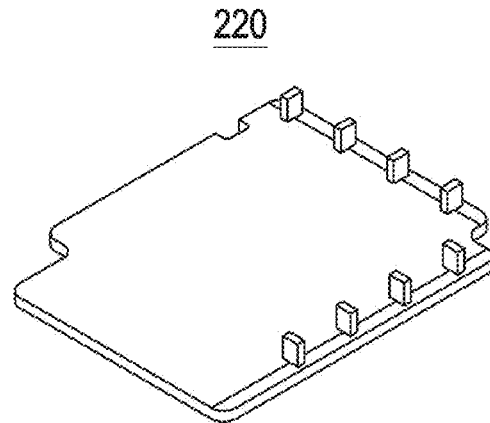
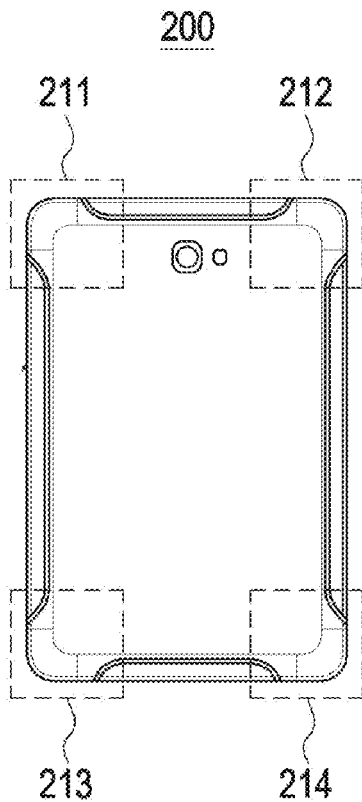
Feb. 6, 2018 (KR) 10-2018-0014463

Publication Classification

(51) **Int. Cl.**
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC **H04M 1/026** (2013.01); **H01Q 1/245**
(2013.01)

(57) **ABSTRACT**

The disclosure relates to a 5G or pre-5G communication system for supporting higher data transmission rates than 4G communication systems such as LTE systems. The disclosure relates to the structure of a housing with a dielectric. A housing of a terminal device using an antenna is provided. The at least one protrusion formed of a dielectric in the housing is configured to be positioned between a side surface of the housing and the antenna.





US 20190245954A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0245954 A1**

(43) **Pub. Date: Aug. 8, 2019**

(54) **FOLDABLE MOBILE DEVICE**

Publication Classification

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

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

(72) Inventors: **Huixiang LIU**, Cupertino (US); **Yuehui OUYANG**, Sunnyvale, CA (US); **Yiwen GONG**, Cupertino, CA (US); **Peng XIONG**, Shanghai (CN)

(52) **U.S. Cl.**
CPC **H04M 1/0214** (2013.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **16/276,299**

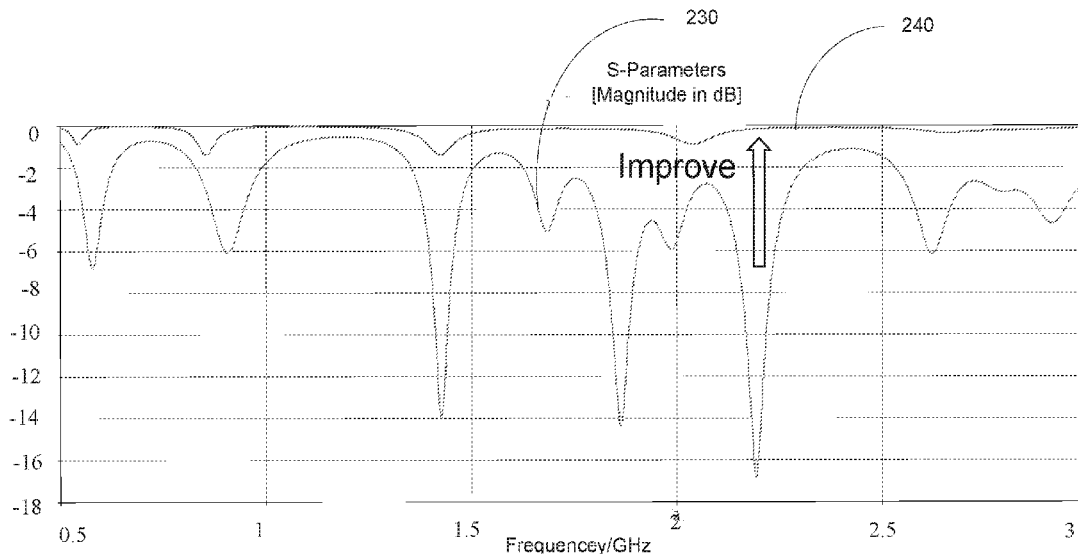
An embodiment of the disclosure involves a foldable mobile device. The foldable mobile device includes a housing having a first portion and a second portion foldable around a folding axis of the housing to allow a folded state of the device; an antenna operatively assembled to the housing; and a display mounted on a front side of the first portion and a front side of the second portion. The first portion has a first plate configured on a back side of the first portion opposite to the front side of the first portion, a contacting structure defined on the first plate. The second portion has a second plate configured on a back side of the second portion opposite to the front side of the second portion. When the mobile device operates is folded, the first plate and the second plate are conductively coupled with each other via the contacting structure.

(22) Filed: **Feb. 14, 2019**

Related U.S. Application Data

(63) Continuation of application No. 15/794,874, filed on Oct. 26, 2017, now Pat. No. 10,230,826.

(60) Provisional application No. 62/548,780, filed on Aug. 22, 2017.





(19) **United States**

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

(10) **Pub. No.: US 2019/0252764 A1**

(43) **Pub. Date: Aug. 15, 2019**

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

H01Q 1/48 (2006.01)

H01Q 1/38 (2006.01)

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

CPC *H01Q 1/243* (2013.01); *H01Q 1/38* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/35* (2015.01)

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

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

(57)

ABSTRACT

An antenna structure includes a side frame, a first feed portion, a second feed portion, and a first ground portion. The side frame defines a first gap and a second gap. The side frame is divided into a first radiating portion by the first gap and the second gap. When the first feed portion supplies current, the current flows through a first resonance section and is grounded through the first ground portion to activate a first operating mode and a second operating mode. When the first feed portion supplies current, the current flows through a second resonance section and is grounded through the second feed portion to activate a third operating mode. When the second feed portion supplies current, the current flows through the second resonance section and the first resonance section, and is grounded through the first ground portion to activate a fourth operating mode.

(21) Appl. No.: **16/261,976**

(22) Filed: **Jan. 30, 2019**

(30) **Foreign Application Priority Data**

Feb. 9, 2018 (CN) 201810136694.X

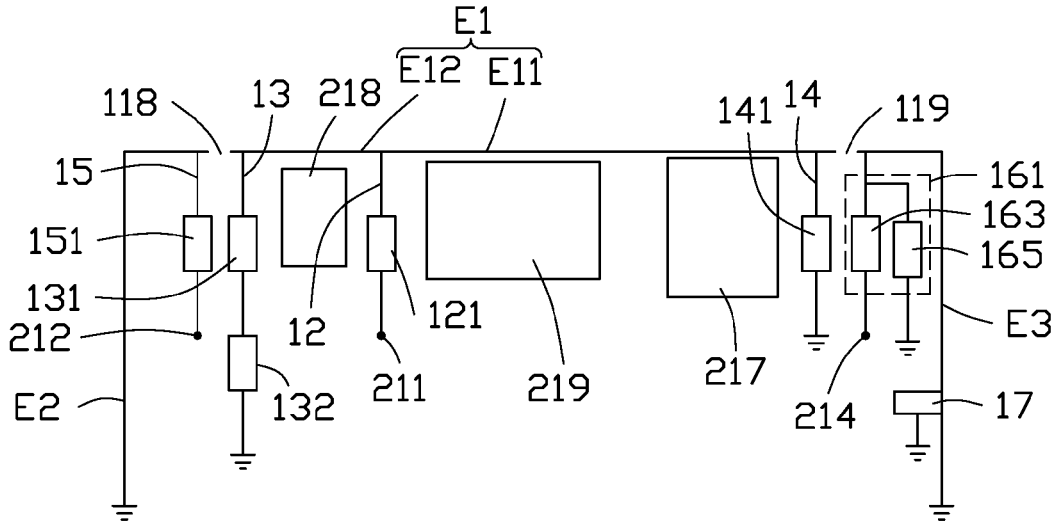
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 5/35 (2006.01)

100





(19) **United States**

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

(10) **Pub. No.: US 2019/0252765 A1**

(43) **Pub. Date: Aug. 15, 2019**

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

H01Q 1/48 (2006.01)

H01Q 1/38 (2006.01)

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

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

(2013.01); *H01Q 1/48* (2013.01); *H01Q 5/378*

(2015.01)

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

(72) Inventors: **YI-TING CHEN**, New Taipei (TW); **YEN-JUNG TSENG**, New Taipei (TW); **CHO-KANG HSU**, New Taipei (TW); **JUNG-SHENG CHIH**, New Taipei (TW); **WEN-CHANG HSU**, New Taipei (TW); **MIN-HUI HO**, New Taipei (TW)

(57)

ABSTRACT

An antenna structure includes a housing, a feeding portion, and a connecting portion. The housing defines a gap and a groove. The housing forms a radiating portion and a coupling portion through the gap and the groove. A portion of the housing between the feeding portion and the gap forms a first radiating section. The connecting portion is electrically connected to one end of the coupling portion adjacent to the gap. When the feeding portion supplies current, the current flows through the feeding portion and the first radiating section, and is coupled to the connecting portion through the gap to activate a first operating mode. When the feeding portion supplies current, the current flows through the feeding portion and the first radiating section, and is coupled to the coupling portion through the gap to activate a second operating mode.

(21) Appl. No.: **16/261,991**

(22) Filed: **Jan. 30, 2019**

(30) **Foreign Application Priority Data**

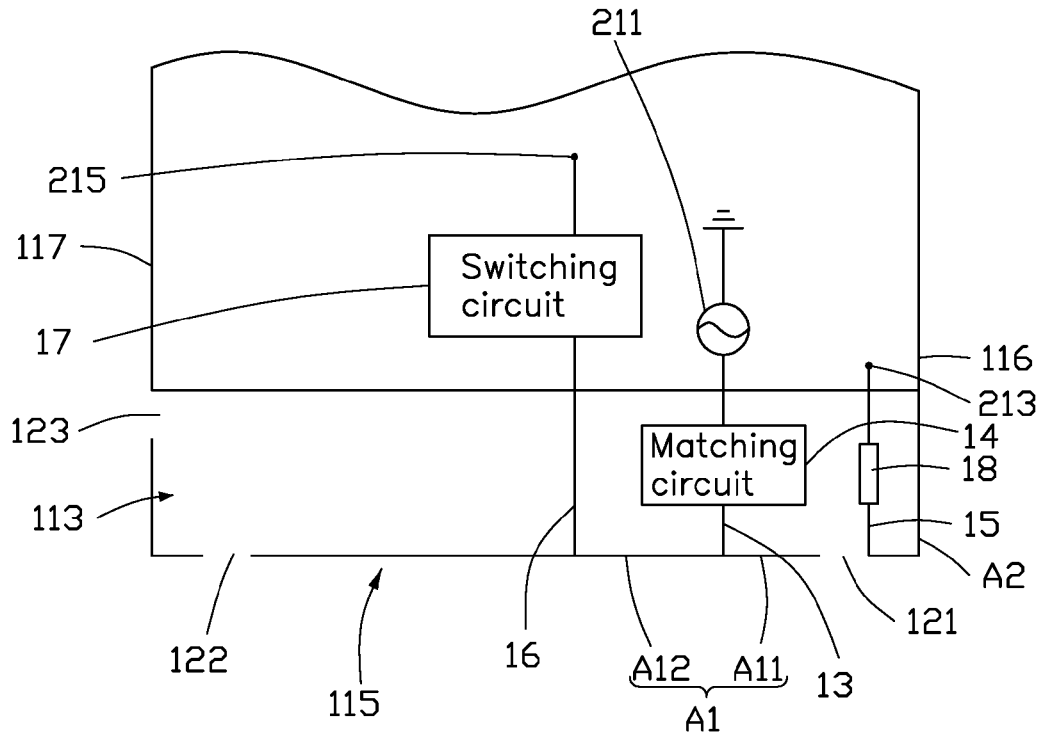
Feb. 9, 2018 (CN) 201810136692.0

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 5/378 (2006.01)





US 20190252766A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0252766 A1**

(43) **Pub. Date: Aug. 15, 2019**

(54) **ELECTRONIC DEVICE INCLUDING CONDUCTIVE MEMBER ELECTRICALLY COUPLED TO OPENING OF BRACKET FOR ADJUSTING RESONANCE GENERATED FROM THE OPENING**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H04M 1/0262* (2013.01); *H04B 1/3833* (2013.01); *H04M 1/0266* (2013.01); *H04M 1/0277* (2013.01)

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

(72) Inventors: **Jaewoong JEON**, Suwon-si (KR);
Jungsik PARK, Suwon-si (KR)

(57) **ABSTRACT**

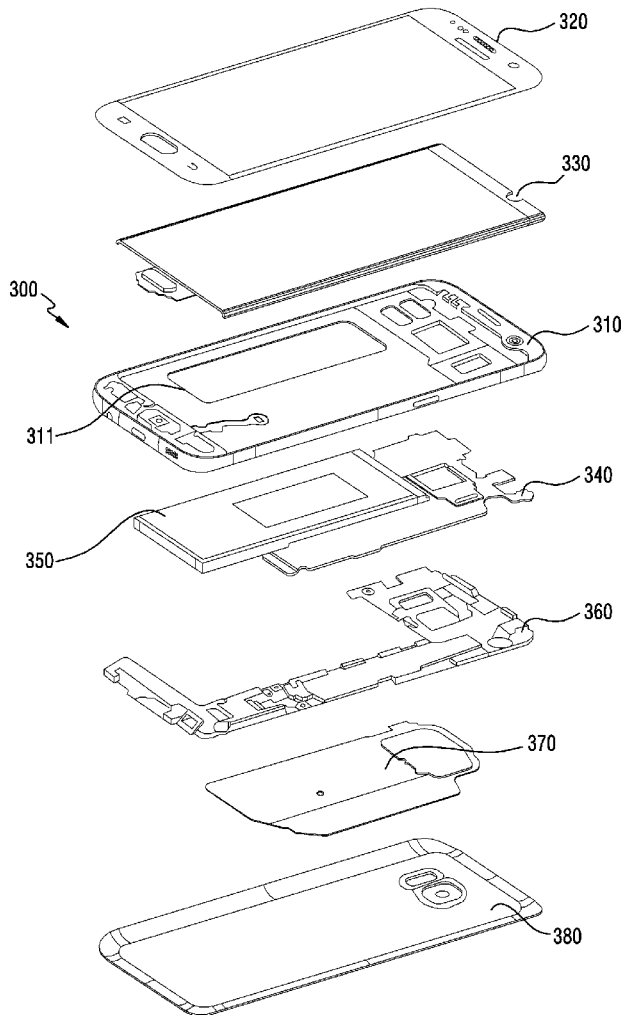
According to various embodiments, an electronic device may include a conductive bracket including an opening in at least part of the bracket, a display disposed on one surface of the bracket, a battery disposed on another surface of the bracket to face at least part of the opening, an antenna disposed within a specified range of the bracket and configured to output a signal of a first frequency band, and a conductive member comprising conductive material electrically coupled to the bracket by crossing at least part of the opening, wherein the opening is divided into a plurality of openings, to adjust resonance of a second frequency band of the opening generated by the signal output from the antenna.

(21) Appl. No.: **16/274,508**

(22) Filed: **Feb. 13, 2019**

(30) **Foreign Application Priority Data**

Feb. 14, 2018 (KR) 10-2018-0018586





US 20190252773A1

(19) **United States**

(12) **Patent Application Publication**
WU

(10) **Pub. No.: US 2019/0252773 A1**

(43) **Pub. Date: Aug. 15, 2019**

(54) **ANTENNA DEVICE FOR MOBILE TERMINAL AND MOBILE TERMINAL**

Publication Classification

(71) Applicant: **GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP., LTD., DONGGUAN (CN)**

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventor: **Qing WU, DONGGUAN (CN)**

(52) **U.S. Cl.**
CPC *H01Q 1/528* (2013.01); *H01Q 1/48* (2013.01); *H01Q 1/242* (2013.01); *H01Q 9/0442* (2013.01); *H01Q 1/24* (2013.01)

(21) Appl. No.: **16/393,265**

(22) Filed: **Apr. 24, 2019**

(57) **ABSTRACT**

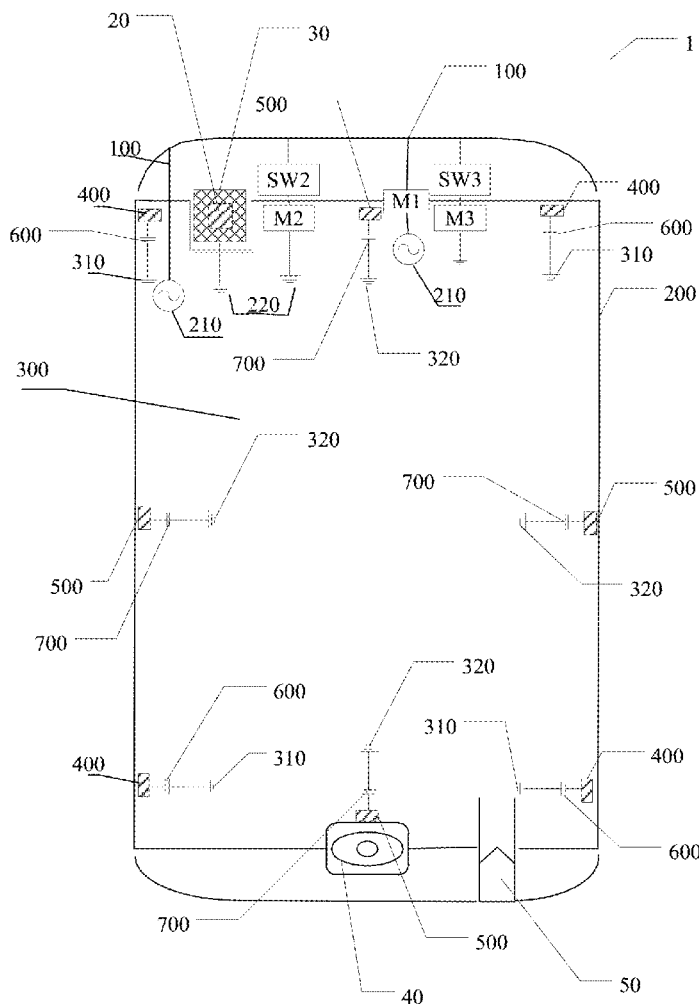
Related U.S. Application Data

(63) Continuation of application No. 15/668,778, filed on Aug. 4, 2017, now Pat. No. 10,312,585.

An antenna device for a mobile terminal as well as a mobile terminal is provided. The antenna device includes: a metal battery cover including a plurality of first ground points; a mainboard including a plurality of second ground points; a plurality of antennas coupled to the mainboard; a plurality of first connecting members coupling the plurality of first ground points to the plurality of second ground points; and a plurality of first capacitors coupled between the plurality of first connecting members and the plurality of first ground points respectively.

Foreign Application Priority Data

Nov. 18, 2016 (CN) 201611036734.0
Nov. 18, 2016 (CN) 201621257004.9





(19) **United States**

(12) **Patent Application Publication**
Shin

(10) **Pub. No.: US 2019/0252786 A1**

(43) **Pub. Date: Aug. 15, 2019**

(54) **DEVICES AND METHODS FOR IMPLEMENTING MIMO IN METAL RING STRUCTURES USING TUNABLE ELECTRICALLY SMALL ANTENNAS**

(52) **U.S. CI.**
CPC *H01Q 9/0442* (2013.01); *H01Q 5/335* (2015.01); *H01Q 1/523* (2013.01); *H01Q 21/0025* (2013.01); *H01Q 1/243* (2013.01)

(71) Applicant: **wiSpry, Inc.**, Irvine, CA (US)

(57) **ABSTRACT**

(72) Inventor: **Joungsub Shin**, Irvine, CA (US)

(21) Appl. No.: **16/271,776**

(22) Filed: **Feb. 8, 2019**

Related U.S. Application Data

(60) Provisional application No. 62/628,691, filed on Feb. 9, 2018.

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/335 (2006.01)
H01Q 1/24 (2006.01)
H01Q 21/00 (2006.01)
H01Q 1/52 (2006.01)

Devices and methods for implementing MIMO in metal ring structures using tunable electrically small antennas. In some embodiments, the metal ring structure includes a mobile device including electrically small antennas arranged on it, tunable band-stop circuits, wherein each of the electrically small antennas has a largest dimension that is substantially equal to or less than one-tenth of a length of a wavelength corresponding to a frequency within a communications operating frequency band. In some embodiments, the tunable electrically small antennas utilize parts of the metal ring structure of the mobile device as antenna radiators. The TESA are tunable for low-band frequencies between about 600 MHz-960 MHz. Additionally, the TESA have a wide bandwidth in high-band between about 1700 MHz-2700 MHz. In order to separate the TESA radiators from the rest of the metal ring structure, the radiators are connected by insulating material.

