US 20210119337A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0119337 A1

NAMBA (43) Pub. Date: Apr. 22, 2021

(54) **ANTENNA DEVICE**

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

(72) Inventor: **Masahito NAMBA**, Shinagawa-ku, Tokyo (JP)

(21) Appl. No.: **16/606,594**

(22) PCT Filed: **Apr. 20, 2018**

(86) PCT No.: **PCT/JP2018/016297**

§ 371 (c)(1),
(2) Date: **Oct. 18, 2019**

(30) **Foreign Application Priority Data**

May 1, 2017 (JP) 2017-091334

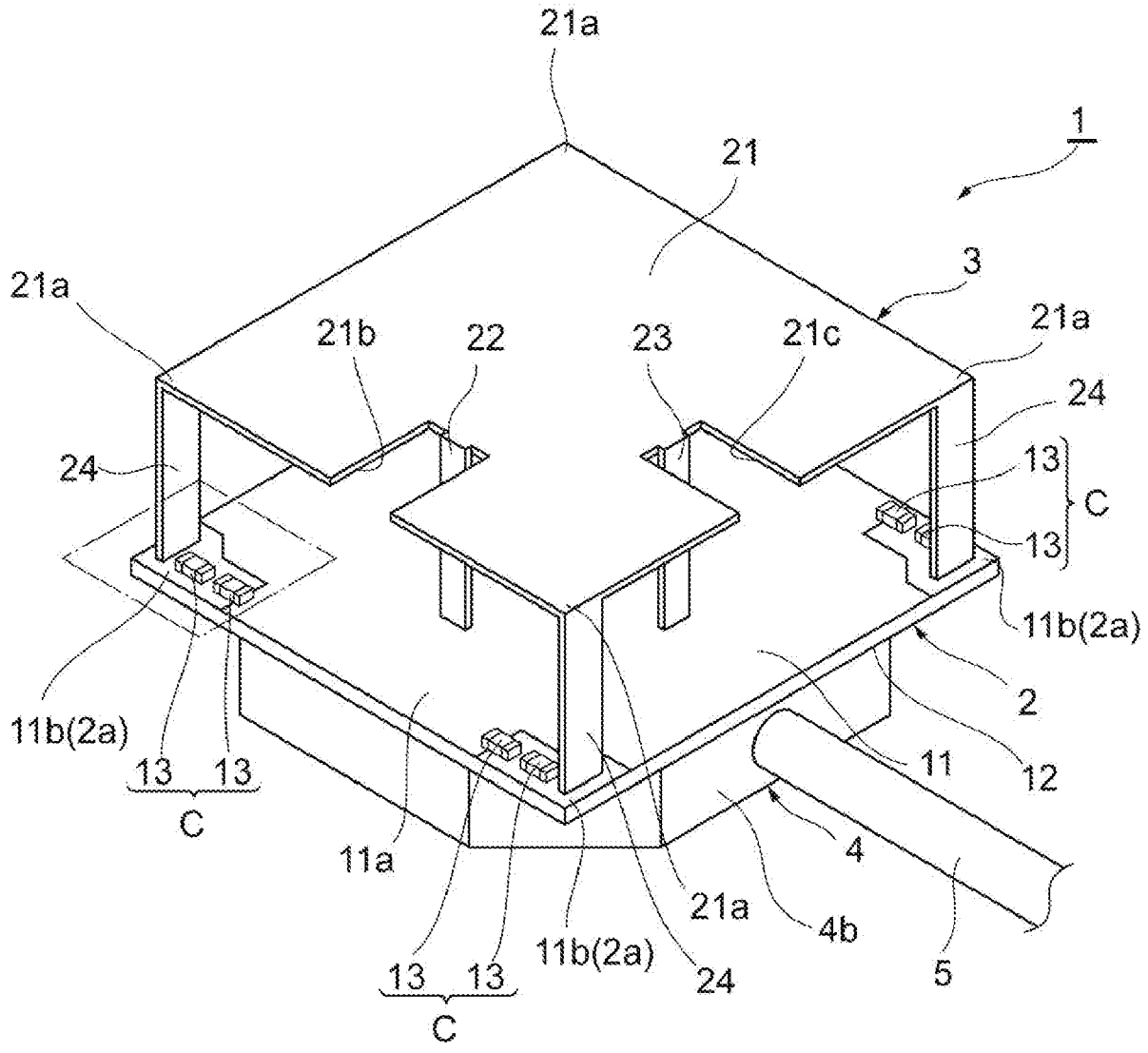
Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/32 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0435*** (2013.01); ***H01Q 1/32*** (2013.01); ***H01Q 9/0421*** (2013.01)

(57) **ABSTRACT**

An antenna device is provided for a vehicle. The antenna device includes a substrate, an antenna element and a capacitor part. The substrate includes a pair of main surfaces which face opposite sides each other. The antenna element includes a metal plate part which is disposed over and separated from one of the main surfaces, and a metal leg part which extends from the metal plate part toward the substrate. The capacitor part is electrically connected to the metal plate part through the metal leg part and includes two or more capacitors connected in series.



US 20210119338A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0119338 A1

Avser et al. (43) Pub. Date: Apr. 22, 2021

(54) ELECTRONIC DEVICES WITH DIELECTRIC RESONATOR ANTENNAS

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

(72) Inventors: **Bilgehan Avser**, San Bruno, CA (US); **Harish Rajagopalan**, San Jose, CA (US); **Simone Paulotto**, Redwood City, CA (US); **Jennifer M. Edwards**, San Francisco, CA (US); **Hao Xu**, Cupertino, CA (US); **Rodney A. Gomez Angulo**, Santa Clara, CA (US); **Matthew D. Hill**, Santa Clara, CA (US); **Mattia Pascolini**, San Francisco, CA (US)

(21) Appl. No.: **17/111,131**

(22) Filed: **Dec. 3, 2020**

Related U.S. Application Data

(62) Division of application No. 16/289,433, filed on Feb. 28, 2019, now Pat. No. 10,886,619.

Publication Classification

(51) **Int. Cl.**

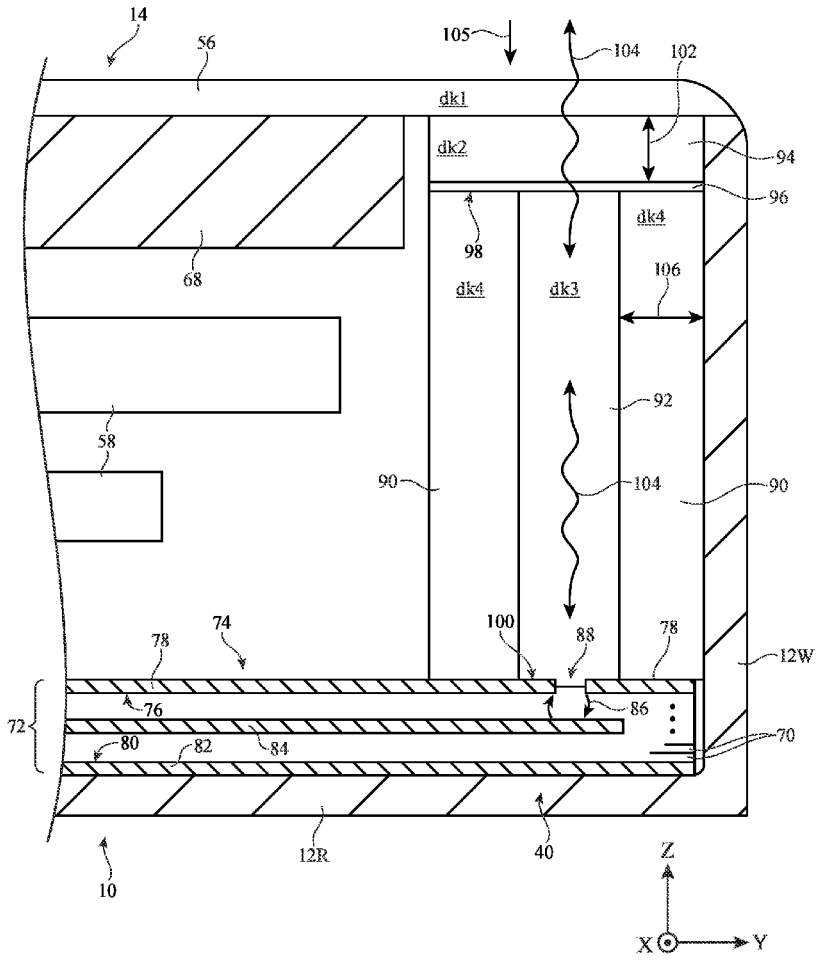
H01Q 9/04	(2006.01)
H01Q 21/00	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 9/0485*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 21/0075*** (2013.01)

(57) **ABSTRACT**

An electronic device may be provided with a phased antenna array and a display cover layer. The phased antenna array may include a dielectric resonator antenna. The dielectric resonator antenna may include a dielectric resonating element embedded in a lower permittivity dielectric substrate. The substrate and the resonating element may be mounted to a flexible printed circuit. A slot may be formed in ground traces on the flexible printed circuit and aligned with the resonating element. The slot may excite resonant modes of the resonating element. The resonating element may convey corresponding radio-frequency signals through the cover layer. A dielectric matching layer may be interposed between the resonating element and the cover layer. If desired, the slot may radiate additional radio-frequency signals and the matching layer may have a tapered shape. Dielectric resonator antennas for covering different polarizations and frequencies may be interleaved across the array.



US 20210119342A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0119342 A1**

(43) **Pub. Date: Apr. 22, 2021**

Leung et al.

(54) **FILTER-ANTENNA AND METHOD FOR MAKING THE SAME**

(71) Applicant: **City University of Hong Kong**, Kowloon (HK)

(72) Inventors: **Kwok Wa Leung**, Kowloon Tong (HK); **Yan Ting Liu**, Kowloon (HK); **Nan Yang**, Kowloon (HK)

(21) Appl. No.: **16/658,388**

(22) Filed: **Oct. 21, 2019**

Publication Classification

(51) **Int. Cl.**

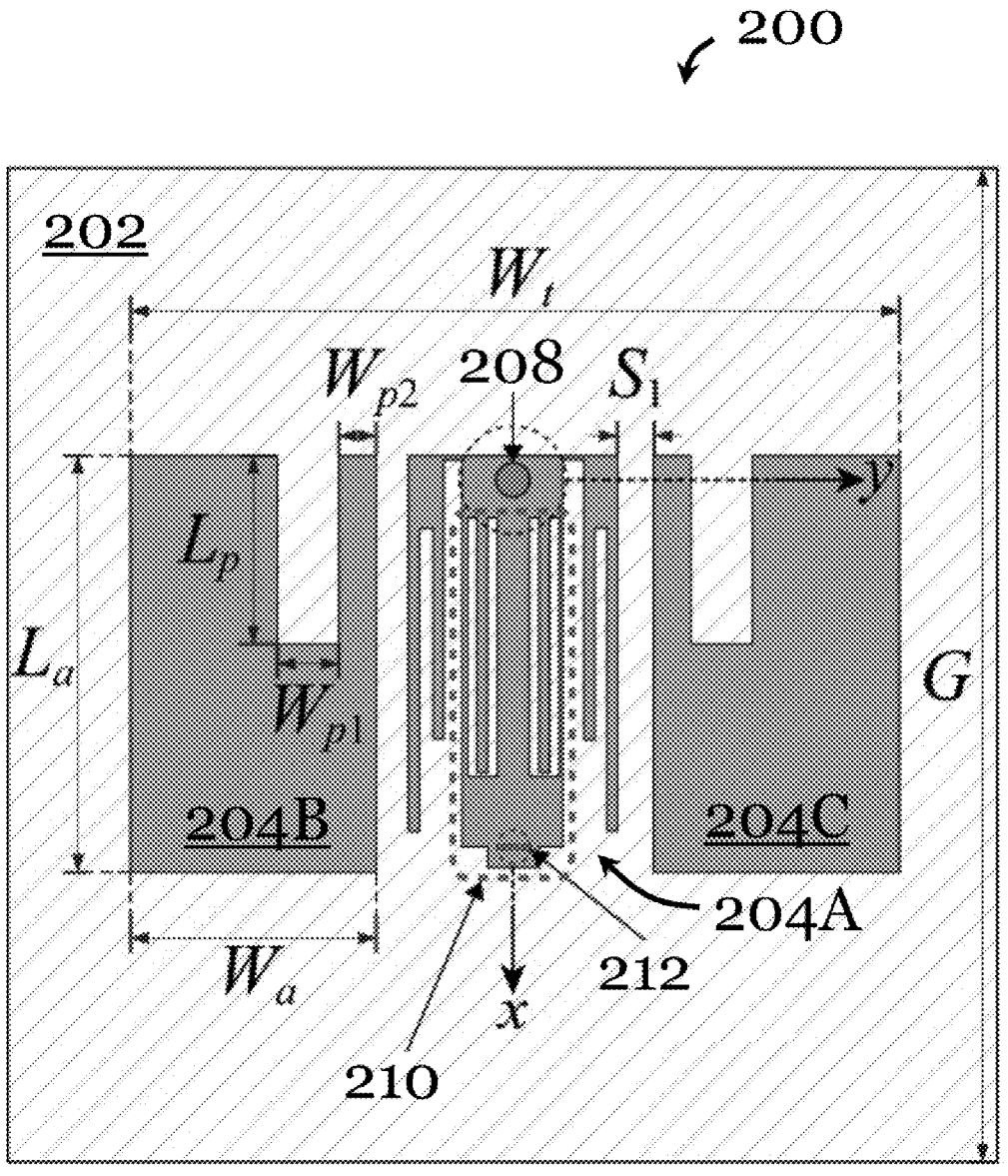
H01Q 17/00	(2006.01)
H01Q 9/04	(2006.01)
H01Q 19/00	(2006.01)
H01Q 9/30	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 17/00*** (2013.01); ***H01Q 9/045*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/30*** (2013.01); ***H01Q 19/005*** (2013.01)

(57) **ABSTRACT**

A filter-antenna and a method for making a filter-antenna. The filter antenna includes a microstrip antenna, such as a patch antenna, integrated with an absorptive (e.g., bandstop) filter for absorbing or dissipating energy.



US 20210120110A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0120110 A1**

HWANG et al. (43) **Pub. Date: Apr. 22, 2021**

(54) **MOBILE TERMINAL**

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

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

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

(21) Appl. No.: **17/111,457**

(22) Filed: **Dec. 3, 2020**

Related U.S. Application Data

(63) Continuation of application No. 16/742,785, filed on Jan. 14, 2020, now Pat. No. 10,887,434, which is a continuation of application No. 16/383,399, filed on Apr. 12, 2019, now Pat. No. 10,560,557, which is a 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.

(30) **Foreign Application Priority Data**

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

Publication Classification

(51) **Int. Cl.**

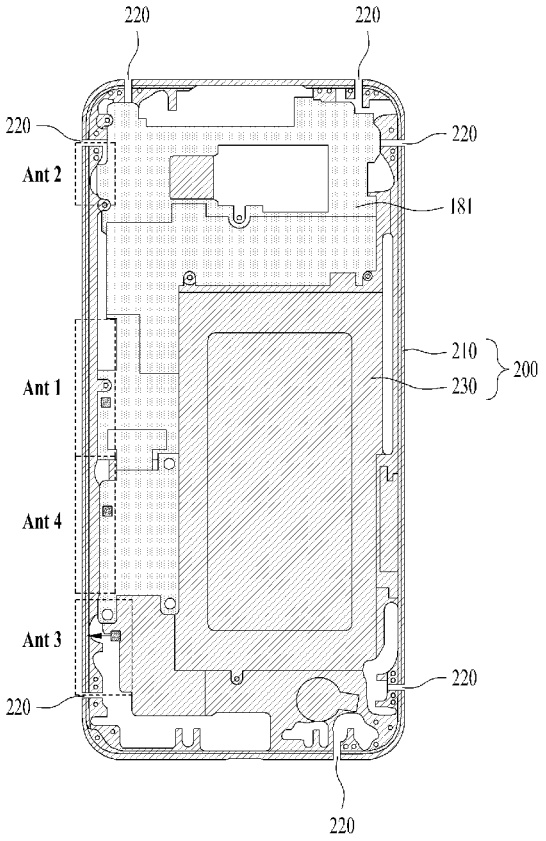
H04M 1/02	(2006.01)
H01Q 1/24	(2006.01)
H01Q 13/10	(2006.01)
H04B 1/3827	(2006.01)

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

CPC ***H04M 1/0202*** (2013.01); ***H01Q 1/243*** (2013.01); *H04W 88/02* (2013.01); ***H04B 1/3833*** (2013.01); ***H04M 1/026*** (2013.01); ***H01Q 13/10*** (2013.01)

(57) **ABSTRACT**

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 20210126342A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126342 A1**

Yang et al. (43) **Pub. Date: Apr. 29, 2021**

(54) **ANTENNA ASSEMBLY AND WIRELESS TERMINAL**

(71) Applicant: **BOE Technology Group Co., Ltd.**, Beijing (CN)

(72) Inventors: **Jun Yang**, Beijing (CN); **Tao Li**, Beijing (CN)

(21) Appl. No.: **16/893,461**

(22) Filed: **Jun. 5, 2020**

(30) **Foreign Application Priority Data**

Oct. 29, 2019 (CN) 201921831154.X

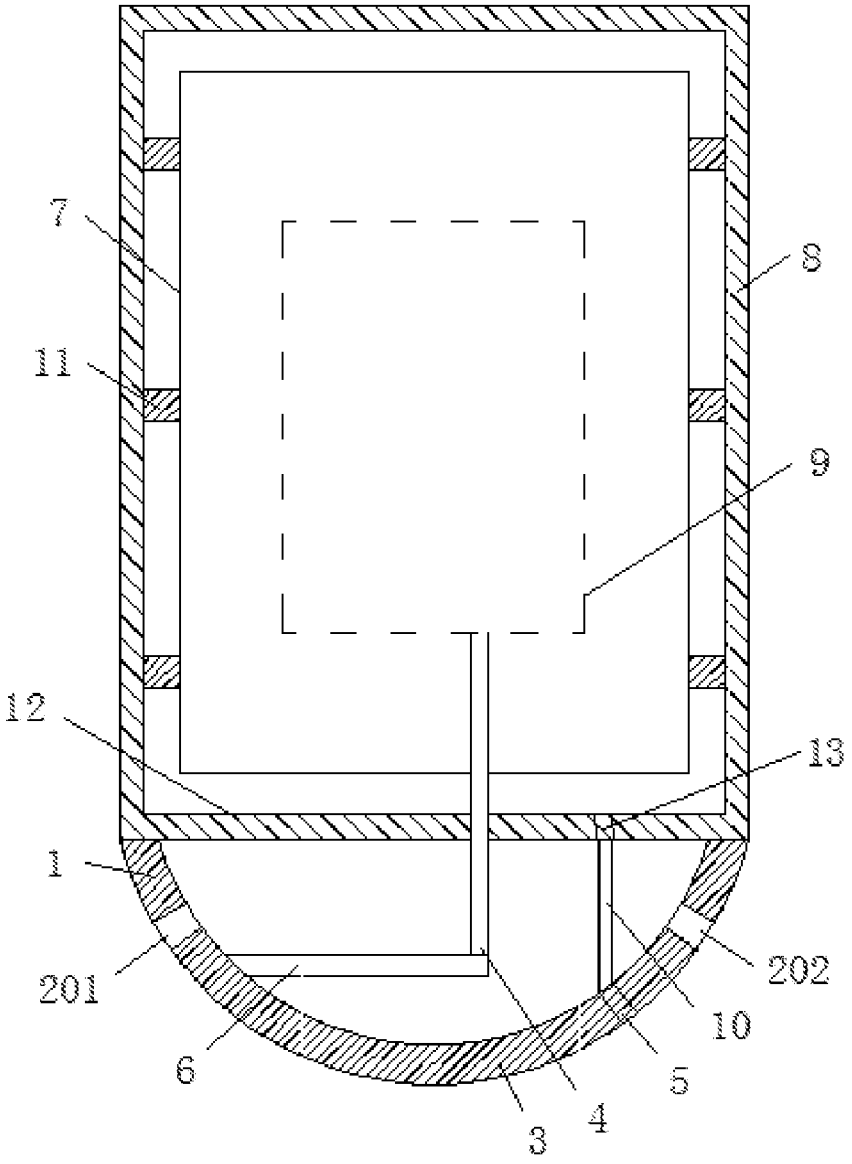
Publication Classification

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

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

(57) **ABSTRACT**

Disclosed are an antenna assembly and a wireless terminal. The antenna assembly includes: a metal frame, wherein a first partition gap and a second partition gap are spacedly arranged on the metal frame, and the metal frame positioned between the first partition gap and the second partition gap forms a first radiator; and a radio frequency module, wherein the radio frequency module is coupled to the first radiator by a radio frequency signal feeder, wherein the metal frame between the first partition gap and the second partition gap is provided with a first ground point.



US 20210126343A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126343 A1**

CHANG et al. (43) **Pub. Date: Apr. 29, 2021**

(54) **MOBILE DEVICE**

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

(72) Inventors: **Kun-Sheng CHANG**, New Taipei City (TW); **Ching-Chi LIN**, New Taipei City (TW)

(21) Appl. No.: **16/789,509**

(22) Filed: **Feb. 13, 2020**

(30) **Foreign Application Priority Data**

Oct. 29, 2019 (TW) 108138981

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

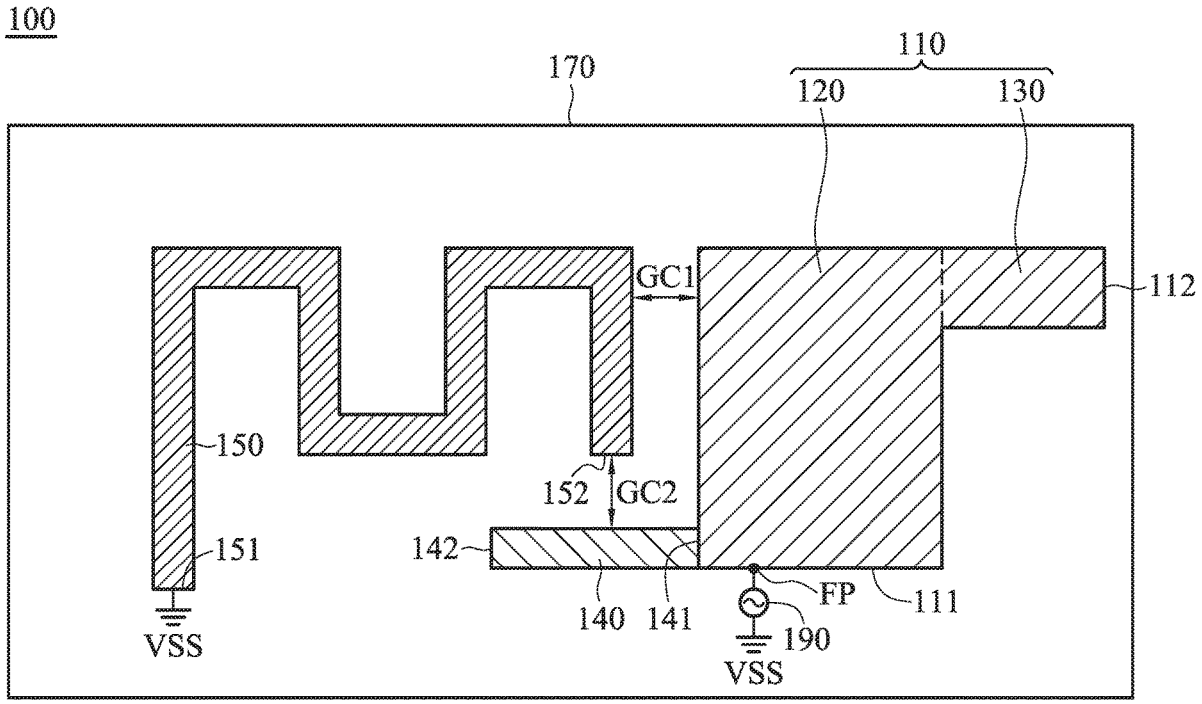
H01Q 5/335 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 5/335*** (2015.01)

(57) **ABSTRACT**

A mobile device includes a feeding radiation element, a first radiation element, a second radiation element, and a dielectric substrate. The feeding radiation element includes a wide portion and a narrow portion. The wide portion of the feeding radiation element has a feeding point. The first radiation element is coupled to the wide portion of the feeding radiation element. The first radiation element and the narrow portion of the feeding radiation element substantially extend in opposite directions. The second radiation element is coupled to a ground voltage and has a meandering structure. The second radiation element is adjacent to the feeding radiation element and the first radiation element. The feeding radiation element, the first radiation element, and the second radiation element are disposed on the dielectric substrate. An antenna structure is formed by the feeding radiation element, the first radiation element, and the second radiation element.



US 20210126345A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0126345 A1

YOO et al. (43) Pub. Date: Apr. 29, 2021

(54) ELECTRONIC DEVICE INCLUDING SLOT ANTENNA MODULE

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

(72) Inventors: **Jangsun YOO**, Gyeonggi-do (KR); **Sunggeun GO**, Gyeonggi-do (KR); **Jihye MOON**, Gyeonggi-do (KR); **Myeonggil LEE**, Gyeonggi-do (KR); **Jongmyung KIM**, Gyeonggi-do (KR); **Cheehwan YANG**, Gyeonggi-do (KR); **Kwangyong LEE**, Gyeonggi-do (KR)

(21) Appl. No.: **17/074,805**

(22) Filed: **Oct. 20, 2020**

(30) **Foreign Application Priority Data**

Oct. 28, 2019 (KR) 10-2019-0134849

Publication Classification

(51) **Int. Cl.**

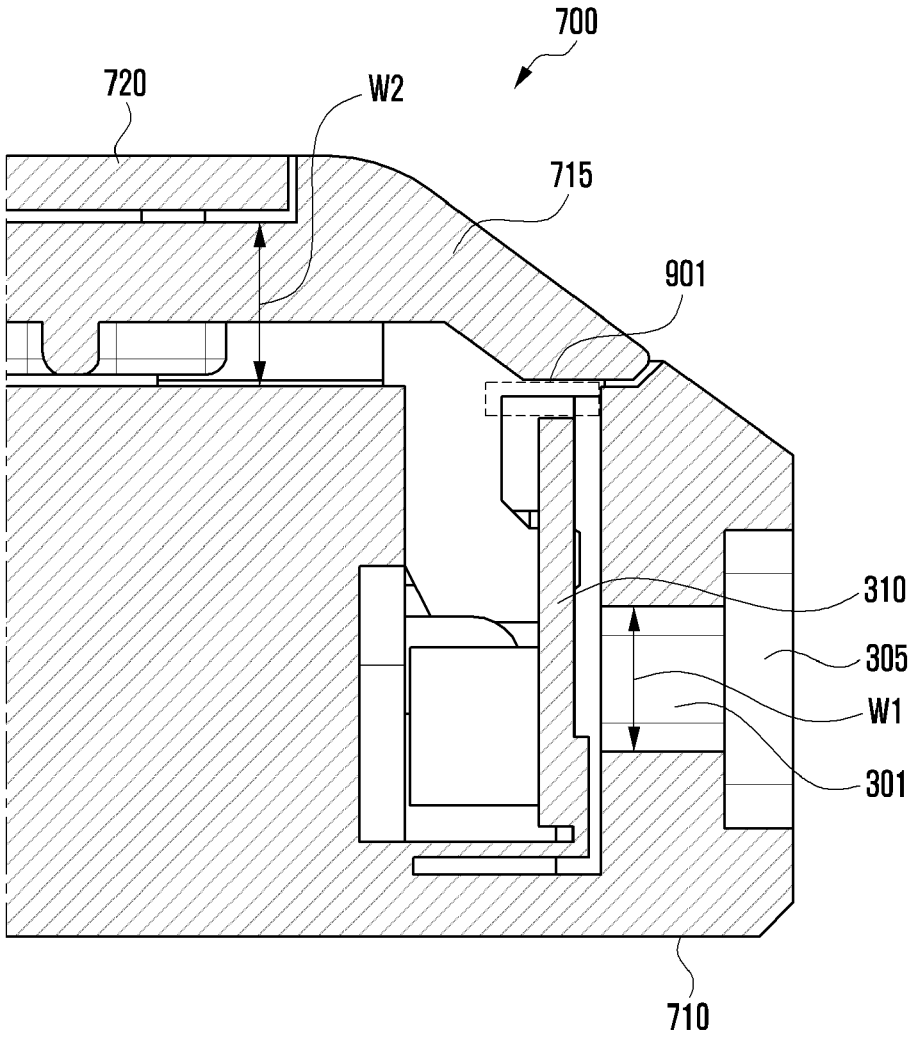
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 13/10 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); *H01Q 1/2266* (2013.01); ***H01Q 13/10*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

In an embodiment, an electronic device may include a first cover covering an upper portion of a main body and containing a first antenna module disposed on a lateral portion thereof, a spacer member disposed over the first cover, and a second cover disposed over the spacer member. The first and second covers may be spaced apart from each other at a predetermined distance due to the spacer member, and a separation space between the first and second covers may be configured to operate as a second antenna module. It is therefore possible to guarantee high-efficiency wireless performance having iso-directionality without compromising the design of the electronic device. Other embodiments are also possible.



US 20210126346A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126346 A1**

Nyström (43) **Pub. Date: Apr. 29, 2021**

(54) **SUBSTRATE INTEGRATED MULTI BAND INVERTED F ANTENNA**

(71) Applicant: **ASCOM (SWEDEN) AB**, Göteborg (SE)

(72) Inventor: **Mikael Nyström**, Göteborg (SE)

(21) Appl. No.: **17/077,415**

(22) Filed: **Oct. 22, 2020**

(30) **Foreign Application Priority Data**

Oct. 23, 2019 (EP) 19204929.4

Publication Classification

(51) **Int. Cl.**

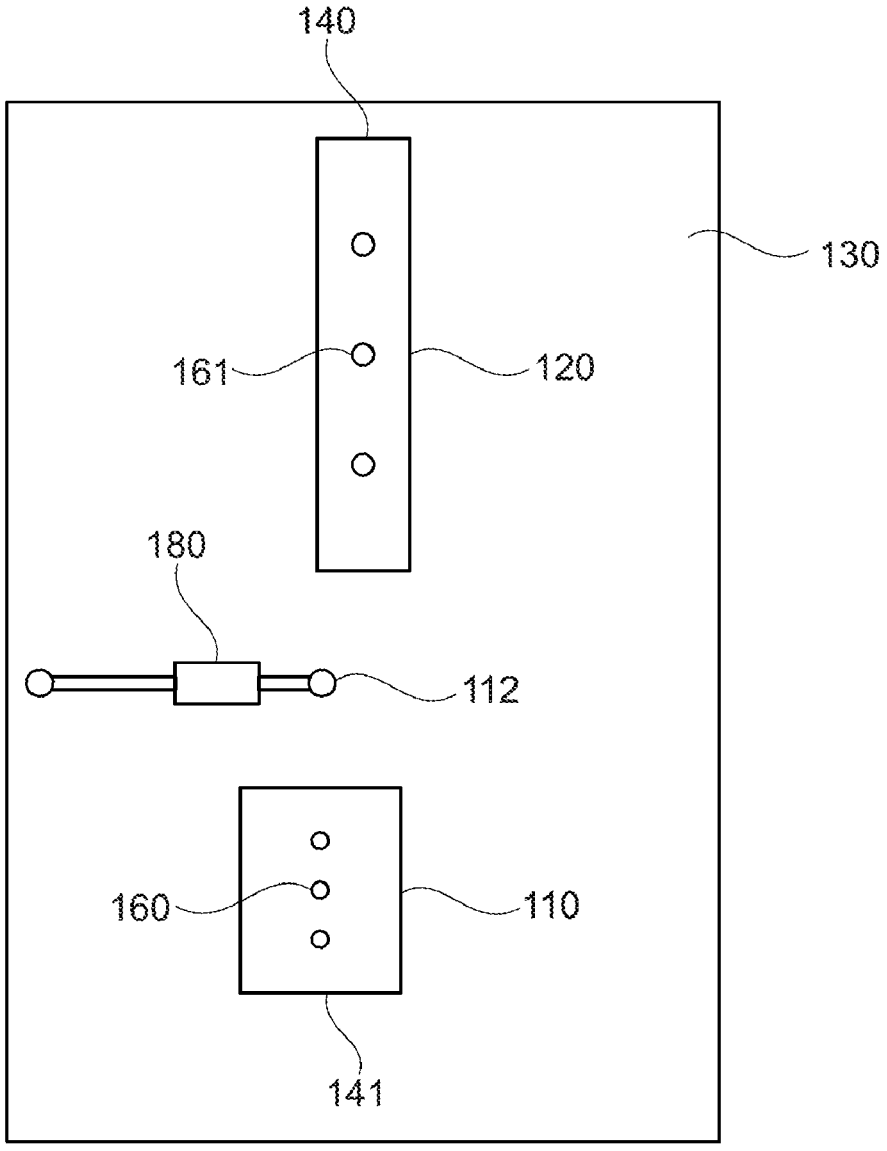
H01Q 1/24	(2006.01)
H01Q 1/38	(2006.01)
H01Q 7/02	(2006.01)
H01Q 1/22	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/2225*** (2013.01); ***H01Q 7/02*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

The present disclosure provides an antenna for wireless communication that includes a first planar conductor, which is adapted to resonate at frequencies of a first frequency range; and a second planar conductor, which is adapted to resonate at frequencies of a second frequency range that spans lower frequencies than the first frequency range. Thus, a compact and efficient antenna layout is provided that enables reception and transmission of radio signals on multiple frequency bands.



US 20210126347A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0126347 A1

KIM et al. (43) Pub. Date: Apr. 29, 2021

(54) **ELECTRONIC DEVICE INCLUDING AN ANTENNA STRUCTURE**

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

(72) Inventors: **Kyungbin KIM**, Suwon-si (KR); **Chongo YOON**, Suwon-si (KR); **Sumin YUN**, Suwon-si (KR); **Hyunseock ROH**, Suwon-si (KR); **Gyubok PARK**, Suwon-si (KR); **Jinwoo JUNG**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR); **Hochul HWANG**, Suwon-si (KR)

(21) Appl. No.: **17/082,520**

(22) Filed: **Oct. 28, 2020**

(30) **Foreign Application Priority Data**

Oct. 28, 2019 (KR) 10-2019-0134682

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

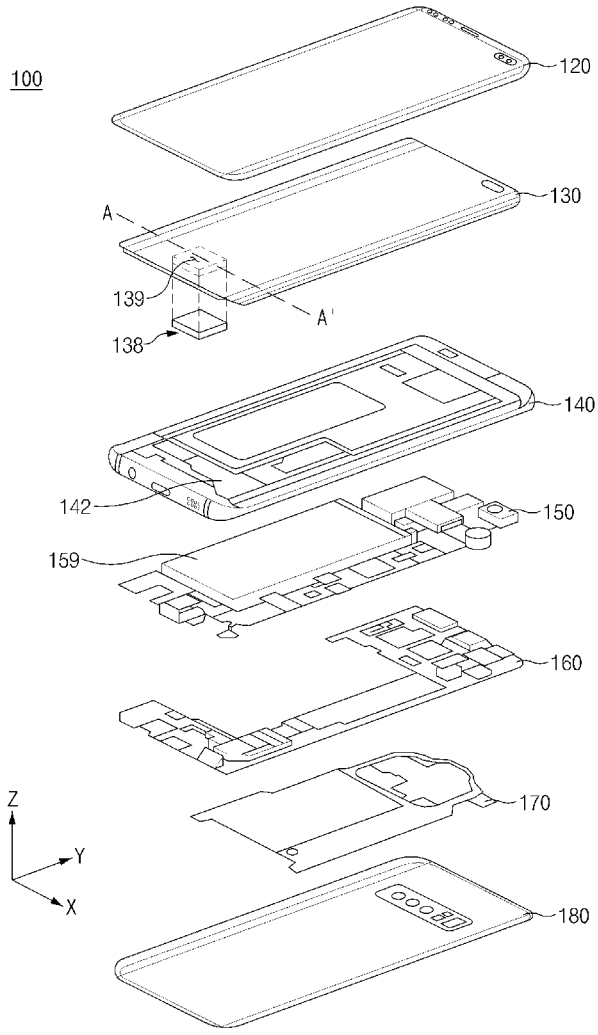
H04M 1/02 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H04M 1/0266*** (2013.01); ***H04M 1/0277*** (2013.01)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a housing structure that includes a ceramic portion including a ceramic material, and a polymer portion formed on an inner surface of the ceramic portion and including a polymer material, and an antenna structure that is disposed within the housing structure and radiates a radio frequency (RF) signal to an outside of the housing structure. The housing structure includes a first portion including at least a portion of a region through which the RF signal passes, and a second portion formed around the first portion. In the first portion, a ratio of a thickness of the polymer portion to an entire thickness of the first portion is a first ratio. In the second portion, a ratio of a thickness of the polymer portion to an entire thickness of the second portion is a second ratio.



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(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0126349 A1**

(43) **Pub. Date: Apr. 29, 2021**

ZHOU et al.

(54) **ANTENNA ASSEMBLY AND ELECTRONIC DEVICE**

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

(72) Inventors: **Lin ZHOU**, Dongguan (CN); **Liang GU**, Dongguan (CN)

(21) Appl. No.: **17/144,867**

(22) Filed: **Jan. 8, 2021**

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/CN2019/087578, filed on May 20, 2019.

(30) **Foreign Application Priority Data**

Jul. 11, 2018 (CN) 201810758289.1

Publication Classification

(51) **Int. Cl.**

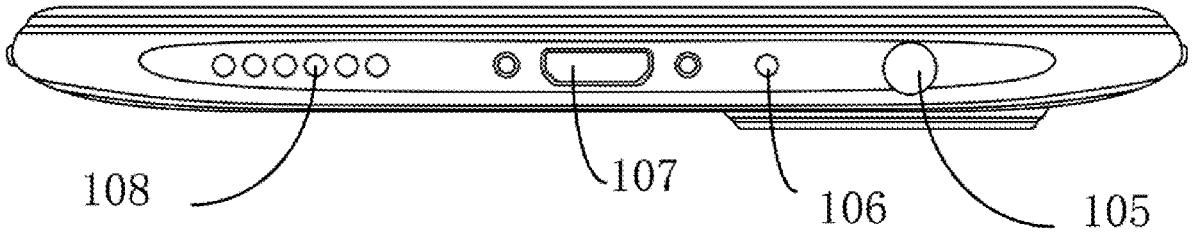
H01Q 1/24	(2006.01)
H01Q 21/00	(2006.01)
H01Q 5/335	(2006.01)
H01Q 1/36	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/36*** (2013.01); ***H01Q 5/335*** (2015.01); ***H01Q 21/0006*** (2013.01)

(57) **ABSTRACT**

An antenna assembly and an electronic device are provided. The antenna assembly includes a metal main body, a first metal connecting part, a second metal connecting part, and eight radiating elements disposed on the metal main body. The metal main body includes a first end, a second end opposite to the first end, a third end, and a fourth end opposite to the third end. The first metal connecting part and the second metal connecting part are respectively connected to the third end and the fourth end. The antenna assembly is configured to be operated as an 8×8 5G MIMO antenna system.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126355 A1**

CHUANG (43) **Pub. Date: Apr. 29, 2021**

(54) **ANTENNA STRUCTURE**

(71) Applicant: **Wistron Corp.**, New Taipei City (TW)

(72) Inventor: **Shih Ming CHUANG**, New Taipei City (TW)

(21) Appl. No.: **16/689,752**

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

(30) **Foreign Application Priority Data**

Oct. 23, 2019 (TW) 108138171

Publication Classification

(51) **Int. Cl.**

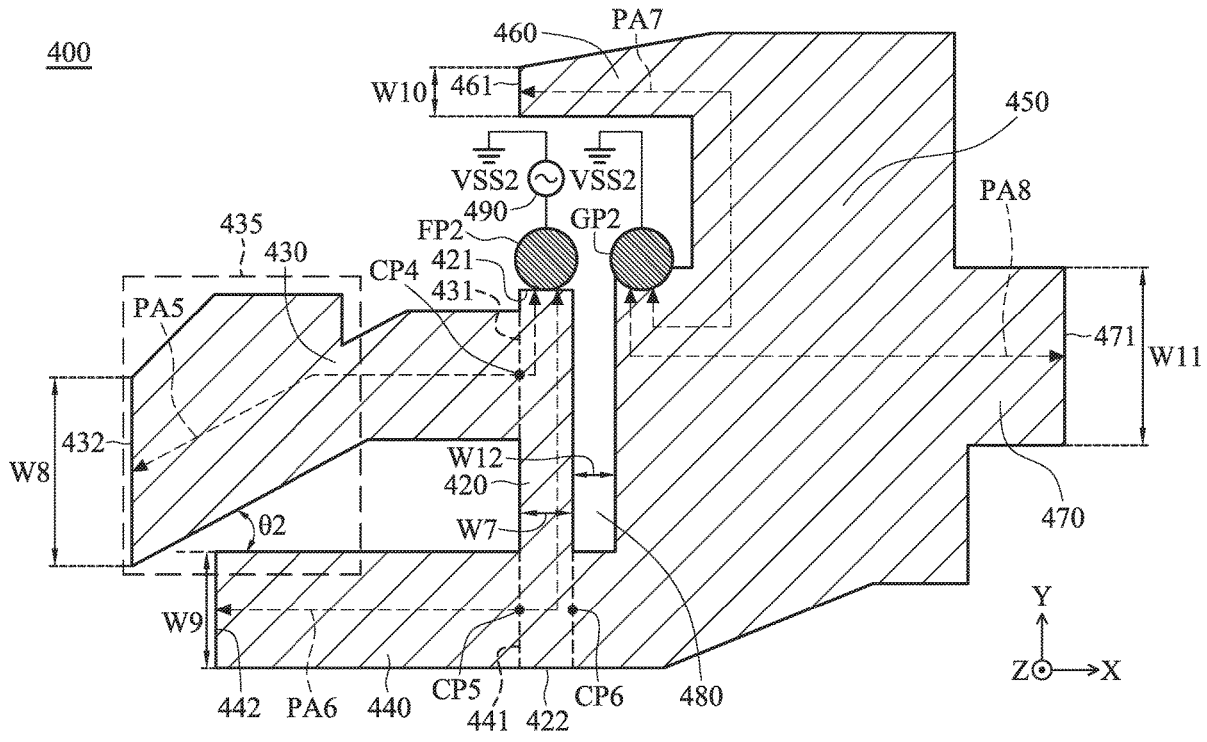
H01Q 1/38	(2006.01)
H01Q 1/24	(2006.01)
H01Q 19/24	(2006.01)

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

CPC ***H01Q 1/38*** (2013.01); ***H01Q 19/24*** (2013.01); ***H01Q 1/245*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a feeding radiation element, a first radiation element, a second radiation element, and a third radiation element. The feeding radiation element has a feeding point. The first radiation element is coupled to a first connection point on the feeding radiation element. The first radiation element includes a bending portion. The second radiation element is coupled to a second connection point on the feeding radiation element, and is adjacent to the bending portion of the first radiation element. The second radiation element is not parallel to the first radiation element. The third radiation element has a grounding point, and is coupled to a third connection point on the feeding radiation element. The third radiation element includes a first protruding portion and a second protruding portion. The first protruding portion and the second protruding portion of the third radiation element extend in different directions.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126356 A1**

FANG et al. (43) **Pub. Date: Apr. 29, 2021**

(54) **ANTENNA SYSTEM**

(71) Applicant: **Wistron Corp.**, New Taipei City (TW)

(72) Inventors: **Ying-Sheng FANG**, New Taipei City (TW); **Nien-Chao CHUANG**, New Taipei City (TW); **Po-Tsang LIN**, New Taipei City (TW); **Chia-Wei SU**, New Taipei City (TW)

(21) Appl. No.: **16/710,586**

(22) Filed: **Dec. 11, 2019**

(30) **Foreign Application Priority Data**

Oct. 29, 2019 (TW) 108138963

Publication Classification

(51) **Int. Cl.**

H01Q 1/52 (2006.01)

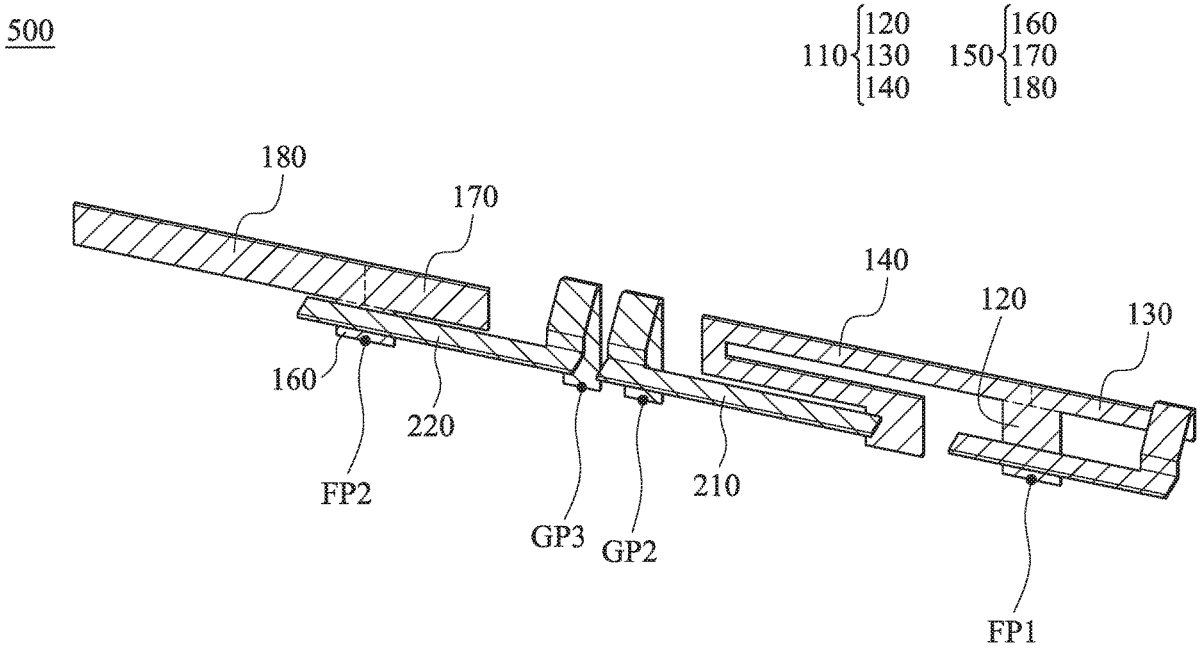
H01Q 5/307 (2006.01)

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

CPC ***H01Q 1/521*** (2013.01); *H01Q 1/242* (2013.01); ***H01Q 5/307*** (2015.01)

(57) **ABSTRACT**

An antenna system includes a first antenna, a second antenna, a first parasitic element, and a second parasitic element. The first antenna includes a first feeding element, a first radiation element, and a shorting element. The first radiation element is coupled to the first feeding element. The first feeding element is coupled through the shorting element to a first grounding point. The second antenna includes a second feeding element, a second radiation element, and a third radiation element. The second radiation element and the third radiation element are coupled to the second feeding element. The first parasitic element is coupled to a second grounding point. The second parasitic element is coupled to a third grounding point. The first parasitic element and the second parasitic element are disposed between the first and second antennas. The first parasitic element and the second parasitic element extend away from each other.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126365 A1**

Wan et al. (43) **Pub. Date: Apr. 29, 2021**

(54) **SINGLE ANTENNA SYSTEM**

(71) Applicant: **ASUSTeK COMPUTER INC.**, Taipei (TW)

(72) Inventors: **Che-Chi Wan**, Taipei (TW); **Saou-Wen Su**, Taipei (TW); **Cheng-Tse Lee**, Taipei (TW)

(21) Appl. No.: **17/075,790**

(22) Filed: **Oct. 21, 2020**

(30) **Foreign Application Priority Data**

Oct. 29, 2019 (TW) 108139136

Publication Classification

(51) **Int. Cl.**

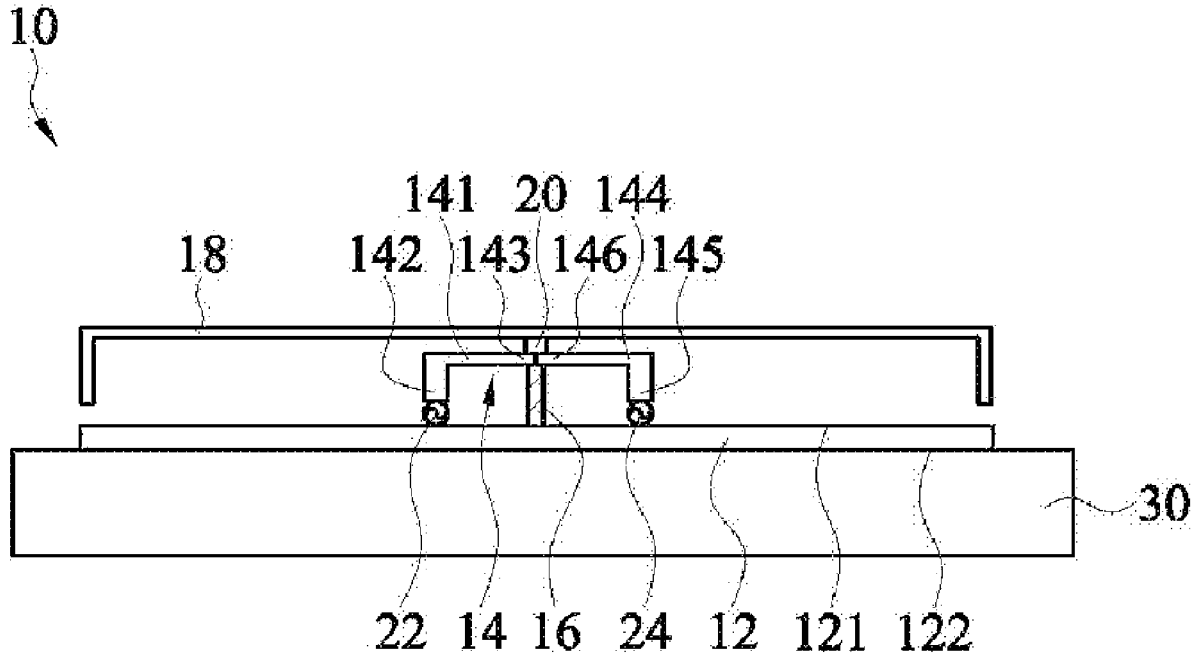
H01Q 5/35	(2006.01)
H01Q 9/04	(2006.01)
H01Q 1/38	(2006.01)
H01Q 1/22	(2006.01)

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

CPC ***H01Q 5/35*** (2015.01); ***H01Q 1/2283*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 9/0407*** (2013.01)

(57) **ABSTRACT**

The disclosure provides a single antenna system comprising a ground element, a feeding metal part, at least one shorting metal part, a radiating metal part, a decoupling circuit, a first feed source, and a second feed source. The single antenna system with an integrated decoupled circuit not only effectively achieves size reduction, but achieve high antenna isolation. Moreover, the single antenna system is applied for narrow-bezel notebooks and small-size antenna systems in future.



US 20210126368A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126368 A1**

Hsiao et al. (43) **Pub. Date: Apr. 29, 2021**

(54) **LOOP-LIKE DUAL-ANTENNA SYSTEM**

(71) Applicant: **ASUSTeK COMPUTER INC.**, Taipei (TW)

(72) Inventors: **Ya-Wen Hsiao**, Taipei (TW); **Saou-Wen Su**, Taipei (TW); **Wei-Hsuan Chang**, Taipei (TW)

(21) Appl. No.: **17/073,496**

(22) Filed: **Oct. 19, 2020**

(30) **Foreign Application Priority Data**

Oct. 23, 2019 (TW) 108138316

Publication Classification

(51) **Int. Cl.**

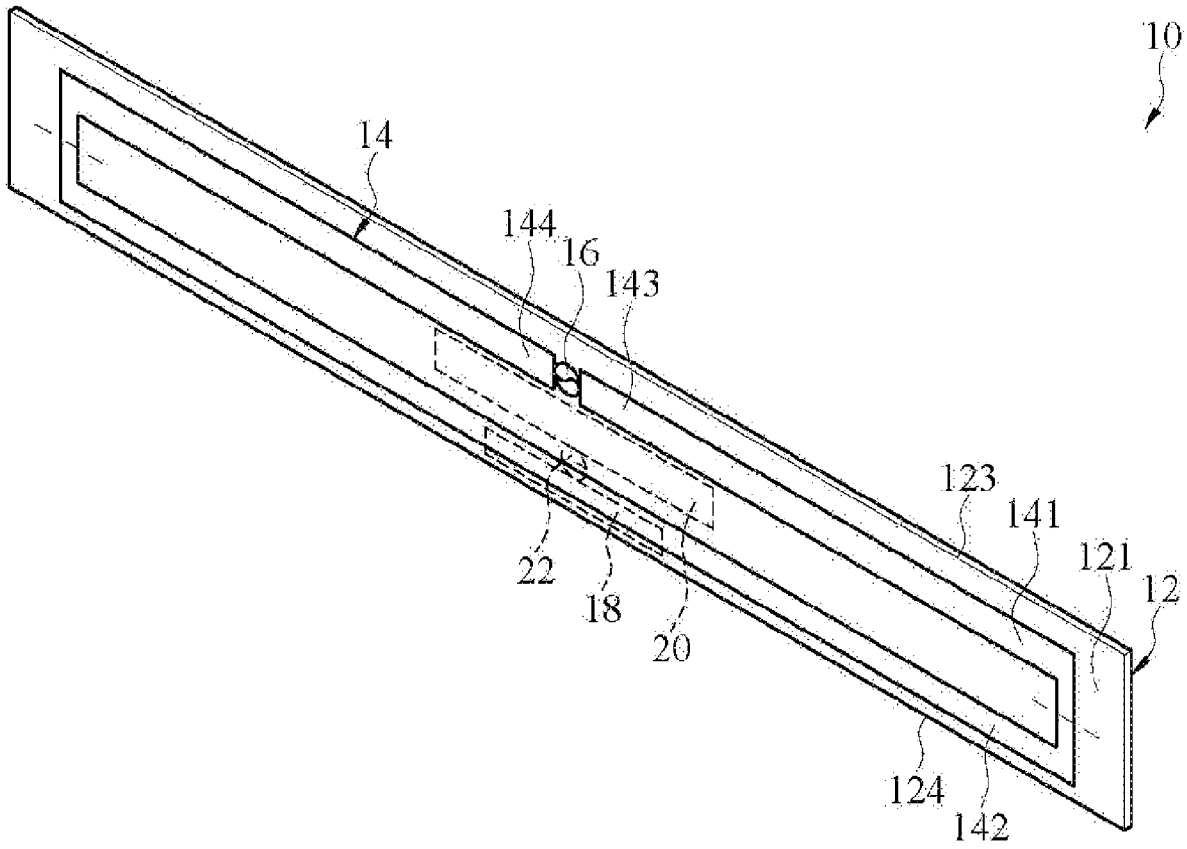
H01Q 7/00	(2006.01)
H01Q 1/38	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 7/00*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

A loop-like dual-antenna system is provided. The loop-like dual-antenna system includes a dielectric substrate having a first surface and a second surface opposite to each other. The loop radiating element includes a first radiating part with two ends and a second radiating part opposite to the first radiating part. A first signal source is disposed on the first surface of the dielectric substrate and electrically connected to two ends of the first radiating part. A grounding part is disposed on the second surface of the dielectric substrate and disposed on one side of the dielectric substrate away from the first signal source. A coupling matching element is disposed on the second surface of the dielectric substrate and adjacent to the grounding part, for coupling to and exciting the second radiating part. A second signal source, disposed on the second surface of the dielectric substrate, and electrically connected to the coupling matching element and the grounding part.



US 20210126370A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0126370 A1**

Tang (43) **Pub. Date: Apr. 29, 2021**

(54) **ANTENNA SYSTEM**

(71) Applicant: **PCI Private Limited**, Singapore (SG)

(72) Inventor: **Wee Hua Tang**, Singapore (SG)

(21) Appl. No.: **17/072,690**

(22) Filed: **Oct. 16, 2020**

(30) **Foreign Application Priority Data**

Oct. 24, 2019 (SG) 10201909947Y

Publication Classification

(51) **Int. Cl.**

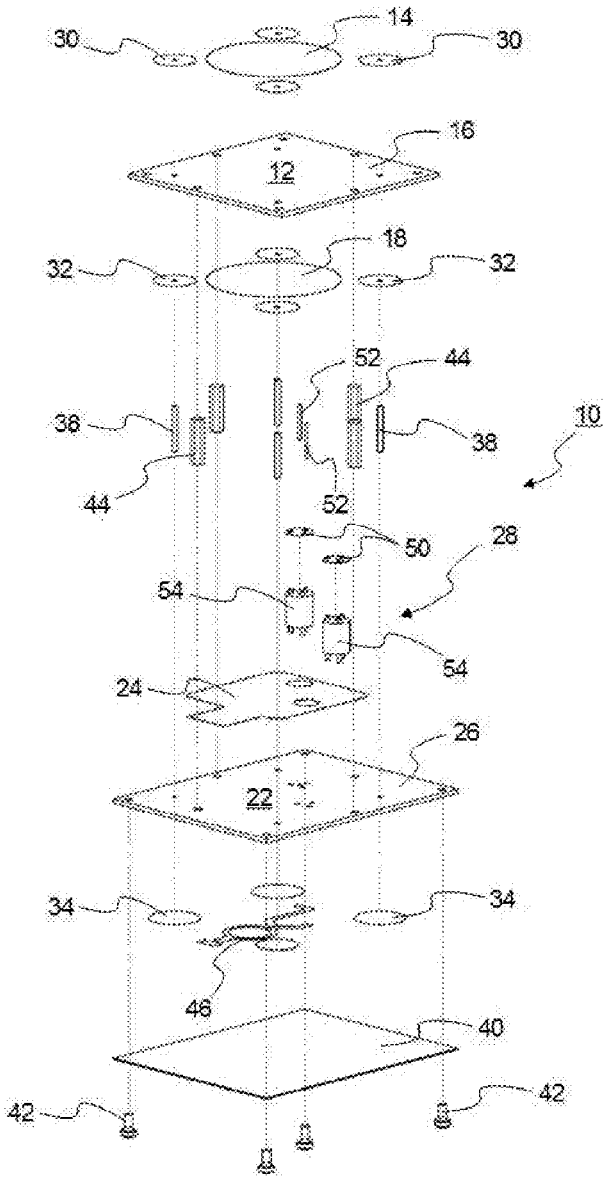
H01Q 9/04	(2006.01)
H01Q 1/48	(2006.01)
H01Q 19/00	(2006.01)
H01P 5/16	(2006.01)

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

CPC ***H01Q 9/0414*** (2013.01); ***H01Q 1/48*** (2013.01); *H01Q 9/0435* (2013.01); ***H01P 5/16*** (2013.01); ***H01Q 19/005*** (2013.01)

(57) **ABSTRACT**

An antenna system includes a first substrate, the first substrate being a dielectric substrate, a first patch on a first surface of the dielectric substrate and a second patch on a second surface of the dielectric substrate. The first and second patches are coupled to form a first capacitor with the dielectric substrate. A second substrate is coupled to the first substrate and a ground layer is provided on a first surface of the second substrate. An antenna feed is coupled to the second substrate.



US 20210126372A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0126372 A1**

(43) **Pub. Date: Apr. 29, 2021**

DUAN et al.

(54) **ANTENNA UNIT, ARRAY ANTENNA, AND ELECTRONIC DEVICE**

(71) Applicant: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(72) Inventors: **Xiaochao DUAN**, Beijing (CN); **Lupeng ZHANG**, Beijing (CN)

(73) Assignee: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(21) Appl. No.: **16/798,189**

(22) Filed: **Feb. 21, 2020**

(30) **Foreign Application Priority Data**

Oct. 29, 2019 (CN) 201911040141.5

Publication Classification

(51) **Int. Cl.**

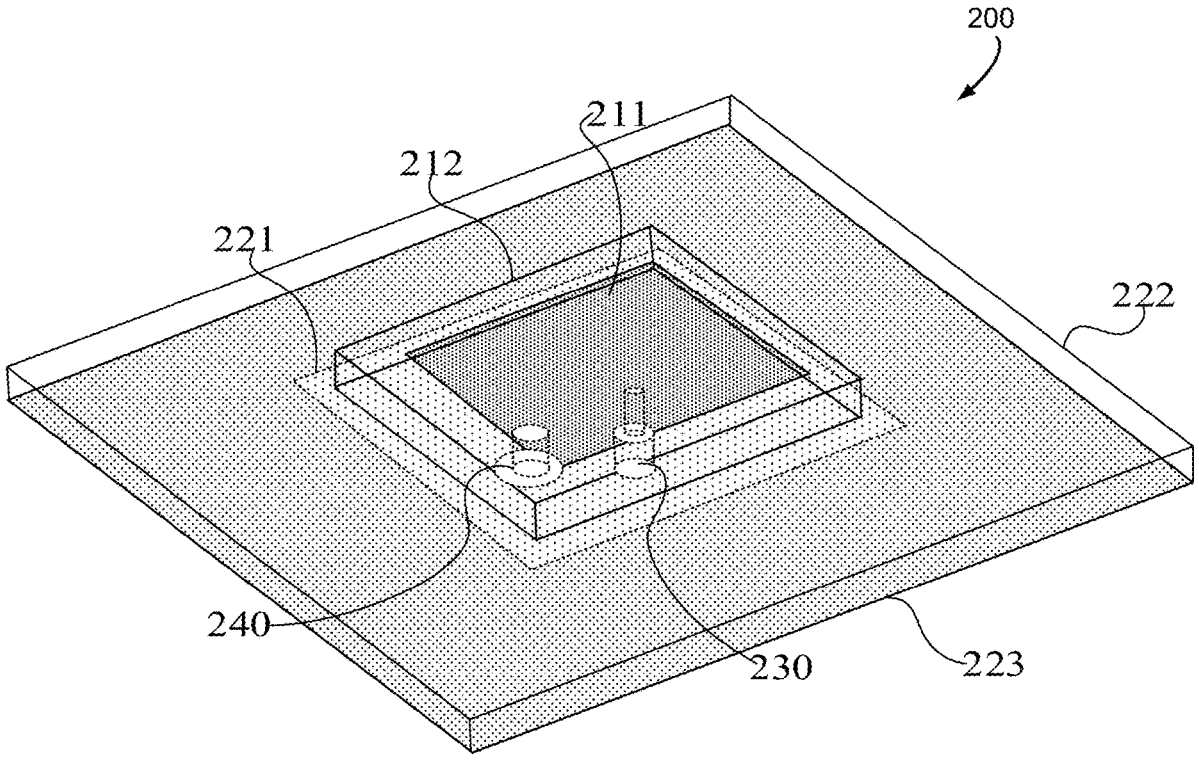
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 21/00 (2006.01)
H01Q 1/36 (2006.01)

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

CPC ***H01Q 9/0457*** (2013.01); ***H01Q 1/36*** (2013.01); ***H01Q 21/0075*** (2013.01); ***H01Q 1/24*** (2013.01)

(57) **ABSTRACT**

An antenna unit, an array antenna and an electronic device are provided. The antenna unit includes a first microstrip antenna, comprising a first radiating layer coupled to a first dielectric layer wherein the first microstrip antenna operates at a first band, a second microstrip antenna, comprising a second radiating layer, a second dielectric layer, and a ground layer, sequentially coupled, wherein the second radiating layer is coupled to a side of the first dielectric layer facing away from the first radiating layer, and wherein the second microstrip antenna operates at a second band that is smaller than the first band, a first feeder line, electrically coupled to the first radiating layer and the second radiating layer, and a second feeder line, electrically coupled to the second radiating layer and the ground layer.



US 20210132736A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0132736 A1**

Kim et al. (43) **Pub. Date: May 6, 2021**

(54) **ELECTRONIC DEVICE**

(71) Applicant: **SAMSUNG DISPLAY CO., LTD.**, Yongin-Si (KR)

(72) Inventors: **Jae-Kyoung Kim**, Hwaseong-si (KR); **Kiseo Kim**, Yongin-si (KR); **Wonsang Park**, Yongin-si (KR); **Bonghyun You**, Seoul (KR)

(21) Appl. No.: **16/933,026**

(22) Filed: **Jul. 20, 2020**

(30) **Foreign Application Priority Data**

Nov. 5, 2019 (KR) 10-2019-0140246

Publication Classification

(51) **Int. Cl.**

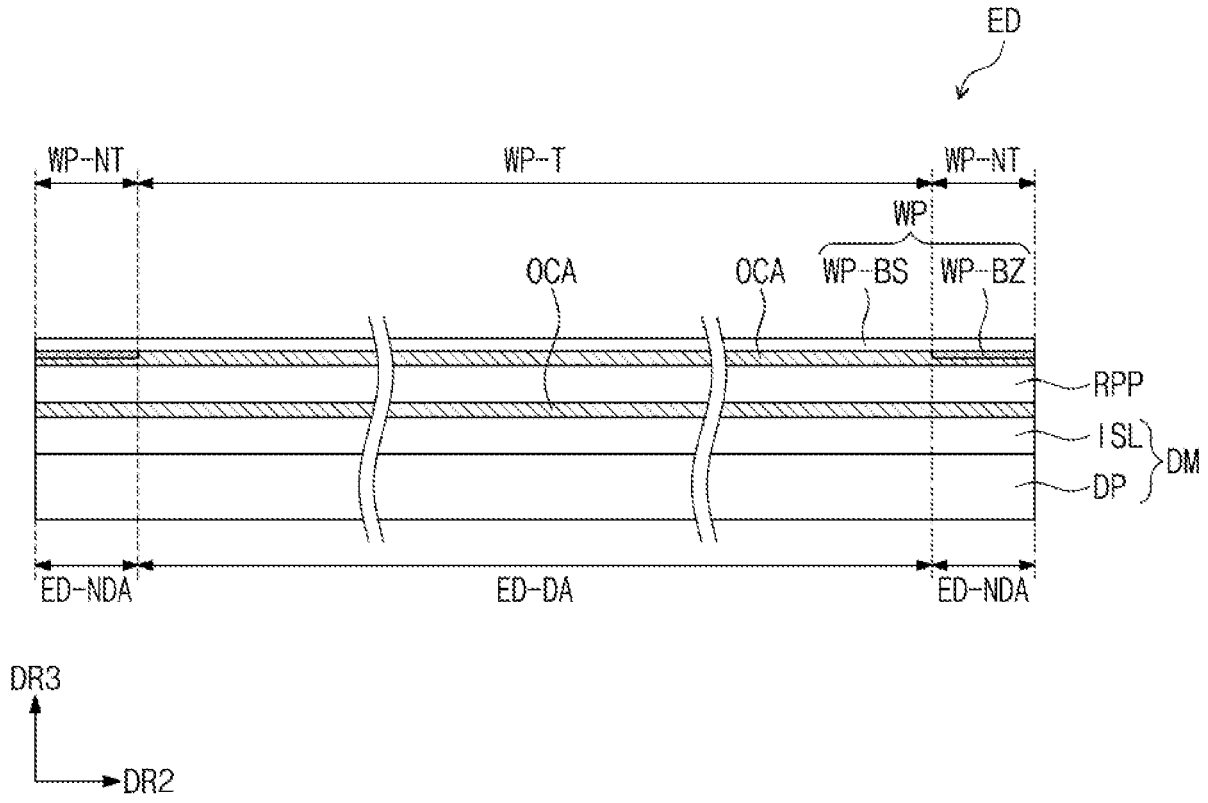
G06F 3/044	(2006.01)
H01L 27/32	(2006.01)
H01L 51/00	(2006.01)
H01L 51/52	(2006.01)
H01Q 1/36	(2006.01)
H01Q 1/27	(2006.01)

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

CPC ***G06F 3/0443*** (2019.05); ***H01L 27/3244*** (2013.01); ***H01L 27/323*** (2013.01); ***H01L 51/0097*** (2013.01); ***H01L 51/5253*** (2013.01); *G06F 2203/04102* (2013.01); ***H01Q 1/36*** (2013.01); ***H01Q 1/273*** (2013.01); *H01L 2251/5338* (2013.01); *G06F 2203/04111* (2013.01); ***G06F 3/0446*** (2019.05)

(57) **ABSTRACT**

An electronic device includes a display panel including a display region and a non-display region adjacent thereto, an input sensor overlapping a first region of the display region, and an antenna overlapping a second region of the display region. The input sensor includes a first sensing layer including a bridge pattern and a second sensing layer including sensor electrodes and disposed on a different layer from the first sensing layer. The bridge pattern connects two adjacent sensor electrodes. The antenna includes a first antenna layer including a first antenna with a first frequency band, the first antenna layer and the first sensing layer disposed on the same layer, and a second antenna layer including a second antenna with a second frequency band different from the first frequency band. The second antenna layer and the second sensing layer are disposed on the same layer.



US 20210134927A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0134927 A1**

KIM et al. (43) **Pub. Date: May 6, 2021**

(54) **DISPLAY APPARATUS AND ELECTRONIC APPARATUS INCLUDING THE SAME**

(71) Applicant: **Samsung Display Co., Ltd.**, Yongin-Si (KR)

(72) Inventors: **Jae-Kyoung KIM**, Hwaseong-si (KR); **Ki Seo KIM**, Yongin-si (KR); **Won Sang PARK**, Yongin-si (KR); **Bong Hyun YOU**, Seoul (KR)

(21) Appl. No.: **17/005,846**

(22) Filed: **Aug. 28, 2020**

(30) **Foreign Application Priority Data**

Oct. 31, 2019 (KR) 10-2019-0137292

Publication Classification

(51) **Int. Cl.**

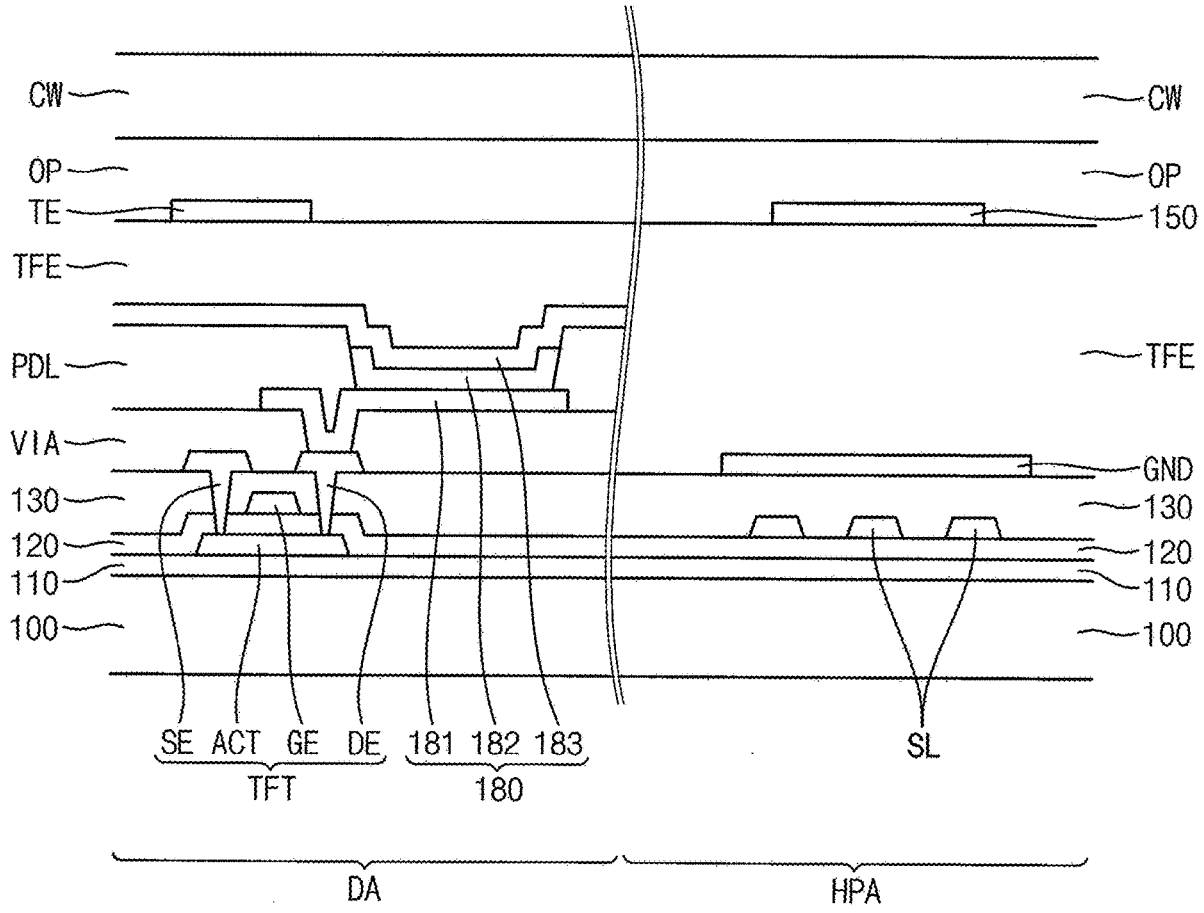
H01L 27/32	(2006.01)
H01Q 1/24	(2006.01)
H01L 51/52	(2006.01)

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

CPC ***H01L 27/3276*** (2013.01); ***H01Q 1/243*** (2013.01); *H01L 2251/308* (2013.01); ***H01L 27/323*** (2013.01); ***H01L 27/3234*** (2013.01); ***H01L 51/5237*** (2013.01)

(57) **ABSTRACT**

A display apparatus includes a base substrate including an opening area which transmits light, an opening peripheral area which is a non-display area surrounding the opening area, and a display area surrounding the opening peripheral area, a thin film transistor disposed on the base substrate, a light emitting structure electrically connected to the thin film transistor, and a loop-type antenna electrode disposed on the base substrate in the opening peripheral area to surround the opening area.



US 20210135334A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0135334 A1

ZHOU et al. (43) Pub. Date: May 6, 2021

(54) **INTEGRATED CIRCUIT AND TERMINAL DEVICE**

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

(72) Inventors: **Weixi ZHOU**, Shanghai (CN); **Ming CHANG**, Shanghai (CN); **Hailin DONG**, Shanghai (CN); **Liangsheng LIU**, Shenzhen (CN); **Hongcheng YIN**, Shenzhen (CN)

(21) Appl. No.: **17/150,365**

(22) Filed: **Jan. 15, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2018/096010, filed on Jul. 17, 2018.

Publication Classification

(51) **Int. Cl.**

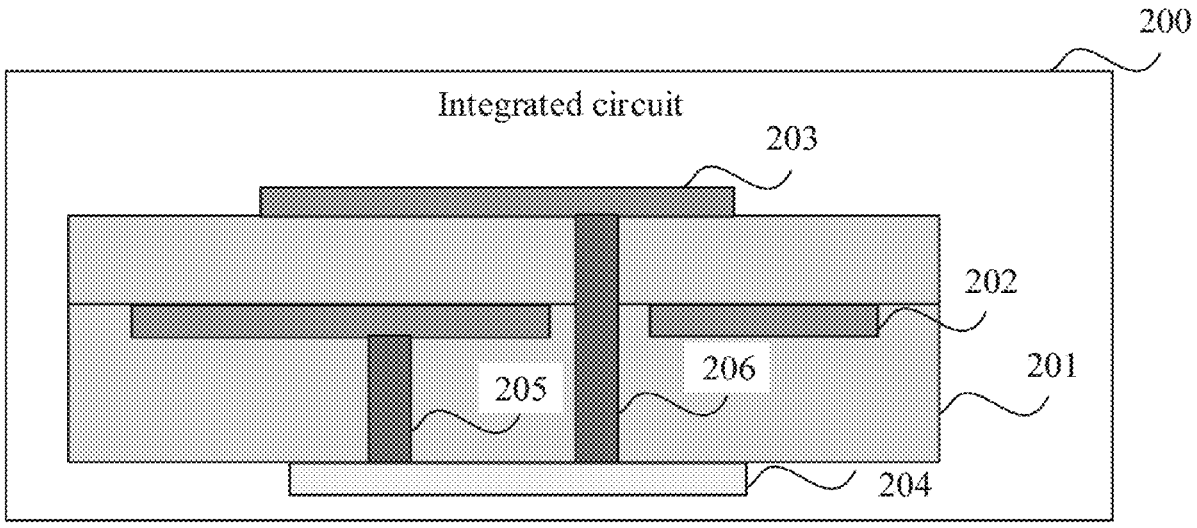
H01Q 1/22	(2006.01)
H01Q 9/04	(2006.01)
H01Q 5/35	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 1/2283*** (2013.01); ***H01Q 9/0414*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/35*** (2015.01)

(57) **ABSTRACT**

Embodiments of this application disclose an integrated circuit and a terminal device, to resolve a problem that an existing dual-band antenna has a relatively small low-frequency band range and is difficult to meet use requirements. An antenna includes a bearer structure, a first radiation patch, a second radiation patch, and a radio frequency processing chip. The first radiation patch, the second radiation patch, and the radio frequency processing chip are separately placed on different layers of the bearer structure. A first feed line and a second feed line are disposed in the bearer structure. The radio frequency processing chip feeds the first radiation patch by using the first feed line. The radio frequency processing chip feeds the second radiation patch by using the second feed line.



US 20210135335A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0135335 A1**

(43) **Pub. Date: May 6, 2021**

SUZUKI et al.

(54) **COMMUNICATION APPARATUS**

(71) Applicant: **Sony Mobile Communications Inc.**, Tokyo (JP)

(72) Inventors: **Yuichiro SUZUKI**, Tokyo (JP); **Shen WANG**, Tokyo (JP); **Toru OZONE**, Tokyo (JP); **Jin SATO**, Tokyo (JP)

(73) Assignee: **Sony Mobile Communications Inc.**, Tokyo (JP)

(21) Appl. No.: **16/491,573**

(22) PCT Filed: **Dec. 19, 2017**

(86) PCT No.: **PCT/JP2017/045522**

§ 371 (c)(1),
(2) Date: **Sep. 6, 2019**

(30) **Foreign Application Priority Data**

Mar. 15, 2017 (JP) 2017-049422

Publication Classification

(51) **Int. Cl.**

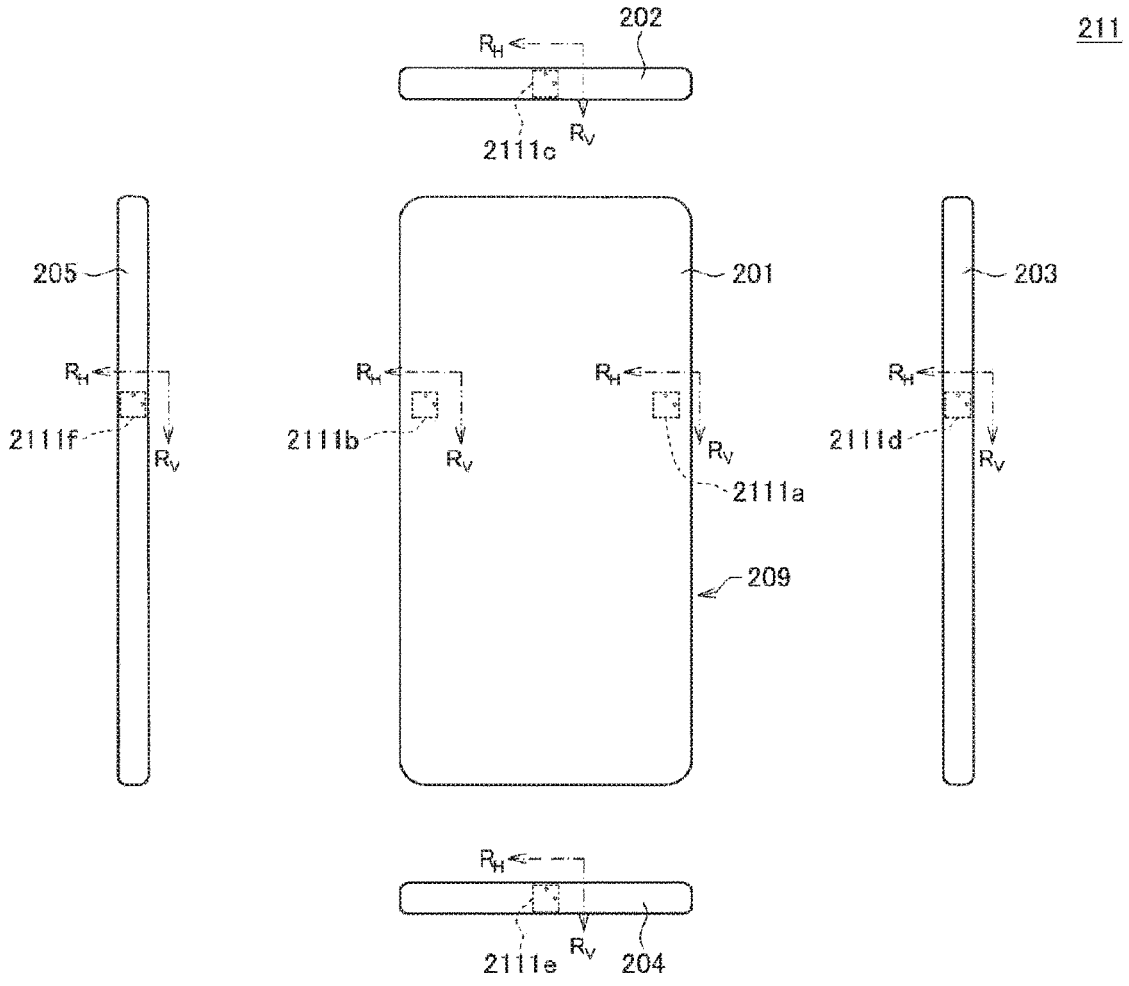
H01Q 1/24	(2006.01)
H04M 1/02	(2006.01)
H01Q 21/24	(2006.01)
H01Q 21/08	(2006.01)
H01Q 21/06	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H04M 1/0266*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 21/08*** (2013.01); ***H01Q 21/24*** (2013.01)

(57) **ABSTRACT**

A communication apparatus includes a plurality of antenna parts configured to receive or transmit a wireless signal, a communication control part configured to control transmitting or receiving the wireless signal via at least any of the plurality of antenna parts, and a casing housing the communication control part, in which each of the plurality of antenna parts is held near each of a plurality of partial regions normal directions of which cross each other or the normal directions of which are mutually twisted in outer faces of the casing, and transmit or receive a first wireless signal and a second wireless signal propagating in directions substantially orthogonal to the partial regions and having mutually different polarization directions.



US 20210135336A1

(19) **United States**

(12) **Patent Application Publication**

KE

(10) **Pub. No.: US 2021/0135336 A1**

(43) **Pub. Date: May 6, 2021**

(54) **METAL MIDDLE FRAME, MILLIMETER-WAVE ANTENNA STRUCTURE, AND MOBILE TERMINAL**

(71) Applicant: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(72) Inventor: **Changqing KE**, Beijing (CN)

(73) Assignee: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(21) Appl. No.: **16/818,492**

(22) Filed: **Mar. 13, 2020**

(30) **Foreign Application Priority Data**

Oct. 30, 2019 (CN) 201911043880.X

Publication Classification

(51) **Int. Cl.**

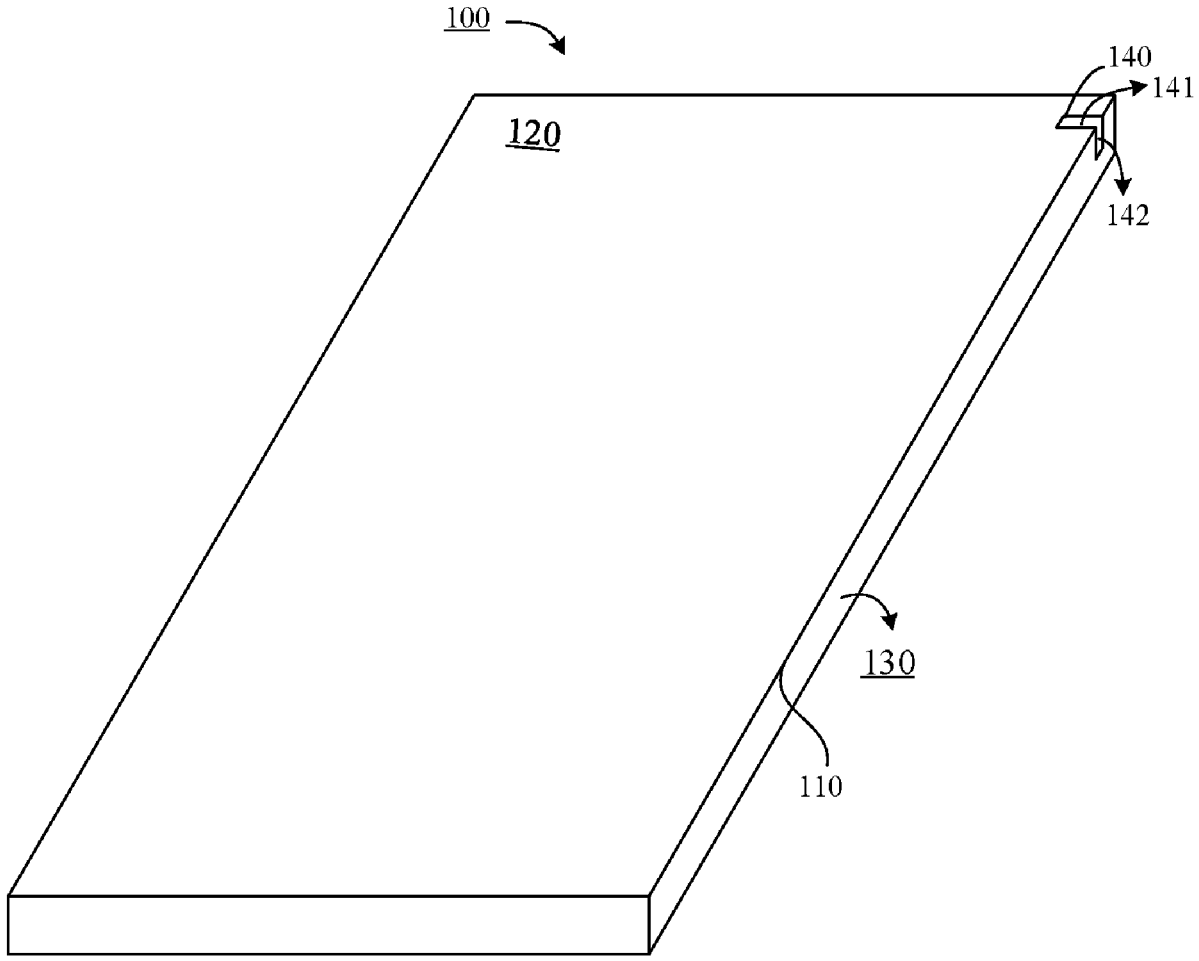
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
H01Q 1/42 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/421*** (2013.01); ***H04M 1/026*** (2013.01)

(57) **ABSTRACT**

A frame body of the metal middle frame includes a first side and a second side, which are jointed at a side edge of the first side and second side; an L-shaped slit is arranged on the frame body, and includes a first slit edge and a second slit edge which are jointed at an end point of the first slit edge and the second slit edge, the first slit edge is arranged on the first side, and the second slit edge is arranged on the second side; and a millimeter-wave antenna is arranged in the L-shaped slit, and the millimeter-wave antenna is configured to perform millimeter-wave radiation through the first slit edge and the second slit edge.



US 20210135337A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0135337 A1**

(43) **Pub. Date: May 6, 2021**

KIM et al.

(54) **ELECTRONIC APPARATUS**

(71) Applicant: **SAMSUNG DISPLAY CO., LTD.**, Yongin-si (KR)

(72) Inventors: **KISEO KIM**, Yongin-si (KR); **JAE-KYOUNG KIM**, Hwaseong-si (KR); **WONSANG PARK**, Yongin-si (KR); **BONGHYUN YOU**, Seoul (KR)

(21) Appl. No.: **17/072,588**

(22) Filed: **Oct. 16, 2020**

(30) **Foreign Application Priority Data**

Nov. 1, 2019 (KR) 10-2019-0138538

Publication Classification

(51) **Int. Cl.**

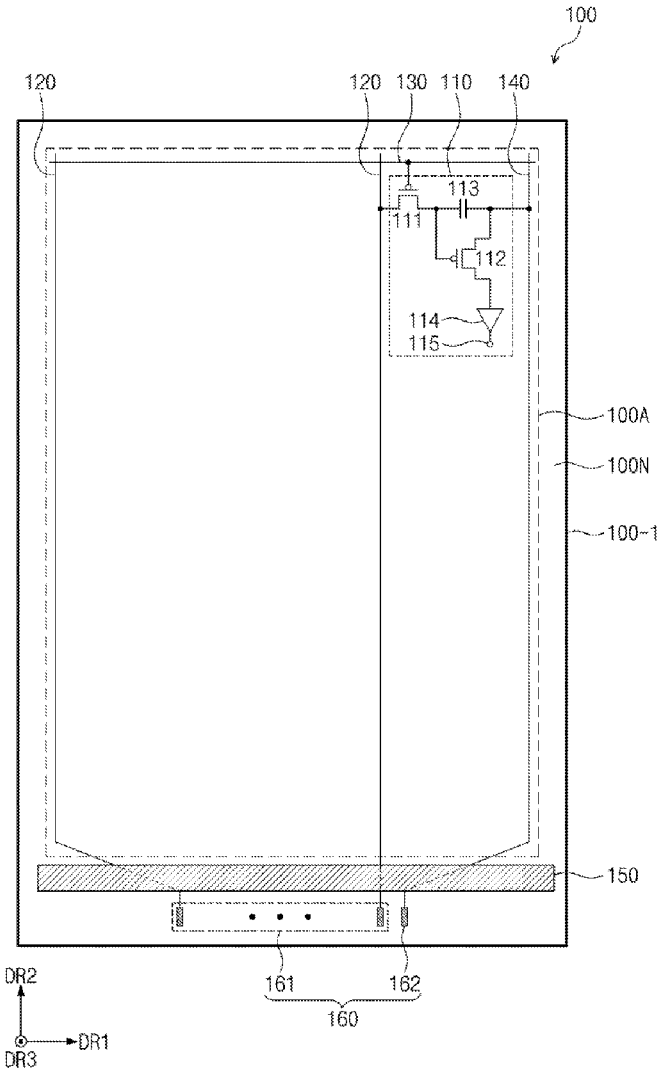
H01Q 1/24	(2006.01)
G06F 3/044	(2006.01)
G06F 3/041	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***G06F 3/0445*** (2019.05); *G06F 2203/04102* (2013.01); ***G06F 3/0412*** (2013.01); ***G06F 3/04164*** (2019.05); ***G06F 3/0446*** (2019.05)

(57) **ABSTRACT**

The present disclosure relates to an electronic apparatus. The electronic apparatus includes a display panel, a pattern portion, and a circuit portion. The display panel includes an active area and a peripheral area. The pattern portion includes an antenna pattern disposed on the display panel and a first pad connected to the antenna pattern. The circuit portion includes a second pad facing the first pad, wherein the second pad is spaced apart from the first pad by a predetermined distance. The second pad is capacitively-coupled to the first pad and a radio frequency device electrically connected to the second pad.



US 20210135338A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0135338 A1**

KIM et al. (43) **Pub. Date: May 6, 2021**

(54) **GRIP DETECTION METHOD AND ELECTRONIC DEVICE SUPPORTING SAME**

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

(72) Inventors: **Hyunsoo KIM**, Suwon-si (KR); **Gaeun LEE**, Suwon-si (KR); **Dongil SON**, Suwon-si (KR)

(21) Appl. No.: **17/089,952**

(22) Filed: **Nov. 5, 2020**

(30) **Foreign Application Priority Data**

Nov. 5, 2019 (KR) 10-2019-0140373

Publication Classification

(51) **Int. Cl.**

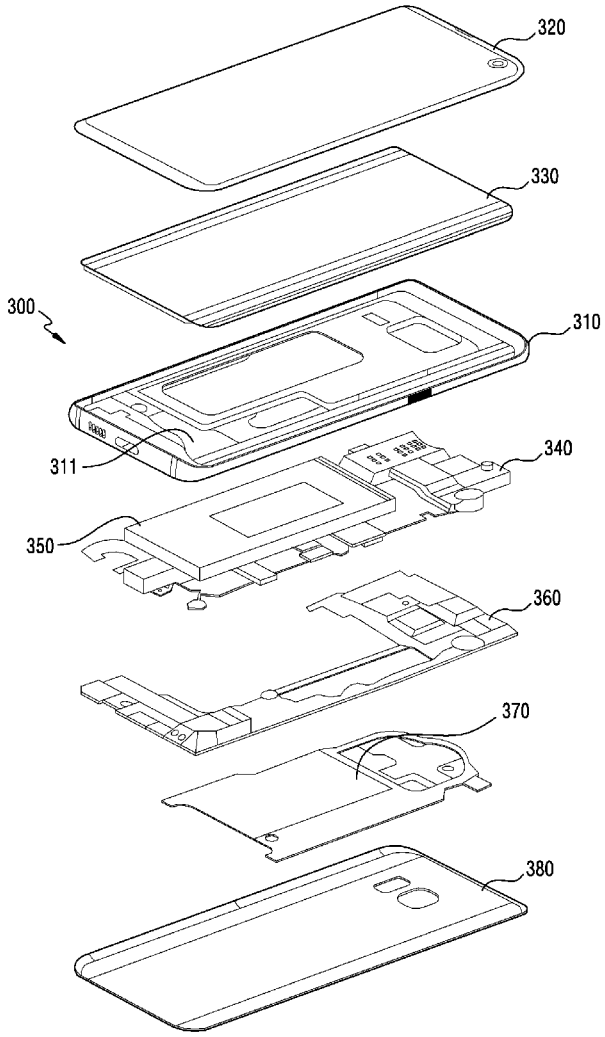
H01Q 1/24	(2006.01)
H04W 4/80	(2006.01)
H04B 5/00	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H04B 5/0081*** (2013.01); ***H04B 5/0037*** (2013.01); ***H04W 4/80*** (2018.02)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a housing including a front surface, a rear surface, and a side surface which at least partially surrounds a space between the front surface and the rear surface, a first antenna disposed in the space, a second antenna disposed substantially in parallel with the rear surface in the space and formed in a coil shape, a conductor spaced a predetermined distance apart from a partial region of the second antenna substantially in parallel therewith and at least partially overlapping the partial region, a sensor electrically connected to the conductor, a communication circuit electrically connected to the first antenna, and a processor electrically connected to the sensor and the communication circuit, and the processor is configured to acquire a capacitance value related to the conductor, and reduce an intensity of a signal outputted through the first antenna according to the acquired capacitance value.



US 20210135339A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0135339 A1**

LEE et al. (43) **Pub. Date: May 6, 2021**

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

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

(72) Inventors: **CHENG-HAN LEE**, New Taipei (TW); **YI-WEN HSU**, New Taipei (TW); **WEI-XUAN YE**, New Taipei (TW)

(21) Appl. No.: **17/144,326**

(22) Filed: **Jan. 8, 2021**

Related U.S. Application Data

(62) Division of application No. 15/647,281, filed on Jul. 12, 2017, now Pat. No. 10,923,801.

(60) Provisional application No. 62/364,303, filed on Jul. 19, 2016.

(30) **Foreign Application Priority Data**

Jun. 23, 2017 (CN) 201710488559.7

Publication Classification

(51) **Int. Cl.**

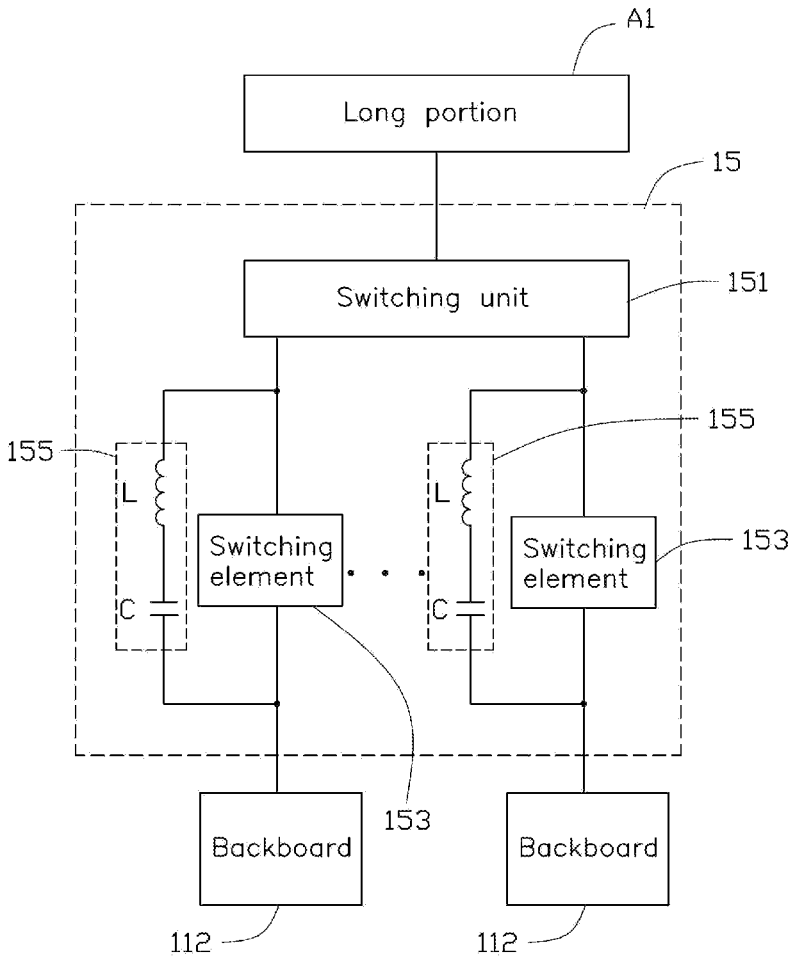
H01Q 1/24	(2006.01)
H01Q 5/50	(2006.01)
H01Q 1/52	(2006.01)
H01Q 9/42	(2006.01)
H01Q 21/28	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 5/50*** (2015.01); ***H01Q 21/28*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 1/528*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a metal housing, a first feed source, and a first radiator. The metal housing includes a front frame, a backboard, and a side frame. The side frame defines a slot and the front frame defines a gap. The metal housing is divided into at least a long portion and a short portion by the slot and the gap. The first radiator is positioned in the housing and includes a first radiating portion and a second radiating portion. One end of the first radiating portion is electrically connected to the first feed source and another end of the first radiating portion is spaced apart from the long portion. One end of the second radiating portion is electrically connected to the first feed source and another end of the second radiating portion is spaced apart from the short portion.



US 20210135340A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0135340 A1**

(43) **Pub. Date: May 6, 2021**

KIM et al.

(54) **RADIO FREQUENCY DEVICE AND ELECTRONIC APPARATUS HAVING THE SAME**

(71) Applicants: **SAMSUNG DISPLAY CO., LTD.**, YONGIN-SI (KR); **(ULSAN NATIONAL INSTITUTE SCIENCE AND TECHNOLOGY)**, Ulsan (KR)

(72) Inventors: **Jae-Kyoung KIM**, Hwaseong-si (KR); **WonSang PARK**, Yongin-si (KR); **Gangil BYUN**, Ulsan (KR); **Jinmyeong HEO**, Suwon-si (KR)

(21) Appl. No.: **17/028,124**

(22) Filed: **Sep. 22, 2020**

(30) **Foreign Application Priority Data**

Oct. 31, 2019 (KR) 10-2019-0137946

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

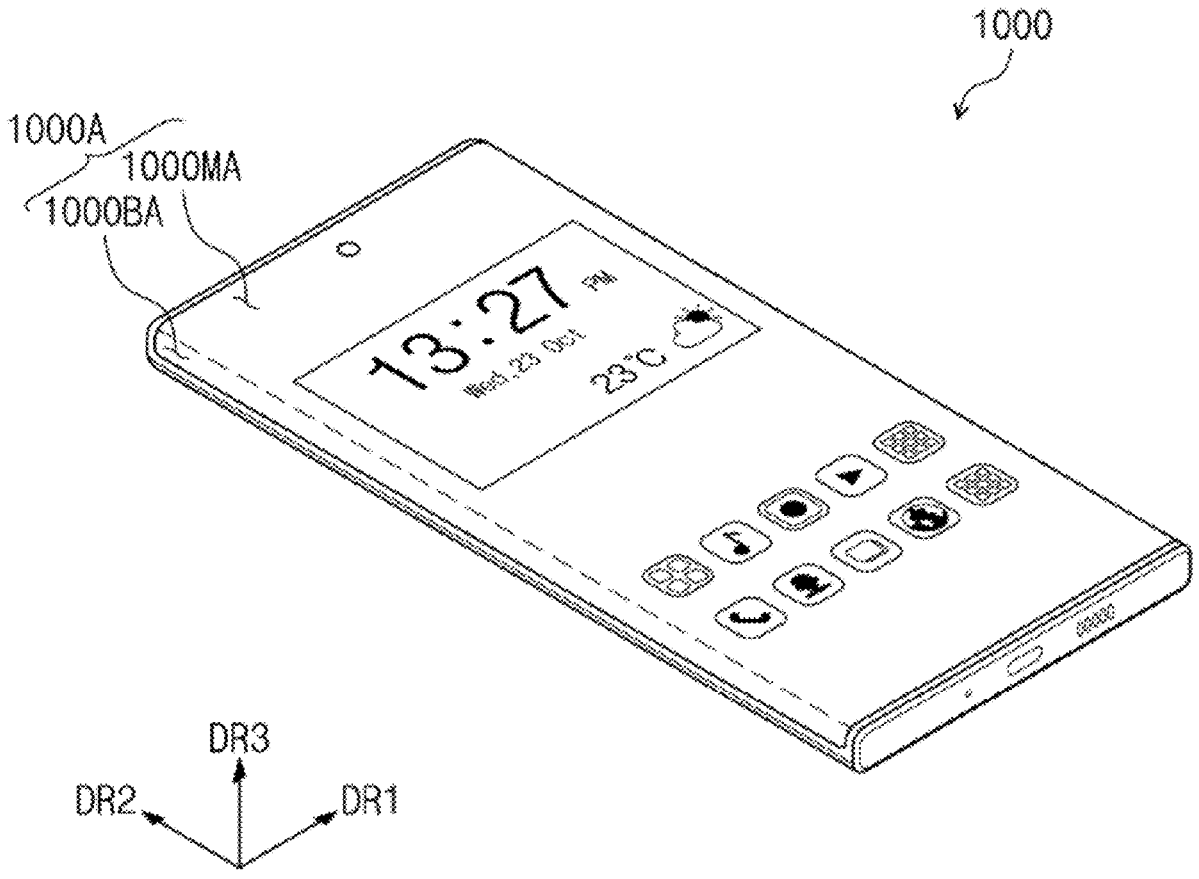
H04M 1/02 (2006.01)

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

CPC ***H01Q 1/245*** (2013.01); ***H04M 1/0295*** (2013.01); ***H04M 1/0268*** (2013.01)

(57) **ABSTRACT**

The present disclosure relates to an electronic apparatus. The electronic apparatus includes a display panel in which an active area and a peripheral area are defined and an antenna with at least a portion overlapping the active area. The antenna includes a first pattern portion having a first characteristic impedance and a first mesh structure, a second pattern portion, and a third pattern portion. The second pattern portion is disposed adjacent to the first pattern portion and has a second characteristic impedance different from the first characteristic impedance and a second mesh structure. The third pattern portion is disposed adjacent to the second pattern portion and has a third characteristic impedance different from the second characteristic impedance and a third mesh structure. The second characteristic impedance has a value between the first characteristic impedance and the third characteristic impedance.



US 20210135351A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0135351 A1

Son et al. (43) Pub. Date: May 6, 2021

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

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

(72) Inventors: **Cheolhong Son**, Gyeonggi-do (KR); **Kyungjae Lee**, Gyeonggi-do (KR); **Sangha Lee**, Gyeonggi-do (KR); **Soonho Hwang**, Gyeonggi-do (KR); **Sungjun Lee**, Gyeonggi-do (KR); **Hyunjeong Lee**, Gyeonggi-do (KR)

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

(21) Appl. No.: **17/090,459**

(22) Filed: **Nov. 5, 2020**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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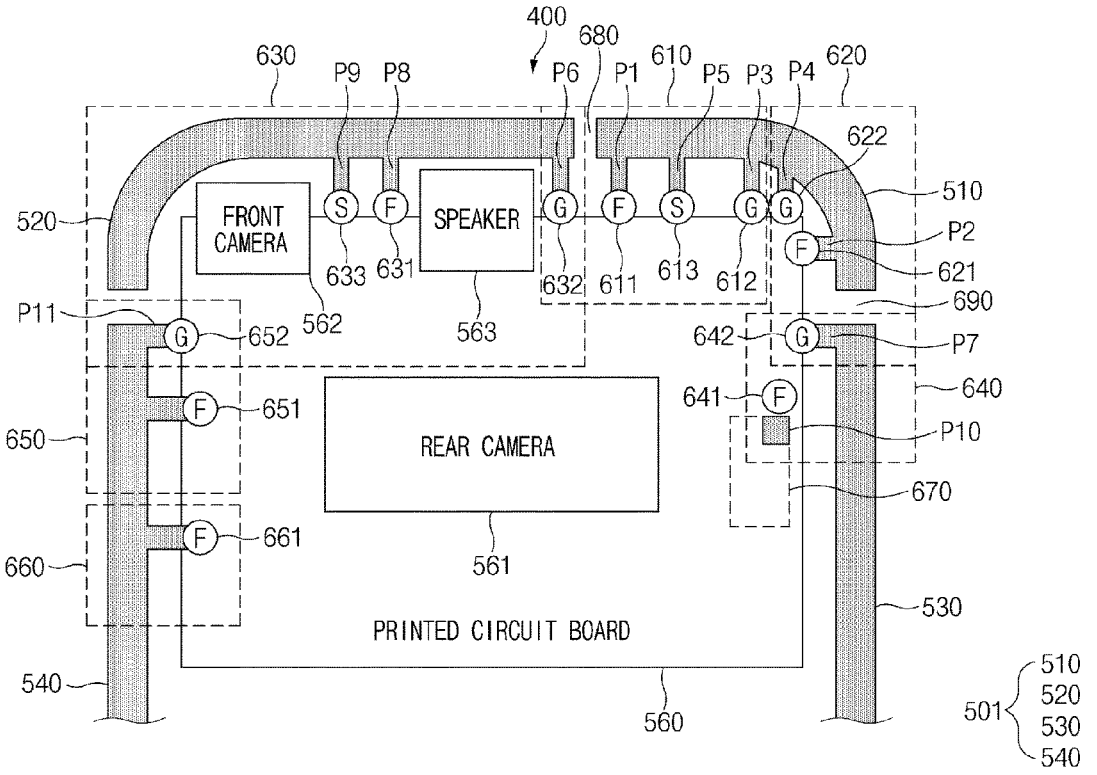
H01Q 1/42	(2006.01)
H01Q 1/48	(2006.01)
H05K 1/02	(2006.01)

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

CPC ***H01Q 1/50*** (2013.01); ***H01Q 1/42*** (2013.01); *H05K 2201/10098* (2013.01); ***H05K 1/0243*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An electronic device includes a housing including a front plate, a rear plate facing away from the front plate, and a side member surrounding a space between the front plate and the rear plate and connecting one side of the front plate to one side of the rear plate, an antenna structure including at least part of the conductive portion, and a printed circuit board disposed in the space and including at least one processor. At least part of the side member is a conductive portion. The conductive portion includes a first conductive pattern, a second conductive pattern disposed at least partially coupled to the first conductive pattern, and a third conductive pattern disposed at least partially coupled to the first conductive pattern and spaced apart from the second conductive pattern. The antenna structure includes a first feeding part electrically connected to a first location of the first conductive pattern, a second feeding part electrically connected to a second location of the first conductive pattern, wherein the second location is closer to the third conductive pattern than the first location, a first ground part electrically connected to a third location between the first location and the second location of the first conductive pattern, a second ground part electrically connected to a fourth location between the second location and the third location of the first conductive pattern, a switch electrically connected to a fifth location between the first location and the third location of the first conductive pattern, a third ground part electrically connected to a sixth location of the second conductive pattern, and a fourth ground part electrically connected to a seventh location of the third conductive pattern.



US 20210135361A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0135361 A1**

Cooper et al. (43) **Pub. Date: May 6, 2021**

(54) **ELECTRONIC DEVICE HAVING DUAL-FREQUENCY ULTRA-WIDEBAND ANTENNAS**

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

(72) Inventors: **Aaron J. Cooper**, San Jose, CA (US); **Amin Tayebi**, San Jose, CA (US); **Carlo di Nallo**, Belmont, CA (US); **Zheyu Wang**, Sunnyvale, CA (US)

(21) Appl. No.: **17/147,117**

(22) Filed: **Jan. 12, 2021**

Related U.S. Application Data

(62) Division of application No. 16/277,808, filed on Feb. 15, 2019, now Pat. No. 10,931,013.

Publication Classification

(51) **Int. Cl.**

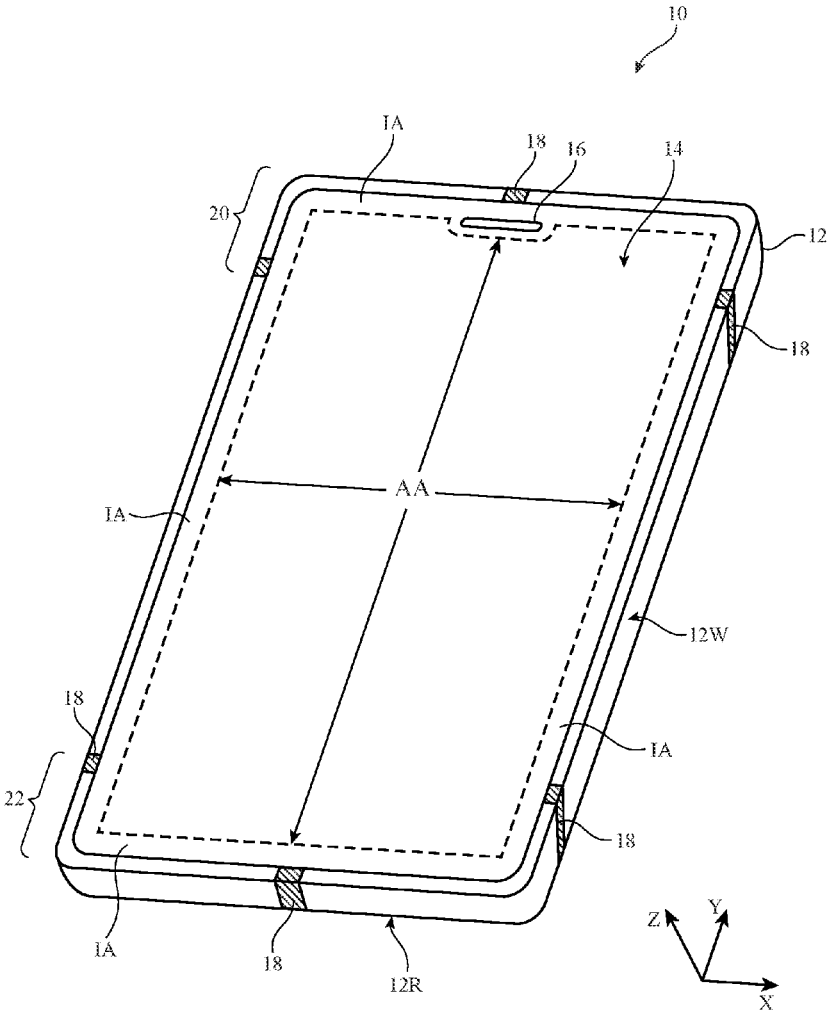
H01Q 5/25	(2006.01)
H01Q 21/28	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/08	(2006.01)

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

CPC ***H01Q 5/25*** (2015.01); ***H01Q 1/085*** (2013.01); ***H01Q 1/241*** (2013.01); ***H01Q 21/28*** (2013.01)

(57) **ABSTRACT**

An electronic device may be provided with antennas for receiving signals in first and second ultra-wideband communications bands. The antennas may include a resonating element formed from conductive traces on a dielectric substrate. The substrate may be mounted to an underlying flexible printed circuit. A fence of conductive vias may extend from the resonating element, through the substrate and the flexible printed circuit, to a ground plane on the flexible printed circuit. The fence may form a return path for the antenna. A shielding ring may be formed on the substrate. Additional fences of vias may couple the shielding ring to the ground plane. If desired, the resonating element may include a patch that is not shorted to the ground plane. The fences of vias, the conductive traces, and the ground plane may form a continuous antenna cavity for the resonating element.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0135362 A1**

HSU et al. (43) **Pub. Date: May 6, 2021**

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

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

(72) Inventors: **CHO-KANG HSU**, New Taipei (TW); **MIN-HUI HO**, New Taipei (TW)

(21) Appl. No.: **17/084,951**

(22) Filed: **Oct. 30, 2020**

(30) **Foreign Application Priority Data**

Oct. 31, 2019 (CN) 201911063223.1
Oct. 31, 2019 (CN) 201911063281.4

Publication Classification

(51) **Int. Cl.**

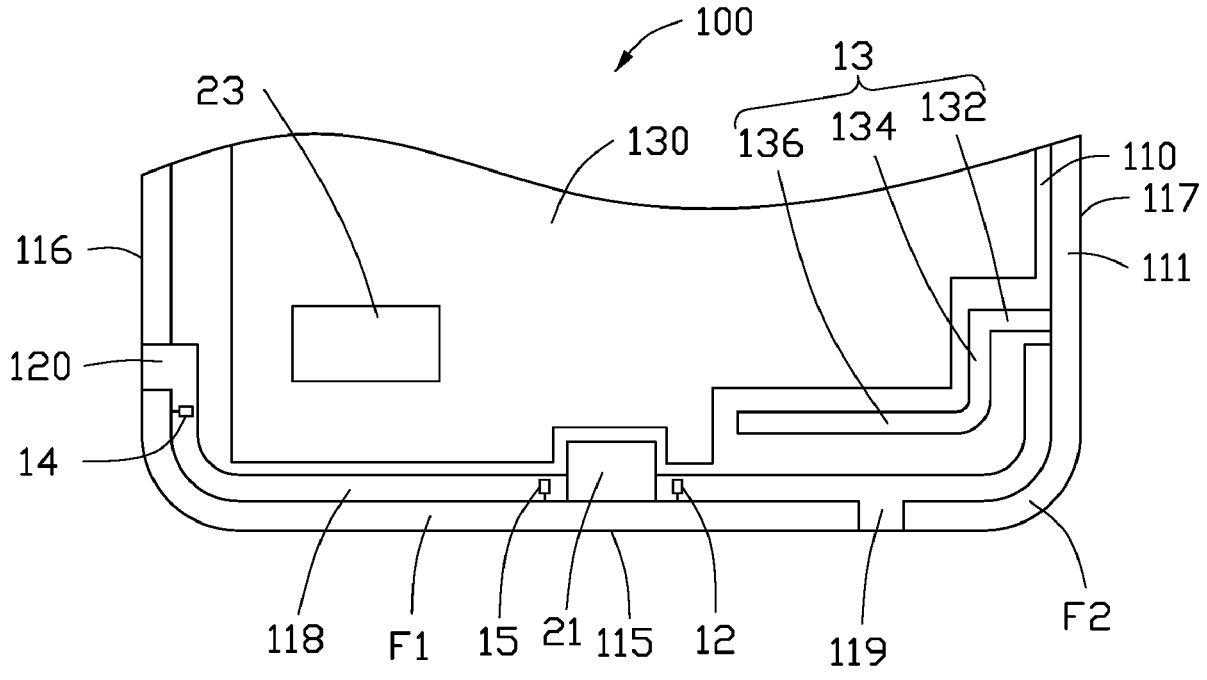
H01Q 5/371	(2006.01)
H01Q 21/28	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 5/371*** (2015.01); ***H01Q 1/243*** (2013.01); ***H01Q 21/28*** (2013.01)

(57) **ABSTRACT**

An antenna structure with wide radiation bandwidth in a reduced physical space includes a housing and a feed portion. The housing defines at least one gap and a slot that divides the housing into two or more radiation portions. The antenna structure further includes a middle-high band reflector (MHR). The MHR is connected to a side frame of the housing and extends along a direction parallel to one radiation portion. The MHR can also be positioned apart from one radiation portion. One end of the MHR is connected to a back board of the housing, the feed portion being electrically connected to one radiation portion. The back board and portions of the side frame without radiation portions are connected to form a system ground plane for grounding the antenna structure.



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(19) **United States**

(12) **Patent Application Publication**

SAMPO

(10) **Pub. No.: US 2021/0135366 A1**

(43) **Pub. Date: May 6, 2021**

(54) **SLOTTED PATCH ANTENNA**

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

(72) Inventor: **Takeshi SAMPO**, Tomioka-shi, Gunma (JP)

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

(21) Appl. No.: **16/491,776**

(22) PCT Filed: **Mar. 2, 2018**

(86) PCT No.: **PCT/JP2018/008168**

§ 371 (c)(1),
(2) Date: **Sep. 6, 2019**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

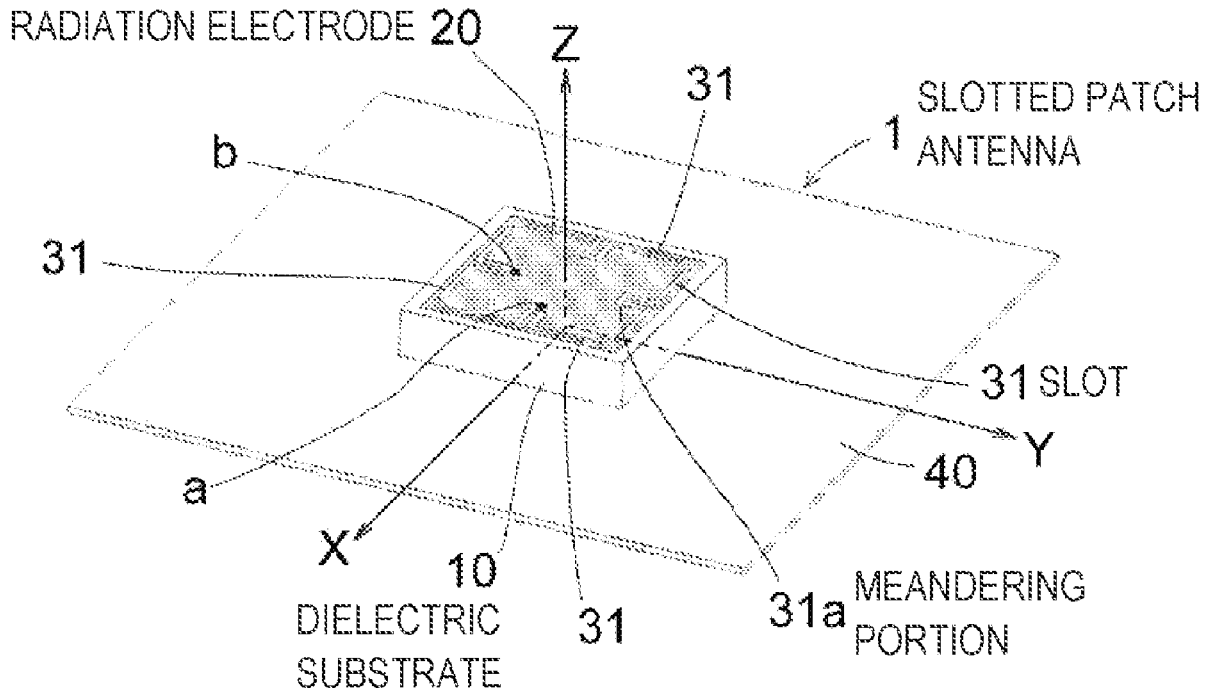
H01Q 9/04 (2006.01)
H01Q 1/28 (2006.01)
H01Q 5/35 (2006.01)
H01Q 13/10 (2006.01)

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

CPC ***H01Q 9/0435*** (2013.01); ***H01Q 13/10*** (2013.01); ***H01Q 5/35*** (2015.01); ***H01Q 1/288*** (2013.01)

(57) **ABSTRACT**

A slotted patch antenna includes a dielectric substrate, a radiation electrode which is provided on a major surface of the dielectric substrate, and a ground conductor which is disposed on a surface that is opposite to the major surface. The radiation electrode is formed with a slots having at least one of a meandering portion, a curve portion, or a folded portion. An external shape of the radiation electrode is a square, and totally two pairs of slots are formed inside the square, each of the slots being along respective sides of the square. Each of the slots is arranged so as to be line-symmetrical with respect to an axis of symmetry that is parallel with one of the sides of the square and passes through a center of the square, and to be point-symmetrical with respect to the center of the square.



US 20210135378A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0135378 A1

CHO et al. (43) Pub. Date: May 6, 2021

(54) ELECTRONIC DEVICE INCLUDING ANTENNA MODULE

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

(72) Inventors: **Woosik CHO**, Suwon-si (KR); **Dowan KIM**, Suwon-si (KR); **Yongsang YUN**, Suwon-si (KR); **Kyungrok LEE**, Suwon-si (KR); **Sunghyup LEE**, Suwon-si (KR); **Wonhyung HEO**, Suwon-si (KR)

(21) Appl. No.: **17/036,313**

(22) Filed: **Sep. 29, 2020**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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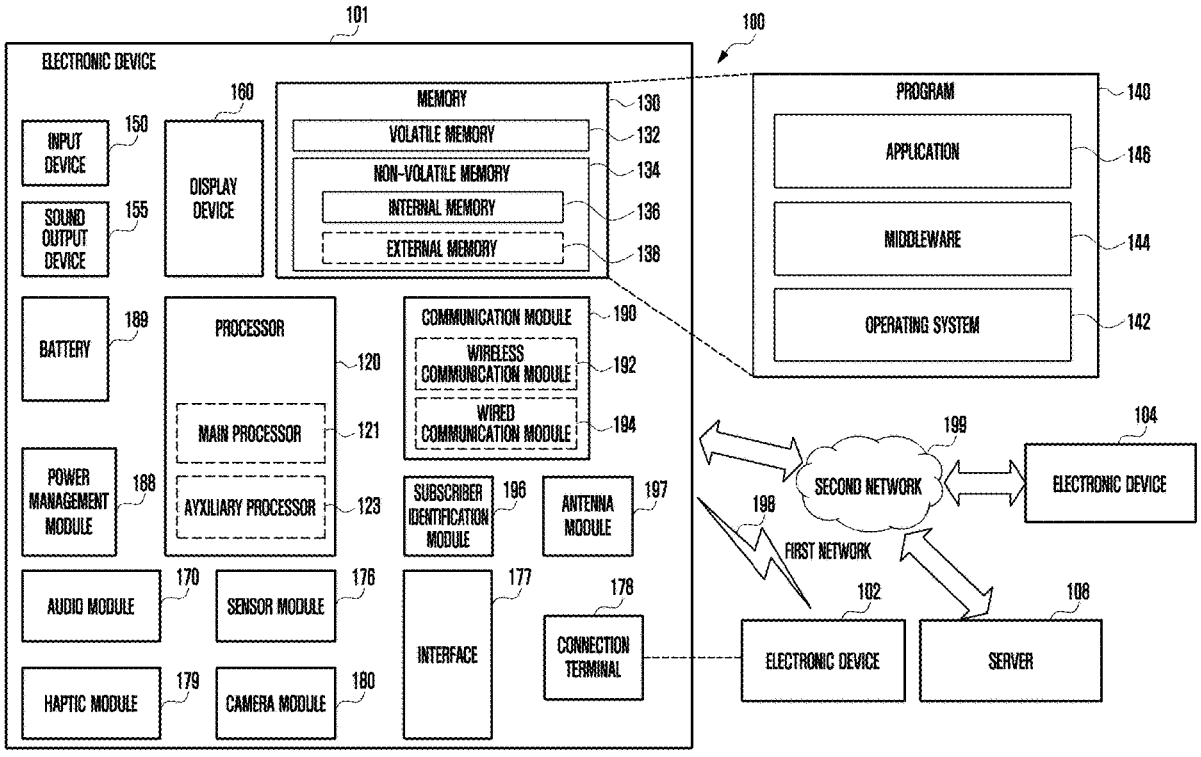
H01Q 1/24	(2006.01)
H01Q 21/06	(2006.01)
H01Q 1/52	(2006.01)
H01Q 1/02	(2006.01)

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

CPC ***H01Q 21/28*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 1/02*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 1/526*** (2013.01); ***H01Q 21/062*** (2013.01)

(57) **ABSTRACT**

An electronic device includes: a housing including a front plate, a rear plate disposed opposite the front plate, and a side bezel enclosing at least a portion of a space between the front plate and the rear plate; a display disposed in the space and visible through at least a portion of the front plate, wherein the display includes a first layer including a plurality of pixels; and a second layer disposed at the first layer and including an opening; and an antenna module disposed in the space, wherein the antenna module includes a printed circuit board including a first surface facing away from the first layer through the opening and a second surface facing opposite the first surface; at least one antenna element disposed on the first surface, or inside the printed circuit board closer to the first surface than the second surface; and a communication circuit disposed at the second surface of the printed circuit board, the communication circuit configured to transmit and/or receive signals of a selected or designated frequency band through the at least one antenna element.



US 20210141426A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0141426 A1

KIM et al. (43) Pub. Date: May 13, 2021

(54) **ANTENNA STRUCTURE AND DISPLAY DEVICE COMPRISING SAME**

(71) Applicant: **DONGWOO FINE-CHEM CO., LTD.**, Jeollabuk-do (KR)

(72) Inventors: **Jong Min KIM**, Gyeonggi-do (KR); **Han Sub RYU**, Gyeongsangbuk-do (KR); **Dong Pil PARK**, Incheon (KR)

(21) Appl. No.: **17/154,266**

(22) Filed: **Jan. 21, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2019/009004, filed on Jul. 22, 2019.

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

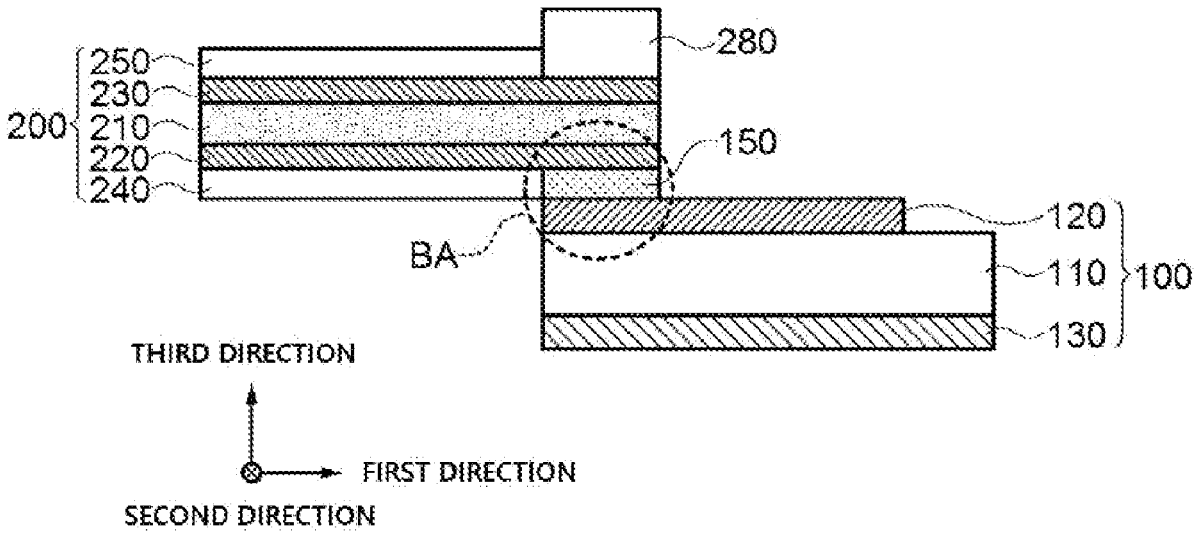
G06F 1/16	(2006.01)
G06F 1/18	(2006.01)
H01Q 1/38	(2006.01)

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

CPC ***G06F 1/1698*** (2013.01); ***H01Q 1/38*** (2013.01); ***G06F 1/189*** (2013.01)

(57) **ABSTRACT**

An antenna structure of an embodiment of the present invention includes a film antenna including a dielectric layer and an antenna electrode layer formed on an upper surface of the dielectric layer, and a flexible circuit board including a power supply wiring electrically connected to the antenna electrode layer. A bonding region is defined by a region in which the antenna electrode layer and the power supply wiring are overlapped with each other in a planar direction, and the bonding region has a length of 1.5 mm or less. Signal efficiency and radiation reliability may be improved by adjusting a length of the bonding region.



US 20210143523A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0143523 A1

WANG et al. (43) Pub. Date: May 13, 2021

(54) **TERMINAL DEVICE**

(71) Applicant: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(72) Inventors: **Yijin WANG**, Dongguan (CN); **Huan-Chu HUANG**, Dongguan (CN); **Xianjing JIAN**, Dongguan (CN)

(73) Assignee: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(21) Appl. No.: **17/156,271**

(22) Filed: **Jan. 22, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2019/097216, filed on Jul. 23, 2019.

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

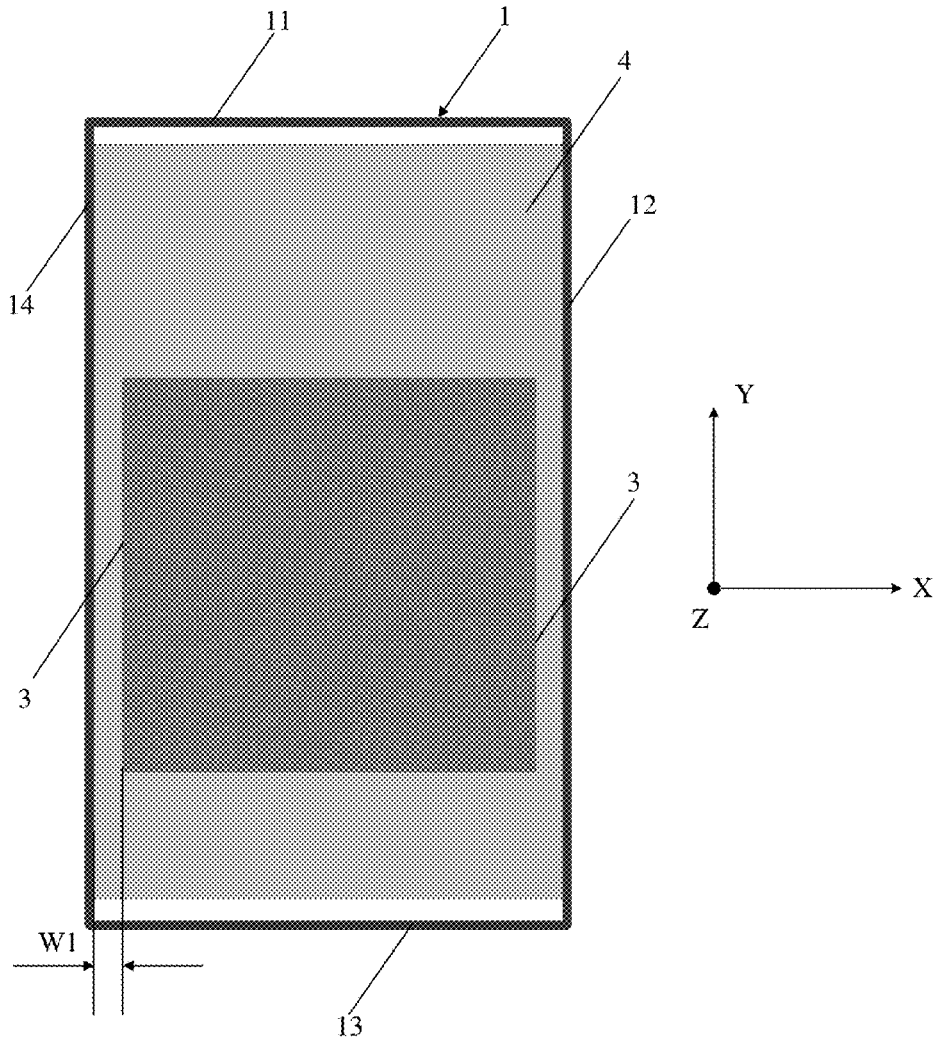
H01Q 1/22 (2006.01)
H05K 5/02 (2006.01)
H05K 5/04 (2006.01)

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

CPC ***H01Q 1/2258*** (2013.01); ***H05K 5/04*** (2013.01); ***H05K 5/0286*** (2013.01)

(57) **ABSTRACT**

A terminal device includes a metal frame. At least two slots are disposed on a side of the metal frame, at least two antenna feedpoints are disposed on an inner side wall of the metal frame, and different antenna feedpoints in the at least two antenna feedpoints are located on side edges of different slots. A signal reflection wall is further disposed inside the terminal device, and a gap exists between the signal reflection wall and the at least two slots. The signal reflection wall is formed by a metal outer wall of a battery of the terminal device. The metal frame and the signal reflection wall are both electrically connected to a ground plate of the terminal device.



US 20210143527A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0143527 A1

CHO et al. (43) Pub. Date: May 13, 2021

(54) **CHIP ANTENNA**

(71) Applicant: **Samsung Electro-Mechanics Co., Ltd.**, Suwon-Si (KR)

(72) Inventors: **Sung Nam CHO**, Suwon-si (KR); **Sung Yong AN**, Suwon-si (KR); **Jae Yeong KIM**, Suwon-si (KR); **Ju Hyoung PARK**, Suwon-si (KR)

(73) Assignee: **SAMSUNG ELECTRO-MECHANICS CO., LTD.**, Suwon-Si (KR)

(21) Appl. No.: **17/151,952**

(22) Filed: **Jan. 19, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/743,453, filed on Jan. 15, 2020, now Pat. No. 10,938,091.

(30) **Foreign Application Priority Data**

Aug. 30, 2019 (KR) 10-2019-0107437

Publication Classification

(51) **Int. Cl.**

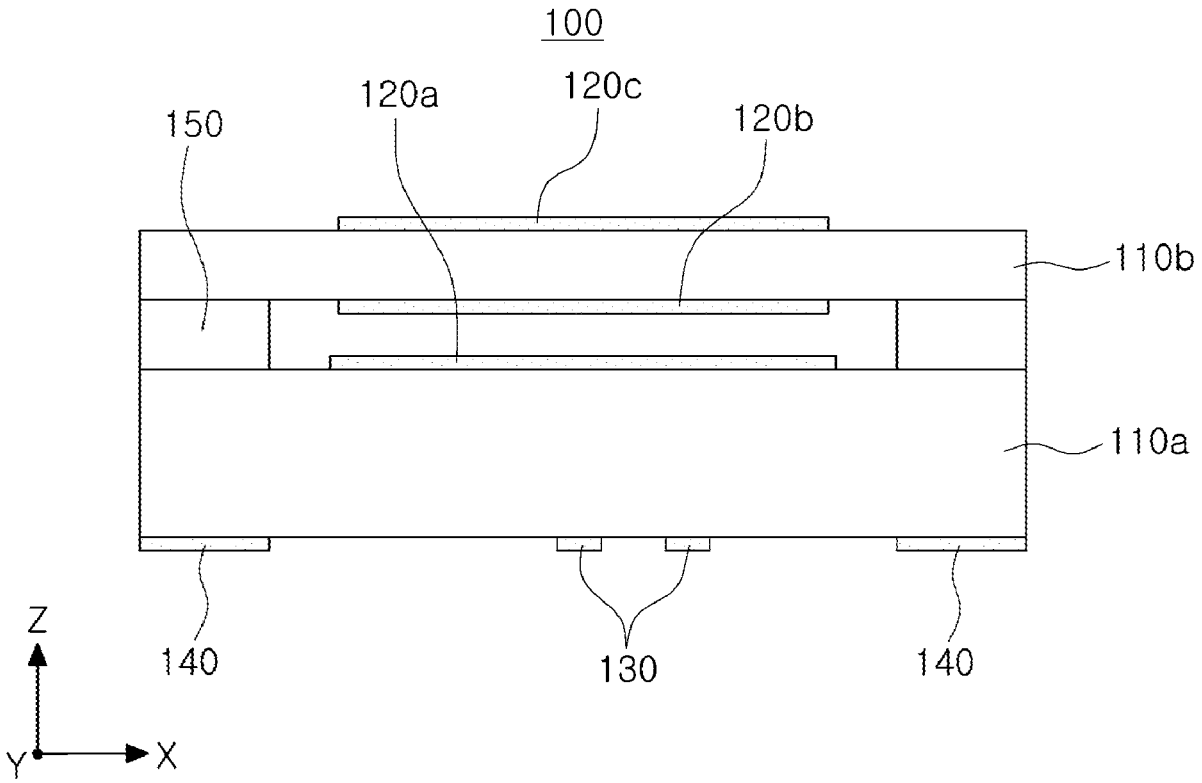
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)

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

CPC ***H01Q 1/2283*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 9/0407*** (2013.01)

(57) **ABSTRACT**

A chip antenna includes a first ceramic substrate, a second ceramic substrate disposed to oppose the first ceramic substrate, a first patch, disposed on the first ceramic substrate, configured to operate as a feed patch, a second patch, disposed on the second ceramic substrate, configured to operate as a radiation patch, an insertion member disposed between the first ceramic substrate and the second ceramic substrate, and a shielding layer disposed on a side surface of the insertion member.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0143529 A1**

HUANG et al. (43) **Pub. Date: May 13, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Chin-Lien HUANG**, Hsinchu (TW); **Kuo-Jen LAI**, Hsinchu (TW)

(21) Appl. No.: **16/867,914**

(22) Filed: **May 6, 2020**

(30) **Foreign Application Priority Data**

Nov. 11, 2019 (TW) 108140790

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(51) **Int. Cl.**

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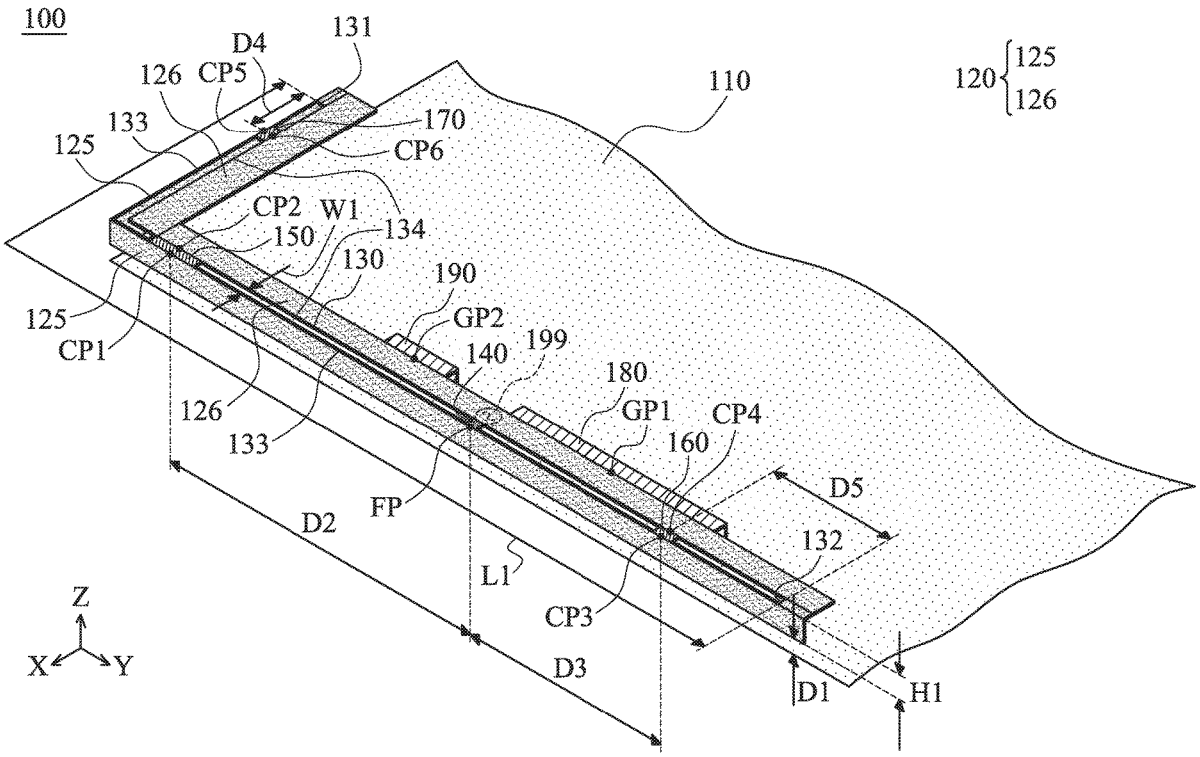
H01Q 9/42	(2006.01)
H01Q 13/10	(2006.01)
H01Q 1/48	(2006.01)
H01Q 5/35	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 5/35*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 13/10*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a ground element, a metal mechanism element, a feeding element, a first connection element, a second connection element, and a shorting element. The metal mechanism element has a slot. The slot has a first edge and a second edge which are opposite to each other. The feeding element extends across the slot. A signal source is coupled through the feeding element to a feeding point on the first edge. The first connection element is coupled between a first connection point on the first edge and a second connection point on the second edge. The second connection element is coupled between a third connection point on the first edge and a fourth connection point on the second edge. A first grounding point on the second edge is coupled through the shorting element to the ground element.



US 20210143551A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0143551 A1

Zekios et al. (43) Pub. Date: May 13, 2021

(54) **ARRAYS WITH FOLDABLE AND DEPLOYABLE CHARACTERISTICS**

(71) Applicants: **Constantinos L. Zekios**, Miami, FL (US); **Stavros Georgakopoulos**, Miami, FL (US); **Muhammad Hamza**, Miami, FL (US)

(72) Inventors: **Constantinos L. Zekios**, Miami, FL (US); **Stavros Georgakopoulos**, Miami, FL (US); **Muhammad Hamza**, Miami, FL (US)

(73) Assignee: **The Florida International University Board of Trustees**, Miami, FL (US)

(21) Appl. No.: **16/680,673**

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

Publication Classification

(51) **Int. Cl.**

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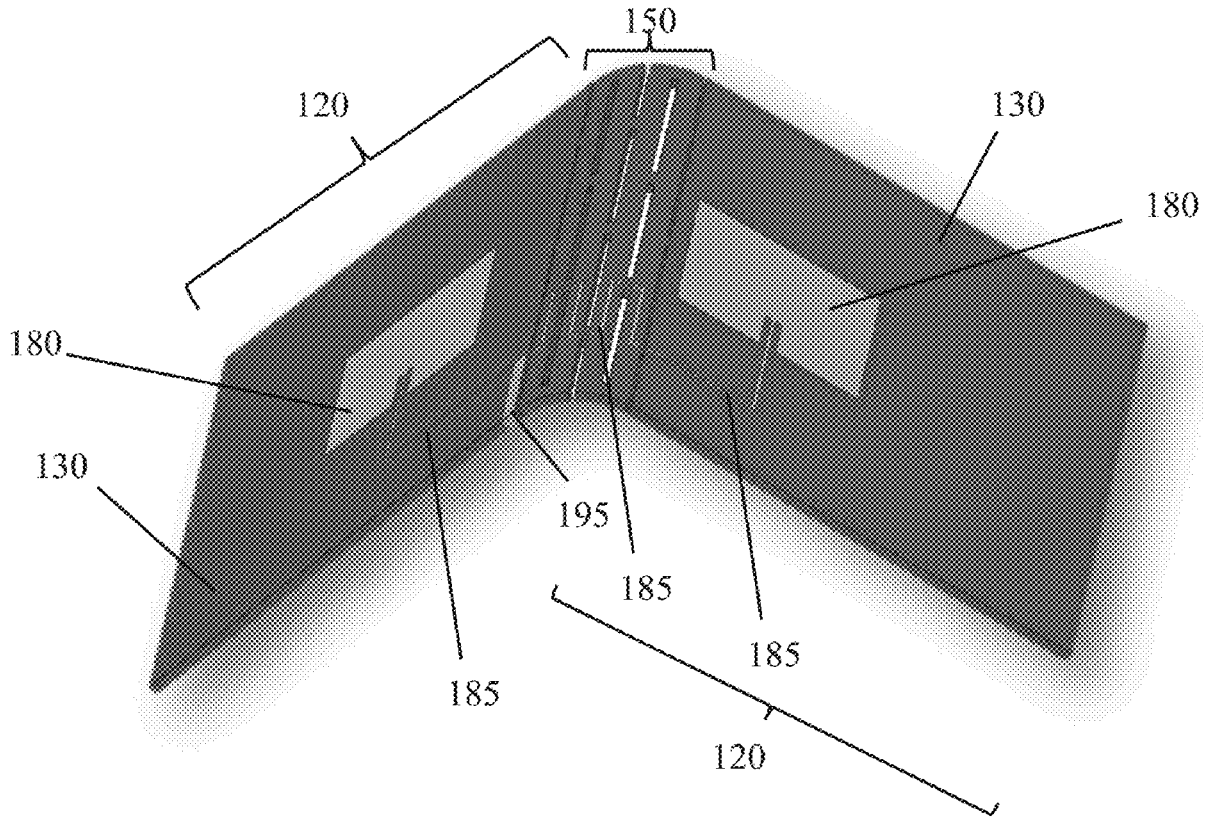
H01Q 9/28	(2006.01)
H01Q 1/38	(2006.01)
H01Q 1/08	(2006.01)

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

CPC ***H01Q 9/0414*** (2013.01); ***H01Q 1/08*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 9/285*** (2013.01)

(57) **ABSTRACT**

Antenna devices are provided, including tightly coupled arrays, transmitarrays, and reflectarrays. An antenna device can include a plurality of substrates each having an antenna element. The substrates can be provided in connected series or in an array. The substrates can be part of an origami array such that the entire array is foldable. The substrates can optionally be attached to a framework that can actuate the substrates to different configurations. By bending, folding, or otherwise repositioning the substrates/array, the electromagnetic characteristics of the antenna device can be easily reconfigured for the desired task.



US 20210143552A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0143552 A1

SHAO et al. (43) Pub. Date: May 13, 2021

(54) **ANTENNA**

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

(72) Inventors: **Jinjin SHAO**, Wuhan (CN); **Zhongyang YU**, Shenzhen (CN)

(21) Appl. No.: **17/155,761**

(22) Filed: **Jan. 22, 2021**

Related U.S. Application Data

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Publication Classification

(51) **Int. Cl.**

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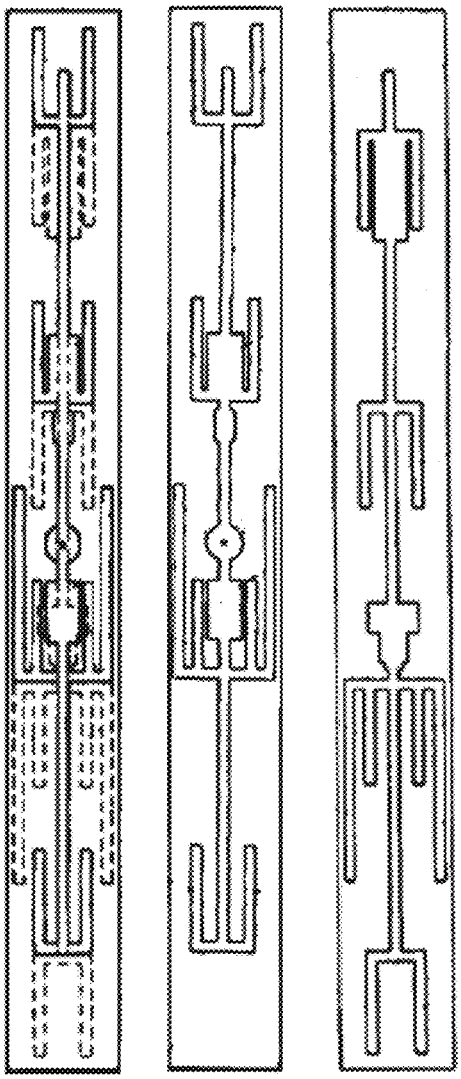
H01Q 11/14	(2006.01)
H01Q 5/371	(2006.01)

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

CPC ***H01Q 9/42*** (2013.01); ***H01Q 5/371*** (2015.01); ***H01Q 11/14*** (2013.01)

(57) **ABSTRACT**

The present disclosure relates to antenna. One example antenna includes a radiating element, a reflecting element, and a radio frequency coaxial cable. The radiating element and the reflecting element are located on a same plane, and the radiating element is connected to the radio frequency coaxial cable. The reflecting element is of a comb structure, the comb structure includes at least two comb teeth, sizes of all the comb teeth are the same, intervals between every two adjacent comb teeth are the same, and a comb-like opening face of the reflecting element is opposite to the radiating element.



US 20210143849A1

(19) **United States**

(12) **Patent Application Publication**

KE et al.

(10) **Pub. No.: US 2021/0143849 A1**

(43) **Pub. Date: May 13, 2021**

(54) **ANTENNA MODULE, TERMINAL, CONTROL METHOD AND DEVICE AND STORAGE MEDIUM**

(71) Applicant: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(72) Inventors: **Changqing KE**, Beijing (CN); **Jiang XIAO**, Beijing (CN)

(73) Assignee: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(21) Appl. No.: **17/152,674**

(22) Filed: **Jan. 19, 2021**

Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

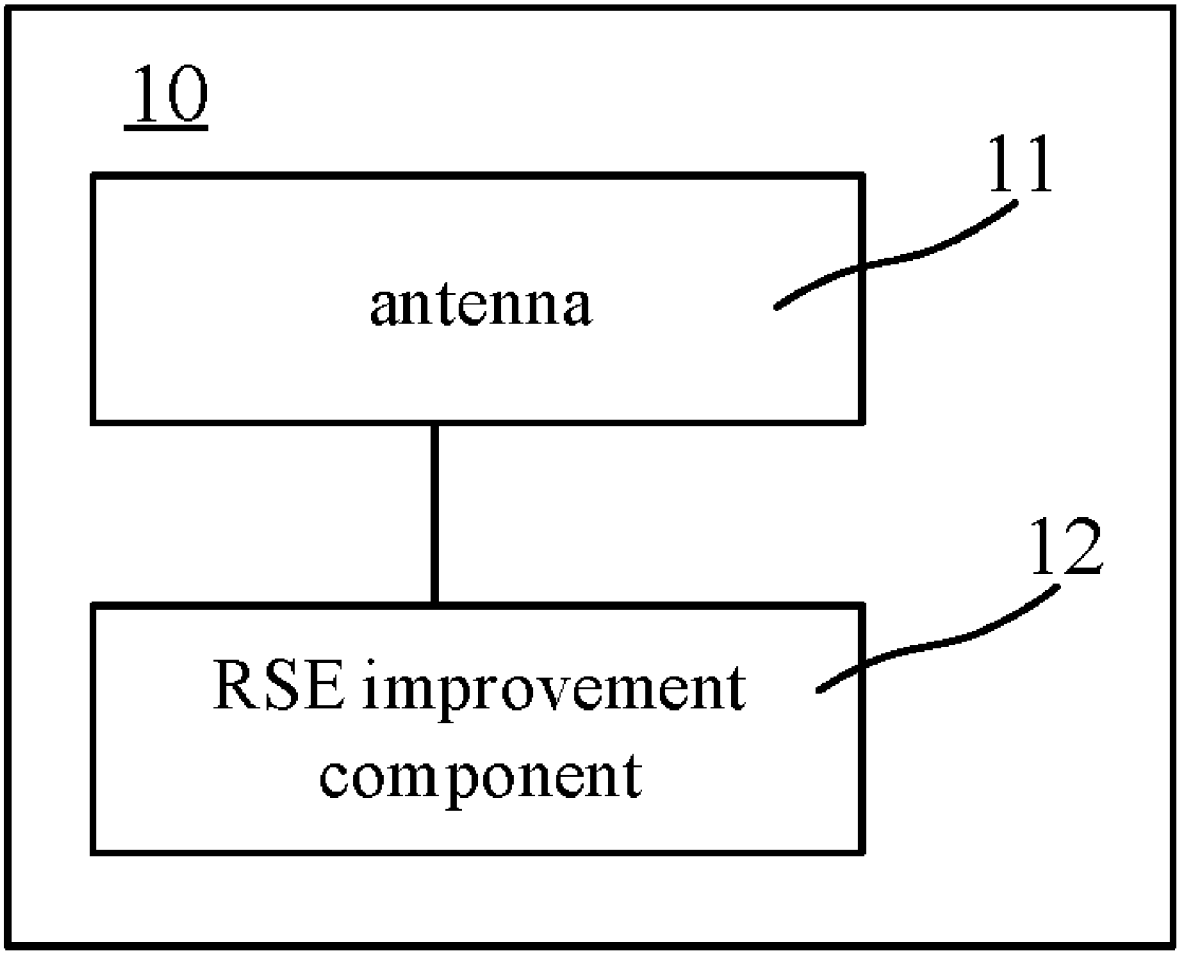
H04B 1/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 23/00 (2006.01)

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

CPC ***H04B 1/0475*** (2013.01); ***H01Q 23/00*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An antenna module for a terminal includes an antenna and a Radiated Spurious Emission (RSE) improvement component. The antenna includes a feed source, a ground point, and at least one radiation arm. The RSE improvement component is coupled to the antenna for suppressing high order harmonics generated by the antenna when the antenna operates in a target frequency band, and includes a radio frequency switch having a terminal connected to the at least one target radiation arm, and another terminal connected to the ground point; or, the radio frequency switch is connected in series into the at least one target radiation arm of the antenna. The at least one target radiation arm is a radiation arm by which the antenna radiates the high order harmonics outward.



US 20210143850A1

(19) **United States**

(12) **Patent Application Publication**

KE et al.

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(54) **ANTENNA MODULE, TERMINAL, CONTROL METHOD AND DEVICE AND STORAGE MEDIUM**

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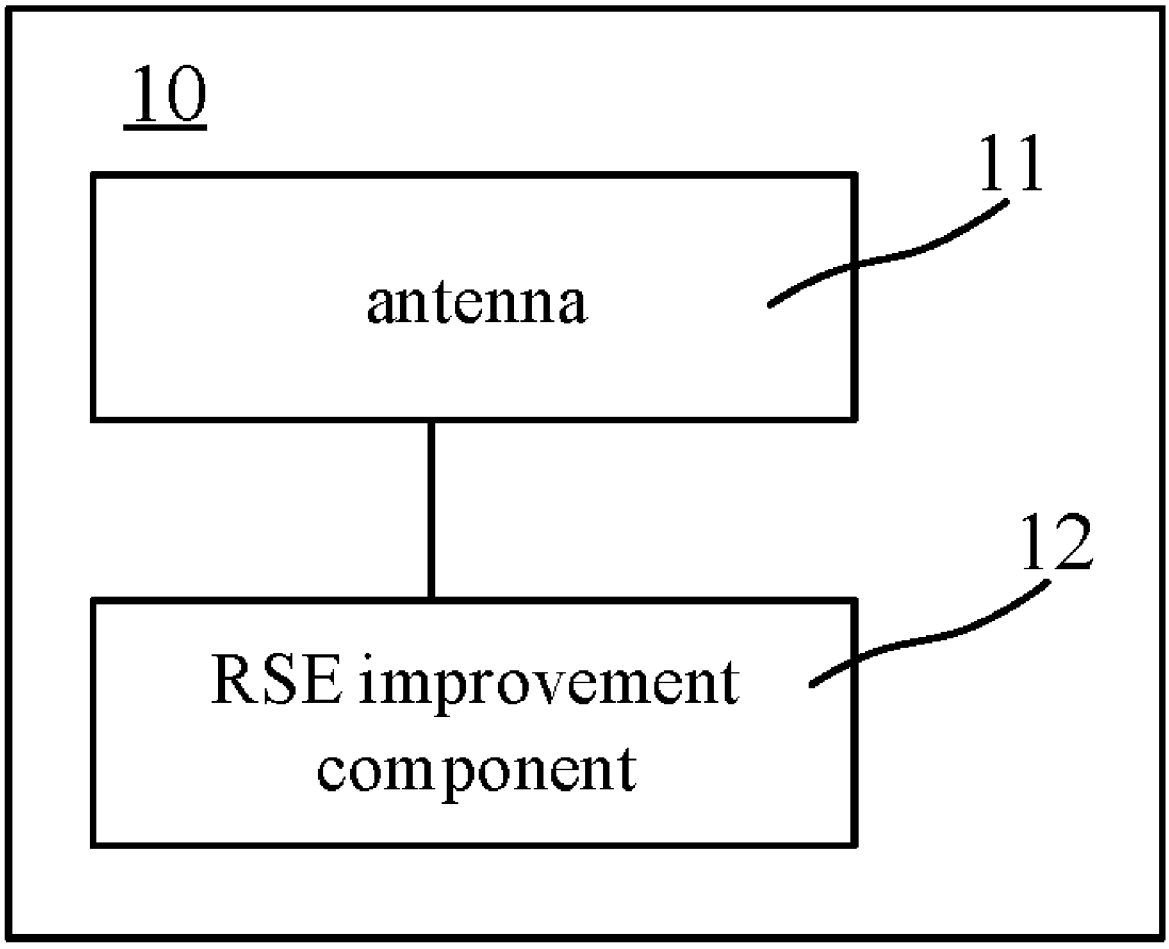
(57) **ABSTRACT**

An antenna module for a terminal includes an antenna and a Radiated Spurious Emission (RSE) improvement component. The antenna includes a feed source, a ground point, and at least one radiation arm. The RSE improvement component is coupled to the antenna for suppressing high order harmonics generated by the antenna when the antenna operates in a target frequency band, and includes a filter circuit configured to suppress the high order harmonics, and a control switch configured to control a working state of the filter circuit. The filter circuit can be a band stop filter circuit. The band stop filter circuit can be connected in series into the at least one target radiation arm of the antenna; or, a terminal of the band stop filter circuit is connected to the at least one target radiation arm of the antenna, and another terminal is connected to the feed source.



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

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(57) **ABSTRACT**

In an embodiment, an electronic device may include a housing including a hinge module, a first housing, and second housing. The first and second housings are rotatably coupled to each other via the hinge module to be in a folded state or an unfolded state. The electronic device may further include a flexible display, at least one conductive pattern disposed in the first housing, at least one conductor disposed at a position in the second housing corresponding to the at least one conductive pattern such that the at least one conductor is capacitively coupled to the conductive pattern when the electronic device is in the folded state, and a wireless communication circuit electrically connected to the at least one conductive pattern in the first housing. Other embodiments are also possible.