



(19) **United States**

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

(10) **Pub. No.: US 2019/0260113 A1**

(43) **Pub. Date: Aug. 22, 2019**

(54) **ANTENNA AND MOBILE TERMINAL**

H01Q 7/00 (2006.01)

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

H01Q 9/04 (2006.01)

H01Q 1/36 (2006.01)

H01Q 9/42 (2006.01)

(72) Inventors: **Hanyang Wang**, Reading (GB);
Jianming Li, Shanghai (CN)

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

CPC **H01Q 1/243** (2013.01); **H01Q 5/378**

(2015.01); **H01Q 5/321** (2015.01); **H01Q 1/48**

(2013.01); **H01Q 9/42** (2013.01); **H01Q 5/00**

(2013.01); **H01Q 7/00** (2013.01); **H01Q**

9/0414 (2013.01); **H01Q 1/36** (2013.01);

H01Q 1/38 (2013.01)

(21) Appl. No.: **16/403,822**

(22) Filed: **May 6, 2019**

Related U.S. Application Data

(63) Continuation of application No. 16/057,374, filed on Aug. 7, 2018, now Pat. No. 10,320,060, which is a continuation of application No. 15/025,714, filed on Mar. 29, 2016, now Pat. No. 10,224,605, filed as application No. PCT/CN2014/074299 on Mar. 28, 2014.

(57)

ABSTRACT

An antenna includes a first radiation part, a matching circuit, and a feed source, where the first radiation part includes a first radiator, a second radiator, and a capacitor structure. A first end of the first radiator is connected to the feed source using the matching circuit, the feed source is connected to a grounding part, a second end of the first radiator is connected to a first end of the second radiator using the capacitor structure, a second end of the second radiator is connected to the grounding part, the first radiation part is configured to generate a first resonance frequency, and a length of the second radiator is one-eighth of a wavelength corresponding to the first resonance frequency which helps to reduce an antenna length, and a volume of a mobile terminal.

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

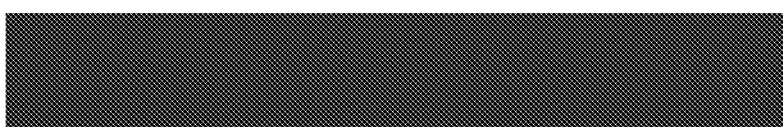
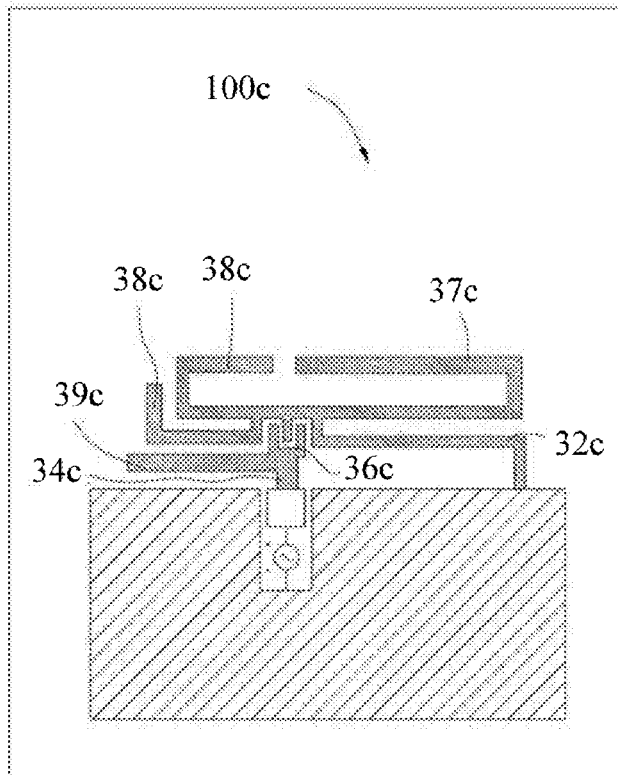
H01Q 5/378 (2006.01)

H01Q 5/321 (2006.01)

H01Q 1/48 (2006.01)

H01Q 1/38 (2006.01)

H01Q 5/00 (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2019/0260127 A1**

(43) **Pub. Date: Aug. 22, 2019**

(54) **MULTI-BAND WIRELESS SIGNALING**

Publication Classification

(71) Applicant: **QUALCOMM Incorporated**, San Diego, CA (US)

(72) Inventors: **Guining SHI**, San Diego, CA (US); **Young Jun SONG**, San Diego, CA (US); **Allen Minh-Triet TRAN**, San Diego, CA (US); **Mohammad Ali TASSOUDJI**, San Diego, CA (US); **Elizabeth WYRWICH**, San Diego, CA (US); **Julio ZEGARRA**, La Jolla, CA (US); **Clinton James WILBER**, San Diego, CA (US); **Neil BURNS**, San Diego, CA (US); **Jorge FABREGA SANCHEZ**, San Diego, CA (US)

(51) **Int. Cl.**
H01Q 5/371 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
 CPC *H01Q 5/371* (2015.01); *H01Q 9/0421* (2013.01); *H01Q 1/38* (2013.01)

(21) Appl. No.: **16/276,957**

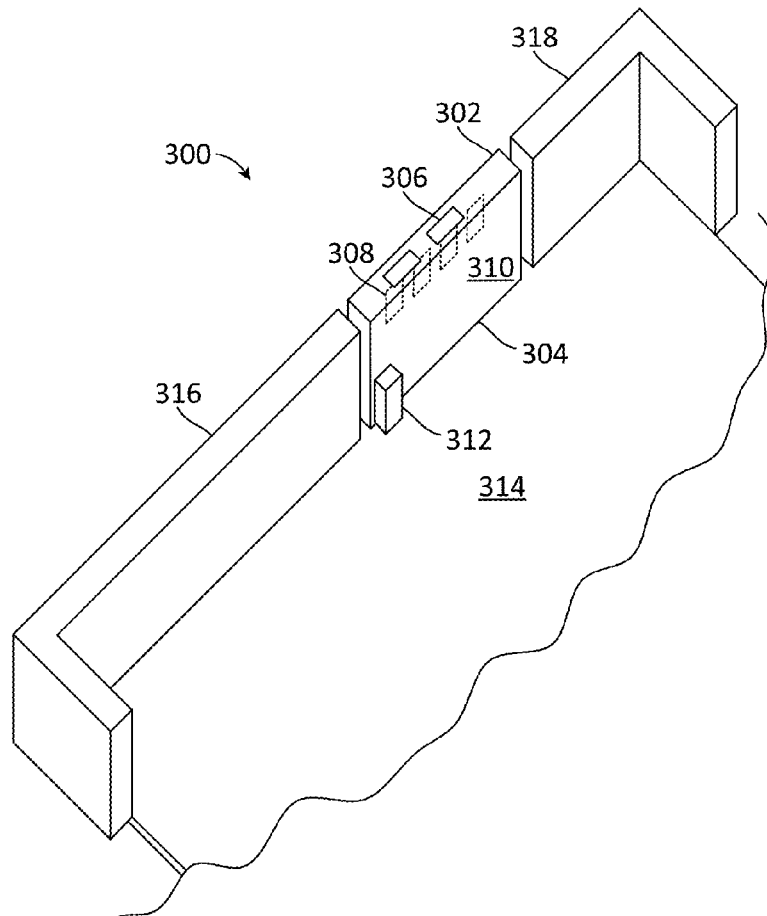
(22) Filed: **Feb. 15, 2019**

Related U.S. Application Data

(60) Provisional application No. 62/710,403, filed on Feb. 16, 2018.

(57) **ABSTRACT**

An antenna system for transducing radio-frequency energy includes: a first antenna sub-system comprising a plurality of radiators and a ground conductor, each of the plurality of radiators being sized and shaped to transduce millimeter-wave energy between first wireless signals and first electrical current signals; and a second antenna sub-system comprising a first radiator configured to transduce sub-6 GHz energy between second wireless signals and second electrical current signals, wherein the first radiator comprises the ground conductor.





US 20190260405A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0260405 A1**

(43) **Pub. Date: Aug. 22, 2019**

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

H01Q 21/28 (2006.01)

H01Q 9/14 (2006.01)

H01Q 1/24 (2006.01)

H01Q 9/04 (2006.01)

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

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

CPC *H04B 1/0483* (2013.01); *H01Q 5/371*

(2015.01); *H01Q 5/328* (2015.01); *H01Q 1/50*

(2013.01); *H01Q 9/145* (2013.01); *H01Q*

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

H01Q 21/28 (2013.01)

(72) Inventors: **Gunhee SON**, Gumi-si (KR);
Hyeongwoo KIM, Busan (KR);
Soon-Sang PARK, Daegu (KR);
Seunghyun YEO, Daegu (KR)

(21) Appl. No.: **16/284,966**

(57)

ABSTRACT

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

Related U.S. Application Data

(63) Continuation of application No. 15/222,899, filed on
Jul. 28, 2016, now Pat. No. 10,218,396.

Various embodiments provide an antenna device that includes: a metal member configured to have a length that contributes to at least a part of an electronic device; a printed circuit board (PCB) configured to be feed-connected to a preset position of the metal member in order to apply the metal member as an antenna radiator; and at least one electronic component electrically connected to a position different from the feeding position of the metal member and grounded to the PCB, and provide an electronic device that includes the same. Accordingly, the antenna device is grounded to the PCB in a desired position of the metal member by using the basically provided electronic component so that it is possible to exclude a separate electrical connection member, thereby reducing the cost, increasing the use of space, enhancing the degree of freedom of the design of the antenna radiator.

Foreign Application Priority Data

Jul. 28, 2015 (KR) 10-2015-0106687

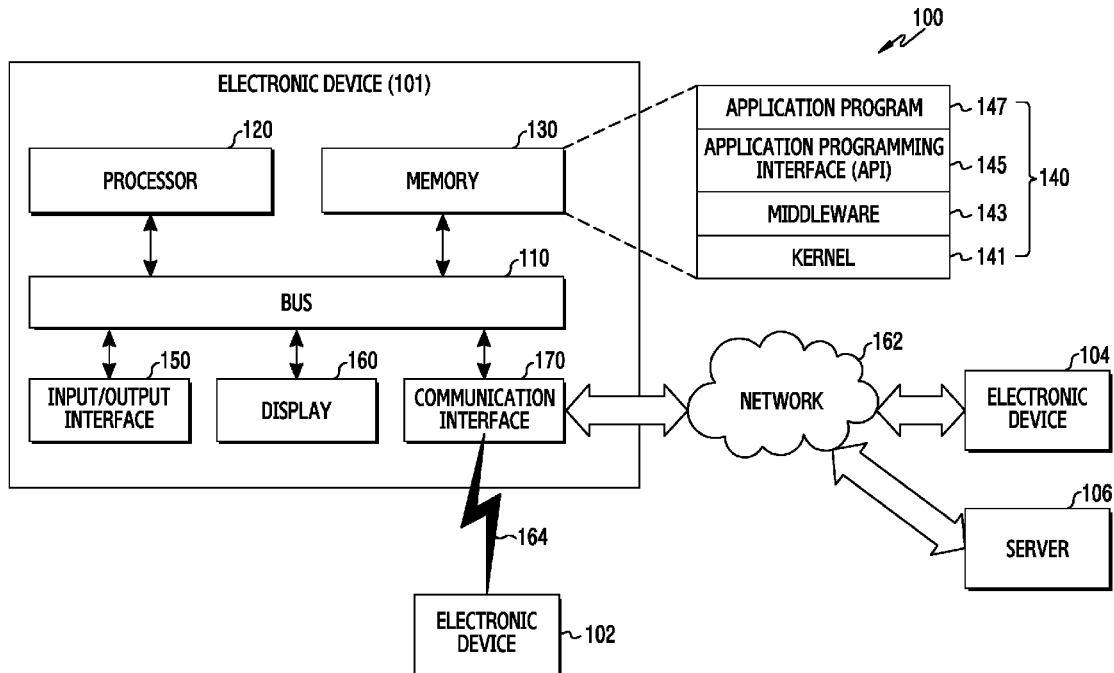
Publication Classification

(51) **Int. Cl.**

H04B 1/04 (2006.01)

H01Q 5/371 (2006.01)

H01Q 5/328 (2006.01)





US 20190267699A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0267699 A1**

(43) **Pub. Date: Aug. 29, 2019**

(54) **ELECTRONIC DEVICE USING METAL COVER AS ANTENNA RADIATOR**

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

CPC **H01Q 1/243** (2013.01); **H04M 1/0277** (2013.01); **H04M 1/0266** (2013.01); **G06F 1/1626** (2013.01); **H01Q 1/48** (2013.01); **H01Q 1/44** (2013.01); **H04M 1/0249** (2013.01)

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

(72) Inventors: **Jaehyung KIM**, Suwon-si (KR); **Jinu KIM**, Suwon-si (KR); **Jesun MOON**, Suwon-si (KR)

(57)

ABSTRACT

An electronic device is provided. The electronic device includes a housing including a front plate and a back plate facing away from the front plate, a display positioned within the housing and exposed through the front plate, and a printed circuit board (PCB) interposed between the front plate and the back plate. The back plate includes a first conductive part having a quadrangular cutting elongated from a corner in the second direction, when viewed from above the back plate, a second conductive part positioned in the cutting, when viewed from above the back plate, and an insulating part of an L shape elongated between the first conductive part and the second conductive part, when viewed from above the back plate, and contacting the first conductive part and the second conductive part.

(21) Appl. No.: **16/287,054**

(22) Filed: **Feb. 27, 2019**

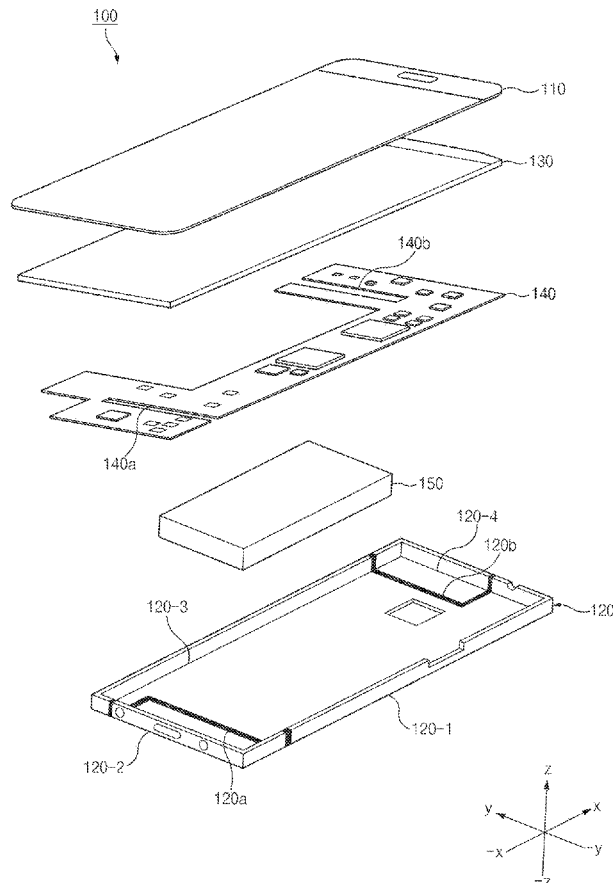
(30) **Foreign Application Priority Data**

Feb. 27, 2018 (KR) 10-2018-0023938

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/44 (2006.01)





US 20190267706A1

(19) **United States**

(12) **Patent Application Publication**
SAMPO

(10) **Pub. No.: US 2019/0267706 A1**

(43) **Pub. Date: Aug. 29, 2019**

(54) **ANTENNA DEVICE**

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

(71) Applicant: **YOKOWO CO., LTD.**, Tokyo (JP)

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

(72) Inventor: **Takeshi SAMPO**, Gunma (JP)

(73) Assignee: **YOKOWO CO., LTD.**, Tokyo (JP)

(57) **ABSTRACT**

(21) Appl. No.: **16/347,594**

(22) PCT Filed: **Nov. 8, 2017**

(86) PCT No.: **PCT/JP2017/040301**

§ 371 (c)(1),

(2) Date: **May 6, 2019**

(30) **Foreign Application Priority Data**

Dec. 16, 2016 (JP) 2016-244805

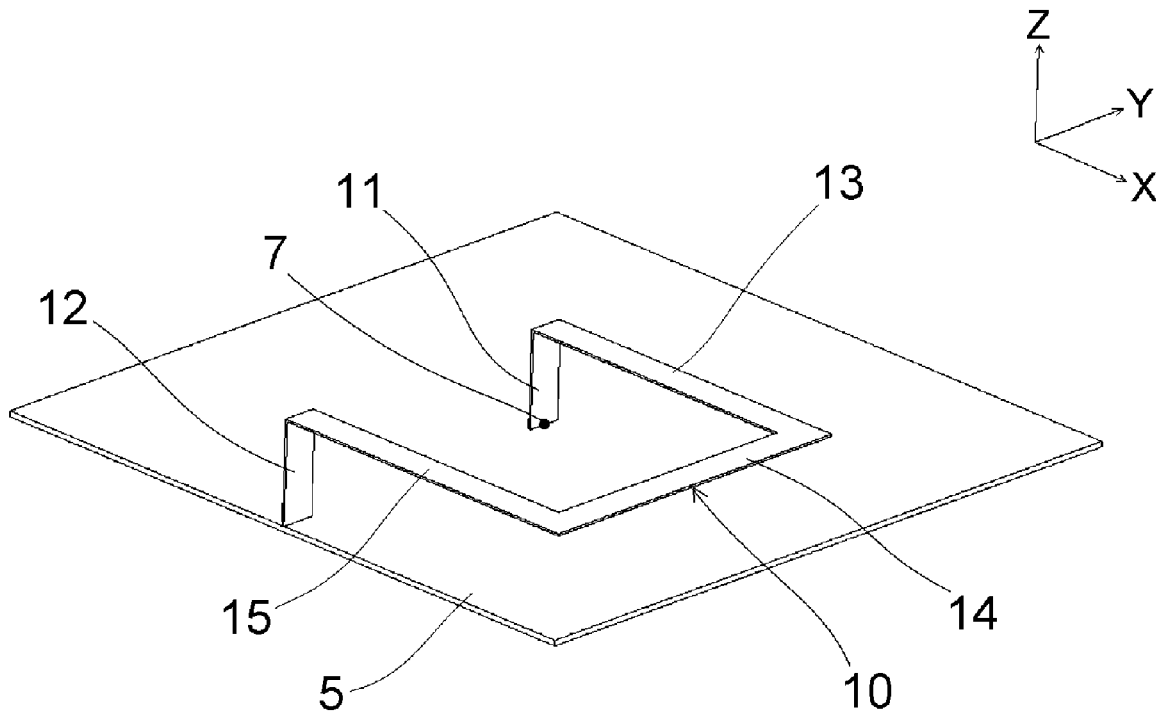
Publication Classification

(51) **Int. Cl.**

H01Q 1/48 (2006.01)

H01Q 9/42 (2006.01)

An antenna device has a configuration in which a feeding point is located at a position that is distant from an outer periphery of a ground conductor plate to a center side and that would correspond to polarized waves parallel to the ground conductor plate. The antenna devices includes a ground conductor plate and an antenna element. The antenna element includes a first vertical portion and a second vertical portion which are erected substantially perpendicularly from the ground conductor plate and a first parallel portion, a second parallel portion, and a third parallel portion which extend substantially parallel to the ground conductor plate. An end portion, in the $-Z$ direction, of the first vertical portion serves as a feeding point and is located at a position that is distant from an outer periphery of the ground conductor plate to a center side.



1 ANTENNA DEVICE



US 20190273307A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0273307 A1**

(43) **Pub. Date: Sep. 5, 2019**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

Publication Classification

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

(72) Inventors: **Yong Soo KWAK**, Seoul (KR); **Gyu Sub KIM**, Seoul (KR); **Hae Yeon KIM**, Suwon-si (KR); **Se Hyun PARK**, Suwon-si (KR); **Kyung Il SEO**, Daegu (KR); **Jung Hoon SEO**, Hwaseong-si (KR); **Dong Min SHIN**, Yongin-si (KR); **Ui Chul JEONG**, Anyang-si (KR); **Jin Woo JUNG**, Seoul (KR); **Young Jun CHO**, Seoul (KR)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)
H01Q 21/30 (2006.01)
H01Q 5/35 (2006.01)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 5/35* (2015.01); *H01Q 21/30* (2013.01); *H01Q 1/48* (2013.01)

(21) Appl. No.: **16/414,111**

(22) Filed: **May 16, 2019**

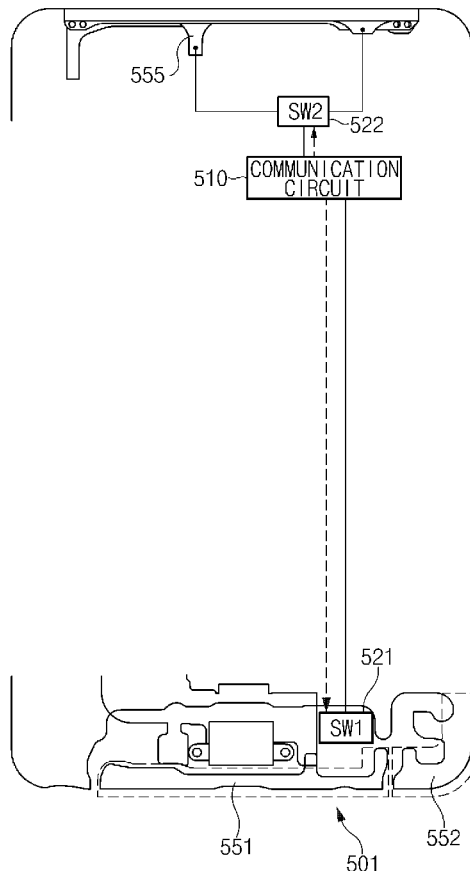
Related U.S. Application Data

(63) Continuation of application No. 15/665,933, filed on Aug. 1, 2017, now Pat. No. 10,305,170.

Foreign Application Priority Data

Aug. 1, 2016 (KR) 10-2016-0098238

(57) **ABSTRACT**
An electronic device is provided. The electronic device includes a housing, a wireless communication circuit, a first antenna radiator electrically connected with a first ground, a second antenna radiator electrically connected with a second ground, a feeding unit that feeds at least one of the first antenna radiator or the second antenna radiator, and a first switch that operates at a first connection state where the feeding unit and the first antenna radiator are electrically connected to each other, at a second connection state where the feeding unit and the second antenna are electrically connected to each other, or at a third connection state where the feeding unit and the first antenna radiator are connected to each other and the feeding unit and the second antenna radiator are electrically connected to each other, based on a first control signal from the wireless communication circuit.





US 20190273308A1

(19) **United States**

(12) **Patent Application Publication**

LEE et al.

(10) **Pub. No.: US 2019/0273308 A1**

(43) **Pub. Date: Sep. 5, 2019**

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

H01Q 19/06 (2006.01)

H01Q 1/38 (2006.01)

H01Q 15/02 (2006.01)

H01Q 1/44 (2006.01)

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

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

CPC *H01Q 1/243* (2013.01); *H01Q 21/28*

(2013.01); *H01Q 19/06* (2013.01); *H01Q*

1/2291 (2013.01); *H01Q 15/02* (2013.01);

H01Q 1/44 (2013.01); *H01Q 1/38* (2013.01)

(72) Inventors: **Young-Ju LEE**, Seoul (KR);
Seung-Tae KO, Bucheon-si (KR);
Hyun-Jin KIM, Seoul (KR)

(21) Appl. No.: **16/417,081**

(57)

ABSTRACT

(22) Filed: **May 20, 2019**

According to various embodiments of the present disclosure, an electronic device may include: an array antenna including a plurality of first radiating conductors that transmit or receive a wireless signal in a first frequency band and are arranged on a circuit board; and a lens unit including at least one lens disposed on a housing of the electronic device to correspond to the first radiating conductors. The lens unit may refract or reflect a wireless signal transmitted/received through each of the first radiating conductors. The electronic device as described above may be variously implemented according to embodiments. For example, a portion of the lens unit may transmit/receive a wireless signal in a frequency band that is different from the frequency band of the wireless signal transmitted/received by the first radiating conductors.

Related U.S. Application Data

(63) Continuation of application No. 15/401,022, filed on Jan. 7, 2017, now Pat. No. 10,297,900.

Foreign Application Priority Data

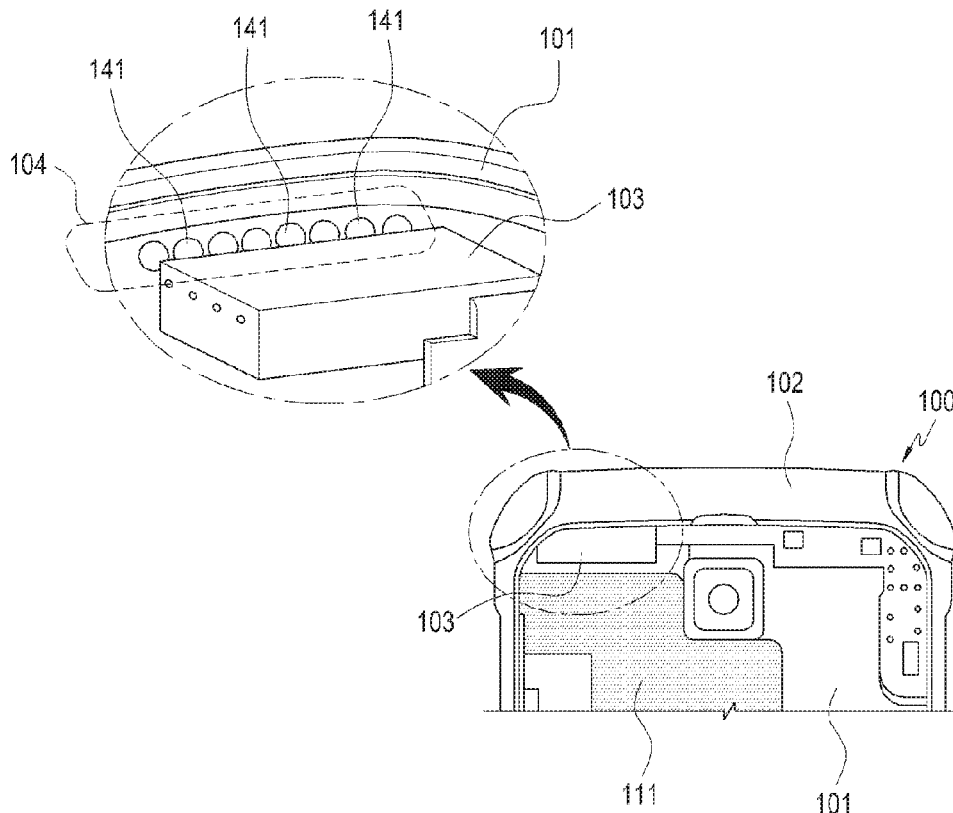
Jan. 7, 2016 (KR) 10-2016-0002003

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 21/28 (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2019/0280370 A1**

(43) **Pub. Date: Sep. 12, 2019**

(54) **MOBILE TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/30 (2006.01)
H04M 1/02 (2006.01)

(72) Inventors: **Seungwoo RYU**, Seoul (KR); **Joohee LEE**, Seoul (KR); **Wonwoo LEE**, Seoul (KR); **Junyoung JUNG**, Seoul (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H04M 1/026** (2013.01); **H01Q 5/30** (2015.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **16/345,899**

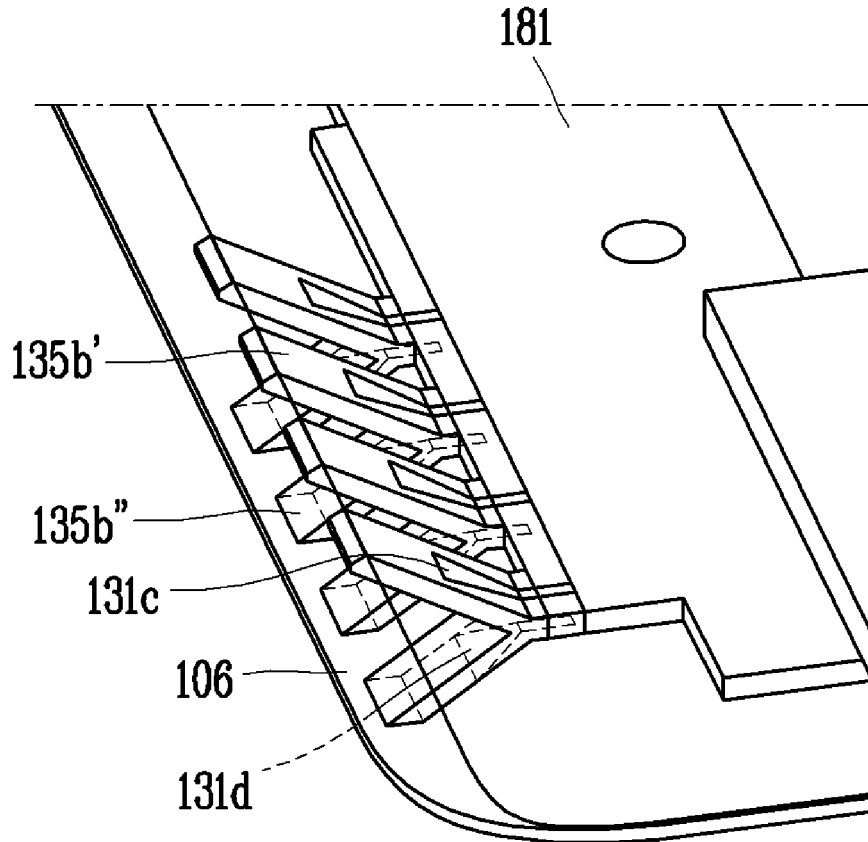
The present invention relates to a mobile terminal comprising: a terminal body; a first antenna device which is provided inside the terminal body and implements a resonant frequency of a first frequency band; and a second antenna device which is formed so as to be adjacent to the first antenna and implements a resonant frequency of a second frequency band, wherein the second antenna device is an antenna array formed by including a plurality of dielectrics operating as a radiator.

(22) PCT Filed: **Nov. 1, 2016**

(86) PCT No.: **PCT/KR2016/012449**

§ 371 (c)(1),

(2) Date: **Apr. 29, 2019**





US 20190280378A1

(19) **United States**

(12) **Patent Application Publication**

Gears et al.

(10) **Pub. No.: US 2019/0280378 A1**

(43) **Pub. Date: Sep. 12, 2019**

(54) **FLEXIBLE DISTRIBUTED ANTENNA SYSTEM USING A WIDEBAND ANTENNA DEVICE**

Nov. 19, 2010, now Pat. No. 9,960,487, filed as application No. PCT/GB2009/000404 on Feb. 12, 2009.

(71) Applicant: **ZINWAVE LIMITED**, Cambridge (GB)

(30) **Foreign Application Priority Data**

(72) Inventors: **Trevor Gears**, Standlake (GB); **Zafer Boz**, Harston (GB); **Graham Ronald Howe**, Caddington (GB); **Emiliano Mezzarobba**, Cambridge (GB); **Benedict Russell Freeman**, Cambridge (GB); **Andrew Robert Bell**, Hungerford (GB)

Feb. 14, 2008 (GB) 0802760.9
Aug. 5, 2008 (GB) 0814363.8

Publication Classification

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/24 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/525** (2013.01); **H01Q 1/246** (2013.01)

(21) Appl. No.: **16/252,244**

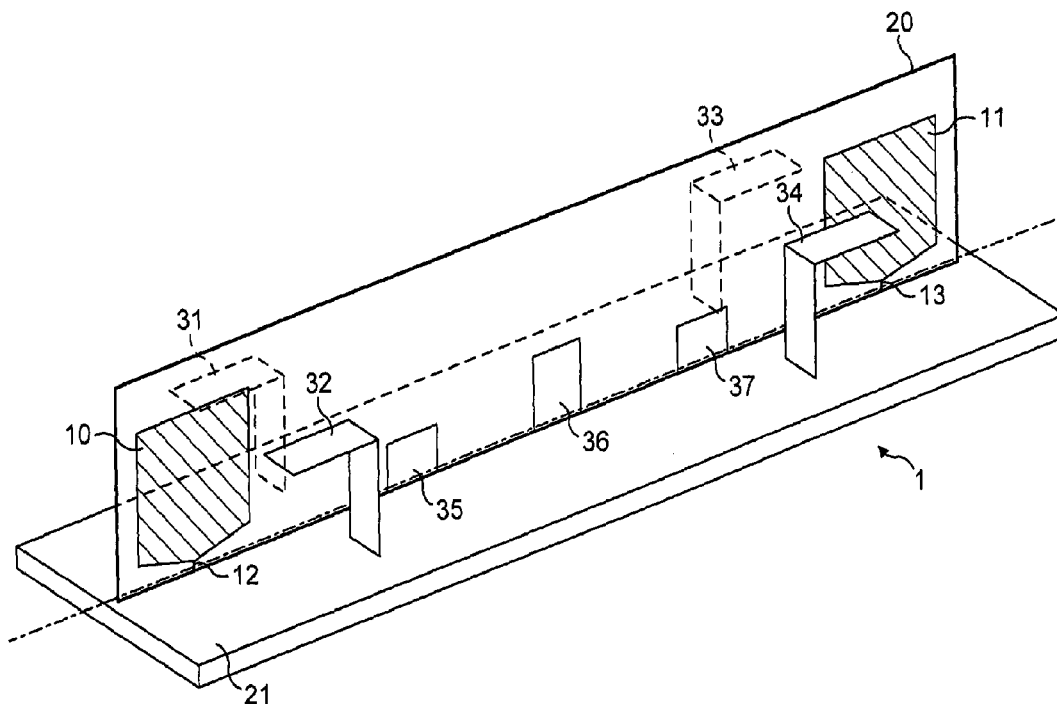
(22) Filed: **Jan. 18, 2019**

Related U.S. Application Data

(63) Continuation of application No. 15/920,106, filed on Mar. 13, 2018, now Pat. No. 10,186,770, which is a continuation of application No. 12/864,846, filed on

(57) **ABSTRACT**

A distributed antenna system (DAS) includes a wideband antenna device having respective transmit and receive antennas disposed in a single package and arranged to provide mutual isolation so that in use noise from the transmit antenna is isolated from the receive antenna, whereby reception is possible at the same frequency as transmission.





(19) **United States**

(12) **Patent Application Publication**
Wang

(10) **Pub. No.: US 2019/0280382 A1**

(43) **Pub. Date: Sep. 12, 2019**

(54) **PRINTED CIRCUIT BOARD ANTENNA AND TERMINAL**

H01Q 7/00 (2006.01)

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

H01Q 21/30 (2006.01)

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

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

CPC *H01Q 5/357* (2015.01); *H01Q 13/16*

(2013.01); *H01Q 5/314* (2015.01); *H01Q*

5/378 (2015.01); *H01Q 9/0421* (2013.01);

H01Q 7/005 (2013.01); *H01Q 7/00* (2013.01);

H01Q 1/38 (2013.01); *H01Q 1/242* (2013.01);

H01Q 21/30 (2013.01); *H01Q 13/106*

(2013.01)

(72) Inventor: **Hanyang Wang**, Reading (GB)

(21) Appl. No.: **16/426,701**

(22) Filed: **May 30, 2019**

Related U.S. Application Data

(63) Continuation of application No. 15/461,297, filed on Mar. 16, 2017, now Pat. No. 10,355,357, which is a continuation of application No. 14/517,418, filed on Oct. 17, 2014, now Pat. No. 9,666,951, which is a continuation of application No. PCT/CN2013/081193, filed on Aug. 9, 2013.

(57)

ABSTRACT

An antenna and a terminal are disclosed. In an embodiment an antenna includes a feedpoint disposed on a printed circuit board of a mobile terminal and a metal frame being an outer frame of a mobile terminal, wherein the metal frame has a split, a first ground point and a second ground point, wherein the first ground point and the second ground point are located at two sides of the split, the first ground point and the second ground point being grounded, wherein the metal frame between the feedpoint and the first ground point forms a first resonance loop, and wherein the metal frame between the feedpoint and the second ground point forms a second resonance loop.

Publication Classification

(51) **Int. Cl.**

H01Q 5/357 (2006.01)

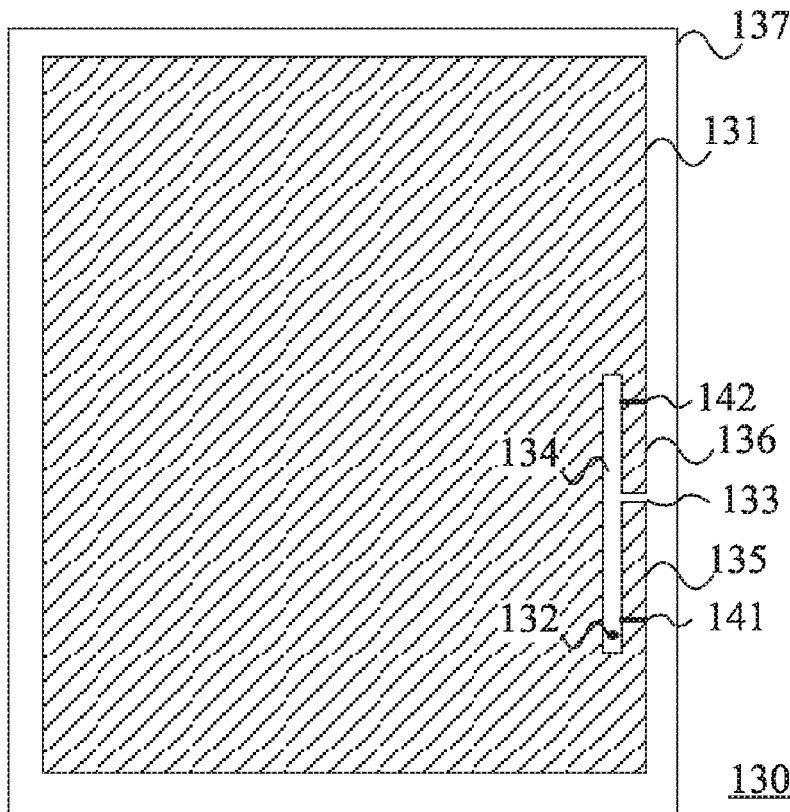
H01Q 13/16 (2006.01)

H01Q 5/314 (2006.01)

H01Q 5/378 (2006.01)

H01Q 9/04 (2006.01)

H01Q 13/10 (2006.01)





US 20190281146A1

(19) **United States**

(12) **Patent Application Publication**

JANG et al.

(10) **Pub. No.: US 2019/0281146 A1**

(43) **Pub. Date: Sep. 12, 2019**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

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

(72) Inventors: **Seyoung JANG**, Suwon-si (KR);
Chulwoo PARK, Suwon-si (KR);
Dongil SON, Suwon-si (KR);
Hyeongju LEE, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H04M 1/026** (2013.01); **H01Q 1/243** (2013.01)

(21) Appl. No.: **16/296,701**

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

(30) **Foreign Application Priority Data**

Mar. 9, 2018 (KR) 10-2018-0028195

(57) **ABSTRACT**

An electronic device includes a housing including a first plate including a glass plate, a second plate facing the first plate, and a side surface surrounding a space between the first plate and the second plate, a display positioned inside the space and exposed through a first area of the first plate, an antenna structure at least partially overlapping a second area of the first plate when viewed from above the first plate and which is connected to the second area, and a processor.

