US 20230327337A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0327337 A1**

(43) **Pub. Date: Oct. 12, 2023**

KIM et al.

(54) **ELECTRONIC APPARATUS COMPRISING ANTENNA**

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

(72) Inventors: **Sungsoo KIM**, Suwon-si (KR); **Seyoon BAE**, Suwon-si (KR); **Byoungryoul SONG**, Suwon-si (KR); **Seungbum CHOI**, Suwon-si (KR); **Wonjoon CHOI**, Suwon-si (KR); **Joon HEO**, Suwon-si (KR); **Seongjin PARK**, Suwon-si (KR); **Sumin YUN**, Suwon-si (KR); **Jaehoon JO**, Suwon-si (KR); **Woosung CHUN**, Suwon-si (KR)

(21) Appl. No.: **18/201,382**

(22) Filed: **May 24, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/016182, filed on Nov. 9, 2021.

(30) **Foreign Application Priority Data**

Nov. 24, 2020 (KR) 10-2020-0159059

Publication Classification

(51) **Int. Cl.**

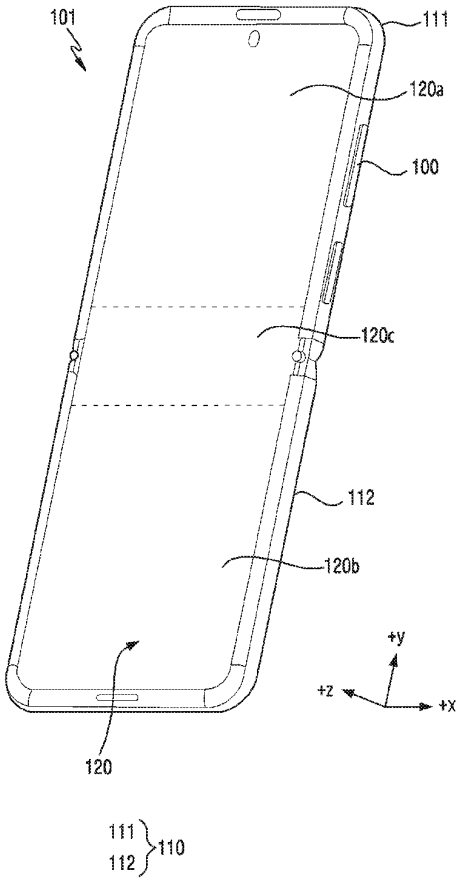
H01Q 1/24	(2006.01)
H01Q 21/06	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 9/0407*** (2013.01); ***H01Q 1/241*** (2013.01); ***H01Q 21/065*** (2013.01)

(57) **ABSTRACT**

An electronic apparatus having a housing, a flexible display, and a key button which is arranged in a first area on a side of a first part is provided. The key button includes at least one protrusion extending toward the inside of the first part and an antenna structure arranged on the inside of the first part with respect to the first area. The housing includes the first part, a second part, and a connection part arranged between the first part and the second part, the second part being rotatably coupled to the first part through the connection part. The antenna structure includes a dome switch arranged above a substrate at a position corresponding to the at least one protrusion, and a plurality of conductive patches provided on a conductive layer of the substrate. The dome switch may be arranged at the corresponding position between the plurality of conductive patches.



US 20230335901A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0335901 A1**

(43) **Pub. Date: Oct. 19, 2023**

TOYAO et al.

(54) **MULTIBAND ANTENNA**

(71) Applicant: **Japan Aviation Electronics Industry, Limited**, Tokyo (JP)

(72) Inventors: **Hiroshi TOYAO**, Tokyo (JP); **Kenta TSUCHIYA**, Tokyo (JP)

(73) Assignee: **Japan Aviation Electronics Industry, Limited**, Tokyo (JP)

(21) Appl. No.: **18/127,176**

(22) Filed: **Mar. 28, 2023**

(30) **Foreign Application Priority Data**

Apr. 18, 2022 (JP) 2022-068160

Publication Classification

(51) **Int. Cl.**

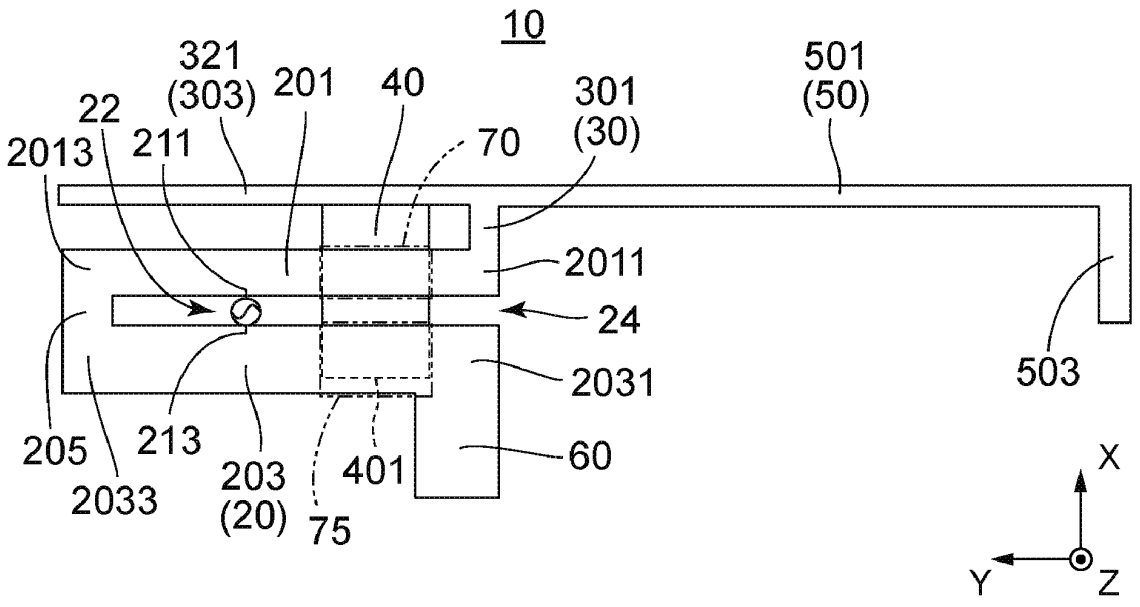
H01Q 5/307	(2006.01)
H01Q 1/48	(2006.01)
H01Q 13/10	(2006.01)

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

CPC ***H01Q 5/307*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 13/106*** (2013.01)

(57) **ABSTRACT**

First and second slot edge portions of a conductive main portion are long in a first direction and sandwich a slot in a second direction. An open portion is formed a part different from the first slot edge portion and opens the slot outside the conductive main portion. A first part of a radiation element extends from an end portion of the first slot edge portion in the second direction. A second part of the radiation element extends from an end portion of the first part in the first direction. An additional element extends from the second part toward a second specific area through a first specific area. In a third direction, the first specific area and the second specific area overlap with the first slot edge portion and the second slot edge portion, respectively.



US 20230335918A1

(19) **United States**

(12) **Patent Application Publication**

FANG et al.

(10) **Pub. No.: US 2023/0335918 A1**

(43) **Pub. Date: Oct. 19, 2023**

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

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

(72) Inventors: **YING-SHENG FANG**, HSINCHU (TW); **SHANG-SIAN YOU**, HSINCHU (TW)

(21) Appl. No.: **18/053,770**

(22) Filed: **Nov. 9, 2022**

(30) **Foreign Application Priority Data**

Apr. 14, 2022 (TW) 111114142

Publication Classification

(51) **Int. Cl.**

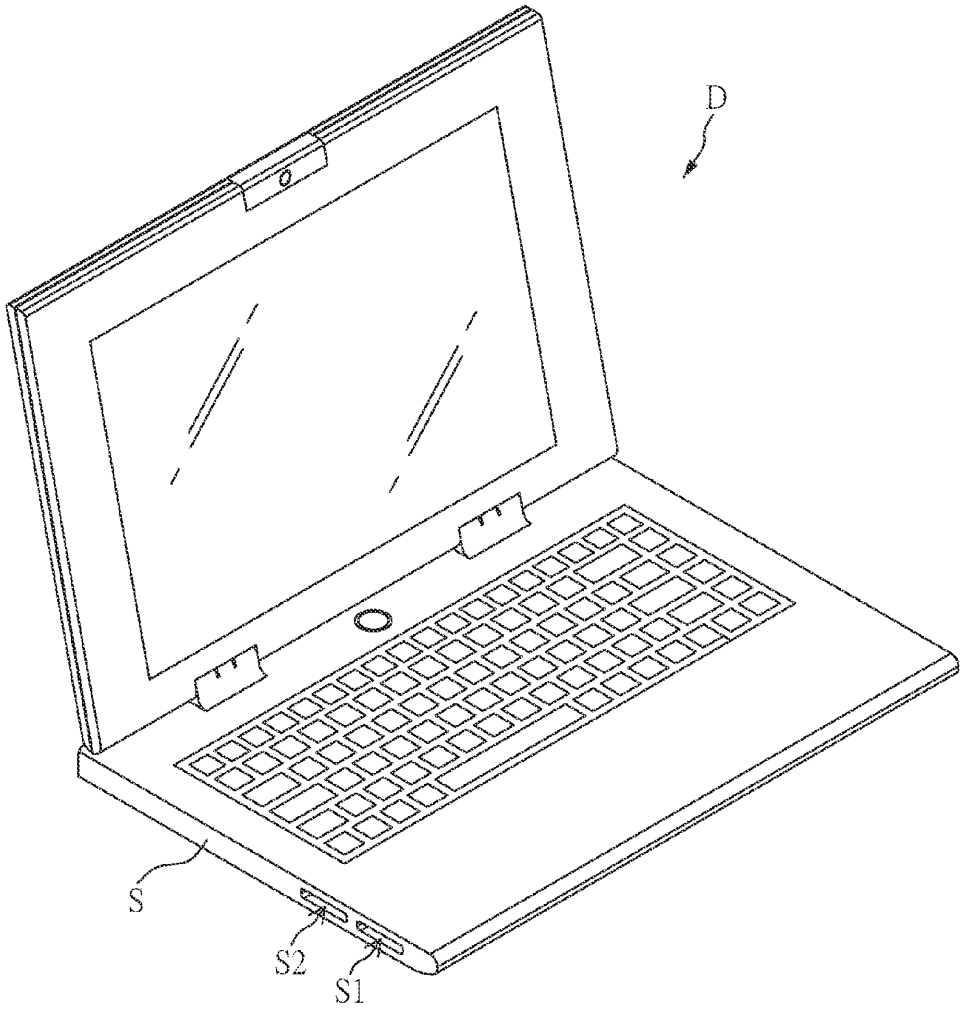
H01Q 21/06 (2006.01)
H01Q 21/00 (2006.01)
H01Q 1/22 (2006.01)

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

CPC ***H01Q 21/065*** (2013.01); ***H01Q 21/0037*** (2013.01); ***H01Q 1/22*** (2013.01)

(57) **ABSTRACT**

An electronic device and an antenna structure are provided. The electronic device includes a metal housing, and the antenna structure is disposed in the metal housing. The antenna structure includes a printed circuit board, two radiating elements, two feeding transmission lines and a connector. The two radiating elements are disposed on the printed circuit board and are close to the two slots. Projections of the two radiating elements projected onto the metal housing at least partially overlap with the two slots. The two feeding transmission line are disposed in the printed circuit board. The two feeding transmission lines are electrically connected to the two radiating elements, respectively, and lengths of the two feeding transmission lines are the same. The connector is connected to the printed circuit board and electrically connected to the two feeding transmission lines.



US 20230335922A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0335922 A1**

(43) **Pub. Date: Oct. 19, 2023**

WANG

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

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

(72) Inventor: **Zedong WANG**, Dongguan (CN)

(21) Appl. No.: **18/341,101**

(22) Filed: **Jun. 26, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/127066, filed on Oct. 28, 2021.

(30) **Foreign Application Priority Data**

Dec. 28, 2020 (CN) 202011580857.7

Publication Classification

(51) **Int. Cl.**

H01Q 25/00 (2006.01)

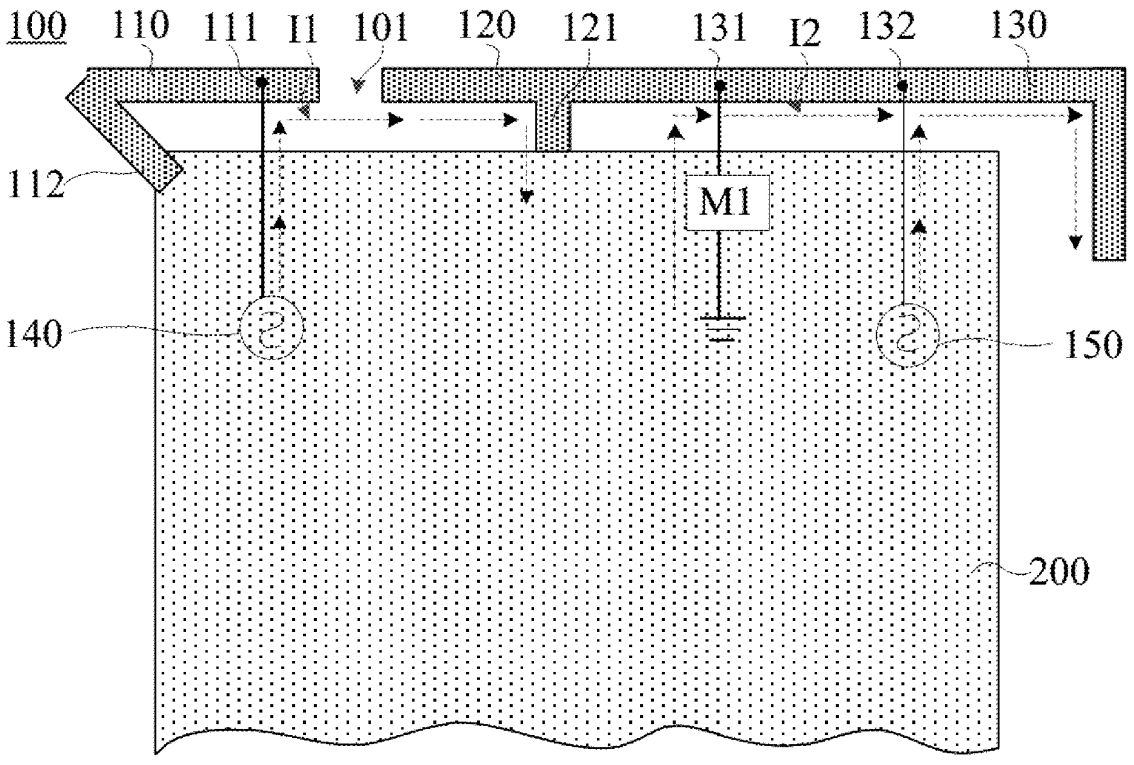
H01Q 1/48 (2006.01)

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

CPC ***H01Q 25/00*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

Provided are an antenna apparatus and an electronic device. A first coupling gap is formed between one end of a second radiator and a first radiator, and the other end of the second radiator is provided with a first ground terminal. One end of a third radiator is connected to the first ground terminal, and the other end thereof extends in a direction away from the second radiator. The third radiator is provided with a second ground terminal spaced apart from the first ground terminal. At least part of the first radiator and the second radiator jointly generate a first resonance. A part of the third radiator located on a side of the second ground terminal away from the first ground terminal generates a second resonance.



US 20230336202A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0336202 A1**

(43) **Pub. Date: Oct. 19, 2023**

KIM et al.

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

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

(72) Inventors: **Sungsun KIM**, Gyeonggi-do (KR); **Joonwon JANG**, Gyeonggi-do (KR)

(21) Appl. No.: **18/082,138**

(22) Filed: **Dec. 15, 2022**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/020218, filed on Dec. 13, 2022.

(30) **Foreign Application Priority Data**

Apr. 15, 2022 (KR) 10-2022-0047211
May 9, 2022 (KR) 10-2022-0056658

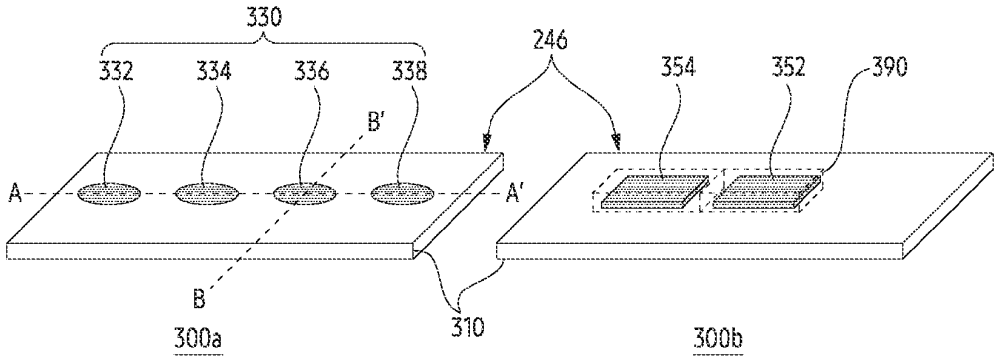
Publication Classification

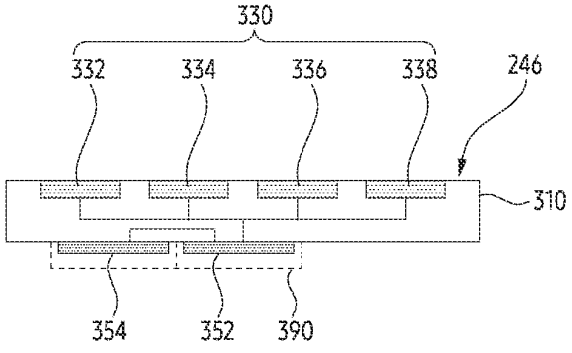
(51) **Int. Cl.**
H04B 1/40 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/307 (2006.01)
H01Q 1/52 (2006.01)

(52) **U.S. Cl.**
CPC ***H04B 1/40*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/307*** (2015.01); ***H01Q 1/526*** (2013.01)

(57) **ABSTRACT**

An electronic device according to an embodiment includes a housing including at least one opening; a support member in the housing; a display disposed on the support member; a first printed circuit board including a plurality of layers; a first wireless communication circuit disposed on a first surface of the first printed circuit board; a feeding structure on another surface of the first printed circuit board electrically connected to the first wireless communication circuit; and a waveguide configured to transmit a signal provided from the first wireless communication circuit to an outside of the housing, and the waveguide extends along one surface of the support member from the feeding structure. Other embodiments are possible.





300c

US 20230336648A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0336648 A1**

LEE et al. (43) **Pub. Date: Oct. 19, 2023**

(54) **APPARATUS HAVING SLOT ANTENNA USING CAMERA COVER IN ELECTRONIC DEVICE**

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

(72) Inventors: **Minkyung LEE**, Suwon-si (KR); **Mincheol SEO**, Suwon-si (KR); **Donghun SHIN**, Suwon-si (KR); **Yoonjung KIM**, Suwon-si (KR); **Huiwon CHO**, Suwon-si (KR)

(21) Appl. No.: **18/212,696**

(22) Filed: **Jun. 21, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/019534, filed on Dec. 21, 2021.

(30) **Foreign Application Priority Data**

Dec. 21, 2020 (KR) 10-2020-0179868

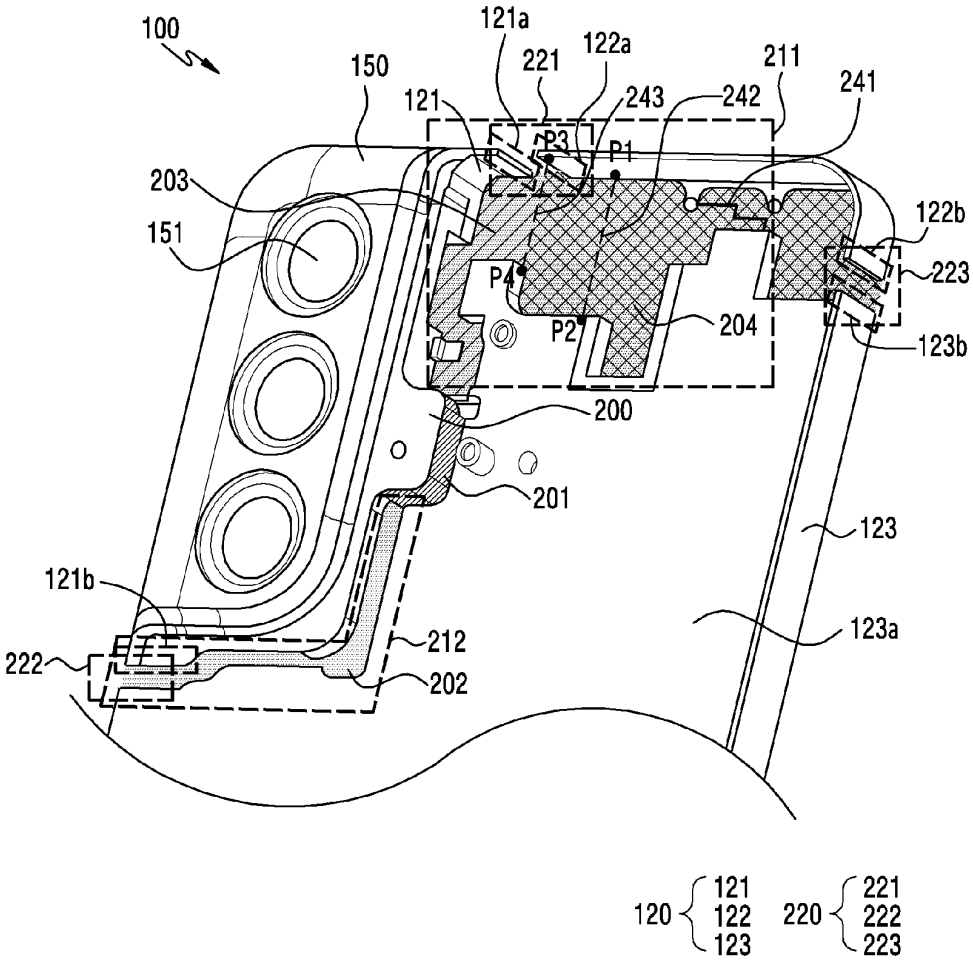
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H04M 1/0264*** (2013.01); ***H01Q 13/10*** (2013.01)

(57) **ABSTRACT**

An electronic device includes a camera cover, a wireless communication circuit, a first frame, a second frame and a third frame, extends from a second surface along a part not included in a first surface and the second surface among the periphery of the camera cover, and is connected to the camera cover. The second frame is positioned away from the first frame to form a part of the second surface, and extends from the second surface to form a part of a third surface. The third frame has a gap from the first frame in a specific direction in a first area and is connected to the first frame in a second area. The wireless communication circuit can receive a signal of a specific frequency band by feeding power to a slot structure comprising the gap between the first frame and the third frame.



US 20230336652A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0336652 A1**

(43) **Pub. Date: Oct. 19, 2023**

KANG et al.

(54) **ELECTRONIC DEVICE INCLUDING MULTIPLE PCBS AND ANTENNAS PRINTED ON PCBS**

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

(72) Inventors: **Taejin KANG**, Suwon-si (KR); **Hyoseok NA**, Suwon-si (KR); **Jongdoo KIM**, Suwon-si (KR); **Kyungdae SON**, Suwon-si (KR); **Jiyoung JUNG**, Suwon-si (KR); **Wanjae JU**, Suwon-si (KR)

(21) Appl. No.: **18/338,854**

(22) Filed: **Jun. 21, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/002448, filed on Feb. 18, 2022.

(30) **Foreign Application Priority Data**

Feb. 18, 2021 (KR) 10-2021-0021914

Publication Classification

(51) **Int. Cl.**

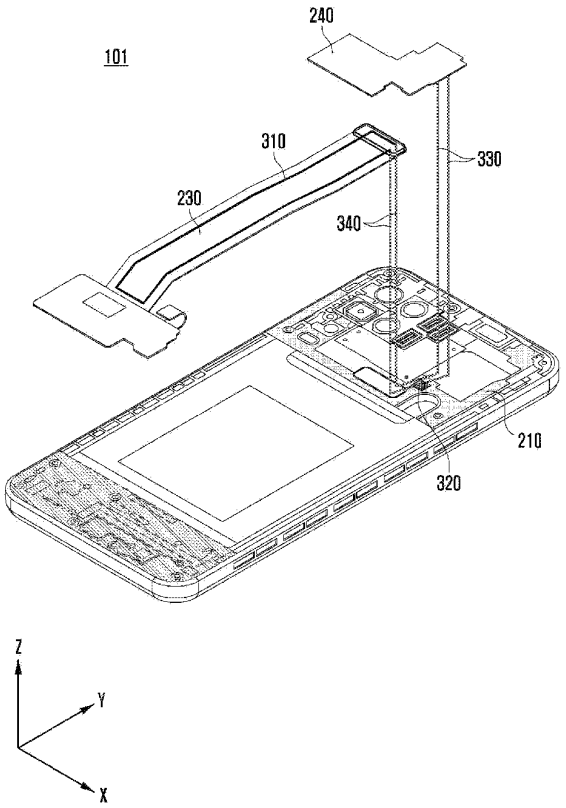
H04M 1/02	(2006.01)
H05K 1/16	(2006.01)
H05K 1/14	(2006.01)
H01Q 1/24	(2006.01)
H01Q 7/06	(2006.01)

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

CPC ***H04M 1/0277*** (2013.01); ***H05K 1/16*** (2013.01); ***H05K 1/142*** (2013.01); ***H05K 1/147*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 7/06*** (2013.01); *H05K 2201/10098* (2013.01); *H04M 2201/38* (2013.01)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a housing including a first plate facing a first direction and a second plate facing a second direction opposite to the first direction, and forming a space between the first plate and the second plate, a display disposed inside the housing and exposed through the first plate, a first printed circuit board disposed between the display and the second plate, a second printed circuit board disposed between the display and the second plate, a third printed circuit board which is disposed between the display and the second plate and electrically connects the first printed circuit board and the second printed circuit board, and a first antenna coupled to the first printed circuit board, wherein the third printed circuit board may include a second antenna electrically connected to the first antenna.



US 20230344129A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0344129 A1**

(43) **Pub. Date: Oct. 26, 2023**

WU

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

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

(72) Inventor: **Xiaopu WU**, Dongguan (CN)

(73) Assignee: **GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP., LTD.**, Dongguan (CN)

(21) Appl. No.: **18/341,563**

(22) Filed: **Jun. 26, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/130984, filed on Nov. 16, 2021.

(30) **Foreign Application Priority Data**

Dec. 29, 2020 (CN) 202011608758.5
Dec. 29, 2020 (CN) 202023287937.1

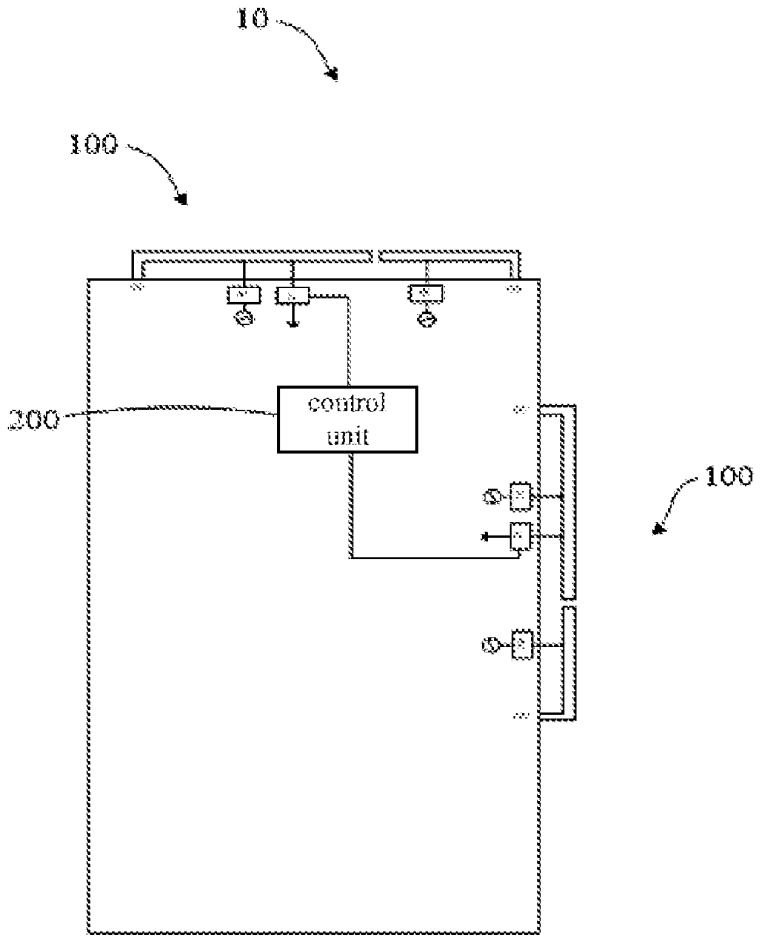
Publication Classification

(51) **Int. Cl.**
H01Q 5/357 (2006.01)
H01Q 5/335 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 5/357*** (2015.01); ***H01Q 5/335*** (2015.01)

(57) **ABSTRACT**

The present application provides an antenna system and an electronic device. The antenna system includes at least two antenna assemblies and a control unit. Each antenna assembly includes a first antenna; the first antenna includes a first radiator, a first signal source, a first matching circuit, and a first adjusting circuit; the first radiator has a first feed point; the first signal source is electrically connected to the first matching circuit and the first feed point; the first adjusting circuit is electrically connected to the first radiator or the first matching circuit, and is configured to adjust a resonant frequency point of the first antenna, so that the first antenna supports transceiving of an electromagnetic wave signal of at least one of an LTE low frequency band and an NR low frequency band.



US 20230344132A1

(19) **United States**

(12) **Patent Application Publication**

WANG et al.

(10) **Pub. No.: US 2023/0344132 A1**

(43) **Pub. Date: Oct. 26, 2023**

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

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

(72) Inventors: **Yali WANG**, Beijing (CN); **Feng QU**, Beijing (CN); **Biqi LI**, Beijing (CN)

(21) Appl. No.: **17/635,703**

(22) PCT Filed: **Apr. 19, 2021**

(86) PCT No.: **PCT/CN2021/088050**

§ 371 (c)(1),
(2) Date: **Feb. 16, 2022**

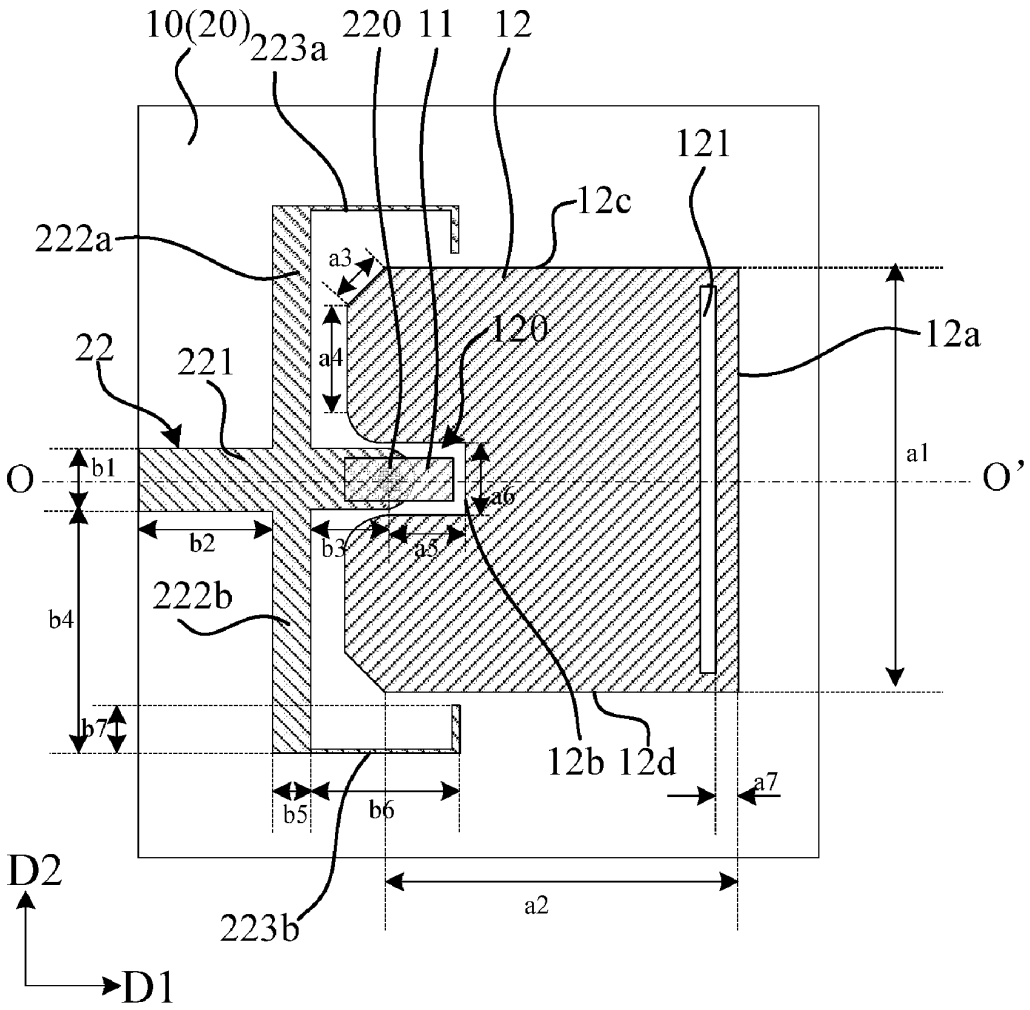
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 9/045*** (2013.01); ***H01Q 9/0421*** (2013.01); *H01Q 1/22* (2013.01)

(57) **ABSTRACT**

An antenna structure includes a first substrate and a second substrate. There is a dielectric layer between the first substrate and the second substrate. The first substrate includes a first dielectric substrate, and a radiation patch and a micro-strip arranged on the first dielectric substrate. The radiation patch and the micro-strip are on one side of the first dielectric substrate away from the second substrate. Orthographic projections of the micro-strip and the radiation patch on the first dielectric substrate do not overlap. The radiation patch has at least one first slot away from the micro-strip. The second substrate includes a second dielectric substrate, a feed structure arranged on one side of the second dielectric substrate close to the first substrate, and a ground layer arranged on one side of the second dielectric substrate away from the first substrate. The feed structure is electrically connected to the micro-strip.



US 20230344151A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0344151 A1**

(43) **Pub. Date: Oct. 26, 2023**

WU

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

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

(72) Inventor: **Xiaopu WU**, Dongguan (CN)

(21) Appl. No.: **18/215,802**

(22) Filed: **Jun. 28, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/131176, filed on Nov. 17, 2021.

(30) **Foreign Application Priority Data**

Dec. 29, 2020 (CN) 202011613294.7

Publication Classification

(51) **Int. Cl.**

H01Q 21/30 (2006.01)

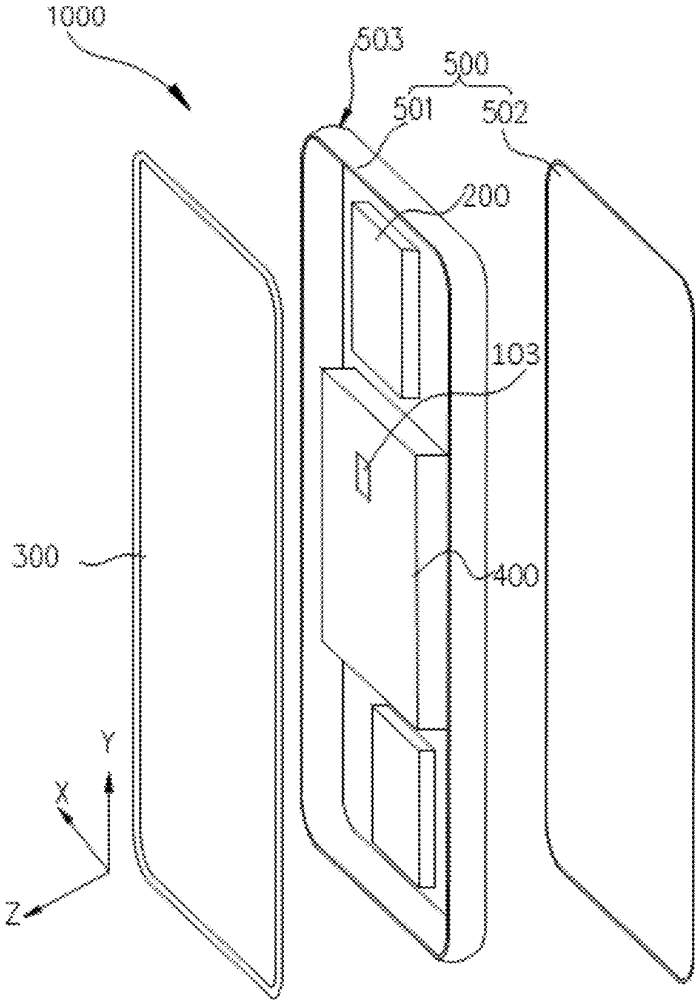
H01Q 1/24 (2006.01)

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

CPC ***H01Q 21/30*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An antenna assembly and an electronic device are provided in the disclosure. The antenna assembly includes a first antenna element, a second antenna element, and a third antenna element. The first antenna element includes a first radiator. The second antenna element includes a second radiator. A first gap is defined between one end of the second radiator and one end of the first radiator, and at least part of the second radiator is configured to be coupled to the first radiator through the first gap. The third antenna element includes a third radiator. A second gap is defined between the third radiator and the other end of the second radiator, and at least part of the third radiator is configured to be coupled to the second radiator through the second gap.



US 20230344152A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0344152 A1**

(43) **Pub. Date: Oct. 26, 2023**

WU

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

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

(72) Inventor: **Xiaopu WU**, Dongguan (CN)

(21) Appl. No.: **18/343,396**

(22) Filed: **Jun. 28, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/131214, filed on Nov. 17, 2021.

(30) **Foreign Application Priority Data**

Dec. 29, 2020 (CN) 202011608717.6

Publication Classification

(51) **Int. Cl.**

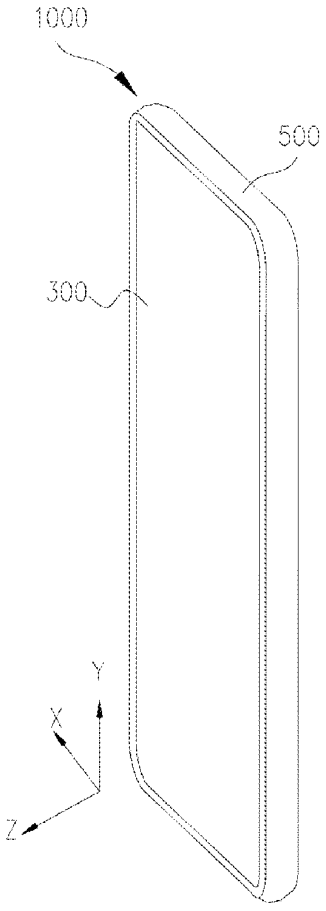
H01Q 21/30	(2006.01)
H01Q 1/52	(2006.01)
H01Q 1/36	(2006.01)

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

CPC ***H01Q 21/30*** (2013.01); ***H01Q 1/521*** (2013.01); ***H01Q 1/36*** (2013.01)

(57) **ABSTRACT**

An antenna assembly and an electronic device are provided in implementations of the disclosure. The antenna assembly includes a first antenna element and a second antenna element. The first antenna element is configured to generate multiple first resonant modes to transmit/receive an electromagnetic wave signal of a first band. The first antenna element includes a first radiator. The second antenna element is configured to generate at least one second resonant mode to transmit/receive an electromagnetic wave signal of a second band. A maximum frequency of the first band is less than a minimum frequency of the second band. The second antenna element includes a second radiator. A first gap is defined between the second radiator and the first radiator. The second radiator is configured to be in capacitive coupling with the first radiator through the first gap.



US 20230352814A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0352814 A1**

(43) **Pub. Date: Nov. 2, 2023**

AN et al.

(54) **SLIDABLE ELECTRONIC DEVICE INCLUDING FLEXIBLE DISPLAY AND ANTENNA**

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

(72) Inventors: **Seongyong AN**, Suwon-si (KR); **Gyusub KIM**, Suwon-si (KR); **Kyungmoon SEOL**, Suwon-si (KR); **Kyihyun JANG**, Suwon-si (KR); **Bumjin CHO**, Suwon-si (KR)

(21) Appl. No.: **18/346,557**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2023/004743, filed on Apr. 7, 2023.

(30) **Foreign Application Priority Data**

Apr. 8, 2022 (KR) 10-2022-0044190
Jun. 8, 2022 (KR) 10-2022-0069471

Publication Classification

(51) **Int. Cl.**

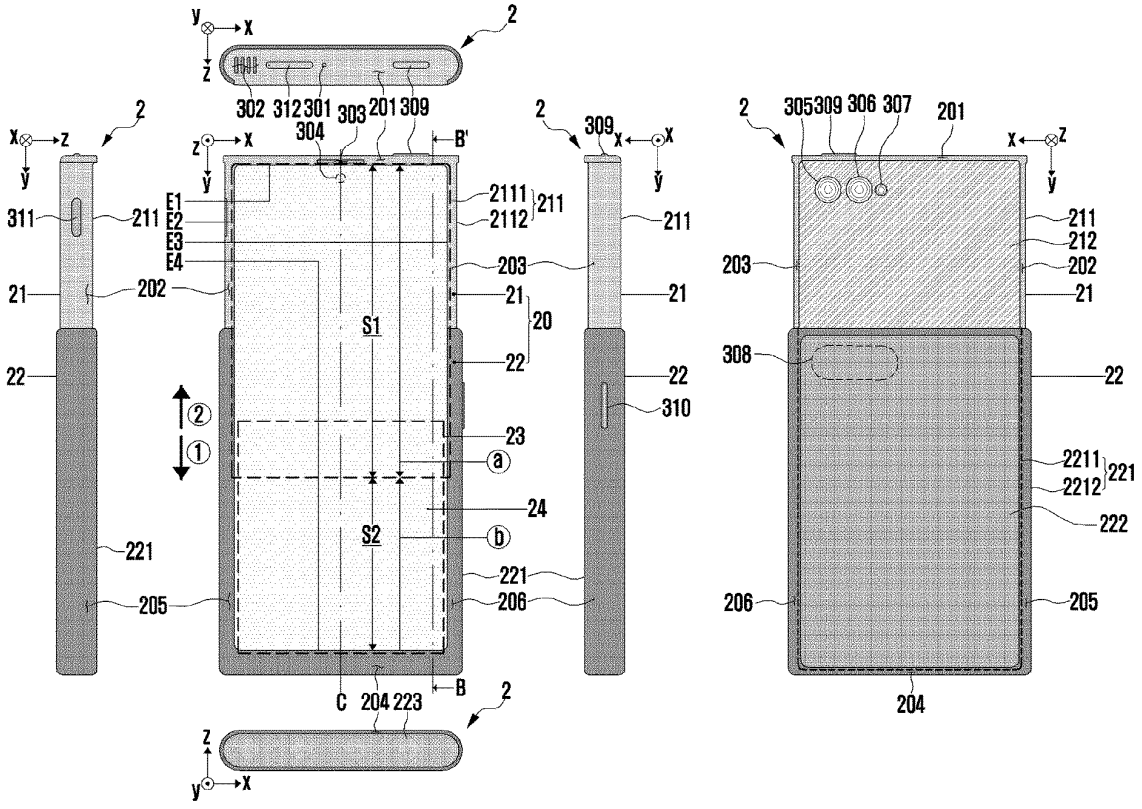
H01Q 1/24	(2006.01)
H01Q 1/38	(2006.01)
G06F 1/16	(2006.01)
H04M 1/02	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/38*** (2013.01); ***G06F 1/1652*** (2013.01); ***G06F 1/1624*** (2013.01); ***H04M 1/0268*** (2013.01); ***H04M 1/0237*** (2013.01); ***H04M 1/0277*** (2013.01); ***G06F 1/1656*** (2013.01)

(57) **ABSTRACT**

According to an example embodiment, a slidable electronic device may include a first housing, a second housing configured to be slidable with respect to the first housing, a flexible display module comprising a flexible display including a first area configured to be seen in a state in which the second housing is slid-in with respect to the first housing, and a second area configured to be at least partially drawn out to the outside to be seen in a state in which the second housing is slid-out with respect to the first housing, and a wireless communication circuit, wherein the second housing includes a first conductive pattern electrically connected to the wireless communication circuit and a second conductive pattern physically separated from the first conductive pattern and configured to operate as an antenna ground.



US 20230352840A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0352840 A1**

Tian et al. (43) **Pub. Date: Nov. 2, 2023**

(54) **ANTENNA ELEMENT AND ANTENNA ARRAY COMPRISING SUCH ANTENNA ELEMENTS**

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

(72) Inventors: **Ruiyuan Tian**, Helsinki (FI); **Timofey Kamyshev**, Helsinki (FI); **Alexander Khripkov**, Helsinki (FI); **Janne Ilvonen**, Helsinki (FI); **Tuomo Katajamäki**, Helsinki (FI)

(21) Appl. No.: **18/311,737**

(22) Filed: **May 3, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/EP2020/081275, filed on Nov. 6, 2020.

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

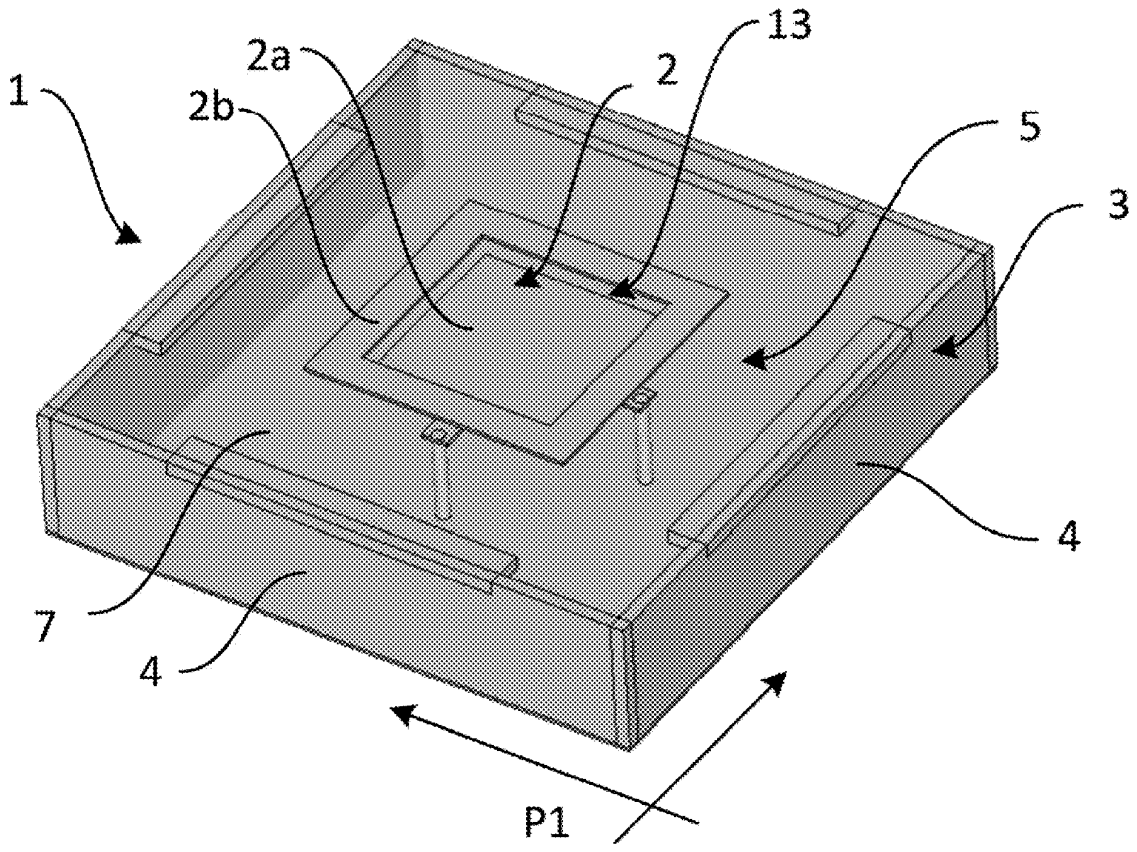
H01Q 5/35 (2006.01)

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

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

(57) **ABSTRACT**

Antenna element comprising a patch antenna extending in a main plane, a conductive structure, a first feed line, and a second feed line. The conductive structure comprises a bottom element and at least one wall element, said wall element at least partially enclosing an aperture, said patch antenna being superposed over said aperture. First feed line and said second feed line extend from said bottom element across said aperture and are coupled to said patch antenna. Aperture may be configured to generate a first resonance frequency (F1) and a fourth resonance frequency (F4), and said patch antenna is configured to generate a second resonance frequency (F2) and a third resonance frequency (F3), (F1)>(F2)>(F3)>(F4). Patch antenna, said conductive structure, second vias, a dielectric gap, and/or a recess is configured to expand the bandwidth of one or several of said resonance frequencies.



US 20230352854A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0352854 A1**

(43) **Pub. Date: Nov. 2, 2023**

Wu

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

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

(72) Inventor: **Jianlin Wu**, Dongguan (CN)

(21) Appl. No.: **18/142,076**

(22) Filed: **May 2, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/116948, filed on Sep. 7, 2021.

(30) **Foreign Application Priority Data**

Nov. 2, 2020 (CN) 202011204405.9

Publication Classification

(51) **Int. Cl.**

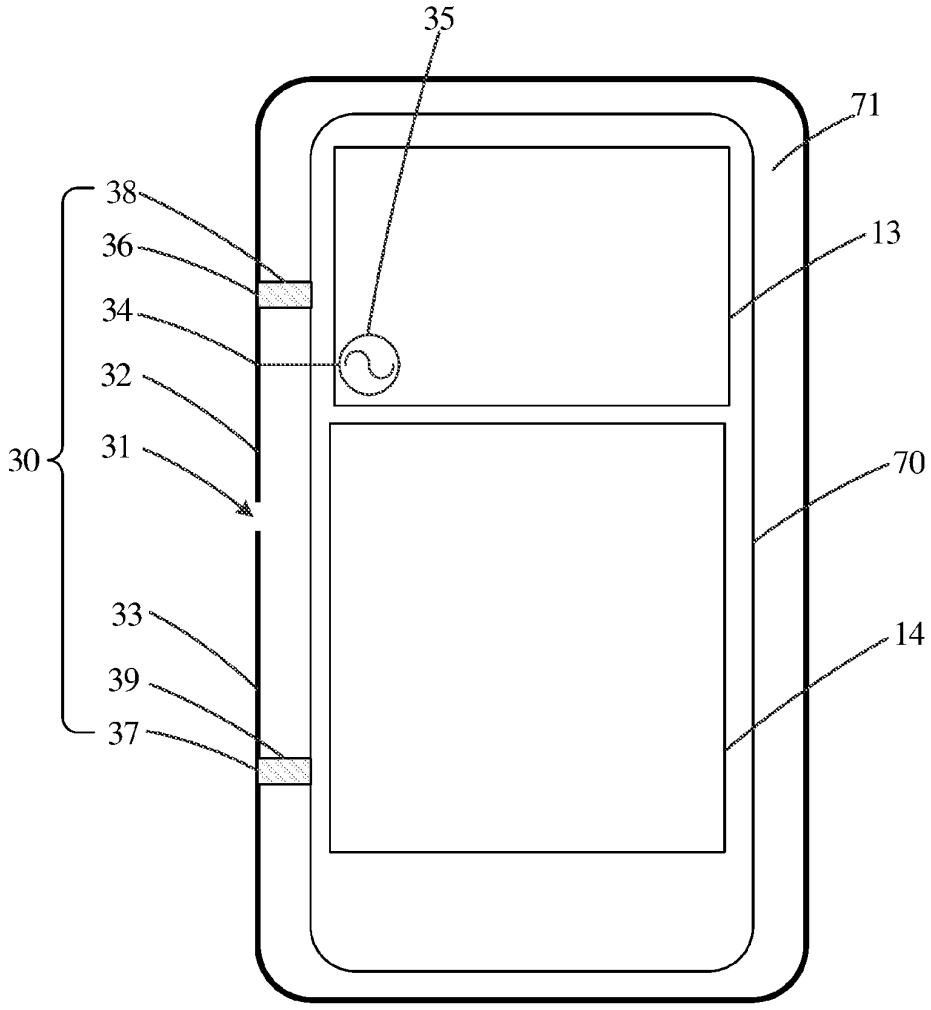
H01Q 23/00 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/48 (2006.01)

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

CPC ***H01Q 23/00*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

Provided are an antenna assembly and an electronic device. The antenna assembly includes a grounding plane, a first radiator, and a first signal source. A first gap is defined between the first radiator and the grounding plane. The first radiator includes a first radiation segment and a second radiation segment that are opposite to each other. A second gap is defined between the first radiation segment and the second radiation segment. The first radiation segment has a first feed point and a first ground terminal that are disposed thereon. The second radiation segment has a second ground terminal disposed thereon. The first signal source is connected to the first radiation segment at the first feed point.



US 20230361449A1

(19) **United States**

(12) **Patent Application Publication**

HSU et al.

(10) **Pub. No.: US 2023/0361449 A1**

(43) **Pub. Date: Nov. 9, 2023**

(54) **ELECTRONIC DEVICE HAVING ANTENNA FEED MODULE**

(71) Applicant: **FIH CO., LTD.**, New Taipei (TW)

(72) Inventors: **CHO-KANG HSU**, New Taipei (TW); **MIN-HUI HO**, New Taipei (TW); **YEN-HUI LIN**, New Taipei (TW); **WEI-CHENG SU**, New Taipei (TW)

(21) Appl. No.: **17/828,306**

(22) Filed: **May 31, 2022**

(30) **Foreign Application Priority Data**

May 7, 2022 (CN) 202210490818.0

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

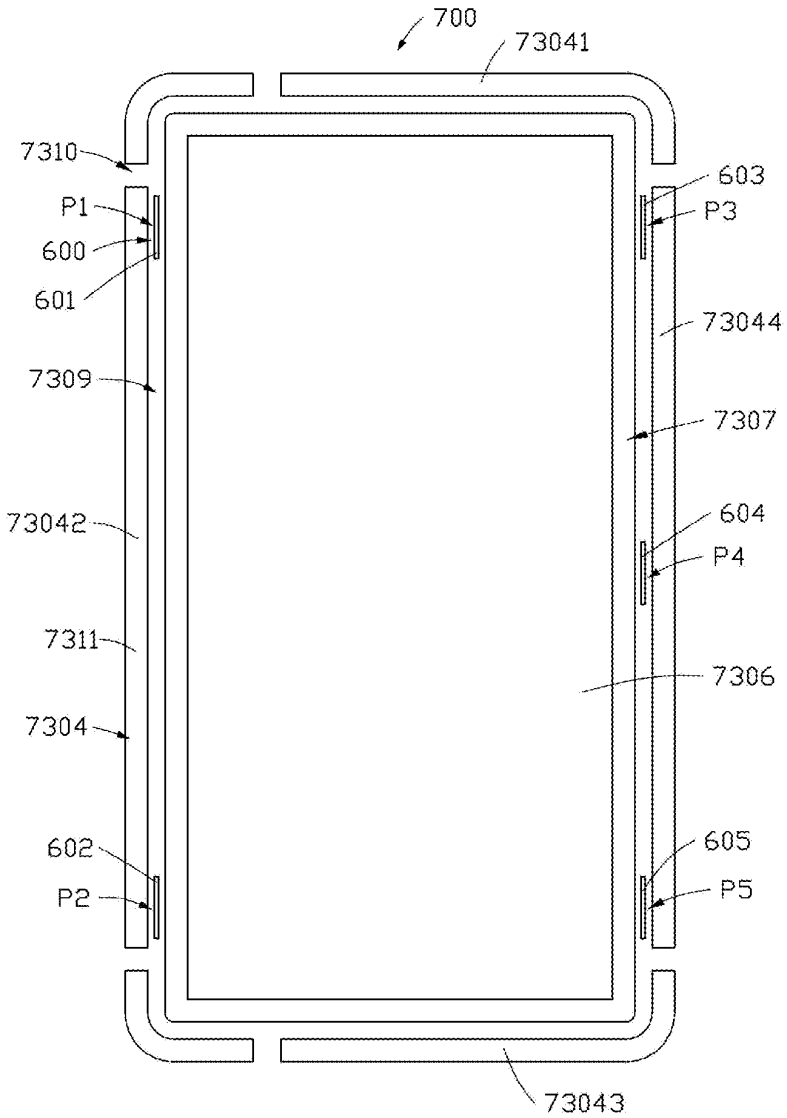
H01Q 5/335 (2006.01)

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

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

(57) **ABSTRACT**

An electronic device includes a metal frame, a middle frame, and at least one antenna feed module. The metal frame includes an upper metal frame, a first side metal frame, a bottom metal frame, and a second side metal frame sequentially connected. The middle frame, spaced apart from the first side metal frame and the second side metal frame, forms a slit, the at least one antenna feed module is received in the slit.



US 20230361450A1

(19) **United States**

(12) **Patent Application Publication**

HSU et al.

(10) **Pub. No.: US 2023/0361450 A1**

(43) **Pub. Date: Nov. 9, 2023**

(54) **MICROMINIATURIZED ANTENNA FEED MODULE AND ELECTRONIC DEVICE USING THE SAME**

(71) Applicant: **FIH CO., LTD.**, New Taipei (TW)

(72) Inventors: **CHO-KANG HSU**, New Taipei (TW); **MIN-HUI HO**, New Taipei (TW); **WEI-CHENG SU**, New Taipei (TW); **YEN-HUI LIN**, New Taipei (TW)

(21) Appl. No.: **17/828,328**

(22) Filed: **May 31, 2022**

(30) **Foreign Application Priority Data**

May 7, 2022 (CN) 202210490827.X

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

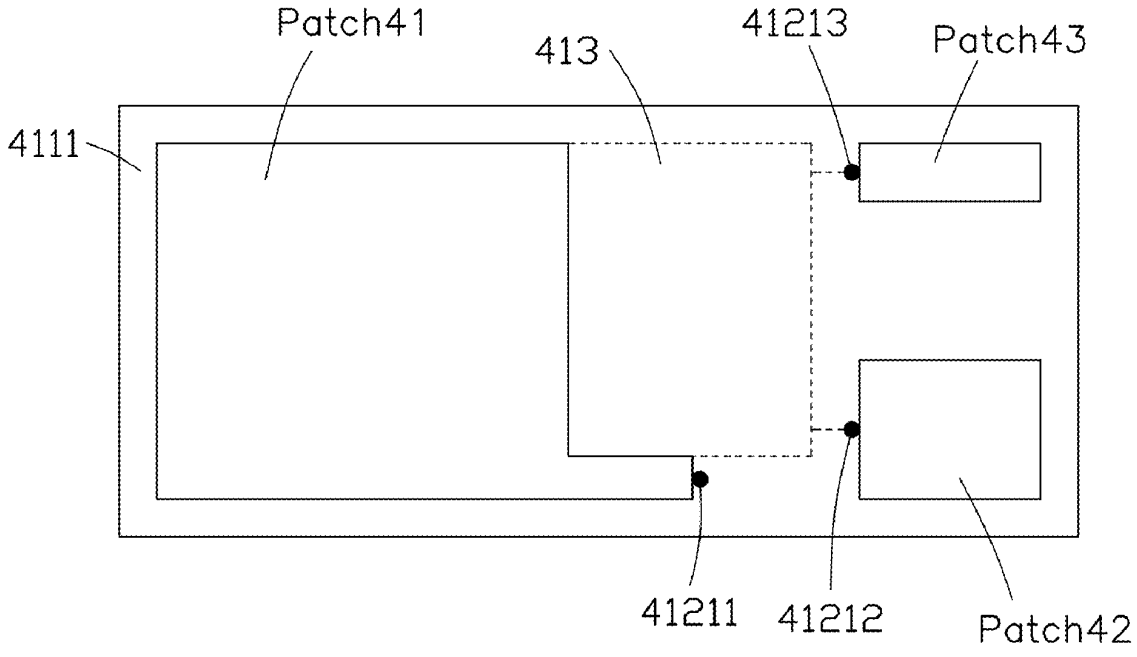
H04B 1/00 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H04B 1/006*** (2013.01)

(57) **ABSTRACT**

A microminiaturized antenna feed module includes a substrate, a plurality of coupled feed portions, and an active circuit. The substrate defines a plurality of visa penetrating the substrate. The coupled feed portions, made of conductive material and have different coupling areas, are electrically connected to the active circuit through the holes, to feed in electrical signals, the coupled feed portions couple the electrical signals to the metal frame to radiate wireless signals; the active circuit controls the switching of radiation modes of the metal frame. The application also provides an electronic device with the microminiaturized antenna feed module.



US 20230361467A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0361467 A1**

(43) **Pub. Date: Nov. 9, 2023**

WU

(54) **ELECTRONIC DEVICE**

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

(72) Inventor: **Xiaopu WU**, Dongguan (CN)

(21) Appl. No.: **18/343,667**

(22) Filed: **Jun. 28, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/131261, filed on Nov. 17, 2021.

(30) **Foreign Application Priority Data**

Dec. 29, 2020 (CN) 202011603135.9

Publication Classification

(51) **Int. Cl.**

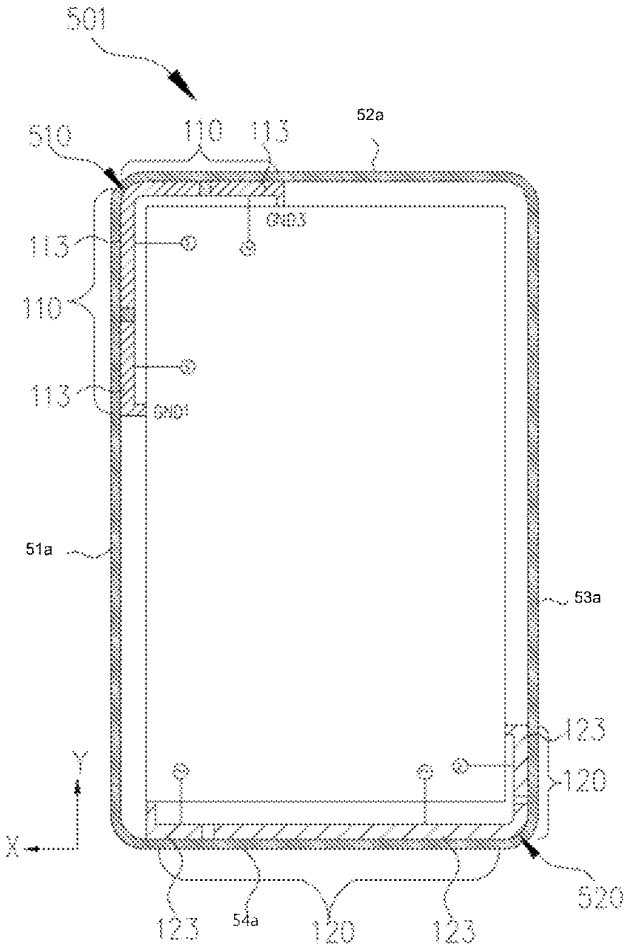
H01Q 5/20	(2006.01)
H01Q 1/24	(2006.01)
H01Q 5/314	(2006.01)
H01Q 1/52	(2006.01)

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

CPC ***H01Q 5/20*** (2015.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/314*** (2015.01); ***H01Q 1/52*** (2013.01)

(57) **ABSTRACT**

An electronic device is provided in the present disclosure. The electronic device includes a housing, a first antenna module, and a second antenna module. The housing includes a first corner portion and a second corner portion that are disposed diagonally. At least part of the first antenna module is disposed at or close to the first corner portion. The first antenna module includes a first radiating element. The first radiating element is configured to transmit and receive a first electromagnetic wave signal, and generate a first induction signal when a subject to-be-detected is approaching. At least part of the second antenna module is disposed at or close to the second corner portion. The second antenna module includes a second radiating element, and the second radiating element is configured to transmit and receive a second electromagnetic wave signal, and generate a second induction signal when the subject to-be-detected is approaching.



US 20230361470A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0361470 A1**

(43) **Pub. Date: Nov. 9, 2023**

WU

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

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

(72) Inventor: **Xiaopu WU**, Dongguan (CN)

(21) Appl. No.: **18/354,475**

(22) Filed: **Jul. 18, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/134511, filed on Nov. 30, 2021.

(30) **Foreign Application Priority Data**

Jan. 28, 2021 (CN) 202110122572.7

Publication Classification

(51) **Int. Cl.**

H01Q 5/335 (2006.01)

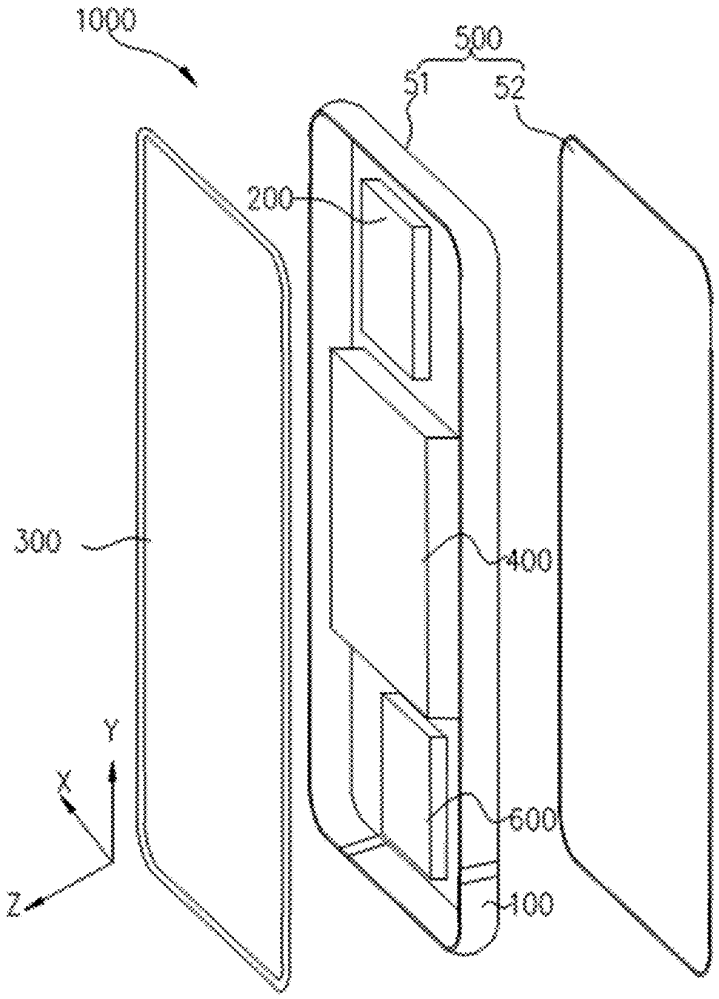
H01Q 1/22 (2006.01)

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

CPC ***H01Q 5/335*** (2015.01); ***H01Q 1/22*** (2013.01)

(57) **ABSTRACT**

Provided is an antenna assembly and an electronic device. The antenna assembly includes the following. A first antenna including a first radiator and a first signal source electrically connected to the first radiator. A second antenna including a second radiator and a third radiator, one end of the second radiator is spaced apart from one end of the first radiator with a first coupling gap, and the other end of the second radiator is spaced apart from one end of the third radiator with a second coupling gap. The first radiator is configured to generate at least one resonant mode under excitation of the first signal source, and a part of the second radiator that is close to the second coupling gap is configured to generate at least one resonant mode under excitation of the first signal source through coupling of the first radiator.



US 20230361487A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0361487 A1**

HSU et al. (43) **Pub. Date: Nov. 9, 2023**

(54) **ANTENNA COUPLED FEED MODULE AND ELECTRONIC DEVICE WITH SAME**

(71) Applicant: **FIH CO., LTD.**, New Taipei (TW)

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

(21) Appl. No.: **17/828,315**

(22) Filed: **May 31, 2022**

(30) **Foreign Application Priority Data**

May 7, 2022 (CN) 202210490801.5

Publication Classification

(51) **Int. Cl.**

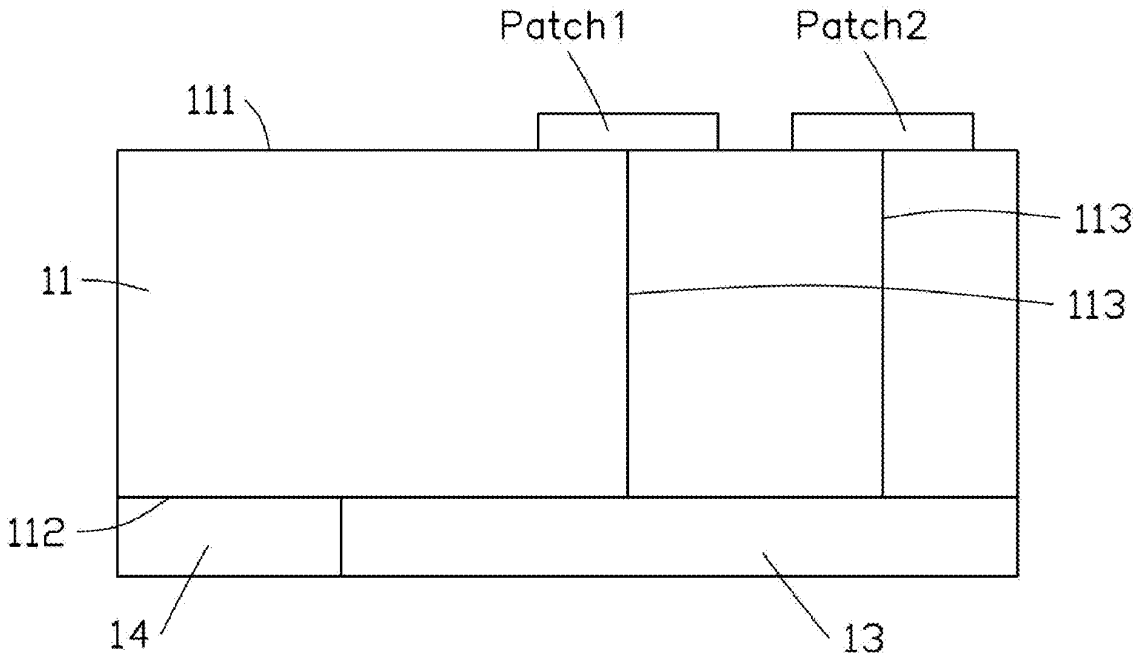
H01Q 21/28	(2006.01)
H01Q 1/38	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 21/28*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 9/0407*** (2013.01)

(57) **ABSTRACT**

An antenna coupled feed module is received in a slit formed between a metal frame and at least one electronic component of an electronic device. The antenna coupled feed module includes a substrate, at least one coupled feed portion, an active circuit, a metal layer, and a non-conductive layer. The coupled feed portion and the active circuit are disposed on opposite surfaces of the substrate; the coupled feed portion couples the electrical signals to the metal layer, the metal layer conducts the electrical signals to the metal frame to radiate wireless signals; the non-conductive layer is arranged between the metal layer and the at least one coupled feed portion, and covers the coupled feed portion; the active circuit switches the electrical signals fed to the coupled feed portion. An electronic device with the antenna coupled feed module is also provided.



US 20230369747A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0369747 A1**

YANG et al. (43) **Pub. Date: Nov. 16, 2023**

(54) **RADIATOR, ANTENNA AND BASE STATION**

(71) Applicant: **Nokia Shanghai Bell Co., Ltd.**, Shanghai (CN)

(72) Inventors: **Wenmin YANG**, Shanghai (CN); **Guangyong He**, Shanghai (CN); **Yonghui Jiang**, Shanghai (CN); **Chengming Liu**, Shanghai (CN)

(73) Assignee: **Nokia Shanghai Bell Co., Ltd.**, Shanghai (CN)

(21) Appl. No.: **18/314,928**

(22) Filed: **May 10, 2023**

(30) **Foreign Application Priority Data**

May 10, 2022 (CN) 202210542831.6

Publication Classification

(51) **Int. Cl.**

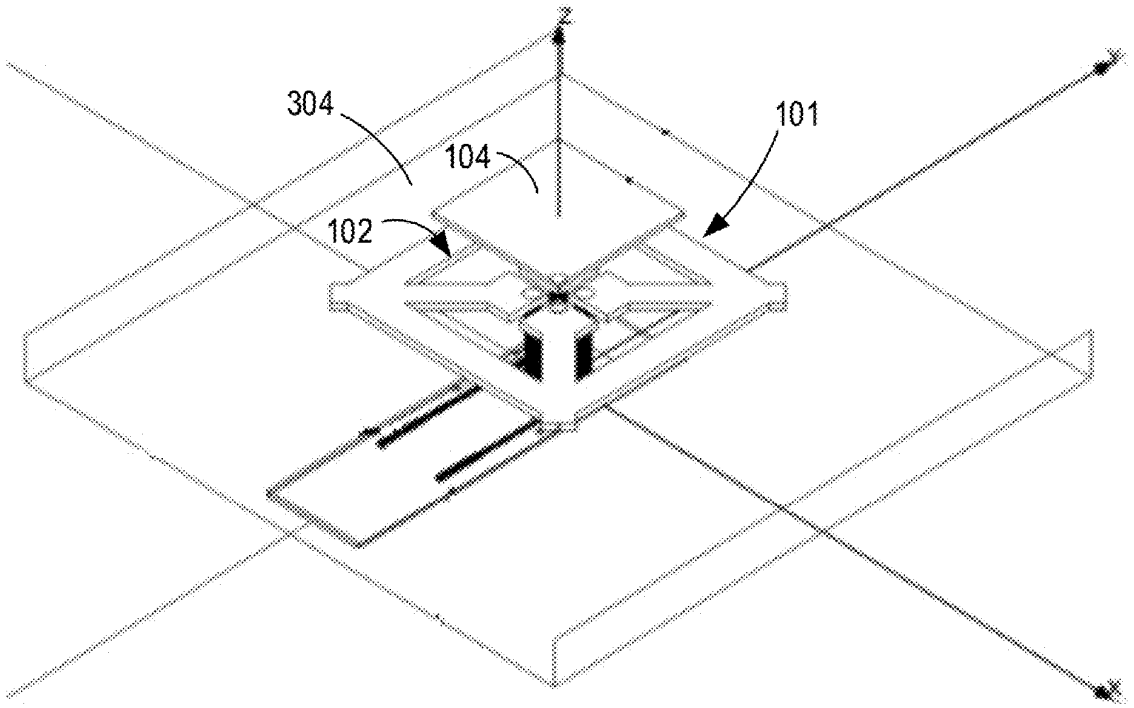
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
H01Q 19/10 (2006.01)
H01Q 21/24 (2006.01)

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

CPC ***H01Q 1/246*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 19/10*** (2013.01); ***H01Q 21/245*** (2013.01)

(57) **ABSTRACT**

The present disclosure provides a radiator, an antenna, and a base station. The radiator comprises a conductor adapted to be arranged in an antenna for transmitting and/or receiving electromagnetic waves; and a pair of slots formed in the conductor and intersecting at a predetermined angle, each of the pair of slots comprising an elongated section at the middle thereof and widened sections at both ends thereof such that the conductor is divided by the pair of slots into: a continuous outer frame portion; and an enclosed portion surrounded by and connected to the continuous outer frame portion. Thus, the bandwidth of the patch antenna can be significantly broadened while maintaining the advantages of light weight, easy layout, wide range of applications, small size, low cost, etc.



US 20230369762A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0369762 A1**

CHANG et al. (43) **Pub. Date: Nov. 16, 2023**

(54) **MOBILE DEVICE WITH COMMUNICATION AND SENSING FUNCTIONS**

(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.: **17/818,077**

(22) Filed: **Aug. 8, 2022**

(30) **Foreign Application Priority Data**

May 16, 2022 (TW) 111118175

Publication Classification

(51) **Int. Cl.**

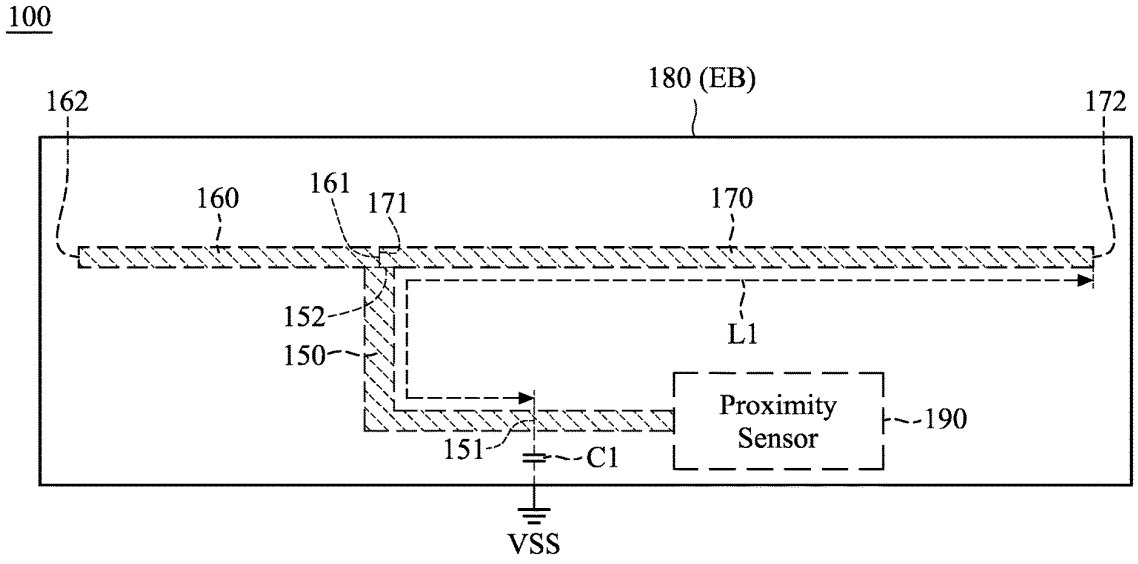
H01Q 5/307	(2006.01)
H01Q 9/42	(2006.01)
H01Q 1/22	(2006.01)

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

CPC ***H01Q 5/307*** (2015.01); ***H01Q 9/42*** (2013.01); ***H01Q 1/22*** (2013.01)

(57) **ABSTRACT**

A mobile device with communication and sensing functions includes a first radiation element, a second radiation element, a third radiation element, a fourth radiation element, a capacitor, a first metal element, a second metal element, a third metal element, a nonconductive support element, and a proximity sensor. The first metal element is coupled through the capacitor to a ground voltage. The second metal element is coupled to the first metal element. The third metal element is coupled to the first metal element. The third metal element and the second metal element substantially extend in opposite directions. The proximity sensor is coupled to the capacitor and the first metal element. A hybrid antenna structure is formed by a first radiation element, a second radiation element, a third radiation element, a fourth radiation element, a first metal element, a second metal element, and a third metal element.



US 20230369764A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0369764 A1**

(43) **Pub. Date: Nov. 16, 2023**

LIN et al.

(54) **MOBILE DEVICE**

(71) Applicant: **HTC Corporation**, Taoyuan City (TW)

(72) Inventors: **Cheng-Hung LIN**, Taoyuan City (TW); **Szu-Po WANG**, Taoyuan City (TW); **Chia-Te CHIEN**, Taoyuan City (TW); **Chun-Chieh WANG**, Taoyuan City (TW); **Kang-Ling LI**, Taoyuan City (TW); **Chun-Hsien LEE**, Taoyuan City (TW); **Yu-Chieh CHIU**, Taoyuan City (TW)

(73) Assignee: **HTC Corporation**, Taoyuan City (TW)

(21) Appl. No.: **17/742,710**

(22) Filed: **May 12, 2022**

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 5/35 (2006.01)

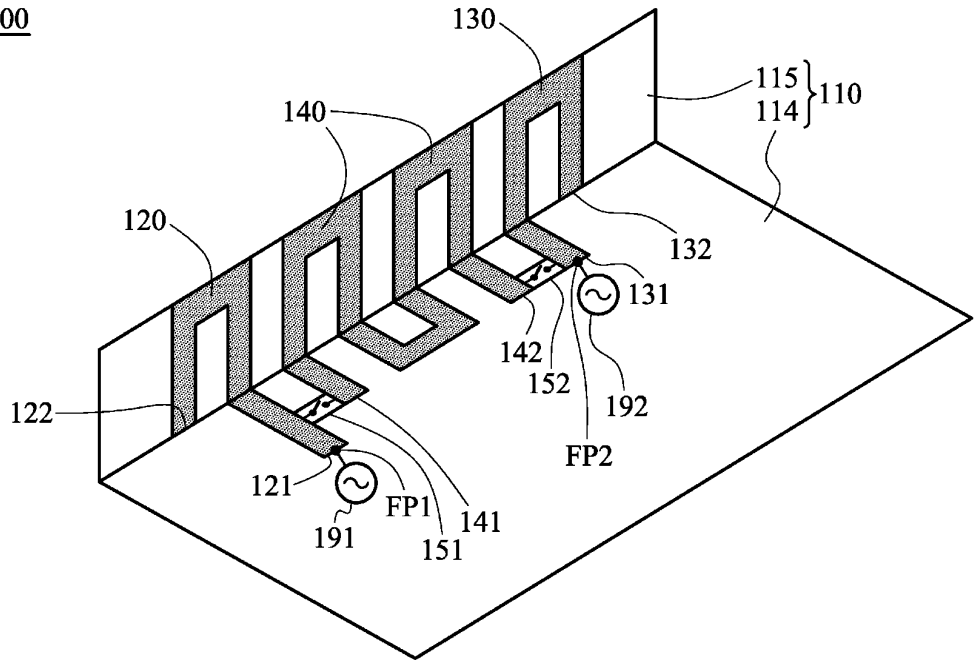
H01Q 15/00 (2006.01)

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

CPC ***H01Q 9/0414*** (2013.01); ***H01Q 5/35*** (2015.01); ***H01Q 15/002*** (2013.01)

(57) **ABSTRACT**

A mobile device includes a housing, a first radiation element, a second radiation element, a third radiation element, a first switch element, and a second switch element. The first radiation element has a first feeding point. The second radiation element has a second feeding point. The first radiation element, the second radiation element, and the third radiation element are distributed over the housing. The first switch element is closed or open, so as to selectively couple the first radiation element to the third radiation element. The second switch element is closed or open, so as to selectively couple the second radiation element to the third radiation element. An antenna structure is formed by the first radiation element, the second radiation element, and the third radiation element.



US 20230369765A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2023/0369765 A1**

(43) **Pub. Date: Nov. 16, 2023**

LI et al.

(54) **TRI-BAND ANTENNA MODULE**

(71) Applicant: **Arcadyan Technology Corporation**, Hsinchu City (TW)

(72) Inventors: **Ting-Ren LI**, Hsinchu County (TW); **Kuo-Chang LO**, Miaoli County (TW)

(21) Appl. No.: **18/139,332**

(22) Filed: **Apr. 25, 2023**

(30) **Foreign Application Priority Data**

May 16, 2022 (TW) 111118223

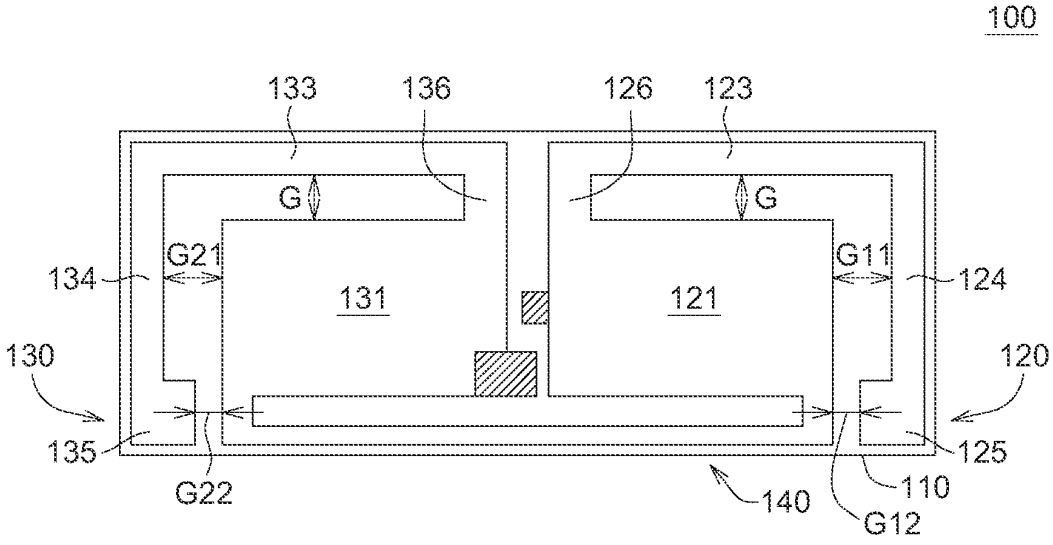
Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01Q 9/0421*** (2013.01); ***H01Q 5/307*** (2015.01)

(57) **ABSTRACT**

A tri-band antenna module includes a substrate, a first radiator, a second radiator, and a short-circuit structure. The substrate has a signal feed-in terminal and a ground terminal. The signal feed-in terminal is connected to the first radiator, and the ground terminal is connected to the second radiator. The first radiator includes a first extension block and a second extension block, and the second radiator includes a third extension block and a fourth extension block. The first extension block and the second extension block are separated by a first interval, and the third extension block and the fourth extension block are separated by a second interval. The short-circuit structure is connected between the first extension block and the third extension block, and the short-circuit structure is respectively separated from the first extension block and the third extension block by a first slot and a second slot.



US 20230369769A1

(19) **United States**

(12) **Patent Application Publication**

WU et al.

(10) **Pub. No.: US 2023/0369769 A1**

(43) **Pub. Date: Nov. 16, 2023**

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

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

(72) Inventors: **Pengfei WU**, Shanghai (CN); **Meng HOU**, Shanghai (CN); **Hanyang WANG**, Reading (GB); **Chien-Ming LEE**, Shenzhen (CN)

(21) Appl. No.: **18/246,801**

(22) PCT Filed: **Sep. 9, 2021**

(86) PCT No.: **PCT/CN2021/117539**

§ 371 (c)(1),
(2) Date: **Mar. 27, 2023**

(30) **Foreign Application Priority Data**

Sep. 28, 2020 (CN) 202011044876.8

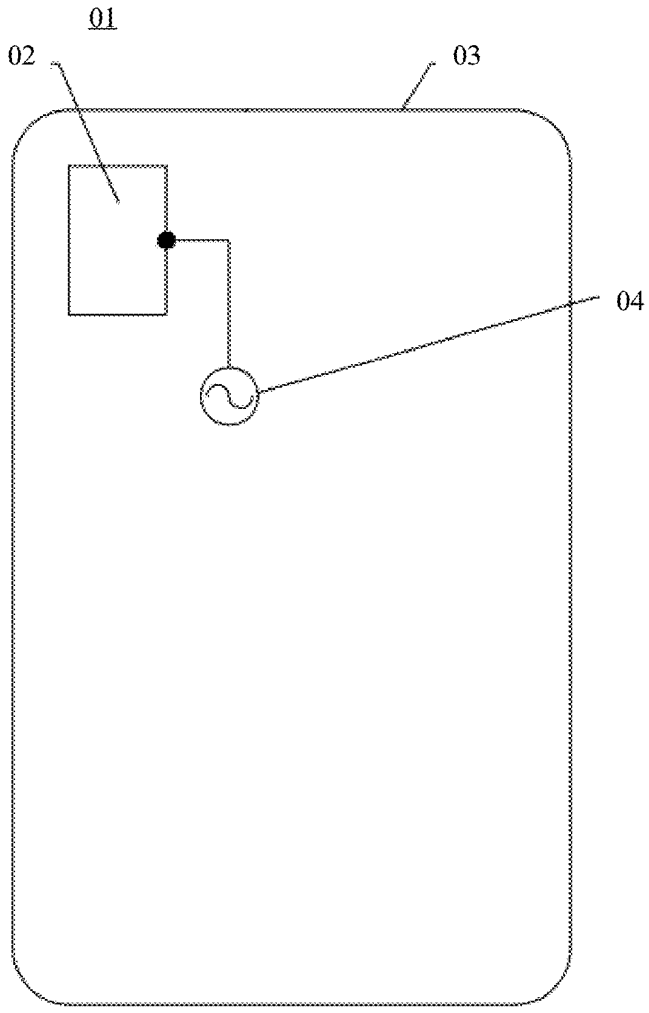
Publication Classification

(51) **Int. Cl.**
H01Q 9/42 (2006.01)
H01Q 21/20 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/42*** (2013.01); ***H01Q 21/20*** (2013.01)

(57) **ABSTRACT**

An antenna includes a first radiator having a first end and a second end, where the second end or a middle position of the first radiator is grounded; a second radiator having a third end and a fourth end, the fourth end is disposed away from the first end relative to the third end, and the second end or a middle position of the second radiator is grounded; a feeding circuit configured to feed the first radiator and the second radiator, at the first end of the first radiator and the third end of the second radiator; and a tuning circuit configured to selectively connect the feeding circuit to the first end of the first radiator or the third end of the second radiator to feed the first radiator or the second radiator.



US 20230370536A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0370536 A1**

Yueh (43) **Pub. Date: Nov. 16, 2023**

(54) **BACK COVER AND TERMINAL**

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

(72) Inventor: **HanLin Yueh**, Taipei City (CN)

(21) Appl. No.: **18/029,332**

(22) PCT Filed: **Sep. 9, 2021**

(86) PCT No.: **PCT/CN2021/117377**

§ 371 (c)(1),
(2) Date: **Mar. 29, 2023**

(30) **Foreign Application Priority Data**

Sep. 30, 2020 (CN) 202022224032.3

Publication Classification

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

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

(57) **ABSTRACT**

A terminal includes a back cover and an antenna. The back cover includes a non-metallic plate body and a multi-frequency AMC structure. The multi-frequency AMC structure is attached to the inner surface of the non-metallic plate body, or the multi-frequency AMC structure is embedded into the non-metallic plate body. A middle part of the multi-frequency AMC structure has an opening, and the antenna is located on an inner side of the back cover and is disposed directly facing the opening. The multi-frequency AMC structure comprises a first AMC structure and a second AMC structure, a resonance frequency of the first AMC structure is a first resonance frequency, a resonance frequency of the second AMC structure is a second resonance frequency, and the first resonance frequency is lower than the second resonance frequency.