



US 20240204391A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0204391 A1**
Niakan (43) **Pub. Date: Jun. 20, 2024**

(54) **ELECTRONIC DEVICE FRAME ANTENNAS**

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

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

CPC **H01Q 1/273** (2013.01); **G02B 27/0172** (2013.01); **G02B 2027/0178** (2013.01)

(72) Inventor: **Nahal Niakan**, Santa Clara, CA (US)

(57) **ABSTRACT**

(21) Appl. No.: **18/505,715**

A head-mounted device may include displays that display images to a user while worn. The device may include a conductive frame having a front portion and temple portions. Waveguides may be mounted to the front portion for directing image light to eye boxes. Projectors that emit the image light may be coupled to the temple portions. The frame may include gaps that divide the frame into segments. Two or more of the segments may be fed radio-frequency signals to form one or more antennas in the temple portions, the front portion, or between the temple portions and front portion and/or to form isolation elements. A conductive ring may be disposed between the waveguide and a transparent layer and may extend along a lateral periphery of the waveguide to form one or more conductors for one or more antennas and/or isolation elements between two or more antennas.

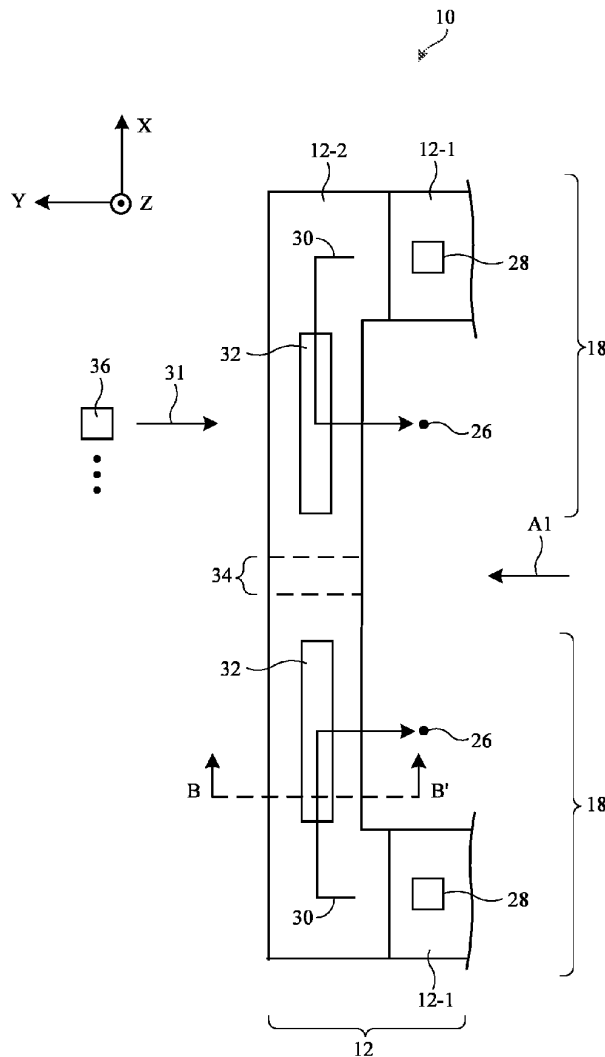
(22) Filed: **Nov. 9, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/476,371, filed on Dec. 20, 2022.

Publication Classification

(51) **Int. Cl.**
H01Q 1/27 (2006.01)
G02B 27/01 (2006.01)





US 20240204397A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0204397 A1**

(43) **Pub. Date: Jun. 20, 2024**

(54) **INTEGRATED ANTENNA STRUCTURE**

Publication Classification

(71) Applicant: **CHILISIN ELECTRONICS CORP.**,
Hsinchu County (TW)

(51) **Int. Cl.**
H01Q 1/52 (2006.01)

H01Q 1/48 (2006.01)

H01Q 5/307 (2006.01)

H01Q 9/04 (2006.01)

(72) Inventors: **SHENG-CHE CHANG**, TAOYUAN
CITY (TW); **HENG-MING LEE**,
TAOYUAN CITY (TW); **HSIEN-YU
CHIU**, TAOYUAN CITY (TW);
SHAO-FU LO, TAOYUAN CITY
(TW)

(52) **U.S. Cl.**
CPC **H01Q 1/521** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/307** (2015.01); **H01Q
9/0407** (2013.01)

(21) Appl. No.: **18/129,937**

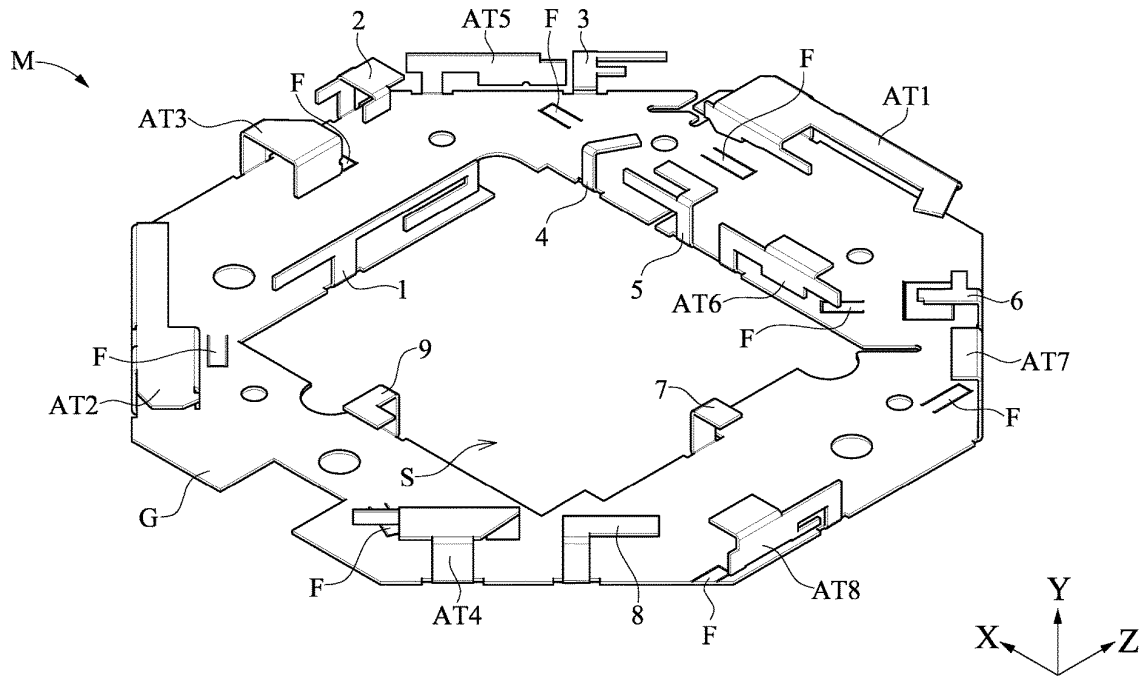
(57) **ABSTRACT**

(22) Filed: **Apr. 3, 2023**

An integrated antenna structure includes a grounding element, a plurality of antenna elements, and a plurality of isolators. The grounding element has an opening. The antenna elements and the isolators are disposed at an outer edge of the grounding element and an edge of the opening. The isolators are located between the antenna elements. Orthogonal projections of the antenna elements and the isolators completely overlap with the grounding element.

(30) **Foreign Application Priority Data**

Dec. 20, 2022 (TW) 111148827





US 20240204406A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0204406 A1**

(43) **Pub. Date: Jun. 20, 2024**

(54) **COUPLED CHASSIS ANTENNA SYSTEM**

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

(71) Applicant: **Microsoft Technology Licensing, LLC,**
Redmond, WA (US)

CPC **H01Q 5/307** (2015.01); **H01Q 1/2266**
(2013.01); **H01Q 9/0421** (2013.01)

(72) Inventors: **Marc HARPER,** Snohomish, WA (US);
Nazy RANJKESH, Redmond, WA (US)

(57) **ABSTRACT**

A computing device includes a first metal computing device chassis component including an aperture, a second metal computing device chassis component including a display, and a hinge connector mechanically and movably connecting the second metal computing device chassis component to the first metal computing device chassis component. The computing device includes a primary antenna positioned within the first metal computing device chassis component, the primary antenna being configured to radiate radiofrequency signals at a first radiofrequency bandwidth through the aperture in the first metal computing device chassis component and to capacitively couple to the second metal computing device chassis component to radiate radiofrequency signals at a second radiofrequency bandwidth.

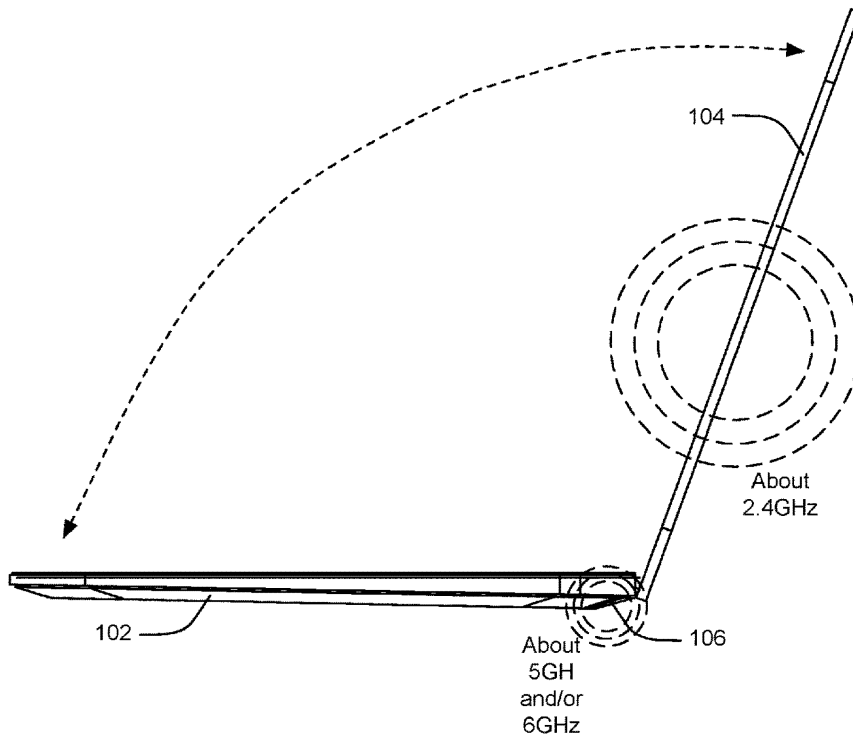
(21) Appl. No.: **18/067,468**

(22) Filed: **Dec. 16, 2022**

Publication Classification

(51) **Int. Cl.**
H01Q 5/307 (2006.01)
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)

100 →





US 20240204409A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0204409 A1**

(43) **Pub. Date: Jun. 20, 2024**

(54) **ANTENNA AND DISPLAY APPARATUS**

Publication Classification

(71) Applicants: **Beijing BOE Technology Development Co., Ltd.**, Beijing (CN); **BOE Technology Group Co., Ltd.**, Beijing (CN)

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/22 (2006.01)

(72) Inventors: **Yali Wang**, Beijing (CN); **Feng Qu**, Beijing (CN)

(52) **U.S. Cl.**
CPC **H01Q 9/0407** (2013.01); **H01Q 1/22** (2013.01)

(73) Assignees: **Beijing BOE Technology Development Co., Ltd.**, Beijing (CN); **BOE Technology Group Co., Ltd.**, Beijing (CN)

(57) **ABSTRACT**

An antenna is provided. The antenna includes a ground plate; a dielectric layer on the ground plate; and a microstrip feed line and a radiating patch on a side of the dielectric layer away from the ground plate, the radiating patch being coupled to the microstrip feed line and configured to receive a signal from the microstrip feed line. The radiating patch includes a main body having a parallelogram shape with a first notch truncating a corner of the parallelogram shape, at least a portion of the main body truncated by the first notch having an arc-shaped contour line. The radiating patch further includes a first branch structure.

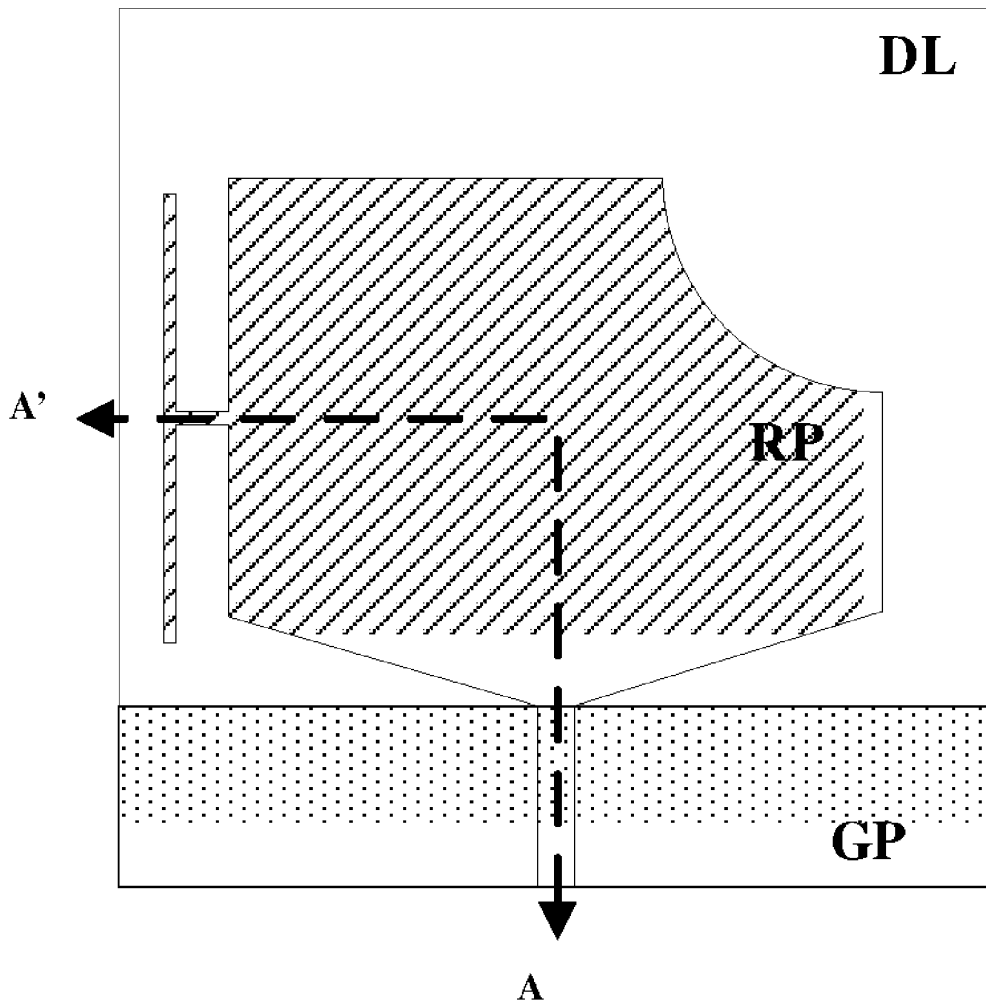
(21) Appl. No.: **17/904,255**

(22) PCT Filed: **Nov. 17, 2021**

(86) PCT No.: **PCT/CN2021/131070**

§ 371 (c)(1),

(2) Date: **Aug. 15, 2022**





US 20240204410A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0204410 A1**

(43) **Pub. Date: Jun. 20, 2024**

(54) **ANTENNA AND COMMUNICATION DEVICE**

Publication Classification

(71) Applicant: **ZTE Corporation**, Shenzhen (CN)

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

(72) Inventors: **Hongbo JING**, Shenzhen (CN); **Fei CAO**, Shenzhen (CN); **Dianping XU**, Shenzhen (CN); **Jianqiang CHEN**, Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H01Q 9/0407** (2013.01); **H01Q 1/38** (2013.01)

(21) Appl. No.: **18/593,769**

(57) **ABSTRACT**

(22) Filed: **Mar. 1, 2024**

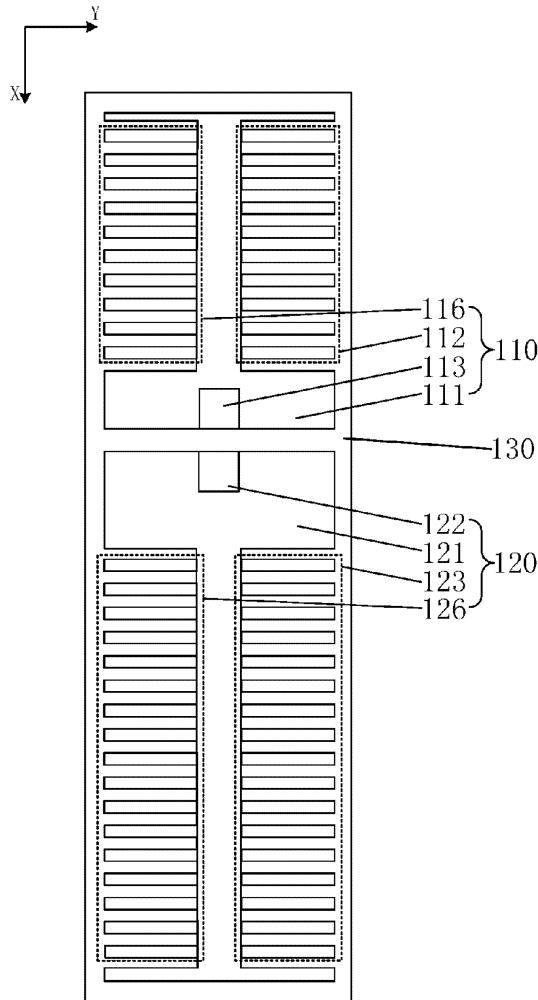
An antenna includes a first patch and a second patch, where one of the first patch and the second patch is a choke patch, and the other one of the first patch and the second patch is a radiation patch. The first patch includes a first body, a first periodic slow wave line structure, and a first pad, the first body is provided with a first side and is provided with a first accommodating notch on the first side, and the first periodic slow wave line structure is located within the first accommodating notch and connected with an edge of the first accommodating notch. The second patch includes a second body and a second pad. In addition, embodiments of the disclosed technology further provide a communication device that includes the antenna.

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2022/105565, filed on Jul. 13, 2022.

Foreign Application Priority Data

(30) Sep. 3, 2021 (CN) 202111034321.X





US 20240204412A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0204412 A1**

(43) **Pub. Date: Jun. 20, 2024**

(54) **ANTENNA MODULE AND COMMUNICATION DEVICE MOUNTED WITH SAME**

(71) Applicants: **National University Corporation Saitama University**, Saitama-shi (JP); **Murata Manufacturing Co., Ltd.**, Nagaokakyo-shi (JP)

(72) Inventors: **Masataka OHIRA**, Saitama-shi (JP); **Kaoru SUDO**, Nagaokakyo-shi (JP); **Yoshinori TAGUCHI**, Nagaokakyo-shi (JP)

(73) Assignees: **National University Corporation Saitama University**, Saitama-shi (JP); **Murata Manufacturing Co., Ltd.**, Nagaokakyo-shi (JP)

(21) Appl. No.: **18/591,003**

(22) Filed: **Feb. 29, 2024**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2022/029670, filed on Aug. 2, 2022.

Foreign Application Priority Data

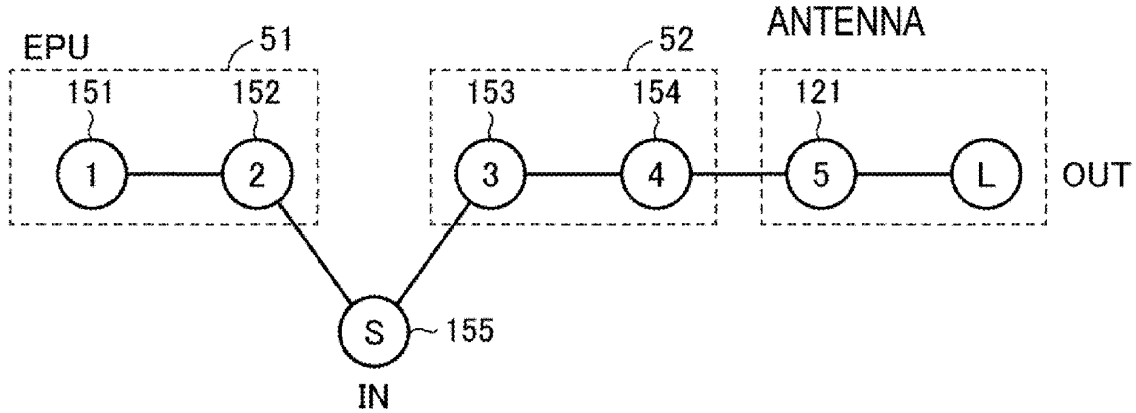
Aug. 30, 2021 (JP) 2021-139853

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01P 1/20 (2006.01)
H01Q 1/24 (2006.01)
H01Q 23/00 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 9/0442* (2013.01); *H01Q 1/243* (2013.01); *H01Q 23/00* (2013.01); *H01P 1/20* (2013.01)

(57) **ABSTRACT**

An antenna module includes a dielectric substrate, a radiating element that is arranged in the dielectric substrate, ground electrodes that are arranged to be opposed to the radiating element, and a resonance circuit. The resonance circuit is arranged between the radiating element and the ground electrode and includes resonators. The radiating element and the resonance circuit constitute a filter device. The resonance circuit includes an input line that receives a radio frequency signal from an RFIC, a resonance portion that is coupled with the input line, and a resonance portion that is coupled with the input line and the radiating element. The ground electrode is arranged between the radiating element and the input line. The resonance portion functions as an extracted pole unit. The input line is arranged between the resonance portion and the resonance portion.





US 20240211716A1

(19) **United States**

(12) **Patent Application Publication**
ALI

(10) **Pub. No.: US 2024/0211716 A1**

(43) **Pub. Date: Jun. 27, 2024**

(54) **CHIP CARD WITH RADIO-FREQUENCY ANTENNAS**

Publication Classification

(71) Applicant: **IDEMIA FRANCE**, Courbevoie (FR)

(51) **Int. Cl.**
G06K 19/077 (2006.01)

(72) Inventor: **Ahmed ALI**, Courbevoie (FR)

(52) **U.S. Cl.**
CPC . **G06K 19/07722** (2013.01); **G06K 19/07773** (2013.01)

(73) Assignee: **IDEMIA FRANCE**, Courbevoie (FR)

(57) **ABSTRACT**

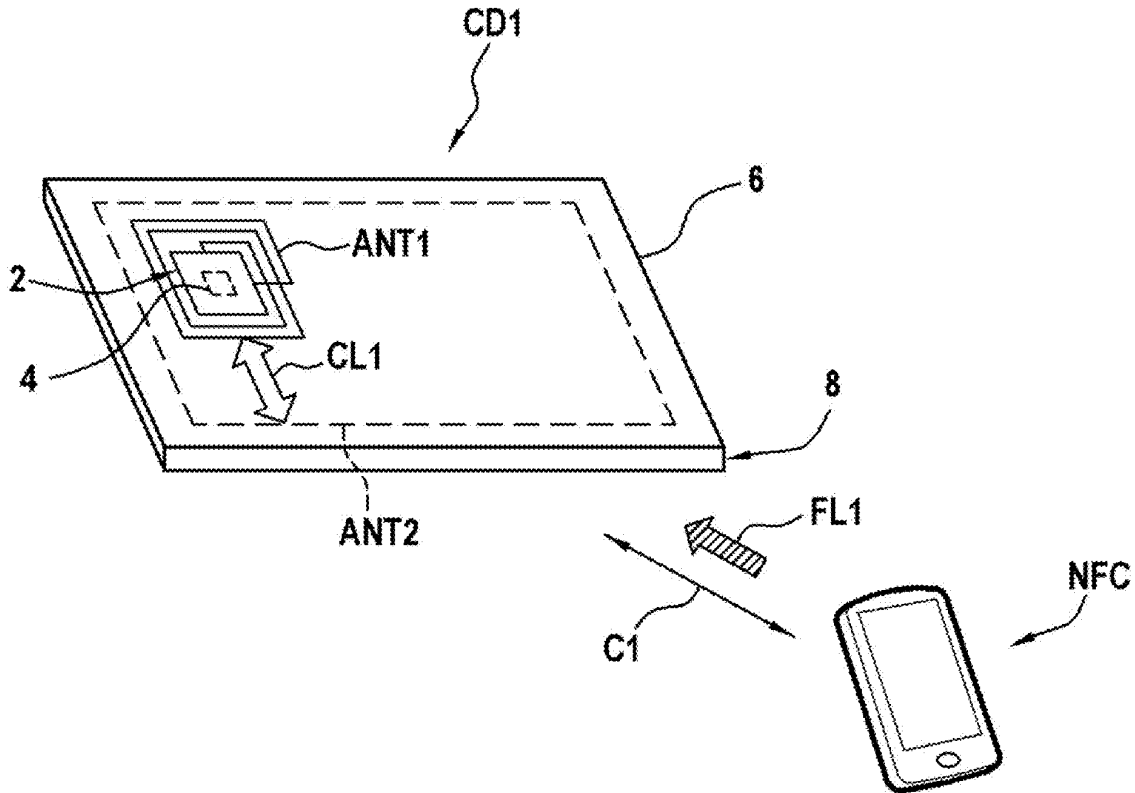
(21) Appl. No.: **18/545,287**

A chip card including a card body including a metal layer, an RF chip, and a first RF antenna placed in a cut-out zone and connected to the chip. The metal layer has two regions, the first region completely containing the cut-out zone. A first slit connects the cut-out zone to an edge of the first region, a second slit opens onto an edge of the layer or into the cut-out zone and ends in the second region. A second RF antenna allows coupling to the first antenna. The chip card includes at least one turn facing the first slit and at least one turn facing the second slit.

(22) Filed: **Dec. 19, 2023**

(30) **Foreign Application Priority Data**

Dec. 23, 2022 (FR) 22 14390





US 20240213643A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0213643 A1**

(43) **Pub. Date: Jun. 27, 2024**

(54) **WAVEGUIDE, METHOD OF
MANUFACTURING WAVEGUIDE AND
ANTENNA**

(52) **U.S. Cl.**
CPC . **H01P 3/02** (2013.01); **H01P 1/02** (2013.01)

(71) Applicant: **Waseda University**, Tokyo (JP)

(57) **ABSTRACT**

(72) Inventors: **Seiji NISHI**, Tokyo (JP); **Takuro SATO**, Tokyo (JP); **Kazuhiko TAMESUE**, Tokyo (JP); **Tetsuya KAWANISHI**, Tokyo (JP)

(21) Appl. No.: **18/169,211**

(22) Filed: **Feb. 15, 2023**

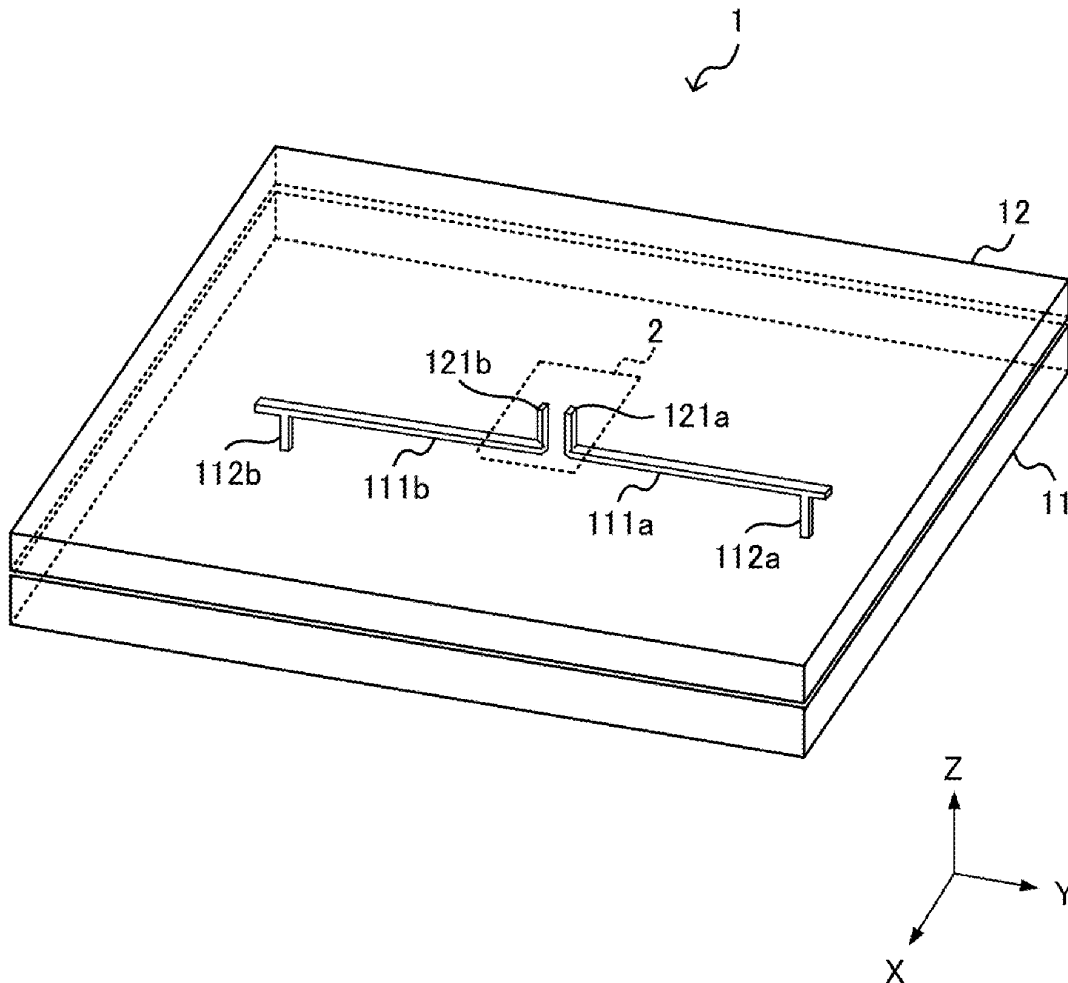
(30) **Foreign Application Priority Data**

Dec. 26, 2022 (JP) 2022-208578

Publication Classification

(51) **Int. Cl.**
H01P 3/02 (2006.01)
H01P 1/02 (2006.01)

The first conductor plate has a groove portion that has a rectangular cross section and is formed in parallel with a first main surface such that the longitudinal direction becomes a first direction, and a first vertical tube portion formed in a direction away from the second conductor plate in a second direction orthogonal to the first direction and the first main surface, with a branch position in the groove as a starting point. The second conductor plate includes a reflection portion that is inserted into the groove portion in a manner protruding from a second main surface, which is a flat surface of the second conductor plate in contact with the first main surface, and has a reflection surface that reflects the radio wave, propagated along the groove portion, toward the first vertical tube portion.





US 20240213680A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0213680 A1**

(43) **Pub. Date: Jun. 27, 2024**

(54) **ANTENNA DEVICE AND COMMUNICATION DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 21/28 (2006.01)

(72) Inventors: **Takaya NEMOTO**, Nagaokakyo-shi (JP); **Hideki UEDA**, Nagaokakyo-shi (JP); **Kengo ONAKA**, Nagaokakyo-shi (JP)

(52) **U.S. Cl.**
CPC *H01Q 9/0407* (2013.01); *H01Q 21/28* (2013.01)

(73) Assignee: **Murata Manufacturing Co., Ltd.**,
Nagaokakyo-shi (JP)

(57) **ABSTRACT**

(21) Appl. No.: **18/597,941**

An antenna device includes a casing including an inner surface including connected first and second regions with a corner therebetween. A first antenna opposes the first region with a gap therebetween, and a second antenna opposes the second region with a gap therebetween. A first waveguide extends from the first antenna toward the first region, and a second waveguide extends from the second antenna toward the second region. In a perpendicular projection of an end surface of the first waveguide closest to the first antenna on a plane including the first region, an end surface of the waveguide closest to the inner surface is adjacent to the first corner. In a perpendicular projection of an end surface of the second waveguide closest to the second antenna on a plane including the second region, an end surface of the second waveguide closest to the inner surface is adjacent to the corner.

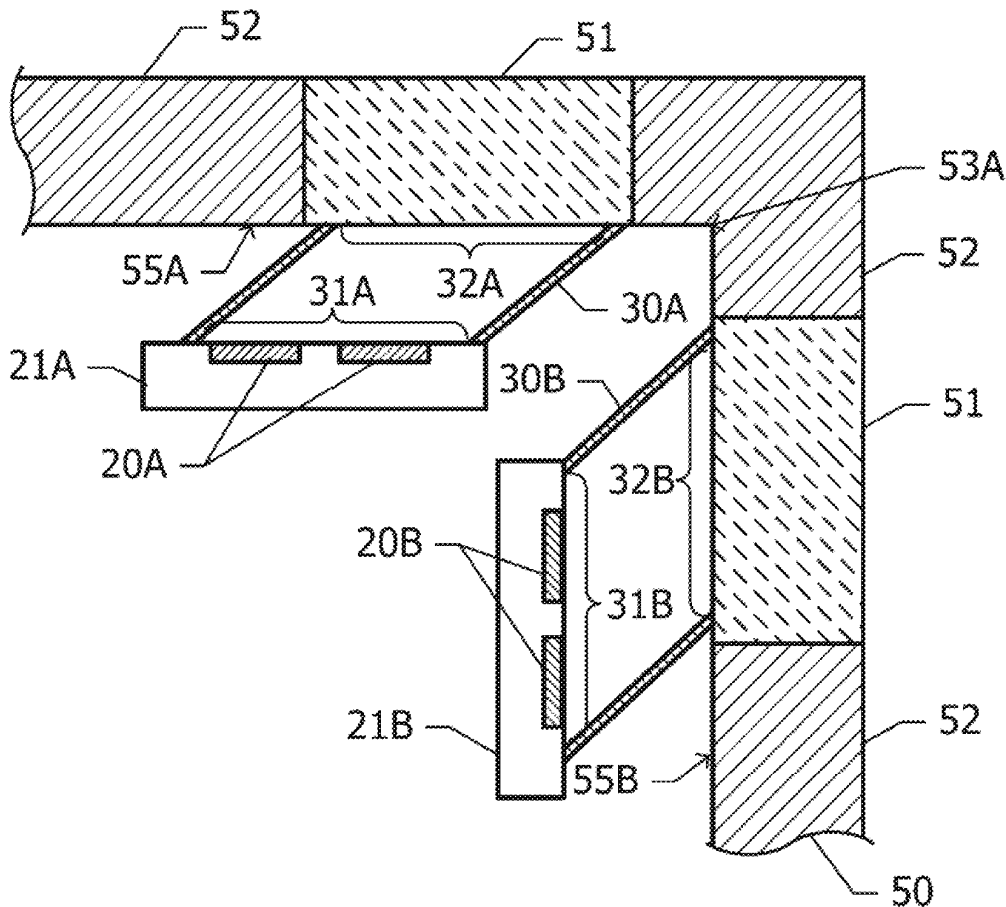
(22) Filed: **Mar. 7, 2024**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2022/033463, filed on Sep. 6, 2022.

Foreign Application Priority Data

(30) Sep. 28, 2021 (JP) 2021-157779





US 20240213682A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0213682 A1**

(43) **Pub. Date: Jun. 27, 2024**

(54) **DECOUPLED MULTI-BAND MICROSTRIP PATCH ANTENNAS**

Publication Classification

(71) Applicants: **Constantinos L. Zekios**, Miami, FL (US); **Stavros Georgakopoulos**, Miami, FL (US); **Nicholas E. Russo**, Miami, FL (US)

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/378 (2015.01)
(52) **U.S. Cl.**
CPC *H01Q 9/0421* (2013.01); *H01Q 5/378* (2015.01)

(72) Inventors: **Constantinos L. Zekios**, Miami, FL (US); **Stavros Georgakopoulos**, Miami, FL (US); **Nicholas E. Russo**, Miami, FL (US)

(57) **ABSTRACT**

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

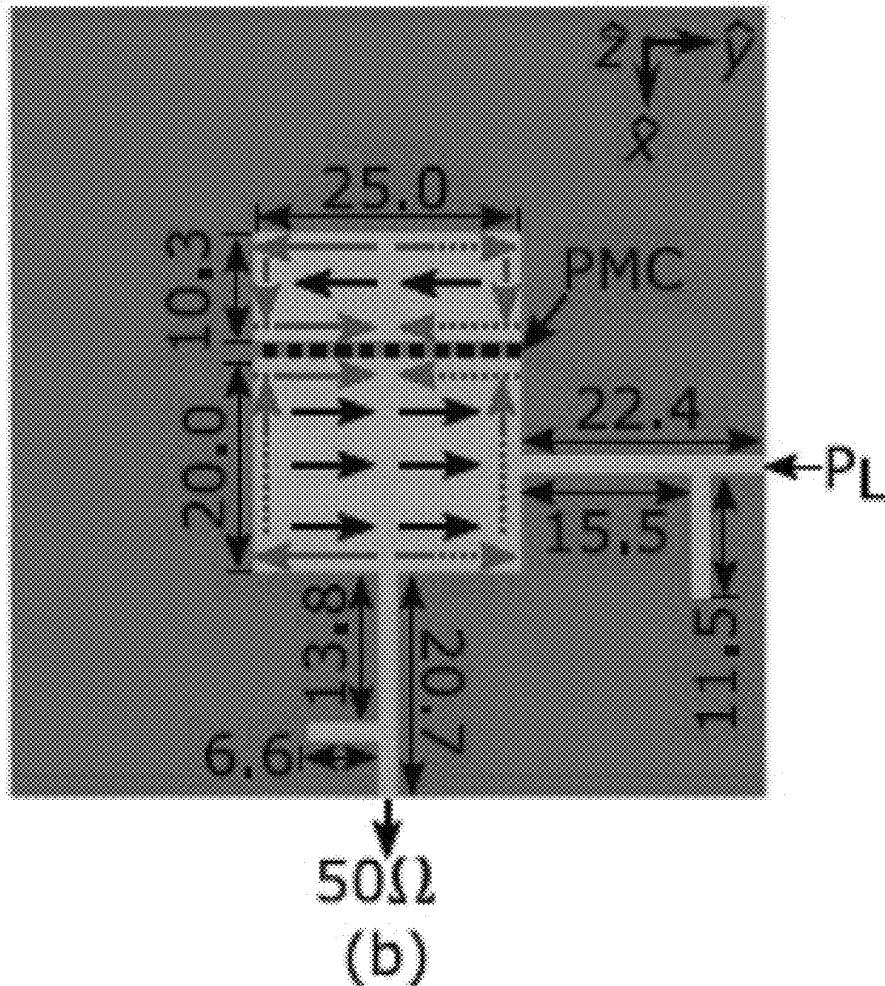
Multi-band, microstrip patch antennas, as well as methods of fabricating the same and methods of using the same, are provided. A decoupling technique can be used where strategically etched slots are provided between the tightly coupled microstrip patch antennas, and the appropriate mode excitation of the corresponding patch antennas can be used. The antennas have high isolation between the frequency bands of operation. Multi-band operation can be achieved by exciting a different mode on each contiguous portion of the patch antenna.

(21) Appl. No.: **17/810,889**

(22) Filed: **Jul. 6, 2022**

Related U.S. Application Data

(60) Provisional application No. 63/218,743, filed on Jul. 6, 2021.





(19) **United States**

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

(10) **Pub. No.: US 2024/0222844 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **ANTENNA DEVICE BASED ON TRANSPARENT SUBSTRATE AND METHOD OF CONFIGURING ANTENNA DEVICE**

H01Q 1/48 (2006.01)
H01Q 13/10 (2006.01)

(52) **U.S. Cl.**
CPC *H01Q 1/1285* (2013.01); *H01Q 1/38* (2013.01); *H01Q 1/48* (2013.01); *H01Q 13/106* (2013.01)

(71) Applicant: **Industrial Technology Research Institute, Hsinchu (TW)**

(72) Inventors: **Wei-Chung Chen**, Kaohsiung City (TW); **Liyang Tsai**, Yilan County (TW); **Kuang-Hui Shih**, Tainan City (TW); **Ruo-Lan Chang**, New Taipei City (TW); **Mei-Ju Lee**, Hsinchu City (TW)

(57) **ABSTRACT**

An antenna device based on a transparent substrate and a method of configuring an antenna device are provided. The antenna device includes a transparent substrate, a first dielectric layer, and an antenna. The transparent substrate includes a first surface and a second surface opposite to the first surface. The first dielectric layer includes a third surface and a fourth surface opposite to the third surface, wherein the first dielectric layer is in contact with the first surface via the third surface to be disposed on the transparent substrate, wherein a permittivity of the first dielectric layer is less than a permittivity of the transparent substrate. The antenna includes a radiation part, wherein the radiation part is disposed on one of the second surface and the fourth surface.

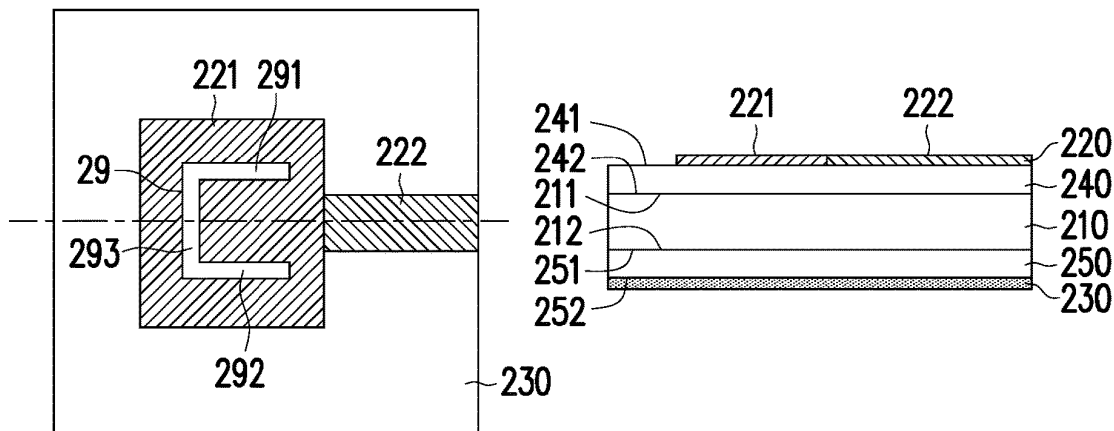
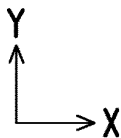
(73) Assignee: **Industrial Technology Research Institute, Hsinchu (TW)**

(21) Appl. No.: **18/090,507**

(22) Filed: **Dec. 29, 2022**

Publication Classification

(51) **Int. Cl.**
H01Q 1/12 (2006.01)
H01Q 1/38 (2006.01)





US 20240222845A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222845 A1**

(43) **Pub. Date: Jul. 4, 2024**

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

Publication Classification

(71) Applicant: **Huawei Technologies Co., Ltd.**,
Shenzhen (CN)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 19/10 (2006.01)
H01Q 21/30 (2006.01)

(72) Inventors: **Yongchao Wang**, Xi'an (CN); **Yu Yao**,
Shanghai (CN)

(52) **U.S. Cl.**
CPC **H01Q 1/2258** (2013.01); **H01Q 19/10**
(2013.01); **H01Q 21/30** (2013.01)

(21) Appl. No.: **18/558,045**

(57) **ABSTRACT**

(22) PCT Filed: **Apr. 18, 2022**

An antenna array includes a plurality of first antenna elements and second antenna element(s). The first antenna elements operate at least in a first frequency band and a second frequency band, and any frequency in the second frequency band is higher than any frequency in the first frequency band. The second antenna element(s) operate at least in a third frequency band, and the third frequency band at least partially overlaps the second frequency band. The first antenna elements are arranged at intervals, and the second antenna element(s) is/are disposed between at least two adjacent first antenna elements. A center distance between every two adjacent first antenna elements is within a preset size range, so that a gain of the antenna array in the first frequency band is greater than or equal to a target value.

(86) PCT No.: **PCT/CN2022/087471**

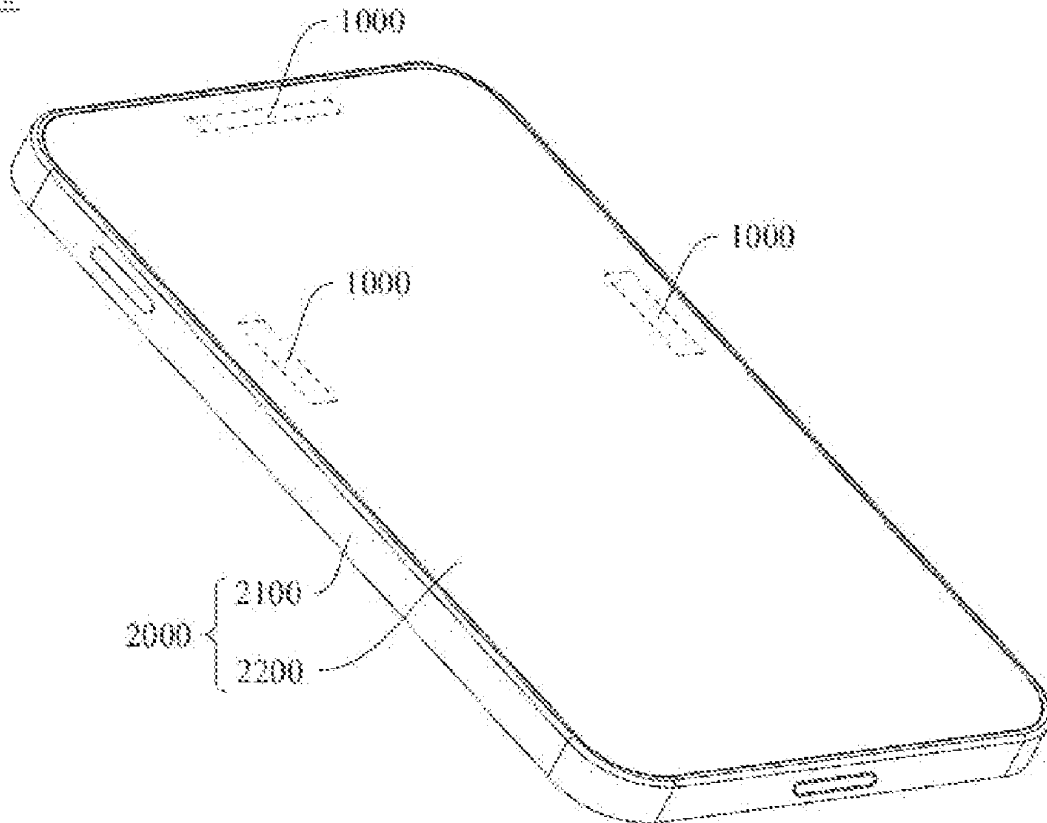
§ 371 (c)(1),

(2) Date: **Oct. 30, 2023**

(30) **Foreign Application Priority Data**

Apr. 30, 2021 (CN) 202110482045.7

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US 20240222854A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222854 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **CEILING ANTENNA**

Publication Classification

(71) Applicants: **BEIJING BOE SENSOR TECHNOLOGY CO., LTD.**, Beijing (CN); **BOE TECHNOLOGY GROUP CO., LTD.**, Beijing (CN)

(51) **Int. Cl.**
H01Q 1/36 (2006.01)
H01Q 1/12 (2006.01)
H01Q 19/10 (2006.01)

(72) Inventors: **Yunnan Jin**, Beijing (CN); **Shuo Yang**, Beijing (CN); **Zhe Chen**, Beijing (CN); **Lei Wang**, Beijing (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/36* (2013.01); *H01Q 1/12* (2013.01); *H01Q 19/104* (2013.01)

(73) Assignees: **BEIJING BOE SENSOR TECHNOLOGY CO., LTD.**, Beijing (CN); **BOE TECHNOLOGY GROUP CO., LTD.**, Beijing (CN)

(57) **ABSTRACT**

The ceiling antenna includes a reflecting bottom plate, wherein the reflecting bottom plate has a via hole; a supporting plate, wherein the supporting plate is fixed to the reflecting bottom plate, and a plane where the supporting plate is located is perpendicular to a plane where the reflecting bottom plate is located; a radiation oscillator, wherein the radiation oscillator is adhered to the supporting plate, the radiation oscillator includes a first radiator, the first radiator has a grid-line-like structure, and a shape of an outer contour of the first radiator is a rectangle having at least one cut corner; and a connector, wherein the connector is located on one side of the reflecting bottom plate that is away from the radiation oscillator, the via hole exposes a part of area of the connector, and the connector is electrically connected to the radiation oscillator through the via hole.

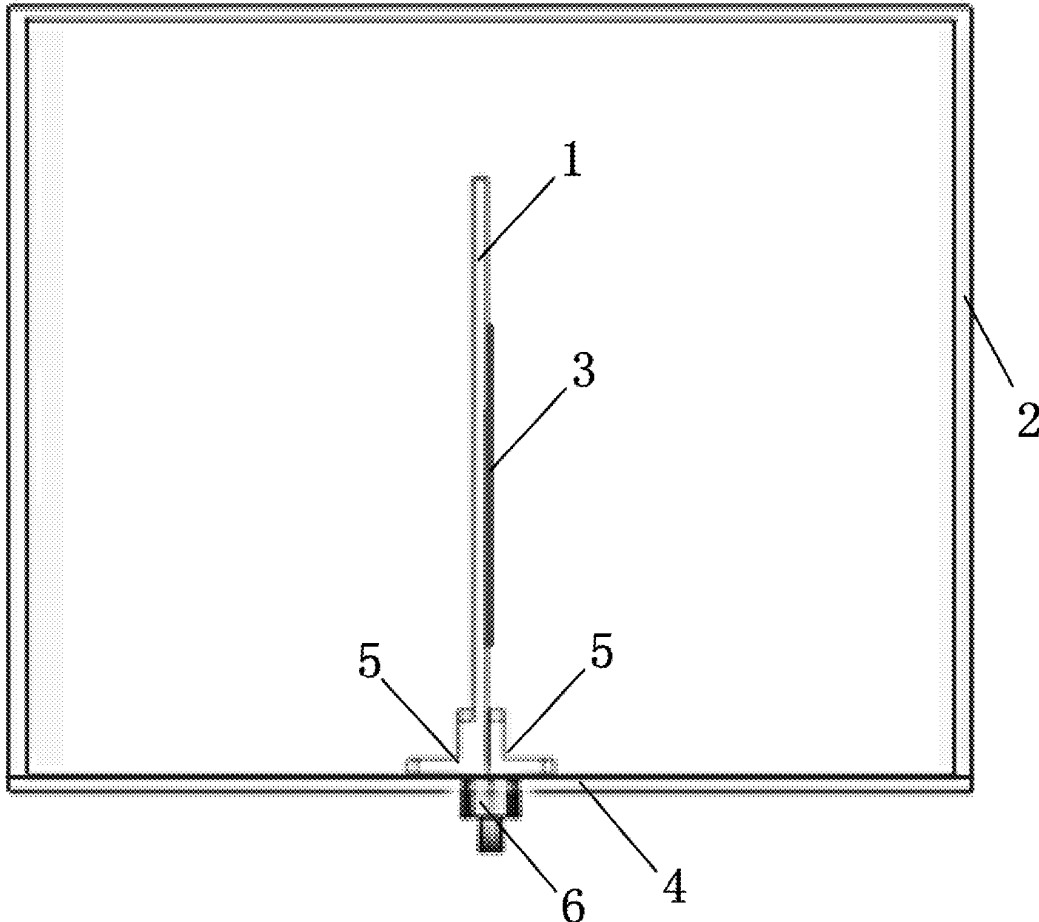
(21) Appl. No.: **17/923,751**

(22) PCT Filed: **Dec. 23, 2021**

(86) PCT No.: **PCT/CN2021/140928**

§ 371 (c)(1),

(2) Date: **Nov. 7, 2022**





US 20240222864A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222864 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **MULTI-WIDEBAND COLLINEAR DIPOLE ANTENNA**

H01Q 5/30 (2006.01)

H03H 7/38 (2006.01)

(71) Applicant: **Norsat International Inc.**, Richmond (CA)

(52) **U.S. Cl.**
CPC *H01Q 5/15* (2015.01); *H01Q 1/42* (2013.01); *H01Q 5/30* (2015.01); *H03H 7/38* (2013.01)

(72) Inventors: **Xiufeng Shi**, Ottawa (CA); **Yazi Cao**, Newmarket (CA); **Tong Li**, Aurora (CA)

(73) Assignee: **Norsat International Inc.**, Richmond, BC (CA)

(57) **ABSTRACT**

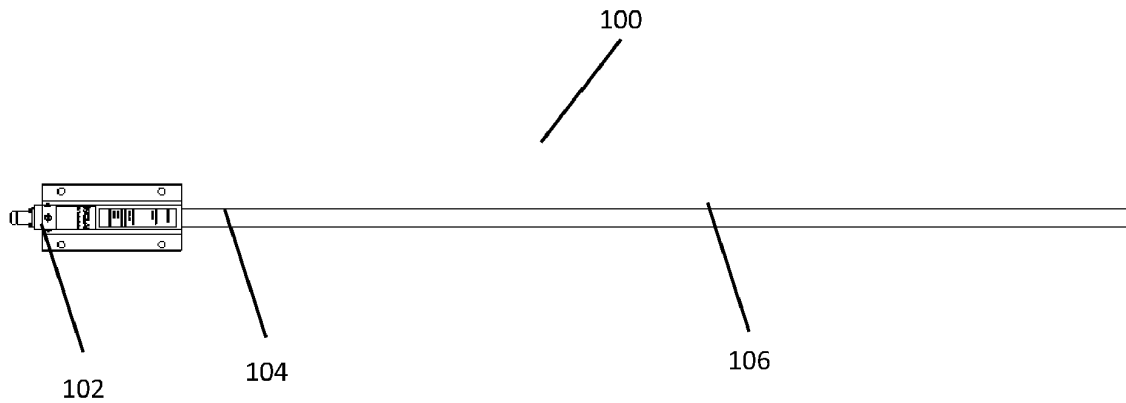
(21) Appl. No.: **18/091,266**

(22) Filed: **Dec. 29, 2022**

Publication Classification

(51) **Int. Cl.**
H01Q 5/15 (2006.01)
H01Q 1/42 (2006.01)

An antenna comprising the primary and secondary radiation structures and impedance-matching circuit are disposed in a collinear configuration with single port. The impedance-matching circuit can expand the antenna bandwidth in plural frequency bands with low VSWR. The transmission line between the RF connector and radiation structures are frictional wrapped by ferrite toroid cores, which improves the antenna in term of electrical stability. This also decreases the antenna sensitivity to the ground plane.





US 20240222865A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222865 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **INTEGRATED 5G AND GNSS COMPACT ANTENNA SYSTEM**

Publication Classification

(71) Applicant: **LIMITED LIABILITY COMPANY "TOPCON POSITIONING SYSTEMS"**, Moscow (RU)

(51) **Int. Cl.**
H01Q 5/20 (2015.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 5/20* (2015.01); *H01Q 9/0421* (2013.01); *H01Q 9/045* (2013.01)

(72) Inventors: **Vasily Valerievich Surikov**, St. Petersburg (RU); **Dmitry Vitalievich Tatarnikov**, Moscow (RU); **Stanislav Borisovich Glybovski**, St. Petersburg (RU)

(57) **ABSTRACT**

An integrated compact radio antenna system for receiving and transmitting 5G signals and receiving GNSS signals is described. The system comprises a high-precision GNSS antenna and a MIMO 5G multi-element antenna system. All the antennas within the proposed compact system are integrated with a shielded housing that enables electronic components of GNSS receiver and 5G modem to be arranged inside. The proposed integrated system has the following advantages: 1) compactness, 2) high efficiency of MIMO 5G antenna system, 3) a high degree of decoupling between 5G antennas, 4) a high degree of decoupling between 5G and GNSS antennas.

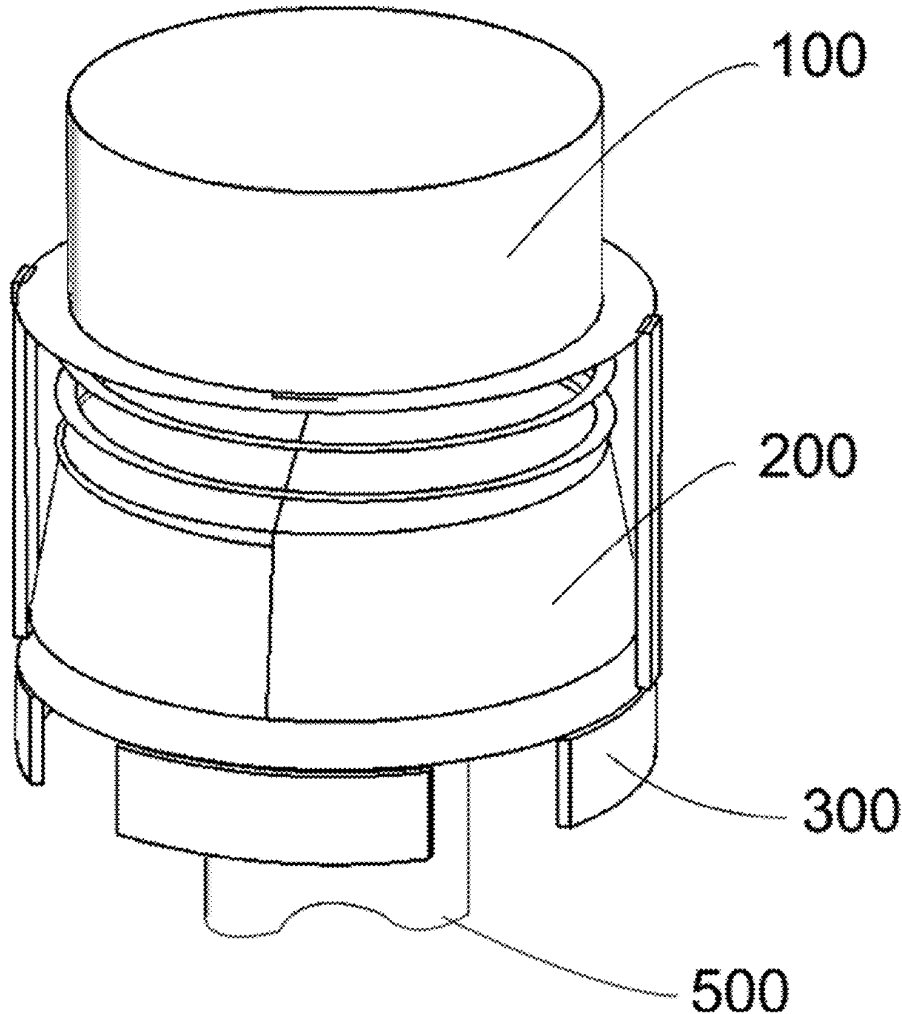
(21) Appl. No.: **17/909,221**

(22) PCT Filed: **Mar. 3, 2022**

(86) PCT No.: **PCT/RU2022/000063**

§ 371 (c)(1),

(2) Date: **Sep. 2, 2022**





US 20240222866A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222866 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **ANTENNA MODULE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/378 (2006.01)
H01Q 21/28 (2006.01)

(72) Inventors: **Cheng-Chieh Yang**, New Taipei City (TW); **Po Yu Chen**, New Taipei City (TW); **Sheng Hui Yang**, New Taipei City (TW)

(52) **U.S. Cl.**
CPC **H01Q 5/378** (2015.01); **H01Q 21/28** (2013.01)

(73) Assignee: **Wistron Corporation**, New Taipei City (TW)

(57) **ABSTRACT**

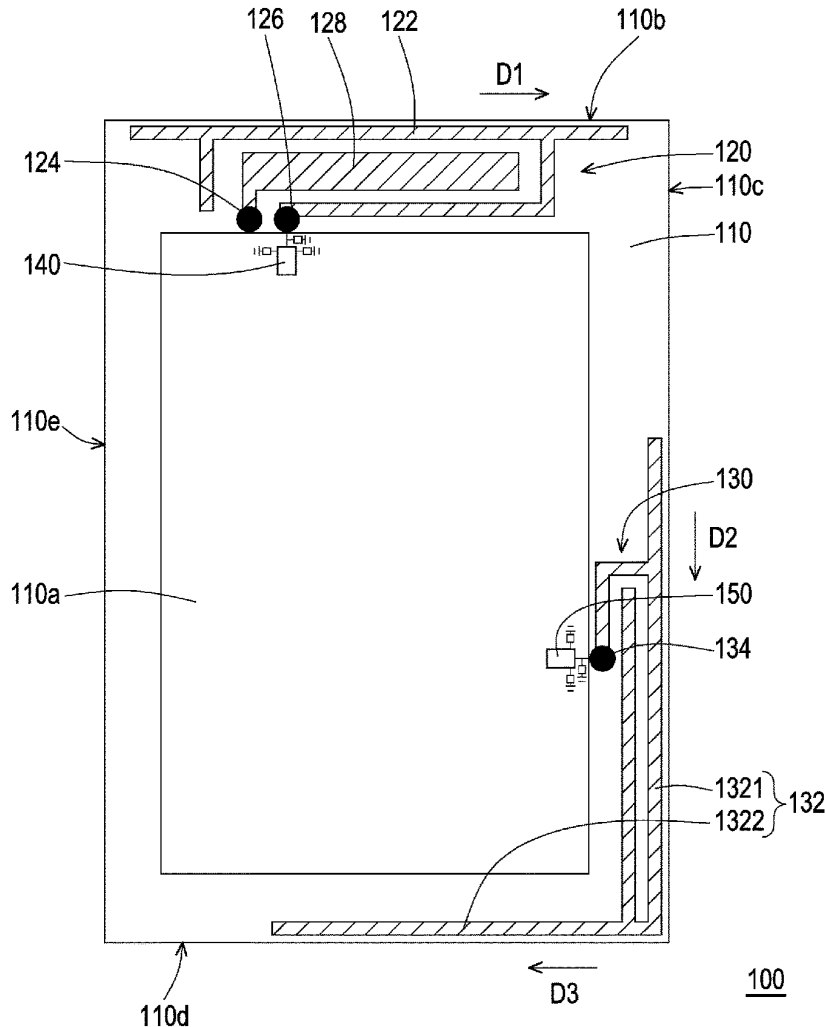
An antenna module including a substrate, a main antenna and a parasitic antenna is provided. The substrate has a ground. The main antenna is disposed on the substrate. The main antenna includes a first irradiating portion, a feeding portion and a first grounding portion, and the first grounding portion is connected to the ground. The parasitic antenna is disposed on the substrate. The parasitic antenna includes a second irradiating portion and a second grounding portion, and the second grounding portion is connected to the ground. An extending direction of the first irradiating portion and an extending direction of at least a part of the second irradiating portion are perpendicular to each other.

(21) Appl. No.: **18/180,128**

(22) Filed: **Mar. 8, 2023**

(30) **Foreign Application Priority Data**

Jan. 4, 2023 (TW) 112100271





US 20240222868A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222868 A1**

(43) **Pub. Date: Jul. 4, 2024**

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

Publication Classification

(71) Applicant: **Universal Global Technology (Kunshan) Co., Ltd.**, Jiangsu Province (CN)

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 3/22 (2006.01)

(72) Inventors: **SHANG HAO LIU**, Jiangsu Province (CN); **YU SHENG SU**, Jiangsu Province (CN); **HUNG WEI CHIU**, Jiangsu Province (CN); **JUI CHIH CHIEN**, Jiangsu Province (CN)

(52) **U.S. Cl.**
CPC **H01Q 9/0414** (2013.01); **H01Q 3/22** (2013.01)

(57) **ABSTRACT**

A composite antenna and an electronic device are proposed. The electronic device includes the composite antenna, and the composite antenna includes a substrate, a first antenna structure, two contact springs, an antenna holder and a second antenna structure. The first antenna structure is disposed on the substrate, and two ends of the first antenna structure are coupled to a feeding point and a grounding point, respectively. The two contact springs are disposed on the first antenna structure, and electrically connected to the feeding point and the grounding point, respectively. The antenna holder is removably disposed on the substrate. The second antenna structure is disposed on the antenna holder and electrically connected to the two contact springs.

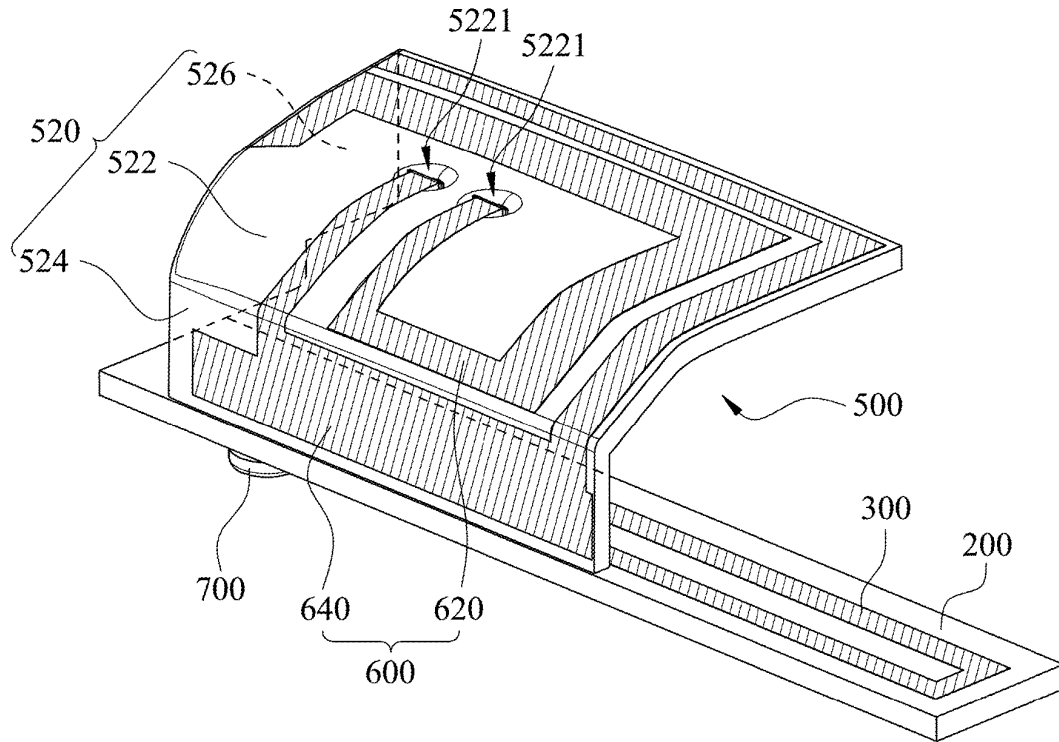
(21) Appl. No.: **18/184,648**

(22) Filed: **Mar. 15, 2023**

(30) **Foreign Application Priority Data**

Dec. 29, 2022 (CN) 202211726830.3

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US 20240222870A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222870 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **ANTENNA AND ELECTRONIC DEVICE**

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

CPC **H01Q 9/0442** (2013.01)

(71) Applicants: **Beijing BOE Technology Development Co., Ltd.**, Beijing (CN); **BOE TECHNOLOGY GROUP CO., LTD.**, Beijing (CN)

(57) **ABSTRACT**

(72) Inventors: **Chunxin LI**, Beijing (CN); **Jingwen GUO**, Beijing (CN); **Qianhong WU**, Beijing (CN); **Feng QU**, Beijing (CN)

An antenna including a dielectric layer, and a first radiation patch and at least one second radiation patch on the dielectric layer; wherein each second radiation patch is connected to the first radiation patch through at least one switch unit; a side edge of the first radiation patch has at least one first opening; each switch unit includes a signal electrode and a membrane bridge; the signal electrode includes a first end connected to the second radiation patch and a second end opposite to the first end; an orthographic projection of the second end on the dielectric layer is within an orthographic projection of one first opening on the dielectric layer; the membrane bridge spans the one first opening and is electrically connected to the first radiation patch; and a first insulating layer is on a surface of the signal electrode close to the membrane bridge.

(21) Appl. No.: **17/920,093**

(22) PCT Filed: **Nov. 24, 2021**

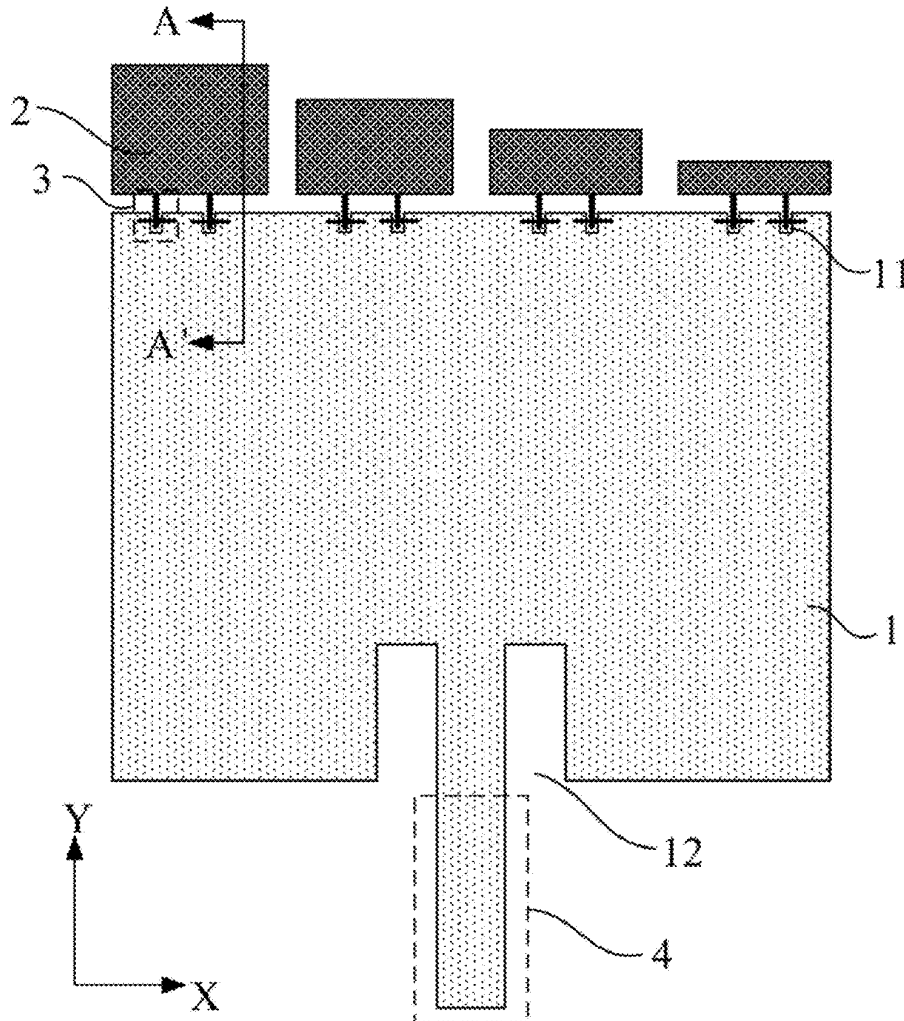
(86) PCT No.: **PCT/CN2021/132765**

§ 371 (c)(1),

(2) Date: **Oct. 20, 2022**

Publication Classification

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





US 20240222873A1

(19) **United States**

(12) **Patent Application Publication**
SHIN

(10) **Pub. No.: US 2024/0222873 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **MOBILE TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H01Q 13/02 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventor: **Minchul SHIN**, Seoul (KR)

(52) **U.S. Cl.**
CPC **H01Q 13/02** (2013.01); **H01Q 1/243** (2013.01)

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

(57) **ABSTRACT**

A mobile terminal comprises: a first frame; a second frame which slides with respect to the first frame; a first horn antenna which is disposed in the first frame; and a second horn antenna which is disposed in the second frame and wirelessly communicates with the first horn antenna. The mobile terminal can omit a physical signal line for transmitting a signal between an electronic component mounted to the first frame and an electronic component mounted to the second frame, and thus can prevent the breakage of the signal line according to sliding movements.

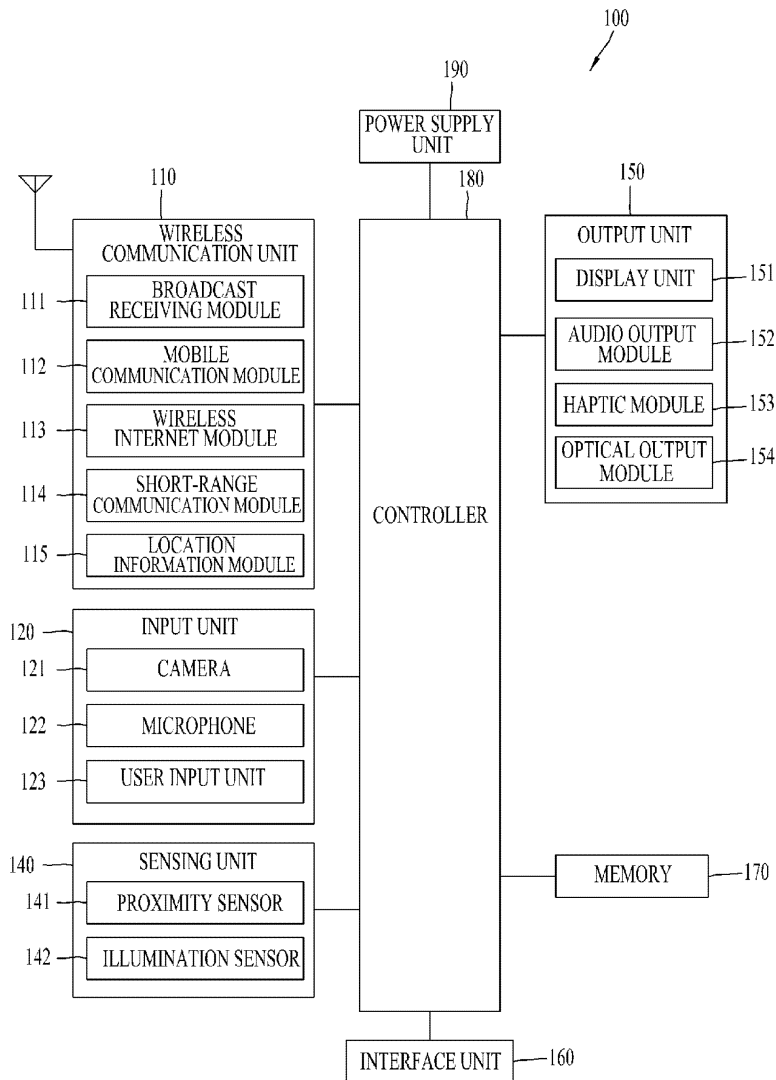
(21) Appl. No.: **18/288,655**

(22) PCT Filed: **Apr. 30, 2021**

(86) PCT No.: **PCT/KR2021/005517**

§ 371 (c)(1),

(2) Date: **Oct. 27, 2023**





US 20240222874A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222874 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **BROADSIDE ANTENNA, ANTENNA IN PACKAGE, AND COMMUNICATION DEVICE**

H01Q 1/36 (2006.01)

H01Q 1/48 (2006.01)

(71) Applicant: **Huawei Technologies Co., Ltd.**,
Shenzhen (CN)

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

CPC *H01Q 13/10* (2013.01); *H01Q 1/22*
(2013.01); *H01Q 1/36* (2013.01); *H01Q 1/48*
(2013.01)

(72) Inventors: **Chen-Fang Tai**, Taipei City (CN);
Chih-Wei Hsu, Taipei City (CN);
Chien-Ming Lee, Taipei City (CN);
Chih Yu Tsai, Taipei City (CN)

(57) **ABSTRACT**

(21) Appl. No.: **18/573,036**

(22) PCT Filed: **Jun. 21, 2022**

(86) PCT No.: **PCT/CN2022/100213**

§ 371 (c)(1),

(2) Date: **Dec. 21, 2023**

(30) **Foreign Application Priority Data**

Jun. 24, 2021 (CN) 202110707696.1

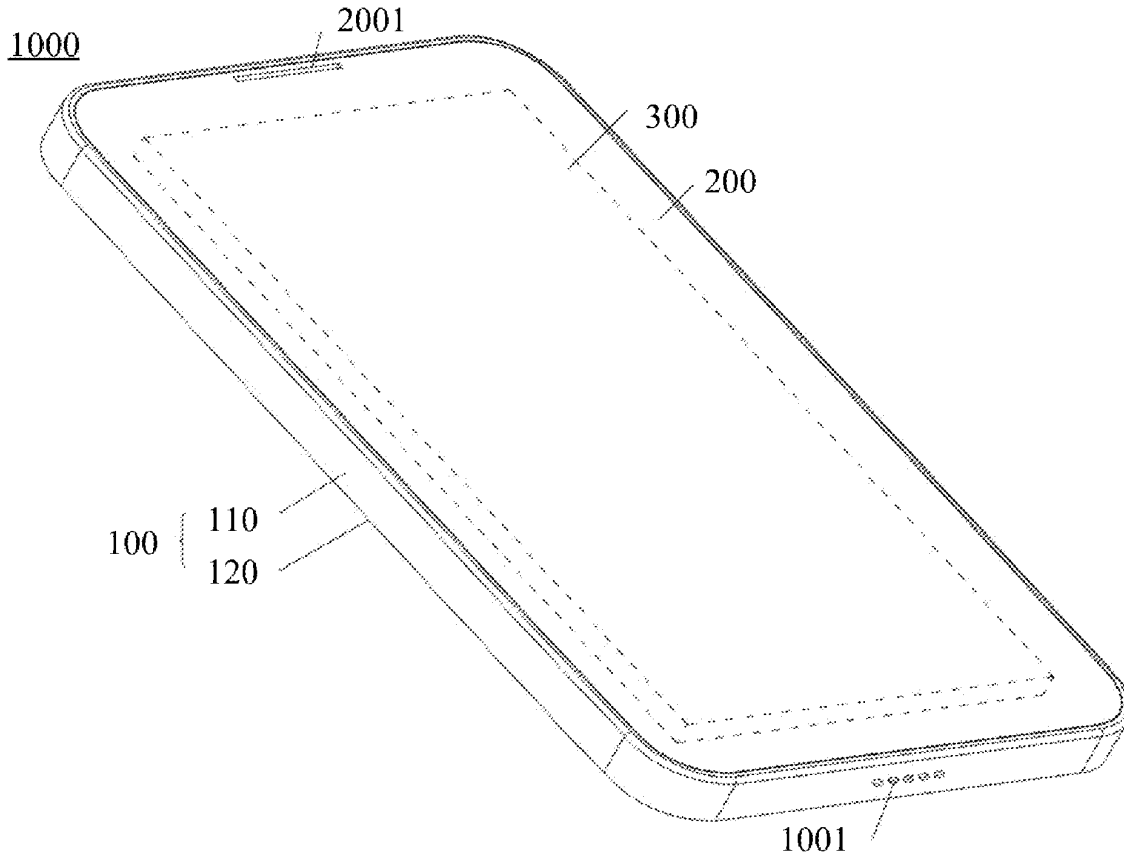
Publication Classification

(51) **Int. Cl.**

H01Q 13/10 (2006.01)

H01Q 1/22 (2006.01)

A broadside antenna includes a first radiation element and a second radiation element arranged at an interval, a first grounding element and a second grounding element arranged at an interval, and a first excitation element. A first gap is formed between the first radiation element and the second radiation element. The first excitation element includes a first feeding structure and a first extension stub that are arranged at an interval. The first feeding structure includes a first feed-in part connected to a feed source. The first extension stub is located on a side of the first feeding structure adjacent close to the first feed-in part. The first extension stub includes a first grounding part adjacent to the first feed-in part. The first grounding part is connected to the grounding surface.





US 20240222876A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0222876 A1**

(43) **Pub. Date: Jul. 4, 2024**

(54) **ANTENNA AND METASURFACE
STRUCTURE FOR ANTENNA**

(52) **U.S. Cl.**
CPC **H01Q 15/0086** (2013.01); **H01Q 9/0442**
(2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Chenfeng Yang,** Kowloon (HK);
Gengbo Wu, Kowloon (HK); **Ka Fai
Chan,** Kowloon (HK); **Chi Hou Chan,**
Kowloon (HK)

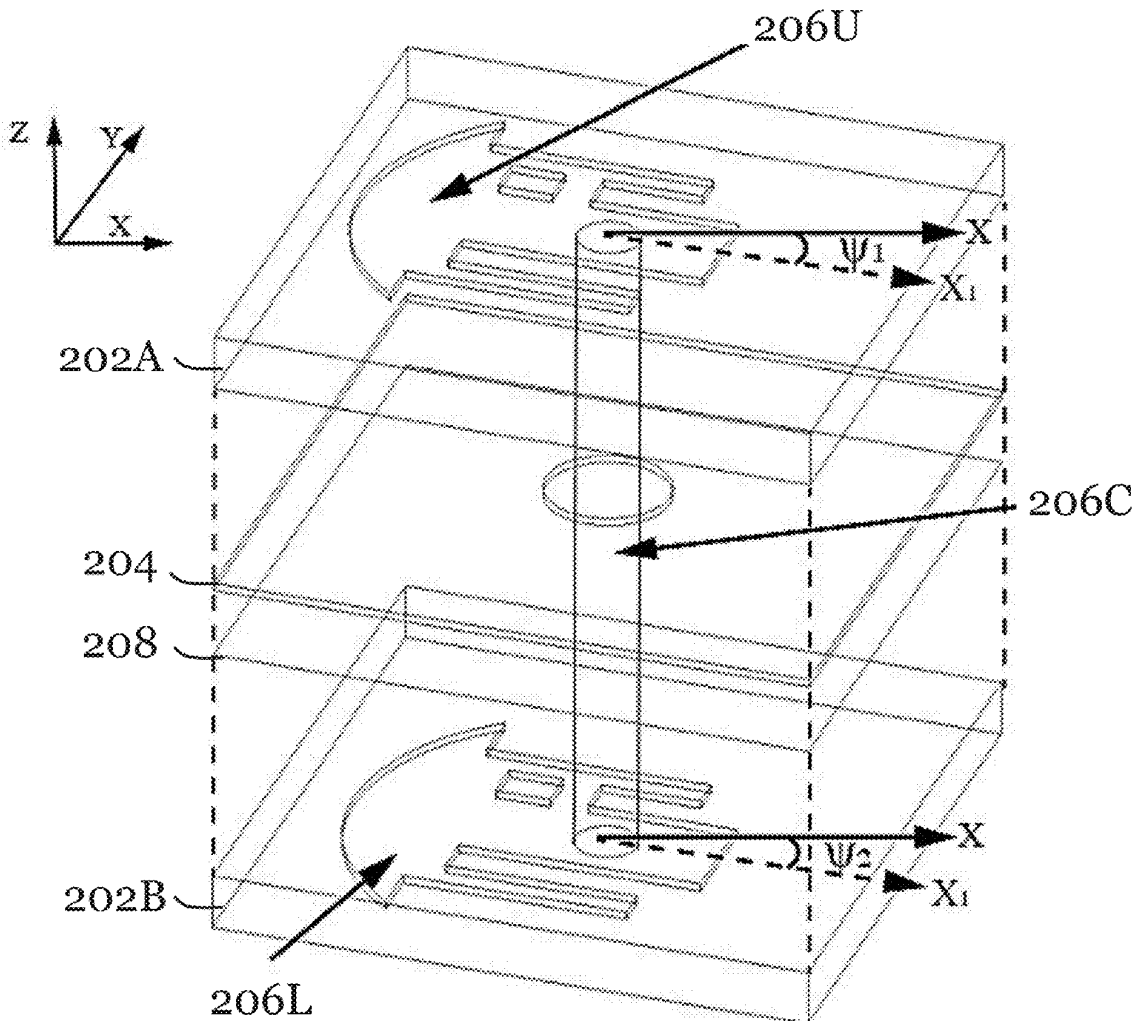
An antenna includes, at least, a metasurface structure assembly and a feed. The feed is coupled with the metasurface structure assembly and is operable to provide a first type of electromagnetic radiation with a first radiation property to the metasurface structure assembly. The metasurface structure assembly is operable to receive the first type of electromagnetic radiation from the feed and to convert the first type of electromagnetic radiation into a second type of electromagnetic radiation and then back to the first type of electromagnetic radiation with a second radiation property for radiation from the metasurface structure assembly. The first radiation property and the second radiation property are different.

(21) Appl. No.: **18/089,720**

(22) Filed: **Dec. 28, 2022**

Publication Classification

(51) **Int. Cl.**
H01Q 15/00 (2006.01)
H01Q 9/04 (2006.01)





US 20240235006A1

(19) **United States**

(12) **Patent Application Publication**
LI

(10) **Pub. No.: US 2024/0235006 A1**

(43) **Pub. Date: Jul. 11, 2024**

(54) **ANTENNA STRUCTURE AND MOBIL
DEVICE HAVING THE SAME**

(52) **U.S. Cl.**
CPC **H01Q 1/2266** (2013.01); **H01Q 9/0421**
(2013.01)

(71) Applicant: **WISTRON NEWEB
CORPORATION, HSINCHU (TW)**

(57) **ABSTRACT**

(72) Inventor: **JIAN-DE LI, HSINCHU (TW)**

An antenna structure is arranged on a metal back cover. The metal back cover has an L-shaped slot, which has first and second partitions respectively arranged along a first direction and a second direction that are perpendicular to one another. The antenna structure includes an L-shaped radiating element that partially overlaps with the second partition and includes a first radiating portion, a second radiating portion, and a grounded radiating portion. The first radiating portion and the second radiating portion extend along the second direction. One end of the second radiating portion is connected to the first radiating portion. A first feeding point is disposed between the first radiating portion and the second radiating portion. The grounded radiating portion is extended along the first direction and connected to another end of the second radiating portion. The grounded radiating portion has a first grounded side grounded through a capacitive element.

(21) Appl. No.: **18/399,986**

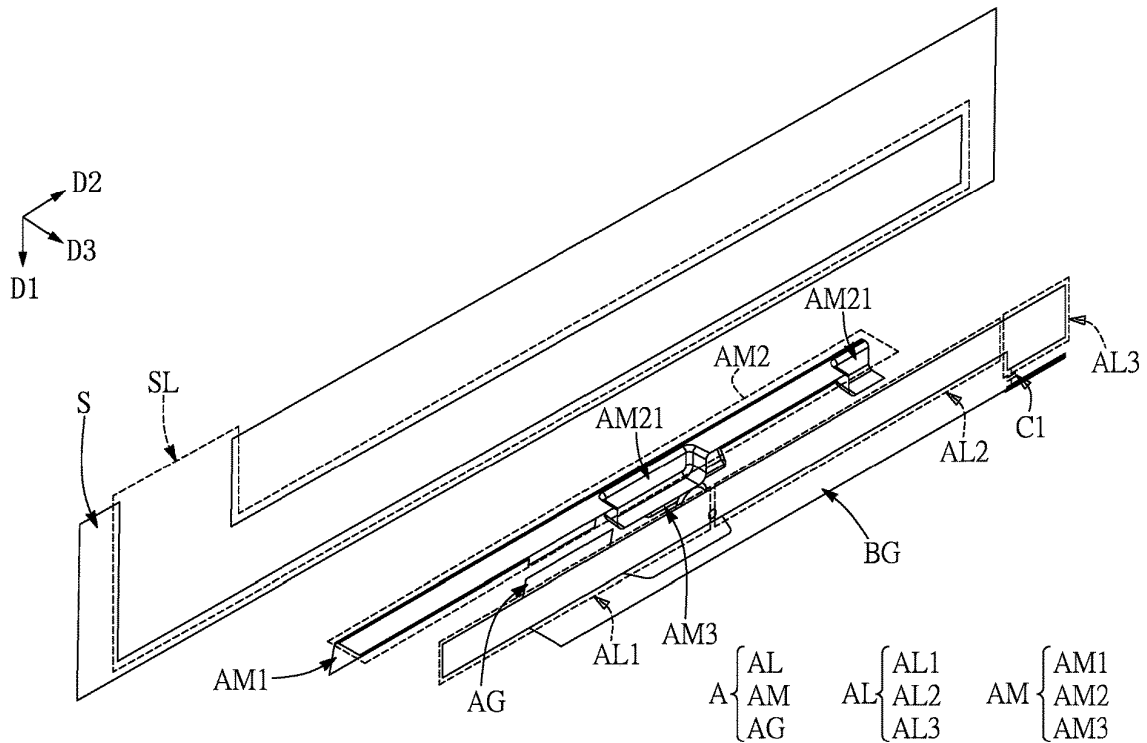
(22) Filed: **Dec. 29, 2023**

(30) **Foreign Application Priority Data**

Jan. 5, 2023 (TW) 112100291

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)





US 20240235058A1

(19) **United States**

(12) **Patent Application Publication**
FU

(10) **Pub. No.: US 2024/0235058 A1**

(43) **Pub. Date: Jul. 11, 2024**

(54) **DECOUPLING DEVICE AND DECOUPLING METHOD**

(52) **U.S. Cl.**
CPC **H01Q 21/062** (2013.01); **H01Q 1/521** (2013.01)

(71) Applicant: **ZTE CORPORATION**, Shenzhen (CN)

(72) Inventor: **Suida FU**, Shenzhen (CN)

(57) **ABSTRACT**

(21) Appl. No.: **18/558,782**

(22) PCT Filed: **Apr. 6, 2022**

(86) PCT No.: **PCT/CN2022/085386**

§ 371 (c)(1),

(2) Date: **Nov. 3, 2023**

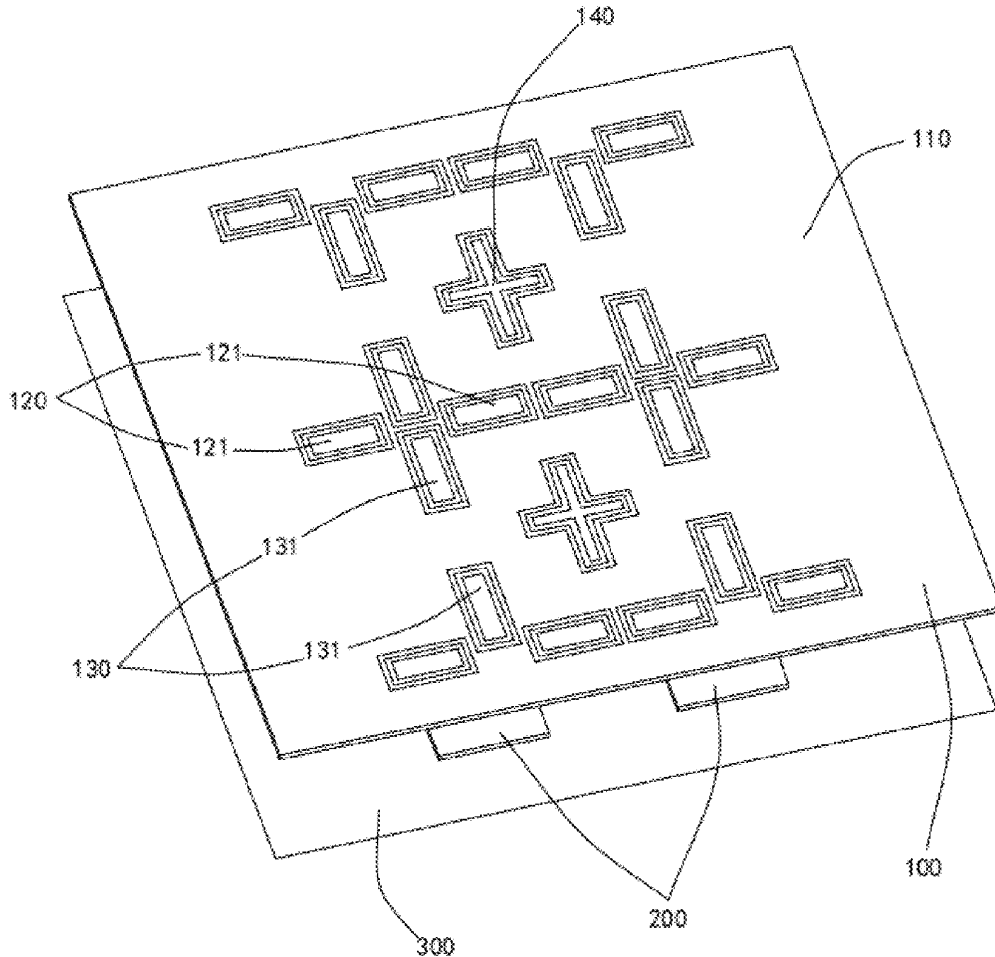
(30) **Foreign Application Priority Data**

May 6, 2021 (CN) 202110488752.7

Publication Classification

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 1/52 (2006.01)

A decoupling device and a decoupling method are disclosed. The decoupling device is applied to an antenna array which may include a plurality of antenna elements. The decoupling device may include: a dielectric substrate (110) located above the antenna elements; first decoupling units (120) arranged on the dielectric substrate (110), each first decoupling unit (120) being located above a middle position between every two E-plane coupled antenna elements; second decoupling units (130) arranged on the dielectric substrate (110), the second decoupling units (130) being located above each antenna element; and third decoupling units (140) arranged on the dielectric substrate (110), each third decoupling unit (140) being located above a middle position between every two H-plane coupled antenna elements.





US 20240204816A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0204816 A1**

(43) **Pub. Date: Jun. 20, 2024**

(54) **TERMINAL ANTENNA CONTROL METHOD AND APPARATUS**

Publication Classification

(71) Applicant: **HONOR DEVICE CO., LTD.**,
Shenzhen (CN)

(51) **Int. Cl.**
H04B 1/3827 (2006.01)
H04B 1/40 (2006.01)

(72) Inventors: **Xiaotao CAI**, Shenzhen (CN); **Liang LIU**, Shenzhen (CN); **Dawei ZHOU**, Shenzhen (CN); **Chunhui YE**, Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H04B 1/3838** (2013.01); **H04B 1/40** (2013.01)

(21) Appl. No.: **18/558,088**

(57) **ABSTRACT**

(22) PCT Filed: **May 15, 2023**

This application provides a terminal antenna control method and apparatus. The method includes: obtaining a real-time reflection coefficient of an antenna of a terminal device; determining, based on a distance difference between locations that are of the real-time reflection coefficient and a free space FS reflection coefficient of the antenna and that are on a Smith chart, whether the antenna is in a human body use scenario; if the antenna is in the human body use scenario, determining whether a specific absorption rate SAR of the antenna is greater than or equal to a first preset threshold; and if the SAR is greater than or equal to the first preset threshold, adjusting an adjustable device of the antenna to increase a reflection coefficient of a transmit frequency band of the antenna, where the adjustable device includes a capacitor and/or an inductor.

(86) PCT No.: **PCT/CN2023/094264**

§ 371 (c)(1),
(2) Date: **Oct. 30, 2023**

(30) **Foreign Application Priority Data**

Aug. 23, 2022 (CN) 202211009495.5

