



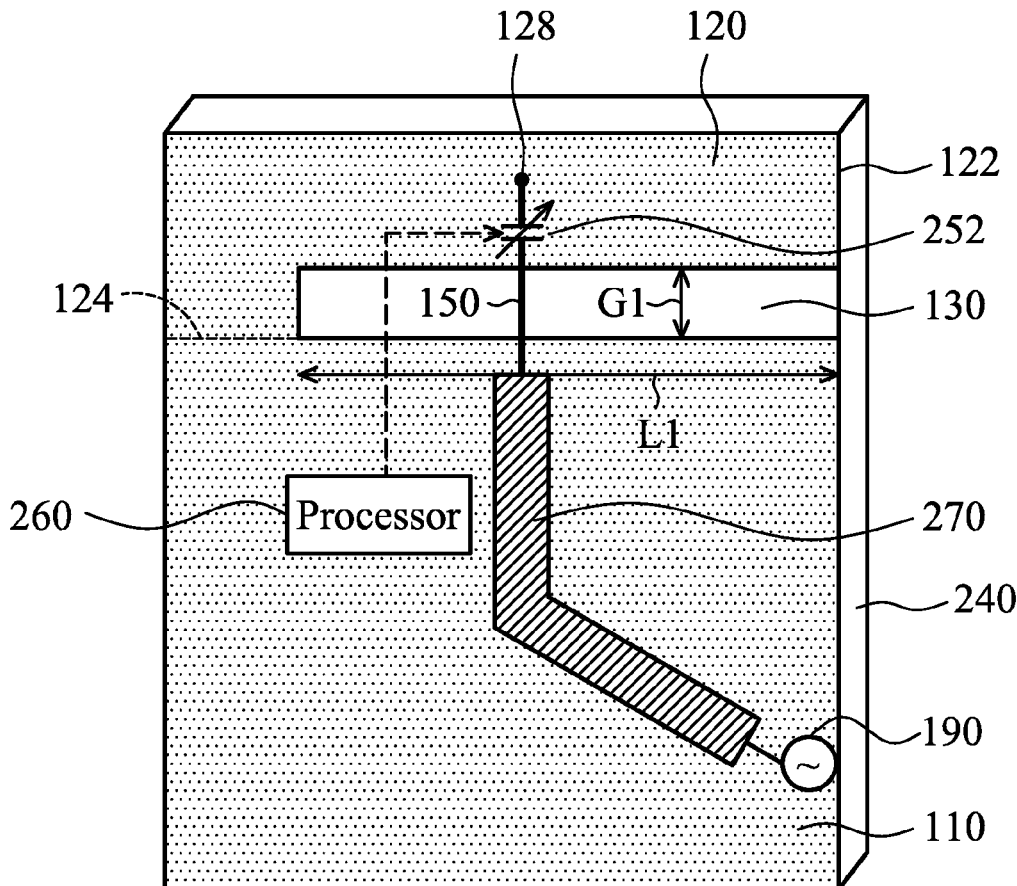
US 20190288376A1

(19) **United States**(12) **Patent Application Publication**
TSAI et al.(10) **Pub. No.: US 2019/0288376 A1**(43) **Pub. Date: Sep. 19, 2019**(54) **MOBILE DEVICE AND ANTENNA
STRUCTURE****Publication Classification**(51) **Int. Cl.***H01Q 1/24* (2006.01)*H01Q 9/42* (2006.01)*H01Q 5/335* (2006.01)*H01Q 5/378* (2006.01)(52) **U.S. Cl.**CPC *H01Q 1/243* (2013.01); *H01Q 5/378*
(2015.01); *H01Q 5/335* (2015.01); *H01Q 9/42*
(2013.01)(71) Applicant: **HTC Corporation**, Taoyuan City (TW)(72) Inventors: **Tiao-Hsing TSAI**, Taoyuan City (TW);
Chien-Pin CHIU, Taoyuan City (TW);
Hsiao-Wei WU, Taoyuan City (TW);
Ying-Chih WANG, Taoyuan City (TW)(73) Assignee: **HTC Corporation**, Taoyuan City (TW)(21) Appl. No.: **16/432,748**(22) Filed: **Jun. 5, 2019****Related U.S. Application Data**(63) Continuation of application No. 15/943,067, filed on
Apr. 2, 2018, now Pat. No. 10,355,341, which is a
continuation of application No. 13/598,317, filed on
Aug. 29, 2012, now Pat. No. 10,003,121.

(57)

ABSTRACT

A mobile device including a ground plane, a grounding branch, wherein a slot is formed between the ground plane and the grounding branch, a connecting element, wherein the grounding branch is electrically coupled through the connecting element to the ground plane and a feeding element, extending across the slot, and electrically coupled between the grounding branch and a signal source, wherein an antenna structure is formed by the grounding branch and the feeding element.

200



US 20190288392A1

(19) **United States**(12) **Patent Application Publication**
KIM et al.(10) **Pub. No.: US 2019/0288392 A1**(43) **Pub. Date: Sep. 19, 2019**(54) **ELECTRONIC DEVICE COMPRISING
ANTENNA**(71) Applicant: **Samsung Electronics Co., Ltd.**,
Suwon-si, Gyeonggi-do (KR)(72) Inventors: **Jaе Hyung KIM**, Yongin-si (KR);
Kyung Bae KO, Hwaseong-si (KR);
Tae Gyu KIM, Hwaseong-si (KR); **Je
Sun MOON**, Suwon-si (KR); **Jin Kyu
BANG**, Suwon-si (KR); **Sang Hoon
LEE**, Seoul (KR)(21) Appl. No.: **16/344,172**(22) PCT Filed: **Nov. 2, 2017**(86) PCT No.: **PCT/KR2017/012363**

§ 371 (c)(1),

(2) Date: **Apr. 23, 2019**(30) **Foreign Application Priority Data**

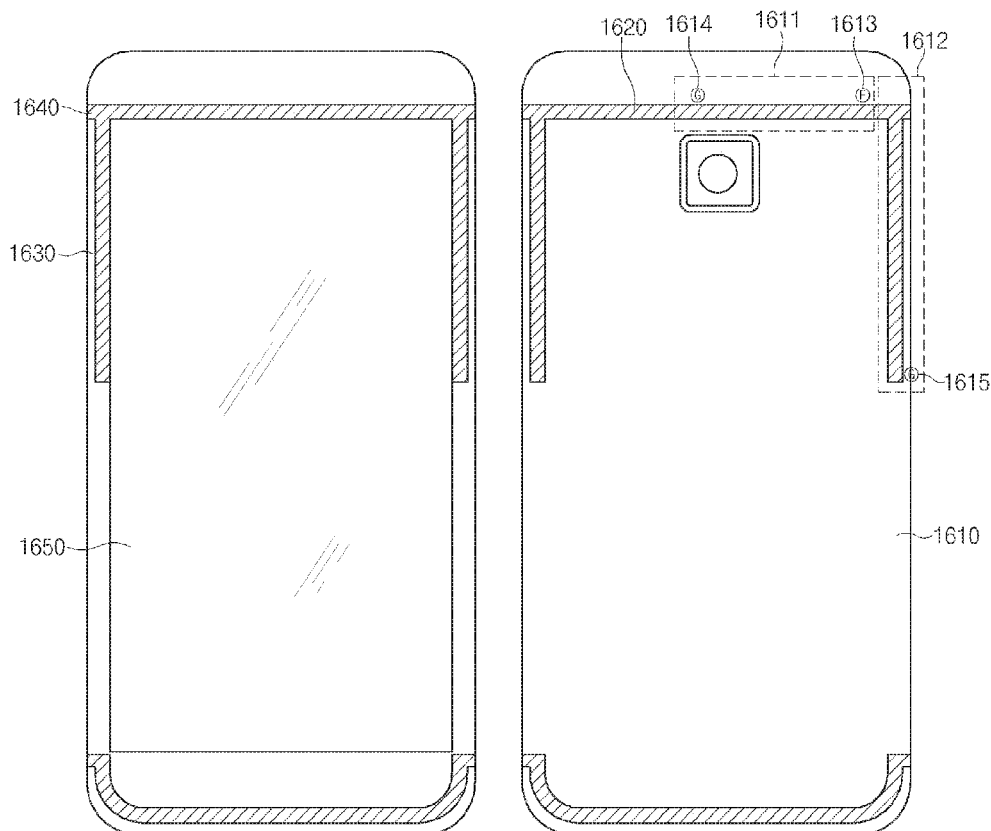
Nov. 7, 2016 (KR) 10-2016-0147315

Publication Classification(51) **Int. Cl.****H01Q 5/30** (2006.01)**H05K 7/14** (2006.01)**H05K 5/02** (2006.01)**H05K 5/00** (2006.01)**H04B 1/3827** (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/30** (2015.01); **H05K 7/1427**(2013.01); **H04B 1/3827** (2013.01); **H05K****5/0086** (2013.01); **H05K 5/0226** (2013.01)

(57)

ABSTRACT

An electronic device according to an embodiment may comprise: a housing including a first slit having a length corresponding to a first frequency and a second slit extending from one point of the first slit in a different direction from the first slit and having a length corresponding to a second frequency, and configured to resonate at the first frequency and the second frequency by the first slit and the second slit; a printed circuit board disposed in the housing and at least partially made of a non-conductive material in regions corresponding to the first slit and the second slit; and a power supply unit for supplying power through one point of the housing, adjacent to the first slit or the second slit. Various other embodiments recognized from the specification are also possible.





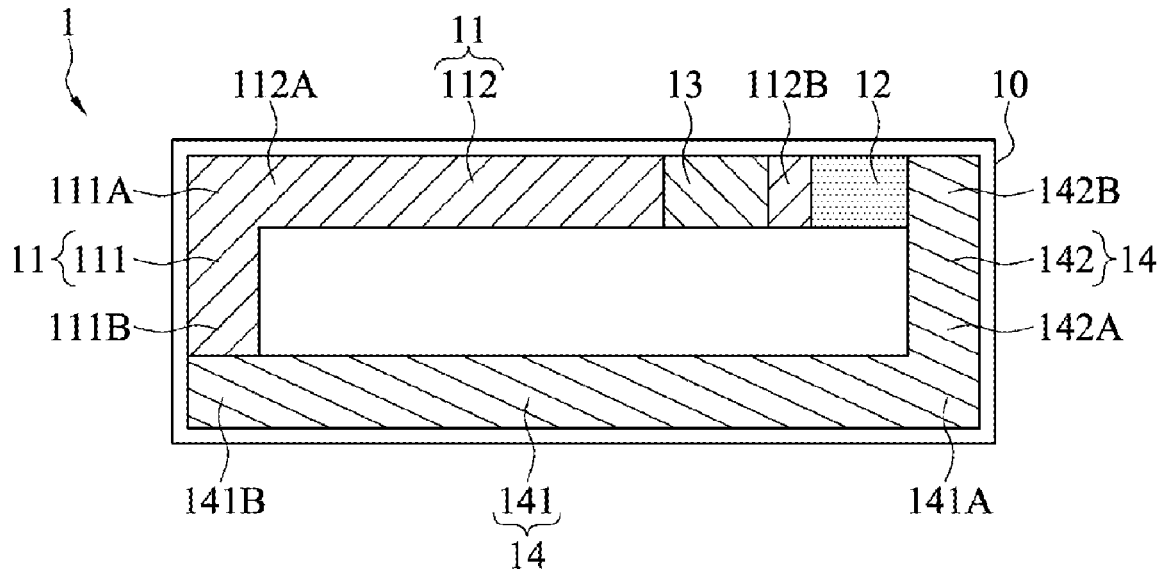
US 20190288395A1

(19) **United States**(12) **Patent Application Publication**
Su(10) **Pub. No.: US 2019/0288395 A1**(43) **Pub. Date: Sep. 19, 2019**(54) **LOOP ANTENNA**(71) Applicant: **ASUSTeK COMPUTER INC.**, Taipei
(TW)(72) Inventor: **Saou-Wen Su**, Taipei (TW)(21) Appl. No.: **16/244,299**(22) Filed: **Jan. 10, 2019**(30) **Foreign Application Priority Data**

Mar. 15, 2018 (TW) 107108923

Publication Classification(51) **Int. Cl.**
H01Q 7/00 (2006.01)**H01Q 5/328** (2006.01)(52) **U.S. Cl.**
CPC **H01Q 7/005** (2013.01); **H01Q 5/328**
(2015.01)(57) **ABSTRACT**

The present disclosure provides a loop antenna, including a substrate, and a grounding portion, a radiating portion, a matching portion, and a feeding portion that are located on the substrate. The grounding portion includes a first grounding segment and a second grounding segment. The second grounding segment is perpendicular to the first grounding segment, and a first end of the second grounding segment is connected to a first end of the first grounding segment. The radiating portion includes a first radiating segment and a second radiating segment. The first radiating segment is connected to a second end of the first grounding segment and extending from the first grounding segment towards a direction away from the first grounding segment. The second radiating segment is connected to the first radiating segment and extending from the first radiating segment towards a direction facing the second grounding segment. The matching portion is located at an end of the second radiating segment close to the second grounding segment. The feeding portion is located between the end of the second radiating segment close to the second grounding segment, and is located between the matching portion and the second grounding segment to receive and transmit a feeding signal.





US 20190296446A1

(19) **United States**(12) **Patent Application Publication**
TSENG et al.(10) **Pub. No.: US 2019/0296446 A1**(43) **Pub. Date: Sep. 26, 2019**(54) **ANTENNA STRUCTURE HAVING MULTIPLE
OPERATING FREQUENCY BANDS**(52) **U.S. Cl.**CPC **H01Q 19/005** (2013.01); **H01Q 7/00**
(2013.01)(71) Applicant: **WISTRON NEWEB
CORPORATION**, Hsinchu (TW)(72) Inventors: **SHIH-HSIEN TSENG**, HSINCHU
(TW); **CHENG-PANG CHANG**,
HSINCHU (TW)

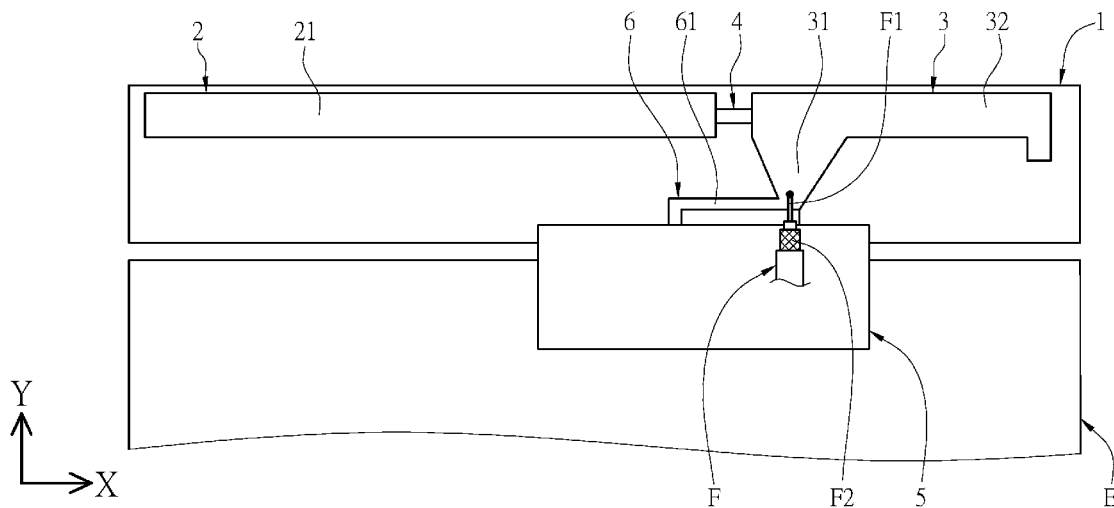
(57)

ABSTRACT(21) Appl. No.: **16/208,604**(22) Filed: **Dec. 4, 2018**(30) **Foreign Application Priority Data**

Mar. 21, 2018 (TW) 107109659

Publication Classification(51) **Int. Cl.****H01Q 19/00** (2006.01)**H01Q 7/00** (2006.01)

An antenna structure includes a substrate, a first radiating element, a second radiating element, a first inductor, a ground element, a first conducting element and a feeding element. The first radiating element is disposed on the substrate. The second radiating element is disposed on the substrate. The second radiating element includes a feed receiving portion. The first inductor is coupled between the first radiating element and the second radiating element. The first conducting element is coupled between the feed receiving portion and the ground element. The feeding element is coupled between the feed receiving portion and the ground element and for feeding in a signal.

U



US 20190305403A1

(19) **United States**(12) **Patent Application Publication**
WANG et al.(10) **Pub. No.: US 2019/0305403 A1**(43) **Pub. Date: Oct. 3, 2019**(54) **ELECTRONIC DEVICE, MOBILE
TERMINAL AND ANTENNA ASSEMBLY****Publication Classification**(71) Applicant: **GUANGDONG OPPO MOBILE
TELECOMMUNICATIONS CORP.,
LTD.**, Dongguan (CN)(51) **Int. Cl.****H01Q 1/24** (2006.01)**H04M 1/02** (2006.01)(52) **U.S. Cl.****CPC** **H01Q 1/243** (2013.01); **H04M 1/0264**
(2013.01); **H04M 1/0237** (2013.01)(72) Inventors: **Xinbao WANG**, Dongguan (CN); **Ning
Zhao**, Dongguan (CN); **Liang Gu**,
Dongguan (CN); **Tianping Liang**,
Dongguan (CN); **Yantao Li**, Dongguan
(CN)

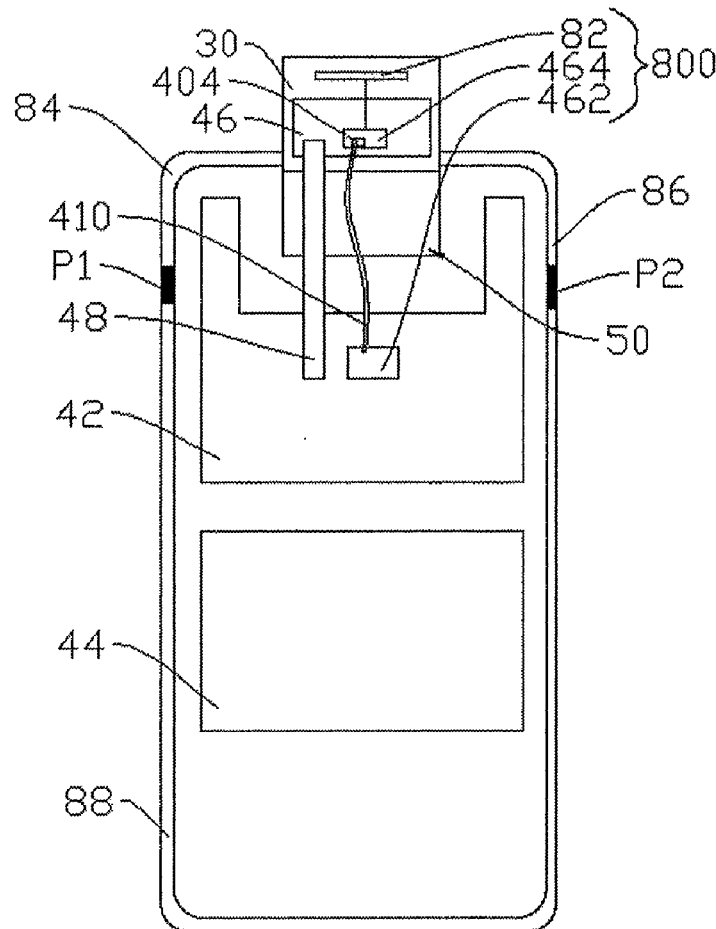
(57)

ABSTRACT(73) Assignee: **GUANGDONG OPPO MOBILE
TELECOMMUNICATIONS CORP.,
LTD.**, Dongguan (CN)(21) Appl. No.: **16/265,499**(22) Filed: **Feb. 1, 2019**(30) **Foreign Application Priority Data**

Mar. 31, 2018 (CN) 201810278705.8

Mar. 31, 2018 (CN) 201810282842.9

The present disclosure provides an electronic device, a mobile terminal and an antenna assembly. The electronic device includes: a case defining an accommodating groove; a movable support slidably connected to the case, and capable of moving out of or retracting into the accommodating groove; and a first antenna installed on the movable support. Since the first antenna may be ejected out of the accommodating groove along with the movable support, influence of other components disposed inside the electronic device on the first antenna may be reduced. Thus, the implementation of the present disclosure may improve antenna performance of the electronic device.





US 20190305404A1

(19) **United States**

(12) **Patent Application Publication**
LI

(10) **Pub. No.: US 2019/0305404 A1**

(43) **Pub. Date: Oct. 3, 2019**

(54) **ELECTRONICAL DEVICE**

Publication Classification

(71) Applicant: **Lenovo (Beijing) Co., Ltd.**, Beijing
(CN)

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

(72) Inventor: **Shichao LI**, Beijing (CN)

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

(21) Appl. No.: **16/370,876**

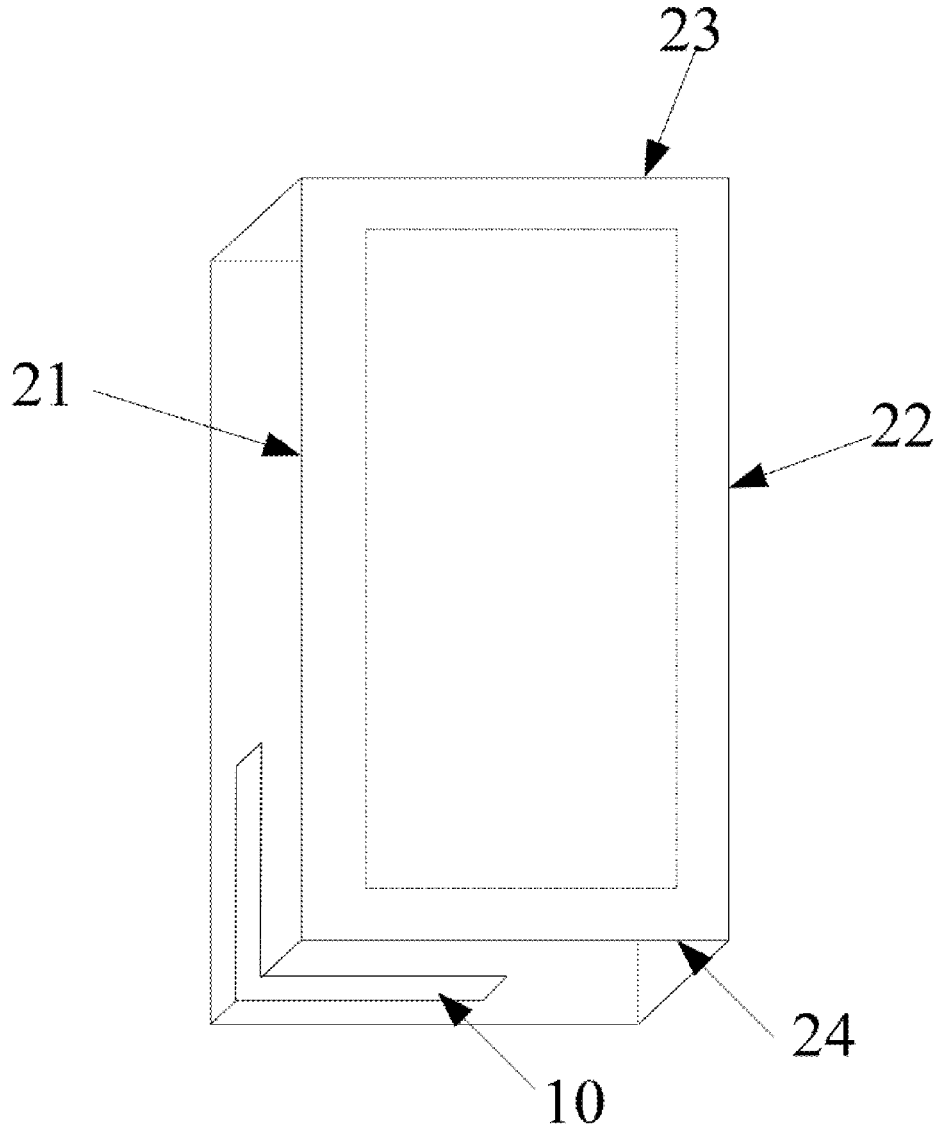
(57) **ABSTRACT**

(22) Filed: **Mar. 29, 2019**

(30) **Foreign Application Priority Data**

Mar. 30, 2018 (CN) 201810298316.1

The present disclosure discloses an electronic device having a first slot disposed along a side surface of the electronic device; and a first metal portion disposed on the side surface corresponding to the first slot being used as a radiator of a first antenna of the electronic device.





US 20190305405A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0305405 A1**

(43) **Pub. Date: Oct. 3, 2019**

(54) **COMMUNICATION DEVICE AND
ELECTRONIC DEVICE**

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

CPC **H01Q 1/243** (2013.01); **H01Q 9/0407**
(2013.01)

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

(72) Inventors: **Hoyoung IM**, Gyeonggi-do (KR);
Seunggil JEON, Gyeonggi-do (KR)

(57)

ABSTRACT

(21) Appl. No.: **16/372,684**

(22) Filed: **Apr. 2, 2019**

(30) **Foreign Application Priority Data**

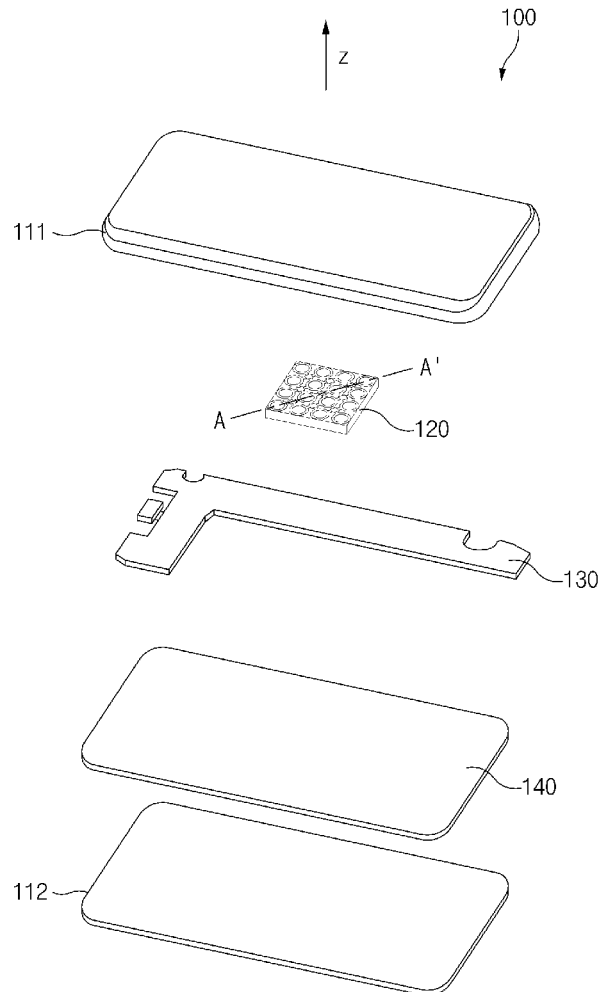
Apr. 3, 2018 (KR) 10-2018-0038436

Publication Classification

(51) **Int. Cl.**

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

An electronic device according to an embodiment disclosed in the disclosure includes a rear cover, a cover glass that faces the rear cover, and a communication device disposed between the rear cover and the cover glass. The communication device includes a printed circuit board including a first surface, a second surface and a side surface that surrounds a space between the first surface and the second surface, a communication circuit disposed in the printed circuit board or on the first surface, and at least one antenna unit disposed in the printed circuit board or on the second surface.





US 20190305824A1

(19) **United States**

(12) **Patent Application Publication**
ANTONETTI

(10) **Pub. No.: US 2019/0305824 A1**

(43) **Pub. Date: Oct. 3, 2019**

(54) **NFC ANTENNA IN A MOBILE DEVICE**

Publication Classification

(71) Applicant: **STMicroelectronics Austria GmbH**,
Graz (AT)

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

(72) Inventor: **Francesco ANTONETTI**, Graz (AT)

(52) **U.S. Cl.**
CPC **H04B 5/0031** (2013.01); **H01Q 1/38**
(2013.01); **H01Q 7/00** (2013.01); **H01Q 1/243**
(2013.01); **H04B 5/0081** (2013.01); **H04B**
5/0087 (2013.01); **H04B 5/0056** (2013.01)

(73) Assignee: **STMicroelectronics Austria GmbH**,
Graz (AT)

(57) **ABSTRACT**

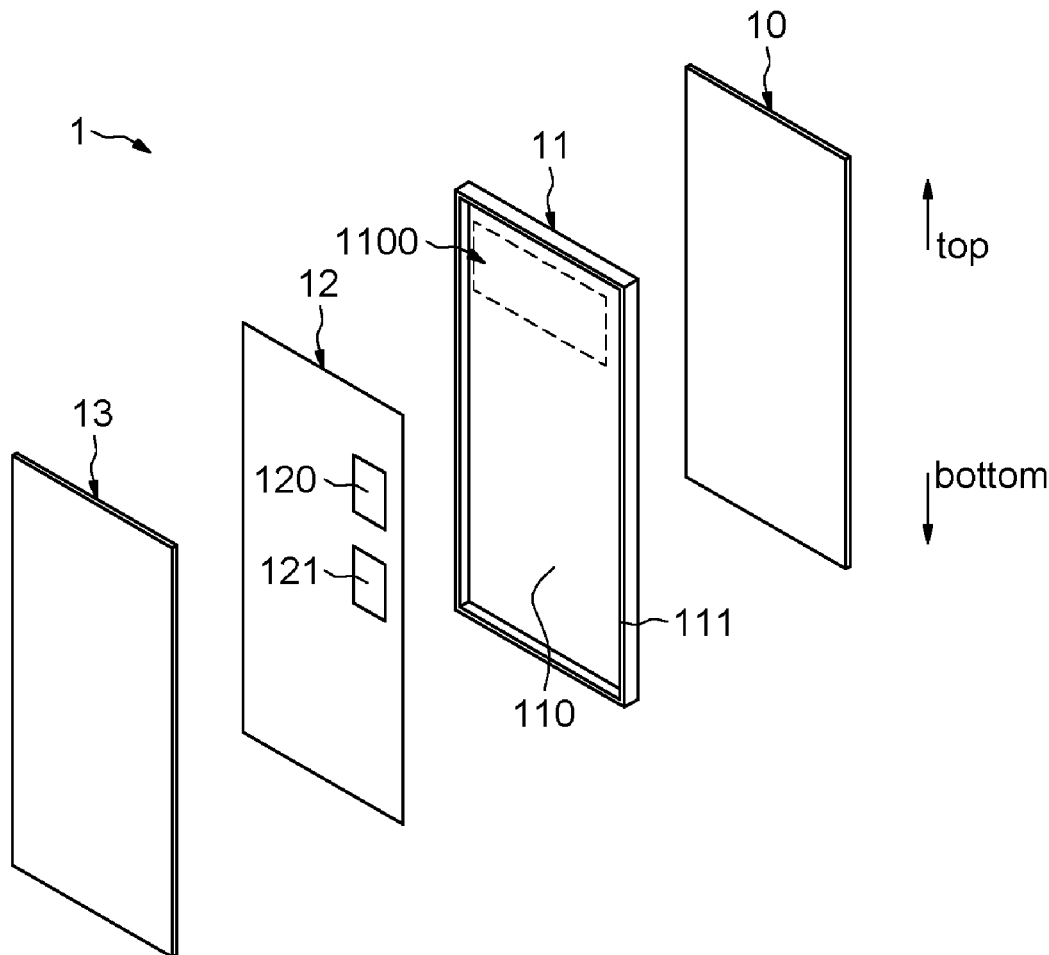
(21) Appl. No.: **16/371,622**

An electronic device includes a back cover, a display, a middle frame sandwiched between the display and the back cover, and a near field communications (NFC) antenna incorporated within the middle frame. An electronic board is positioned within the middle frame, and includes an NFC controller and a matching network coupled to the NFC controller. The matching network is configured to match impedances between the NFC antenna and the NFC controller.

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

(30) **Foreign Application Priority Data**

Apr. 3, 2018 (EP) 18165496.3





US 20190312333A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0312333 A1**

(43) **Pub. Date: Oct. 10, 2019**

(54) **MOBILE TERMINAL**

H04B 1/401 (2006.01)

H04M 1/02 (2006.01)

H01Q 13/10 (2006.01)

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

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

CPC **H01Q 1/242** (2013.01); **H01Q 21/30** (2013.01); **H01Q 13/10** (2013.01); **H04M 1/0266** (2013.01); **H04B 1/401** (2013.01)

(72) Inventors: **Dongjin KIM**, Seoul (KR); **Yunmo KANG**, Seoul (KR); **Youngbae KWON**, Seoul (KR); **Yeomin YOUN**, Seoul (KR); **Jihun HA**, Seoul (KR)

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

(57) **ABSTRACT**

(21) Appl. No.: **16/020,925**

(22) Filed: **Jun. 27, 2018**

Related U.S. Application Data

(60) Provisional application No. 62/653,548, filed on Apr. 5, 2018.

Foreign Application Priority Data

May 3, 2018 (KR) 10-2018-0051313

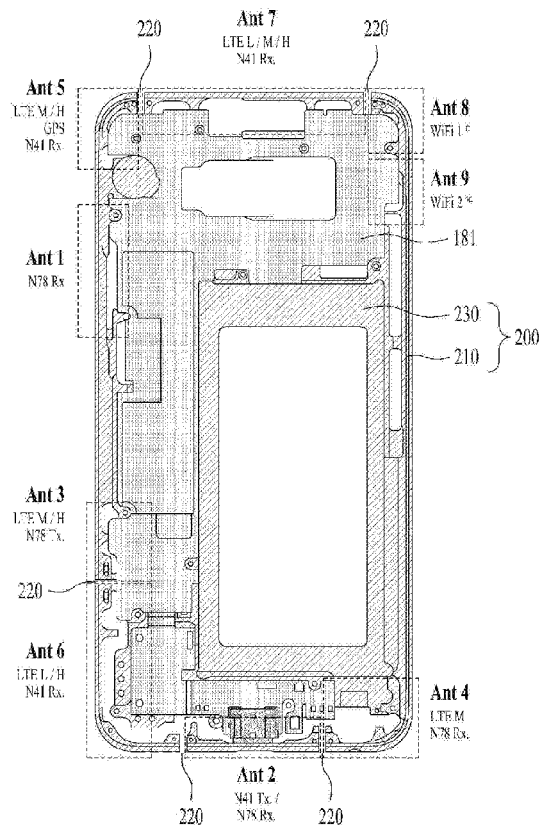
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 21/30 (2006.01)

A mobile terminal is provided including a display unit; a middle frame including a supporting unit that supports a rear surface of the display unit with a side portion around the supporting portion; a main board at a rear surface of the middle frame including a ground; a first wireless communication unit in the main board to transceive a first signal; a second wireless communication unit in the main board to transceive a second signal; and a rear case covering a rear surface of the main board, where the side portion includes a plurality of conductive members with ends divided into slits and the plurality of the conductive members includes a common antenna electrically connectable with the first and second wireless communication units to receive the first and second signals such that the mobile terminal receives different signals with antennas for LTE and 5G communication arranged in a limited space.





US 20190312334A1

(19) **United States**(12) **Patent Application Publication**
SHIN et al.(10) **Pub. No.: US 2019/0312334 A1**(43) **Pub. Date: Oct. 10, 2019**(54) **MOBILE TERMINAL****Publication Classification**(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)(72) Inventors: **Minchul SHIN**, Seoul (KR); **Dongjun CHOI**, Seoul (KR); **Hangseok KIM**, Seoul (KR)(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)(21) Appl. No.: **16/047,849**(22) Filed: **Jul. 27, 2018****Related U.S. Application Data**

(60) Provisional application No. 62/655,218, filed on Apr. 9, 2018.

(30) **Foreign Application Priority Data**

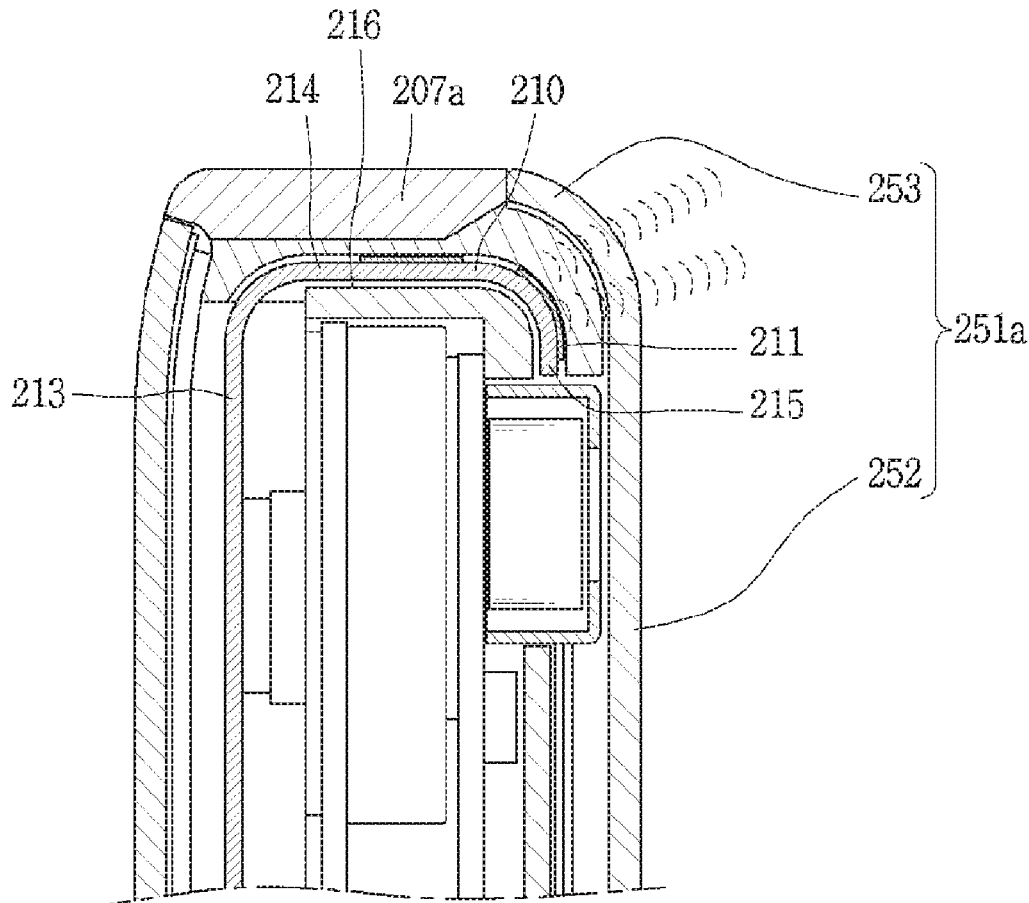
May 2, 2018 (KR) 10-2018-0050825

(51) **Int. Cl.****H01Q 1/24** (2006.01)**H04M 1/02** (2006.01)**H01Q 21/06** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/242** (2013.01); **H01Q 21/065** (2013.01); **H04M 1/0202** (2013.01)

(57)

ABSTRACT

A mobile terminal having a front surface, a rear surface, and side surfaces includes a cover glass allowing an electromagnetic wave to be transmitted therethrough, a case having a metal rim forming an appearance of the top or the bottom of the mobile terminal, and an antenna having a plurality of arrayed antenna patterns to radiate a beamformed transmission signal, wherein the antenna is disposed such that at least a portion thereof is adjacent to the metal rim, and the cover glass includes a planar portion disposed on the front surface or the rear surface and a bent portion bent from at least one end of the planar portion such that the transmission signal is radiated through the cover glass.





US 20190312960A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0312960 A1**

(43) **Pub. Date: Oct. 10, 2019**

(54) **MOBILE TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H04M 1/02 (2006.01)
H04B 1/3827 (2006.01)
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Kyoungsun HWANG**, Seoul (KR); **Moonsoo SONG**, Seoul (KR); **Yoonjae WON**, Seoul (KR); **Deuksu CHOI**, Seoul (KR); **Chisang YOU**, Seoul (KR)

(52) **U.S. Cl.**
CPC **H04M 1/0202** (2013.01); **H04B 1/3833** (2013.01); **H04W 88/02** (2013.01); **H01Q 1/243** (2013.01); **H01Q 13/10** (2013.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **16/383,399**

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

Related U.S. Application Data

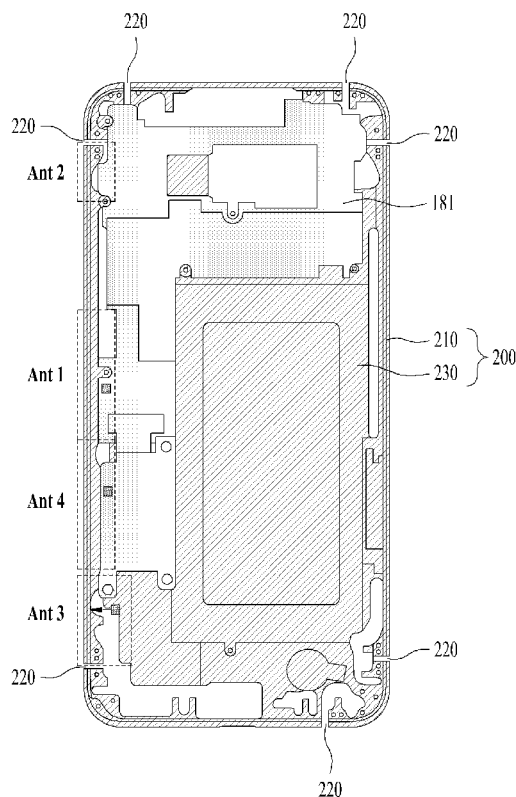
(63) Continuation of application No. 16/022,512, filed on Jun. 28, 2018, now Pat. No. 10,306,029.

(60) Provisional application No. 62/653,550, filed on Apr. 5, 2018.

Foreign Application Priority Data

May 3, 2018 (KR) 10-2018-0051314

There is disclosed a mobile terminal including: a display; a middle frame including a supporting portion and a side portion provided around the supporting portion to define a lateral external appearance; a main board including a ground; a first wireless communication unit configured to transceive a first signal; a second wireless communication unit configured to transceive a second signal; and a rear case configured to cover a rear surface of the main board, wherein the side portion includes a plurality of conductive members of which ends are divided into slits, and the plurality of the conductive members includes a common antenna electrically connectable with the first wireless communication unit and the second wireless communication unit and configured to receive the first signal and the second signal; and an independent antenna electrically connectable with the first wireless communication unit and configured to receive the first signal.





US 20190319342A1

(19) **United States**

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

(10) **Pub. No.: US 2019/0319342 A1**

(43) **Pub. Date: Oct. 17, 2019**

(54) **SUPER DIRECTIVE ARRAY OF
VOLUMETRIC ANTENNA ELEMENTS FOR
WIRELESS DEVICE APPLICATIONS**

(71) Applicant: **AMI Research & Development, LLC,**
Windham, NH (US)

(72) Inventors: **John T. Apostolos,** Lyndeborough, NH
(US); **William Mouyos,** Windham, NH
(US)

(21) Appl. No.: **16/161,177**

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

Related U.S. Application Data

(63) Continuation of application No. 15/362,988, filed on
Nov. 29, 2016, now Pat. No. 10,135,122.

Publication Classification

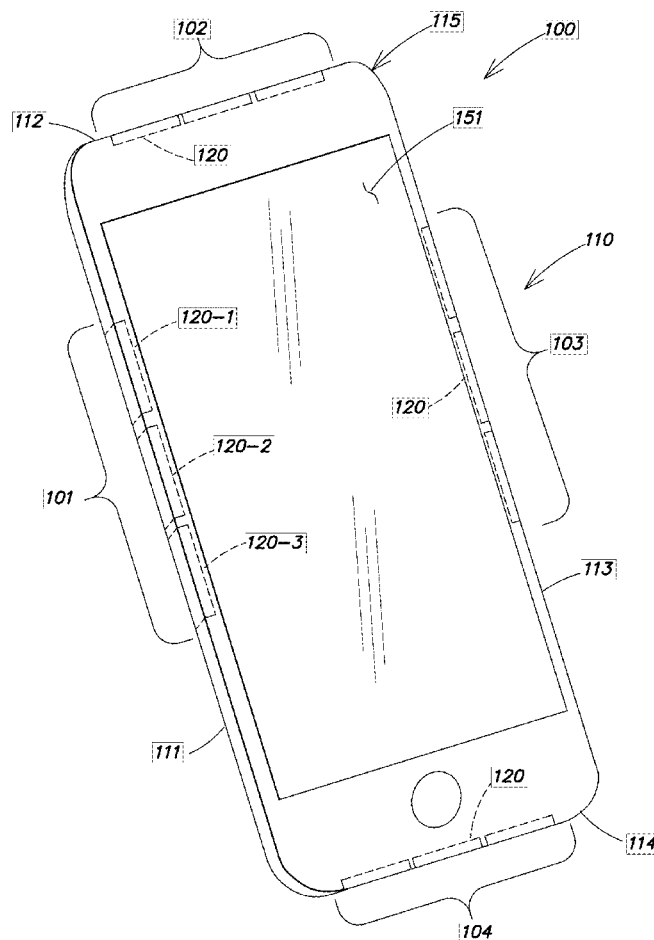
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 25/00 (2006.01)
H01Q 21/28 (2006.01)

H01Q 21/26 (2006.01)
H01Q 21/24 (2006.01)
H01Q 5/48 (2006.01)
H01Q 21/08 (2006.01)
H01Q 19/00 (2006.01)
H01Q 1/22 (2006.01)
H01Q 1/36 (2006.01)
H01Q 21/20 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/245** (2013.01); **H01Q 1/243**
(2013.01); **H01Q 25/00** (2013.01); **H01Q**
21/28 (2013.01); **H01Q 21/26** (2013.01);
H01Q 21/24 (2013.01); **H01Q 21/205**
(2013.01); **H01Q 21/08** (2013.01); **H01Q**
19/005 (2013.01); **H01Q 1/2291** (2013.01);
H01Q 1/36 (2013.01); **H01Q 21/245**
(2013.01); **H01Q 5/48** (2015.01)

(57) **ABSTRACT**

Antenna arrays that use volumetric elements to provide
directive radiation over multiple frequencies, multiple polar-
izations, and/or operate in modes that reduce unnecessary
radiation into a nearby human body. The arrays are particu-
larly adapted for use with handheld wireless devices, such as
smartphones, tablets, and cellular phones.





US 20190319346A1

(19) **United States**

(12) **Patent Application Publication**
Pokorny

(10) **Pub. No.: US 2019/0319346 A1**

(43) **Pub. Date: Oct. 17, 2019**

(54) **CIRCUIT BOARD ANTENNA STRUCTURES
AND SYSTEMS**

(71) Applicant: **Honeywell International Inc.**, Morris
Plains, NJ (US)

(72) Inventor: **Michal Pokorny**, Brno (CZ)

(21) Appl. No.: **15/953,143**

(22) Filed: **Apr. 13, 2018**

Publication Classification

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 5/378 (2006.01)

H01Q 21/06 (2006.01)

H01Q 1/22 (2006.01)

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

CPC **H01Q 1/38** (2013.01); **H01Q 1/2291**
(2013.01); **H01Q 21/061** (2013.01); **H01Q**
5/378 (2015.01)

(57)

ABSTRACT

Circuit board antenna structures and systems are described herein. One circuit board antenna structure, includes a circuit board, a u-shaped antenna body having a first elongate portion and a second elongate portion separated by a short portion and arranged such that the first elongate portion is positioned closer to the circuit board, the second elongate portion being longer than the first elongate portion and having a feeding probe extending from the second elongate portion and attached to the circuit board, and the second elongate portion also having a grounding probe extending from the second elongate portion and attached to the circuit board.

