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(19) **United States**

(12) **Patent Application Publication**

Li et al.

(10) **Pub. No.: US 2024/0088541 A1**

(43) **Pub. Date: Mar. 14, 2024**

(54) **ELECTRONIC DEVICE**

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

(72) Inventors: **Yuanpeng Li**, Shenzhen (CN);
Hanyang Wang, Reading (GB); **Dawei Zhou**, Shenzhen (CN)

(21) Appl. No.: **18/259,909**

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

(86) PCT No.: **PCT/CN2021/140289**
§ 371 (c)(1),
(2) Date: **Jun. 29, 2023**

(30) **Foreign Application Priority Data**
Dec. 30, 2020 (CN) 202011611722.2
Mar. 19, 2021 (CN) 202110296431.7

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/321 (2006.01)
H01Q 5/335 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 5/321**
(2015.01); **H01Q 5/335** (2015.01)

(57) **ABSTRACT**
An electronic device includes an antenna structure having an antenna radiator, a first circuit, a first feeding element, and a second feeding element. The first circuit comprises feeding input ports configured to input electrical signals of the first feeding element and the second feeding element, and feeding output ports configured to feed processed electrical signals to the antenna radiator. The electrical signal of the first feeding element has a same phase on the feeding input ports. The electrical signal of the second feeding element has opposite phases on the feeding input ports.



US 20240088559A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0088559 A1**

(43) **Pub. Date: Mar. 14, 2024**

(54) **MILLIMETER WAVE MODULE CIRCUIT
AND TERMINAL DEVICE**

Publication Classification

(71) Applicant: **Honor Device Co., Ltd.**, Shenzhen
(CN)

(51) **Int. Cl.**
H01Q 3/36 (2006.01)
H01Q 1/24 (2006.01)
H01Q 3/28 (2006.01)
H04M 1/02 (2006.01)

(72) Inventors: **Cheng JIANG**, Shenzhen (CN); **Yu
WANG**, Shenzhen (CN); **Zengchao
QU**, Shenzhen (CN); **Tianyu PEN**,
Shenzhen (CN); **Dongping LIU**,
Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H01Q 3/36** (2013.01); **H01Q 1/243**
(2013.01); **H01Q 3/28** (2013.01); **H04M**
1/0266 (2013.01)

(73) Assignee: **Honor Device Co., Ltd.**, Shenzhen
(CN)

(21) Appl. No.: **18/274,464**

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

(86) PCT No.: **PCT/CN2022/141111**

§ 371 (c)(1),

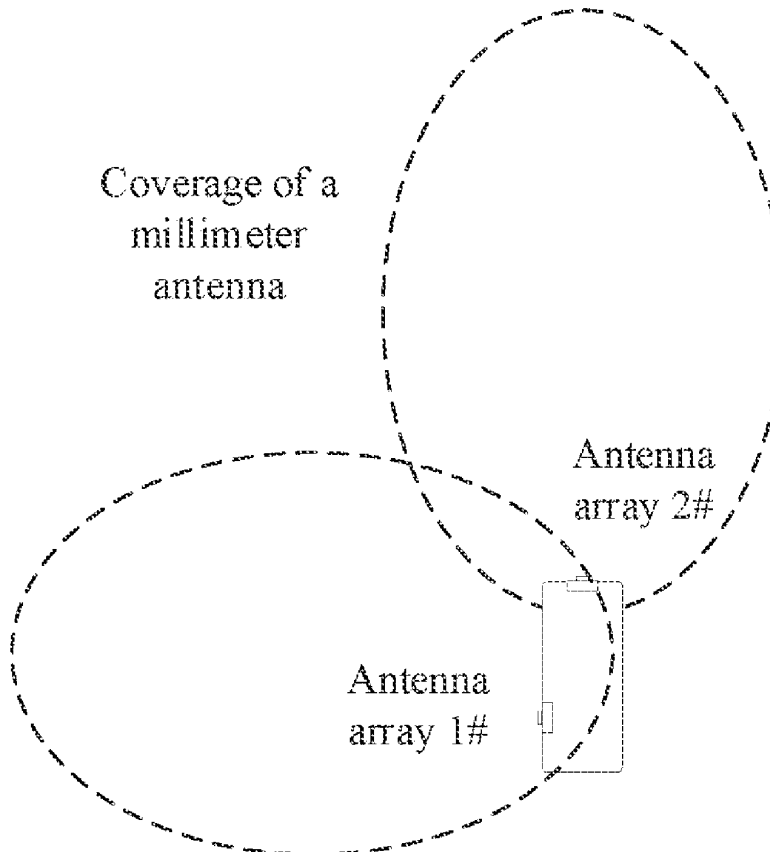
(2) Date: **Jul. 27, 2023**

(30) **Foreign Application Priority Data**

Jan. 12, 2022 (CN) 202210031486.X

ABSTRACT

Embodiments of this application relate to the field of terminal technologies, and provides a millimeter wave module circuit and a terminal device. The first antenna array includes N first antennas, and the second antenna array includes M second antennas, where N is greater than M. The processing module includes a plurality of first processing units. Each of N first antennas is connected to each first processing unit. Each of M second antennas is separately connected to two different first processing units. The first processing unit includes a power amplifier. The processing module is configured to send, through differential feeding, a second signal to the second antenna by using two different first processing units. This can enable a signal coverage of the second antenna array to be increased, improving performance of a millimeter wave module in a coverage region of the second antenna array.





US 20240089367A1

(19) **United States**

(12) **Patent Application Publication**

SHIM et al.

(10) **Pub. No.: US 2024/0089367 A1**

(43) **Pub. Date: Mar. 14, 2024**

(54) **MOBILE TERMINAL**

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

(72) Inventors: **Hongjo SHIM**, Seoul (KR); **Hyunwoo KIM**, Seoul (KR); **Sungwook CHANG**, Seoul (KR)

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

Publication Classification

(51) **Int. Cl.**
H04M 1/725 (2006.01)
H04M 1/724 (2006.01)

(52) **U.S. Cl.**
CPC *H04M 1/725* (2013.01); *H04M 1/724* (2021.01); *H04M 2250/12* (2013.01)

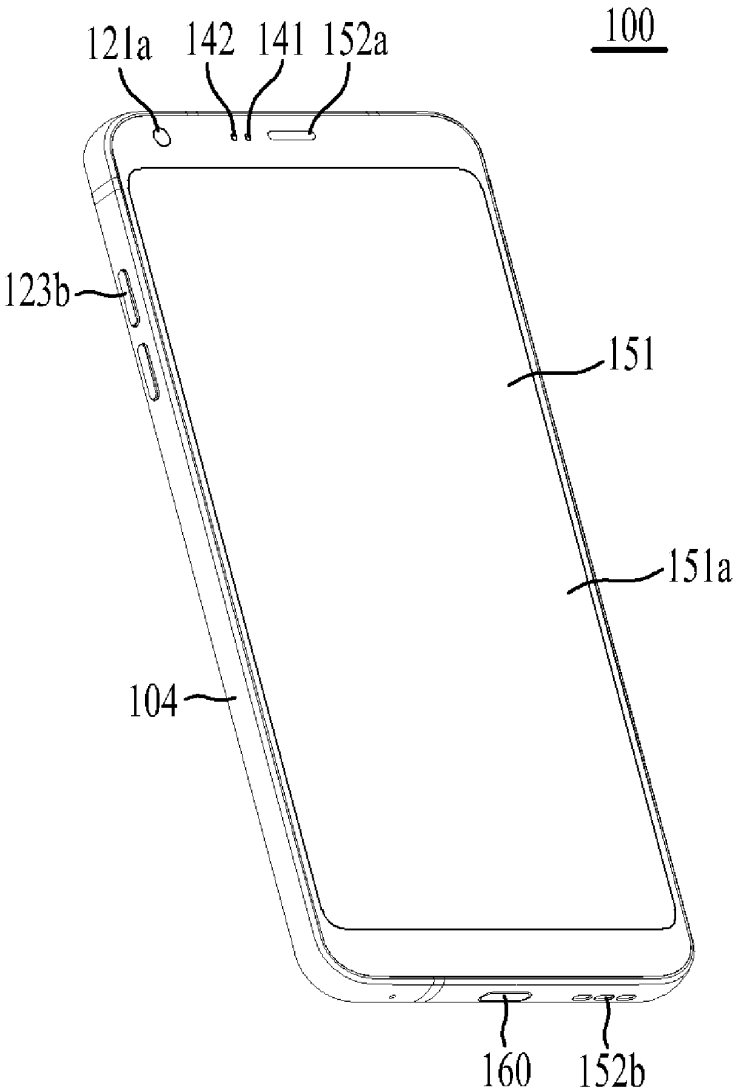
(21) Appl. No.: **17/766,692**

(22) PCT Filed: **Oct. 18, 2019**

(86) PCT No.: **PCT/KR2019/013708**
§ 371 (c)(1),
(2) Date: **Apr. 5, 2022**

(57) **ABSTRACT**

Provided is a mobile terminal which can additionally mount antennas without needing to change the positions of buttons and thus without reducing the usability thereof, the mobile terminal comprising: an antenna module disposed inside the side surface of a case; and a user input module overlappingly disposed inside the antenna module and including a force sensor for pressure sensing.





US 20240097315A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0097315 A1**

(43) **Pub. Date: Mar. 21, 2024**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

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

(72) Inventors: **Dongjin KIM**, Seoul (KR); **Sungwon KIM**, Seoul (KR); **Jihun HA**, Seoul (KR); **Youngbae KWON**, Seoul (KR); **Byungwoon JUNG**, Seoul (KR)

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

(21) Appl. No.: **18/555,964**

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

(86) PCT No.: **PCT/KR2021/005092**

§ 371 (c)(1),

(2) Date: **Oct. 18, 2023**

Publication Classification

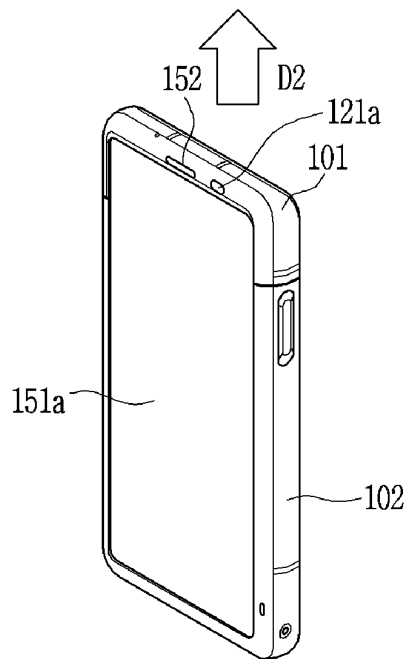
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/52 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/52** (2013.01); **H04M 1/0268** (2013.01)

(57) **ABSTRACT**

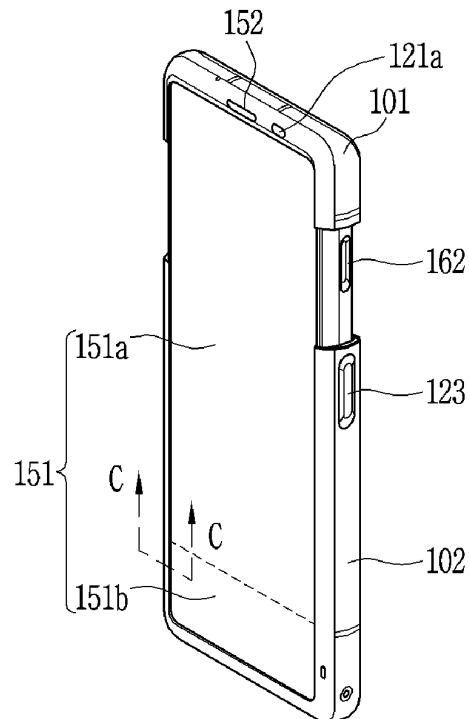
A mobile terminal including an antenna according to an embodiment is provided. The mobile terminal includes a slide metal part and a front metal part, and a contact member configured to contact the slide metal part and the front metal part is provided on a side of the front metal part. In a first state in which a display area of the mobile terminal is contracted, the contact member may remove parasitic resonance caused by a slot area, as the slide metal part and the front metal part contact are contacted by the contact member at a first position which is a lower end of the slot area, and in a second state in which the display area is expanded, the contact member may remove parasitic resonance caused by the slot area, as the slide metal part and the front metal part are contacted by the contact member at a second position which is an upper end of the slot area.

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(a)

100



(b)



US 20240097330A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0097330 A1**

(43) **Pub. Date: Mar. 21, 2024**

(54) **ANTENNA SYSTEM**

(71) Applicant: **Quanta Computer Inc.**, Taoyuan City (TW)

(72) Inventors: **Wen Yuan LO**, Taoyuan City (TW);
Hui LIN, Taoyuan City (TW)

(21) Appl. No.: **18/051,025**

(22) Filed: **Oct. 31, 2022**

(30) **Foreign Application Priority Data**

Sep. 20, 2022 (TW) 111210216

Publication Classification

(51) **Int. Cl.**
H01Q 5/307 (2006.01)
H01Q 5/20 (2006.01)
H01Q 9/26 (2006.01)

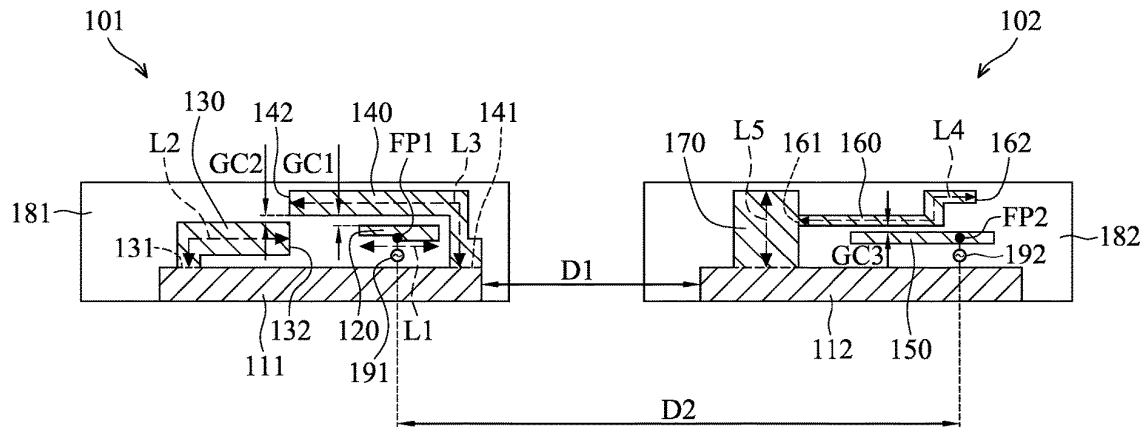
(52) **U.S. Cl.**

CPC **H01Q 5/307** (2015.01); **H01Q 5/20** (2015.01); **H01Q 9/26** (2013.01)

(57) **ABSTRACT**

An antenna system includes a first antenna element and a second antenna element. The first antenna element includes a first ground element, a first radiation element, a second radiation element, and a third radiation element. The first radiation element has a first feeding point. The second radiation element is coupled to the first ground element. The third radiation element is coupled to the first ground element. The third radiation element is adjacent to the first radiation element and the second radiation element. The second antenna element includes a second ground element, a fourth radiation element, a fifth radiation element, and a sixth radiation element. The fourth radiation element has a second feeding point. The fifth radiation element is adjacent to the fourth radiation element. The fifth radiation element is coupled through the sixth radiation element to the second ground element.

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US 20240097338A1

(19) **United States**

(12) **Patent Application Publication**
Navsariwala

(10) **Pub. No.: US 2024/0097338 A1**

(43) **Pub. Date: Mar. 21, 2024**

(54) **LOW-PROFILE ANTENNA FOR
BELOW-GRADE APPLICATIONS**

(71) Applicant: **PCTEL, Inc.**, Bloomington, IL (US)

(72) Inventor: **Umesh Navsariwala**, Bartlett, IL (US)

(73) Assignee: **PCTEL, Inc.**, Bloomington, IL (US)

(21) Appl. No.: **18/367,031**

(22) Filed: **Sep. 12, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/406,893, filed on Sep. 15, 2022.

Publication Classification

(51) **Int. Cl.**

H01Q 9/04

(2006.01)

H01Q 1/22

(2006.01)

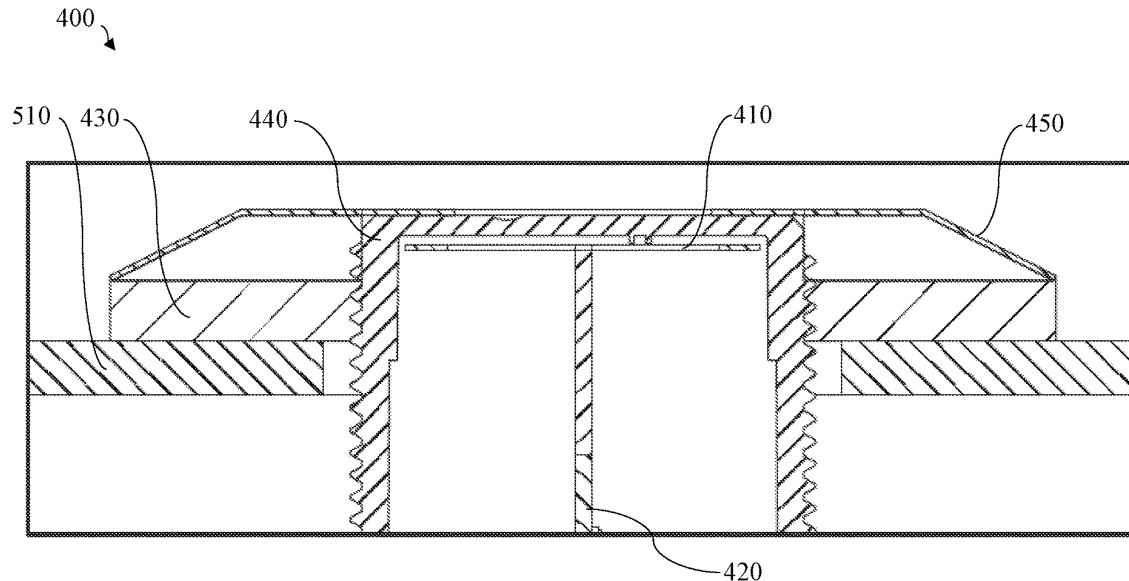
(52) **U.S. Cl.**

CPC **H01Q 9/045** (2013.01); **H01Q 1/2283**
(2013.01)

(57)

ABSTRACT

A capacitively coupled below-grade antenna is provided. The antenna includes a housing; a cap detachable from the housing, the cap having a top surface; a feeding element coupled to a radio module; and a radiating element provided on the cap along the top surface such that the radiating element is capacitively coupled with the feeding element.





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(19) **United States**

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

(10) **Pub. No.: US 2024/0097351 A1**

(43) **Pub. Date: Mar. 21, 2024**

(54) **ANTENNA SYSTEM**

Publication Classification

(71) Applicants: **Inventec (Pudong) Technology Corporation**, Shanghai (CN);
INVENTEC CORPORATION,
TAIPEI CITY (TW)

(51) **Int. Cl.**
H01Q 21/28 (2006.01)
H01Q 9/30 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 21/28** (2013.01); **H01Q 9/30**
(2013.01)

(72) Inventors: **Hsin Hung LIN**, TAIPEI CITY (TW);
Yu Shu TAI, TAIPEI CITY (TW); **Wei**
Chen CHENG, TAIPEI CITY (TW)

(57) **ABSTRACT**

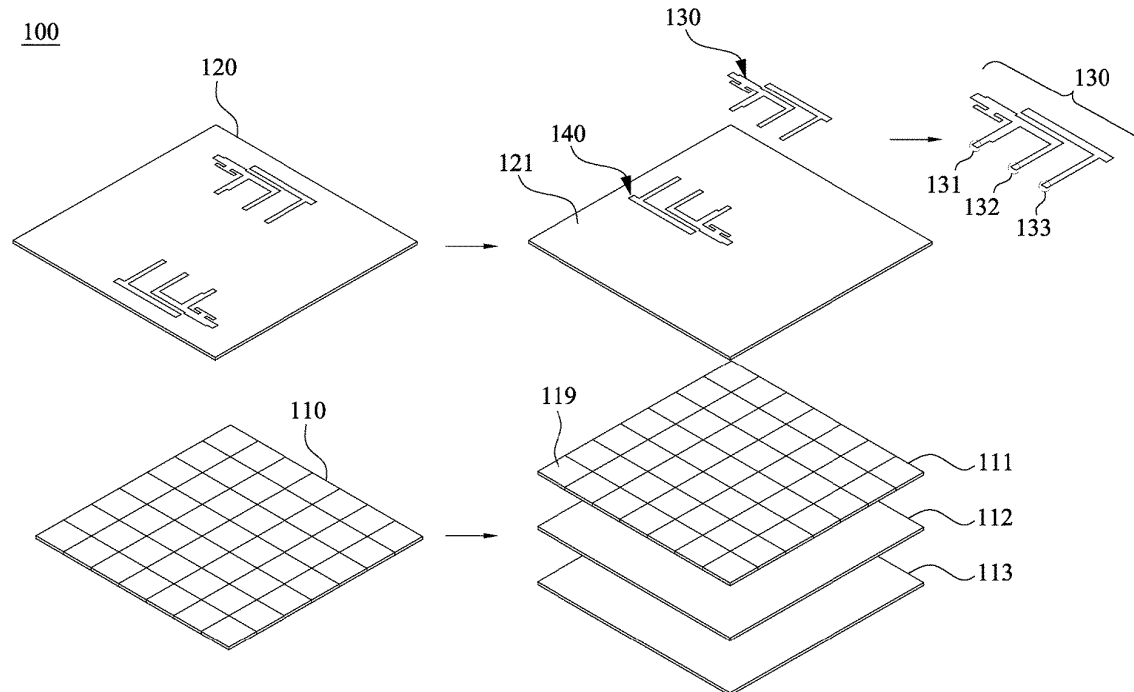
The present disclosure provides an antenna system, which includes a defected ground structure board and an antenna structure board. The defected ground structure board includes a first insulating plate and a defected ground structure layer, and the defected ground structure layer is disposed on the first insulating plate. The antenna structure board is disposed on the defected ground structure board. The antenna structure board includes at least one antenna body and a second insulating plate, the at least one antenna body is disposed on the second insulating plate, and the second insulating plate is disposed on the defected ground structure layer.

(21) Appl. No.: **18/067,739**

(22) Filed: **Dec. 19, 2022**

(30) **Foreign Application Priority Data**

Sep. 15, 2022 (CN) 202211124155.7





US 20240106103A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0106103 A1**

(43) **Pub. Date: Mar. 28, 2024**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

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

(72) Inventors: **Gyusub KIM**, Suwon-si (KR); **Jiho KIM**, Suwon-si (KR); **Kyungmoon SEOL**, Suwon-si (KR); **Seongyong AN**, Suwon-si (KR); **Minkyung LEE**, Suwon-si (KR); **Kyihyun JANG**, Suwon-si (KR); **Myunghun JEONG**, Suwon-si (KR); **Nakchung CHOI**, Suwon-si (KR)

(21) Appl. No.: **18/493,239**

(22) Filed: **Oct. 24, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2023/014812, filed on Sep. 26, 2023.

(30) **Foreign Application Priority Data**

Sep. 26, 2022 (KR) 10-2022-0121327

Oct. 27, 2022 (KR) 10-2022-0140147

Publication Classification

(51) **Int. Cl.**

H01Q 1/22 (2006.01)

H01Q 1/48 (2006.01)

H01Q 5/40 (2006.01)

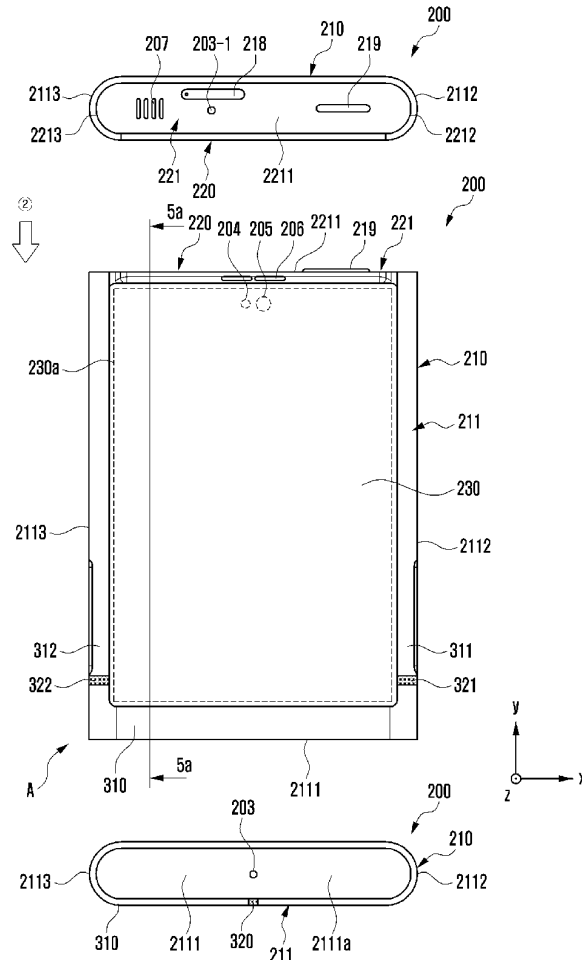
(52) **U.S. Cl.**

CPC **H01Q 1/22** (2013.01); **H01Q 1/48** (2013.01); **H01Q 5/40** (2015.01)

(57)

ABSTRACT

An electronic device is provided. The electronic device includes a housing including a lateral member including a first side surface, a second side surface, and a third side surface, a first conductive portion segmented through a first segmentation portion, a substrate including a ground, and a wireless communication circuit disposed on the substrate, the first conductive portion includes a first power feed unit, a second power feed unit, a first ground part, and a second ground part.





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(19) **United States**

(12) **Patent Application Publication**
LEE

(10) **Pub. No.: US 2024/0106117 A1**

(43) **Pub. Date: Mar. 28, 2024**

(54) **WIDEBAND ANTENNA STRUCTURE**

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

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

CPC **H01Q 5/307** (2015.01); **H01Q 1/48**
(2013.01); **H01Q 9/0421** (2013.01)

(72) Inventor: **Cheng-Tse LEE**, Taipei (TW)

(57) **ABSTRACT**

(21) Appl. No.: **18/311,987**

A wideband antenna structure includes: a first radiating portion on a dielectric substrate is close to a first short side and including a first bending section; a second radiating portion on the dielectric substrate is close to a second short side and including a second bending section; a grounding portion on the dielectric substrate is including a first side edge close to the first short side and a second side edge on the other end, where the first side edge is connected to the first radiating portion; a coupling portion is on the dielectric substrate and between the first radiating portion and the grounding portion; a third radiating portion, one side of which is with a first flange connected to the second side edge and a second flange connected to the second radiating portion; and a signal source, connected to the coupling portion and the grounding portion.

(22) Filed: **May 4, 2023**

(30) **Foreign Application Priority Data**

Sep. 28, 2022 (TW) 111136846

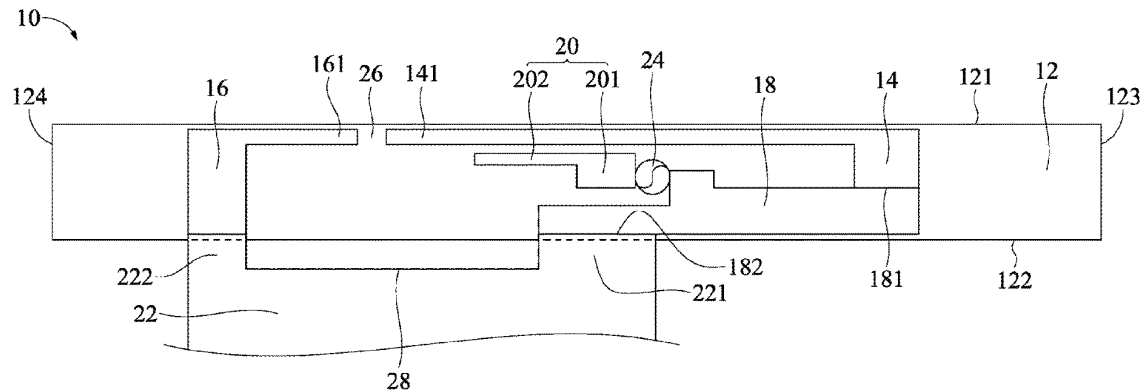
Publication Classification

(51) **Int. Cl.**

H01Q 5/307 (2006.01)

H01Q 1/48 (2006.01)

H01Q 9/04 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2024/0106119 A1**

(43) **Pub. Date: Mar. 28, 2024**

(54) **ANTENNA AND ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/364 (2015.01)
H01Q 9/42 (2006.01)

(72) Inventors: **Dong Yu**, Shanghai (CN); **Jiaming Wang**, Shanghai (CN); **Liang Xue**,
Shanghai (CN); **Yuanpeng Li**,
Shenzhen (CN); **Hanyang Wang**,
Reading (GB); **Meng Hou**, Shanghai
(CN)

(52) **U.S. Cl.**
CPC **H01Q 5/364** (2015.01); **H01Q 9/42**
(2013.01)

(21) Appl. No.: **18/264,859**

(22) PCT Filed: **Dec. 10, 2021**

(86) PCT No.: **PCT/CN2021/137028**

§ 371 (c)(1),

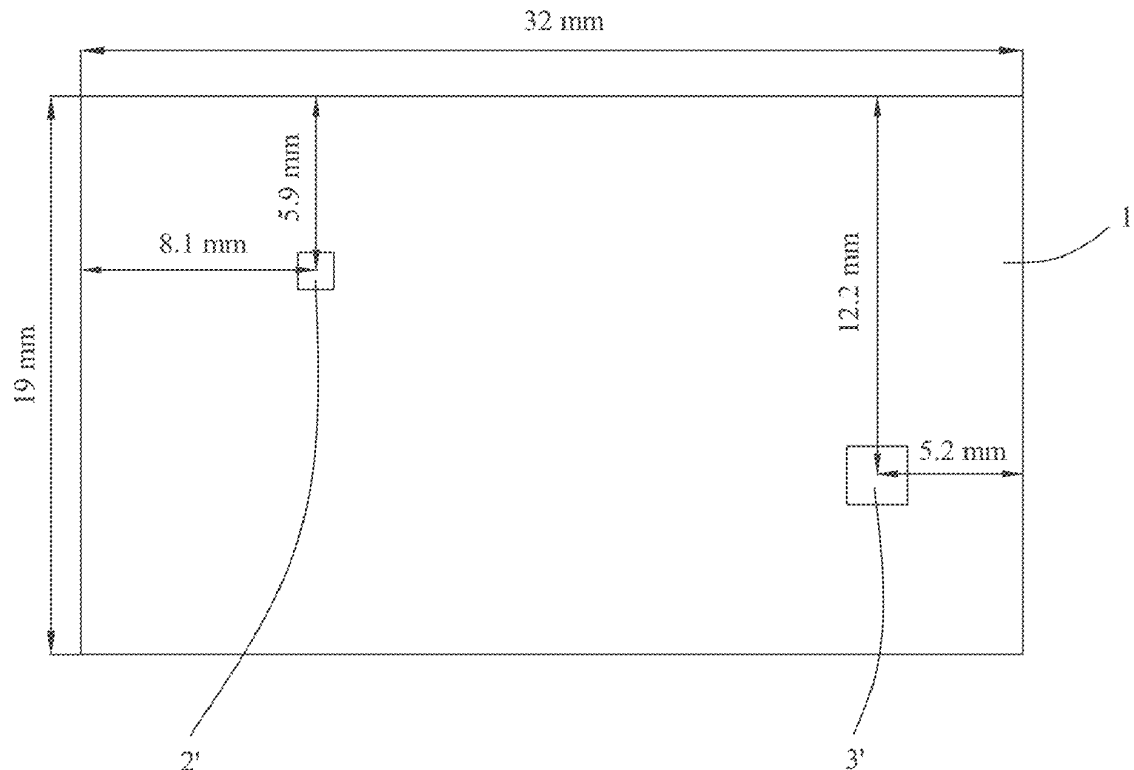
(2) Date: **Aug. 9, 2023**

(30) **Foreign Application Priority Data**

Feb. 10, 2021 (CN) 202110185331.7

ABSTRACT

An antenna includes a patch radiator, a feed point, a first ground point, and a second ground point. The patch radiator has a first side edge and an intersecting second side edge, and a first coupling contact and a second coupling contact. The patch radiator is coupled to the first ground point and the second ground point through the first coupling contact and the second coupling contact, and is biased coupled to the feed point. A distance between the first coupling contact and the first side edge, a distance between the first coupling contact and the second side edge, a distance between the second coupling contact and the first side edge, and a distance between the second coupling contact and the second side edge are all greater than or equal to 0.05λ , where λ is an operating wavelength of the antenna in an operating frequency band range of the antenna.



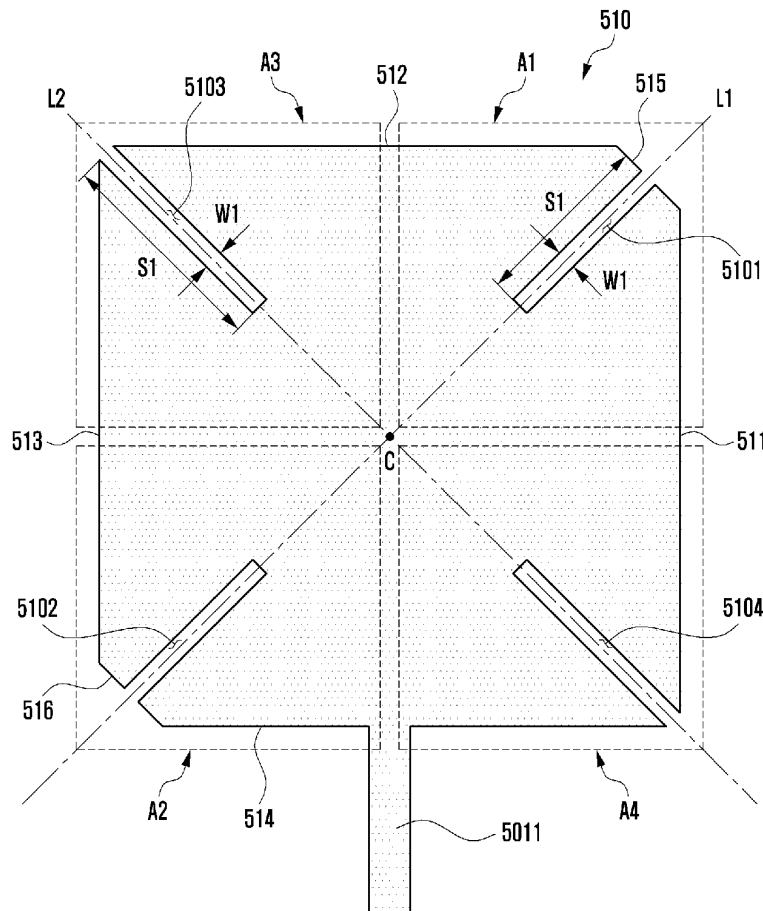


US 20240106125A1

(19) **United States**(12) **Patent Application Publication**
KWON et al.(10) **Pub. No.: US 2024/0106125 A1**(43) **Pub. Date: Mar. 28, 2024**(54) **ANTENNA AND ELECTRONIC DEVICE
COMPRISING SAME****Publication Classification**(71) Applicant: **SAMSUNG ELECTRONICS CO.,
LTD.**, Suwon-si (KR)(72) Inventors: **Soonheung KWON**, Suwon-si (KR);
Hosaeng KIM, Suwon-si (KR); **Ahyun
SHIN**, Suwon-si (KR); **Sumin YUN**,
Suwon-si (KR); **Hyungjoo LEE**,
Suwon-si (KR)(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)
H01Q 5/10 (2006.01)(52) **U.S. Cl.**
CPC **H01Q 9/0407** (2013.01); **H01Q 1/243**
(2013.01); **H01Q 1/48** (2013.01); **H01Q 5/10**
(2015.01)(73) Assignee: **SAMSUNG ELECTRONICS CO.,
LTD.**, Suwon-si (KR)(57) **ABSTRACT**(21) Appl. No.: **18/514,723**(22) Filed: **Nov. 20, 2023****Related U.S. Application Data**(63) Continuation of application No. PCT/KR2022/
004853, filed on Apr. 5, 2022.(30) **Foreign Application Priority Data**

May 20, 2021 (KR) 10-2021-0064740

An electronic device includes a substrate including a ground layer; and a plurality of antenna structures space apart from each other on the substrate. Each of the plurality of antenna structures may include, on the substrate: a rectangular first conductive patch including a pair of cutting portions in which diagonally opposite corners are cut; a rectangular second conductive patch disposed so as to be coupled to the first conductive patch; and a plurality of conductive pads which are disposed along the periphery of the second conductive patch so as to be spaced apart from each other at a specified interval, and are electrically connected to the ground layer.





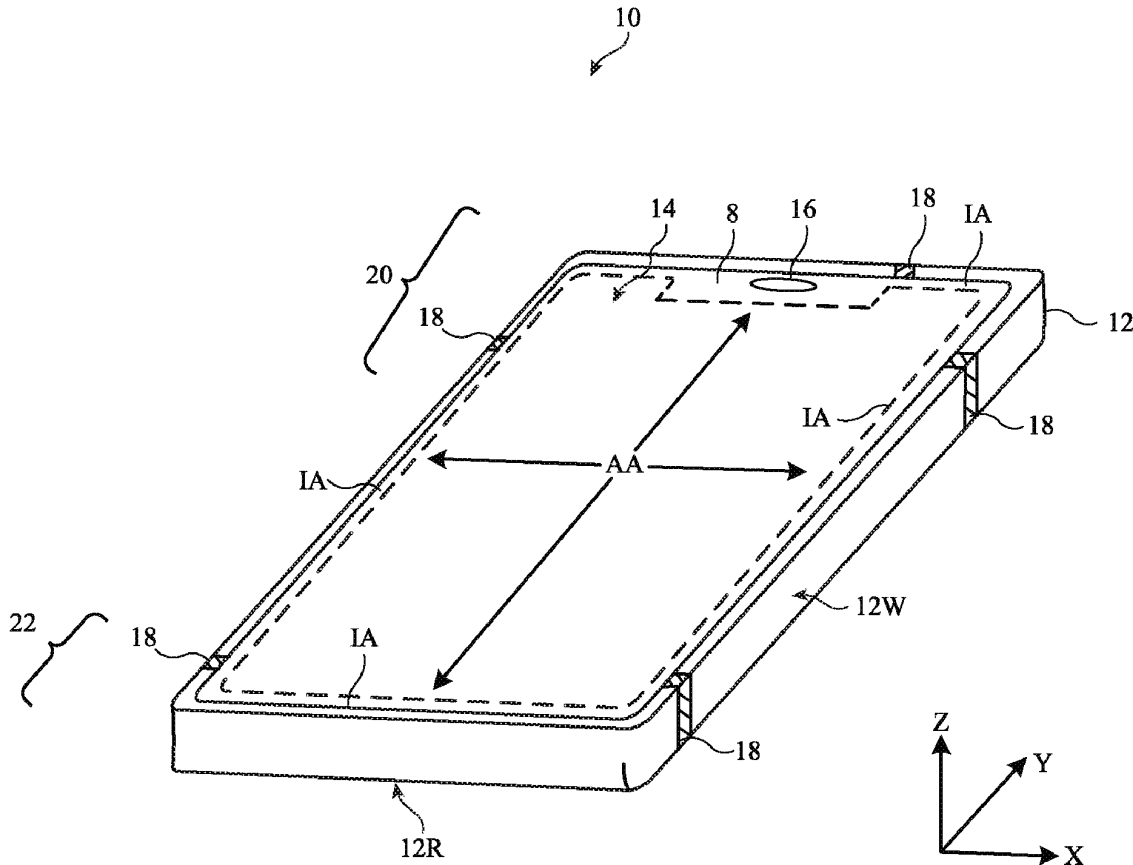
US 20240106128A1

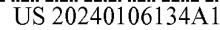
(19) **United States**(12) **Patent Application Publication**
Ramalingam et al.(10) **Pub. No.: US 2024/0106128 A1**(43) **Pub. Date: Mar. 28, 2024**(54) **MULTI-LAYER DIELECTRIC RESONATOR
ANTENNAS WITH PARASITIC ELEMENTS**(52) **U.S. Cl.**CPC **H01Q 9/0485** (2013.01); **H01Q 5/385**
(2015.01); **H01Q 9/0414** (2013.01); **H01Q**
15/0026 (2013.01)(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Subramanian Ramalingam**, Cupertino,
CA (US); **David Garrido Lopez**, San
Jose, CA (US); **Forhad Hasnat**,
Milpitas, CA (US); **Harish**
Rajagopalan, San Jose, CA (US);
Panagiotis Theofanopoulos, Cupertino,
CA (US)(21) Appl. No.: **17/951,938**(22) Filed: **Sep. 23, 2022****Publication Classification**(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/385 (2006.01)
H01Q 15/00 (2006.01)

(57)

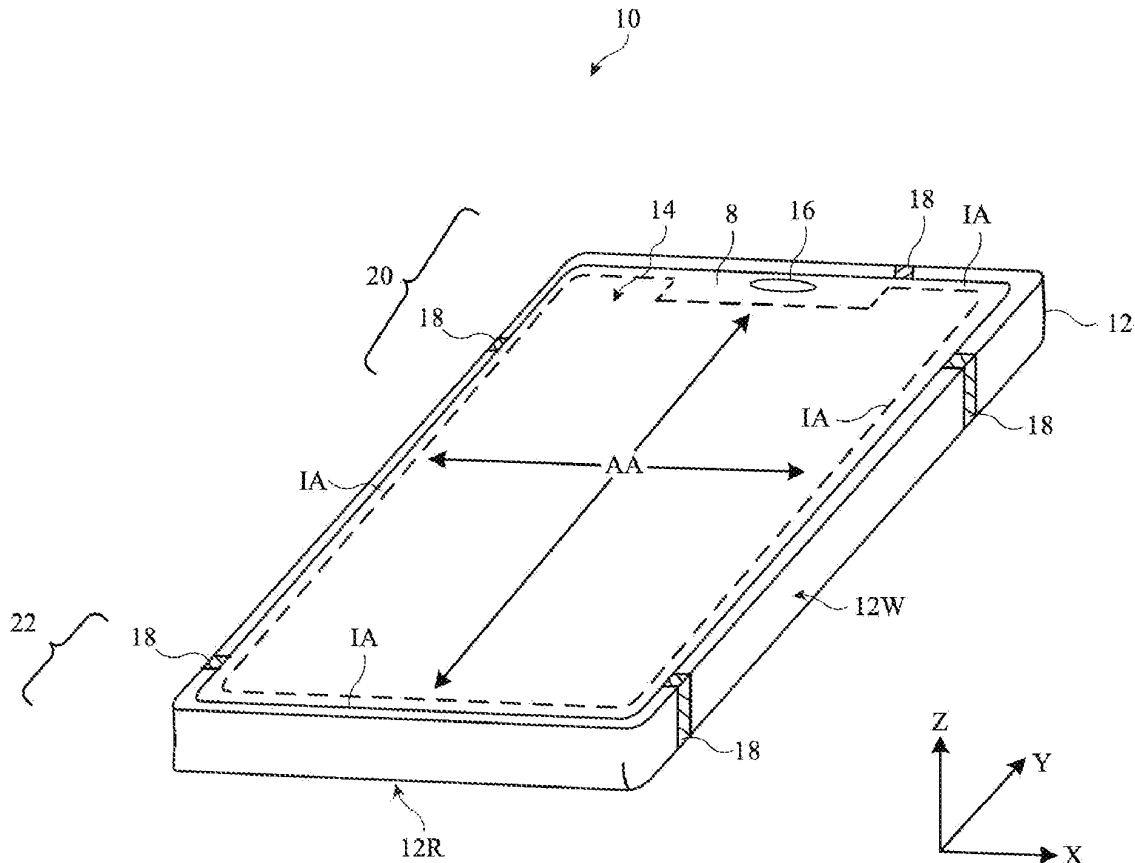
ABSTRACT

An electronic device may be provided with a phased antenna array having a dielectric resonator antenna. The antenna may include a first dielectric block on a printed circuit, a second dielectric block on the first dielectric block, and a third dielectric block on the second dielectric block. At least the second and third dielectric blocks may have different dielectric constants. A parasitic element may be disposed between the second and third dielectric resonating elements and/or a parasitic element may be disposed on a radiative face of the third dielectric resonating element. The parasitic elements may act as electromagnetic mirrors that form images of electric fields in the dielectric resonating elements. The images may make the dielectric resonating elements exhibit a greater electromagnetic height than physical height. This may allow for a reduction in the overall physical height of the dielectric resonator antenna without sacrificing wireless performance.





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(19) **United States**

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

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

(54) **ELECTRONIC DEVICE**

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

(71) Applicant: **Lenovo (Beijing) Limited**, Beijing
(CN)

CPC **H01Q 1/2266** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 9/0407** (2013.01)

(72) Inventors: **Yuling XU**, Beijing (CN); **Dafei MO**,
Beijing (CN)

(57) **ABSTRACT**

(21) Appl. No.: **18/233,786**

An electronic device includes a first body, a second body,
and a first antenna. The first body and the second body are
configured to bend relatively. A periphery of the first body
includes a first conductive frame, and a periphery of the
second body includes a second conductive frame. The first
conductive frame includes a first gap. The first antenna
is arranged in the first body. A feeding end of the first antenna
is connected to the first conductive frame. The first antenna
includes a first working mode and a second working mode.
In the first working mode, the first antenna transmits a signal
based on the first conductive frame having the first gap. In
the second working mode, the first antenna transmits the
signal based on the first conductive frame and the second
conductive frame.

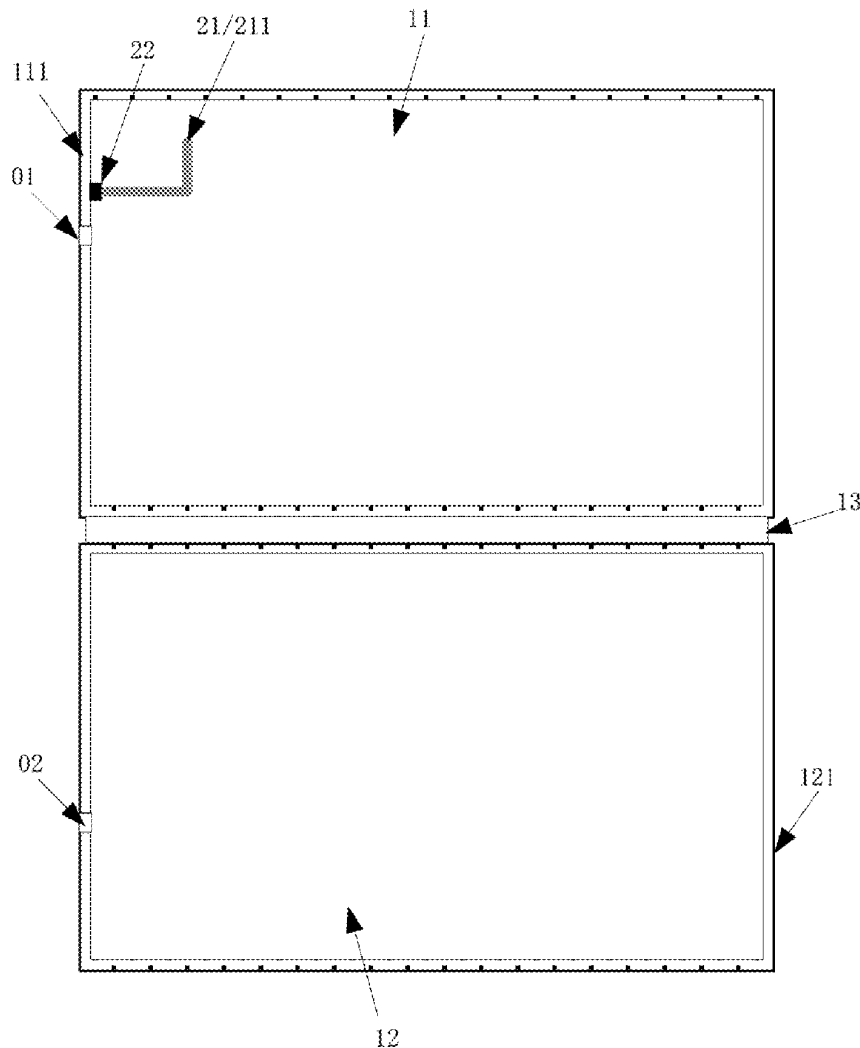
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(30) **Foreign Application Priority Data**

Sep. 30, 2022 (CN) 202211215268.8

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/04 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2024/0113414 A1**

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

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

Publication Classification

(71) Applicants: **Chih-Heng Lin**, Taipei City (TW);
Li-Chun Lee, Taipei City (TW);
Shih-Chia Liu, Taipei City (TW);
Jui-Hung Lai, Taipei City (TW);
Hung-Yu Yeh, Taipei City (TW)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/2291** (2013.01); **H01Q 9/0414**
(2013.01); **H01Q 9/0421** (2013.01)

(72) Inventors: **Chih-Heng Lin**, Taipei City (TW);
Li-Chun Lee, Taipei City (TW);
Shih-Chia Liu, Taipei City (TW);
Jui-Hung Lai, Taipei City (TW);
Hung-Yu Yeh, Taipei City (TW)

(57) **ABSTRACT**

(73) Assignee: **COMPAL ELECTRONICS, INC.**,
Taipei City (TW)

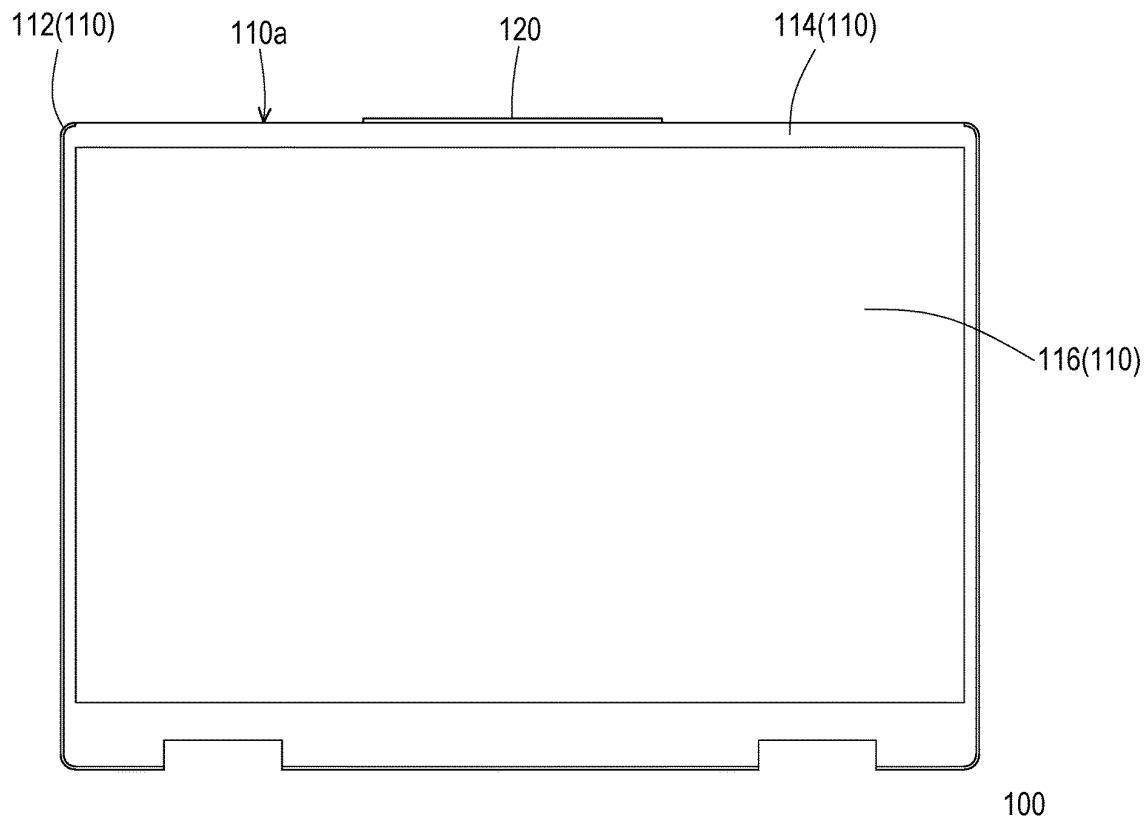
Disclosed is an electronic device including a device body and an antenna module. The antenna module includes a conductive element and at least one antenna element. The conductive element includes a main body portion and at least one assembly portion connected with each other. The at least one assembly portion is assembled on the device body. The at least one antenna element is disposed on the device body and coupled with the conductive element to excite a first resonance mode. The at least one assembly portion overlaps the at least one antenna element in the length direction of the main body portion.

(21) Appl. No.: **18/473,267**

(22) Filed: **Sep. 24, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/411,625, filed on Sep. 29, 2022.





US 20240113416A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0113416 A1**

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

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

Publication Classification

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

(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)

(72) Inventors: **Jiacheng ZHAO**, Dongguan (CN);
Xiaopu WU, Dongguan (CN)

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

(57) **ABSTRACT**

An antenna module and an electronic device are provided. A radiator includes a first radiator and a second radiator, and a coupling gap is between the first radiator and the second radiator. A first grounding end of the first radiator and a second grounding terminal of the second radiator are both electrically connected to a reference ground. A first feed system is used for exciting the radiator to receive and transmit a first electromagnetic wave signal. The first electromagnetic wave signal includes at least one of a GPS signal, and a mobile communication signal of a first frequency band. A second feed system is used for exciting the radiator to receive and transmit a second electromagnetic wave signal. The second electromagnetic wave signal includes a Wi-Fi signal. A third feed system is used for exciting the radiator to receive and transmit a third electromagnetic wave signal.

(21) Appl. No.: **18/503,144**

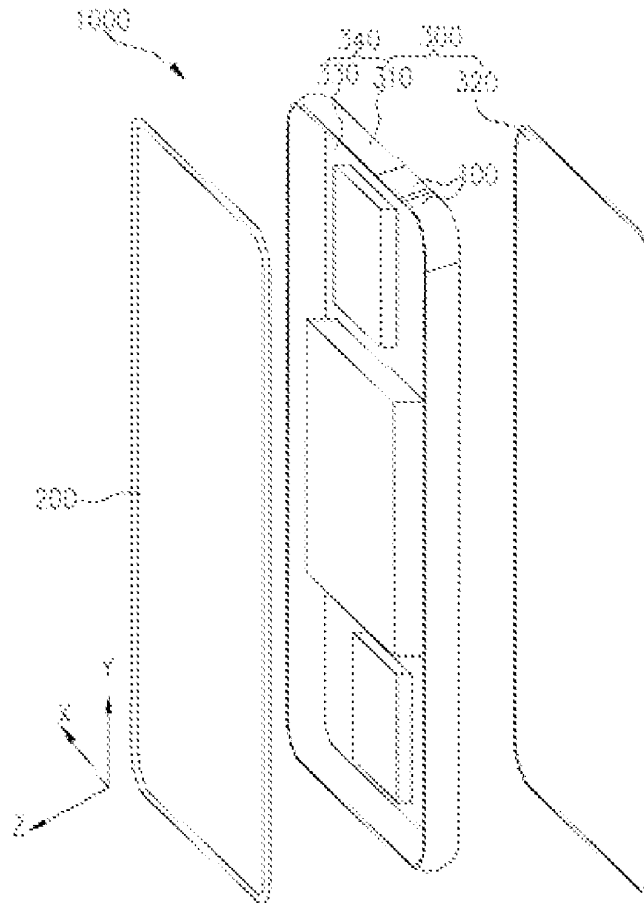
(22) Filed: **Nov. 6, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2022/091426, filed on May 7, 2022.

(30) **Foreign Application Priority Data**

Jun. 30, 2021 (CN) 202110743205.9





US 20240113424A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0113424 A1**

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

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

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

CPC **H01Q 1/48** (2013.01); **H01Q 1/2266**
(2013.01); **H01Q 5/328** (2015.01)

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

(57)

ABSTRACT

(72) Inventors: **SHIH-CHIANG WEI, HSINCHU
(TW); YUNG-CHIEH YU, HSINCHU
(TW)**

An antenna structure and an electronic device are provided. The electronic device includes a housing and the antenna structure disposed in the housing. The antenna structure includes a grounding element, a feeding radiation element, a feeding element, a first grounding radiation element, and a switching element. The feeding radiation element includes a first radiating portion, a second radiating portion, and a third radiating portion. The first radiating portion and the second radiating portion jointly surround the first grounding radiation element. The first radiating portion and the first grounding radiation element are separate from each other and coupled with each other. The switching element is electrically connected to the first grounding radiation element.

(21) Appl. No.: **18/321,028**

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

(30) **Foreign Application Priority Data**

Oct. 3, 2022 (TW) 111137466

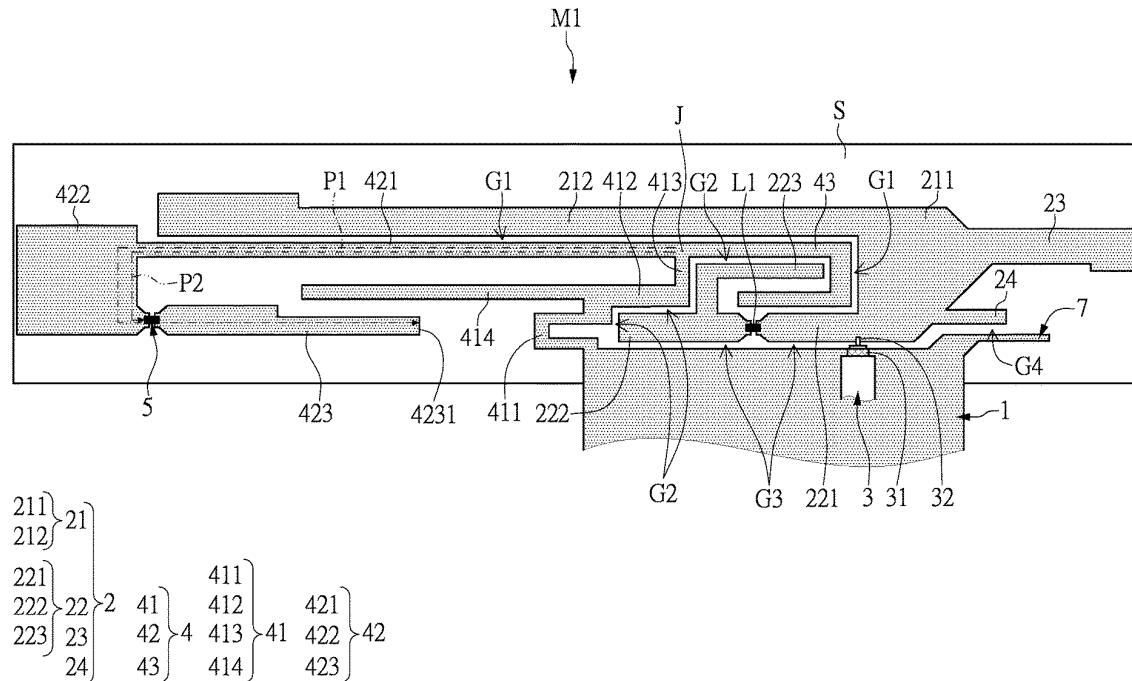
Publication Classification

(51) **Int. Cl.**

H01Q 1/48 (2006.01)

H01Q 1/22 (2006.01)

H01Q 5/328 (2006.01)





US 20240113434A1

(19) **United States**

(12) **Patent Application Publication**
YOSHIKAWA

(10) **Pub. No.: US 2024/0113434 A1**

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

(54) **ANTENNA AND ARRAY ANTENNA**

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

(71) Applicant: **KYOCERA CORPORATION**,
Kyoto-shi, Kyoto (JP)

CPC **H01Q 9/0414** (2013.01); **H01Q 9/0457**
(2013.01); **H01Q 21/0006** (2013.01)

(72) Inventor: **Hiromichi YOSHIKAWA**,
Yokohama-shi, Kanagawa (JP)

(57) **ABSTRACT**

(21) Appl. No.: **18/553,841**

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

(86) PCT No.: **PCT/JP2021/045386**

§ 371 (c)(1),

(2) Date: **Oct. 4, 2023**

(30) **Foreign Application Priority Data**

Apr. 19, 2021 (JP) 2021-070632

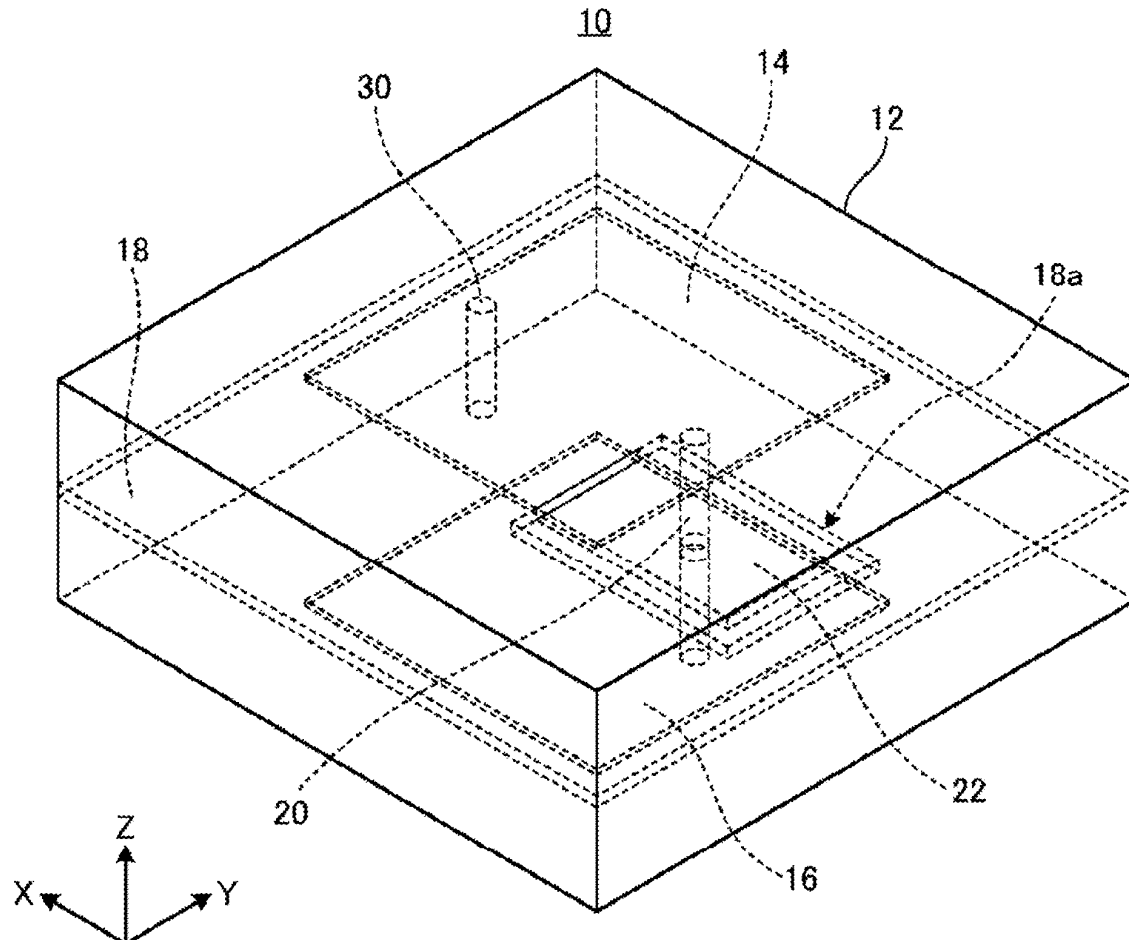
Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 21/00 (2006.01)

An antenna includes a first resonator extending in a first plane direction; a second resonator spaced apart from the first resonator in a first direction and extending in the first plane direction; a third resonator positioned between the first resonator and the second resonator in the first direction and magnetically or capacitively connected to or electrically connected to each of the first resonator and the second resonator; a reference conductor extending in the first plane direction, positioned between the first resonator and the second resonator in the first direction, and serving as a potential reference of the first resonator and the second resonator; and a feeder line connected to the first resonator. The reference conductor surrounds at least a part of the third resonator in the first plane direction.





US 20240113437A1

(19) **United States**

(12) **Patent Application Publication**
CHU

(10) **Pub. No.: US 2024/0113437 A1**

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

(54) **COUPLED-FEED MULTI-BRANCH
ANTENNA SYSTEM**

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

CPC **H01Q 9/0485** (2013.01); **H01Q 5/364**
(2015.01); **H01Q 5/385** (2015.01)

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

(57)

ABSTRACT

(72) Inventor: **Fang-Hsien CHU**, Taipei (TW)

A coupled-feed multi-branch antenna system includes a dielectric substrate and a grounding portion, a first parasitic branch, a second parasitic branch, a first metal branch, a second metal branch, and a signal source on the dielectric substrate. The grounding portion is close to a first short side and disposed along a first long side. The first parasitic branch is close to a second short side, and includes at least one bend to extend along a second long side. One end of the second parasitic branch is connected to the grounding portion, and another end extends towards the first parasitic branch. One end of the first metal branch is on one side of the grounding portion, and another end extends towards the second short side. One end of the second metal branch is connected to the first metal branch, and another end is disposed along the second long side.

(21) Appl. No.: **18/328,121**

(22) Filed: **Jun. 2, 2023**

(30) **Foreign Application Priority Data**

Oct. 4, 2022 (TW) 111137739

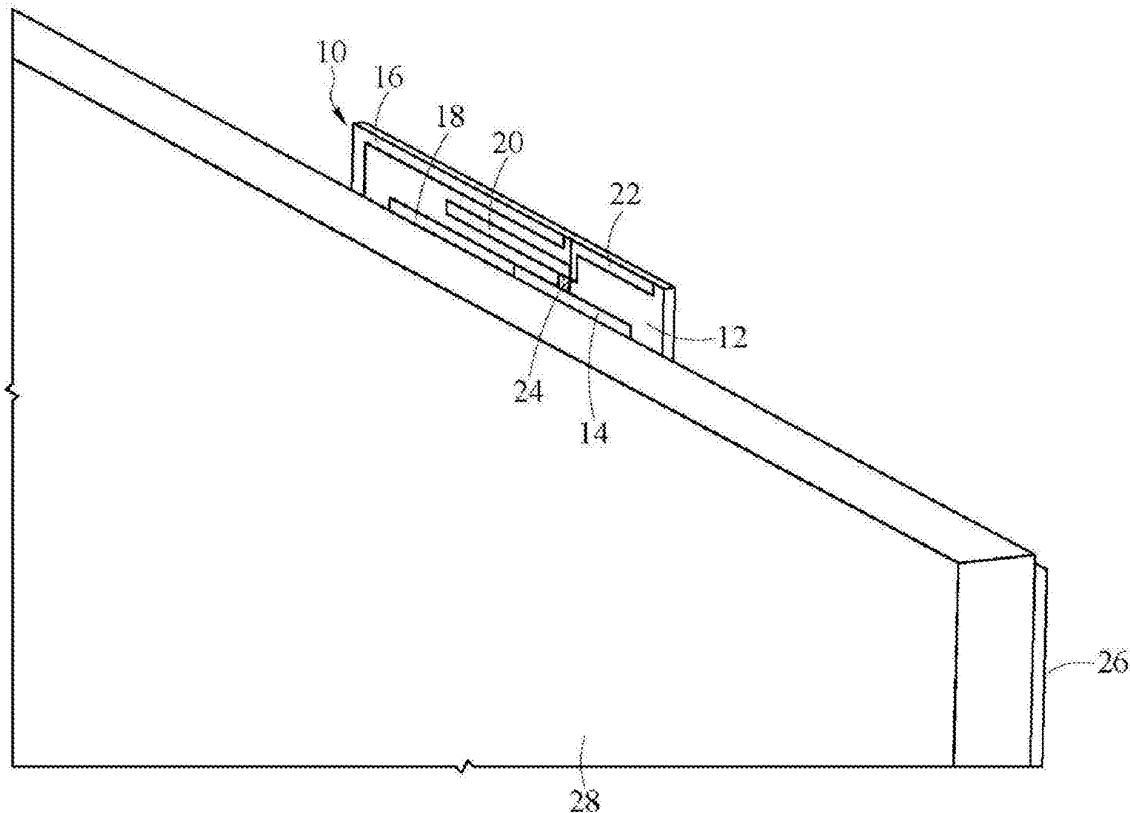
Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 5/364 (2006.01)

H01Q 5/385 (2006.01)





US 20240113441A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0113441 A1**

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

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Jiho KIM**, Suwon-si (KR); **Sumin YUN**, Suwon-si (KR); **Hyeonuk KANG**, Suwon-si (KR); **Kyungmoon SEOL**, Suwon-si (KR); **Seongyong AN**, Suwon-si (KR); **Kyihyun JANG**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 13/10** (2013.01); **H01Q 1/243** (2013.01)

(57) **ABSTRACT**

(21) Appl. No.: **18/323,738**

(22) Filed: **May 25, 2023**

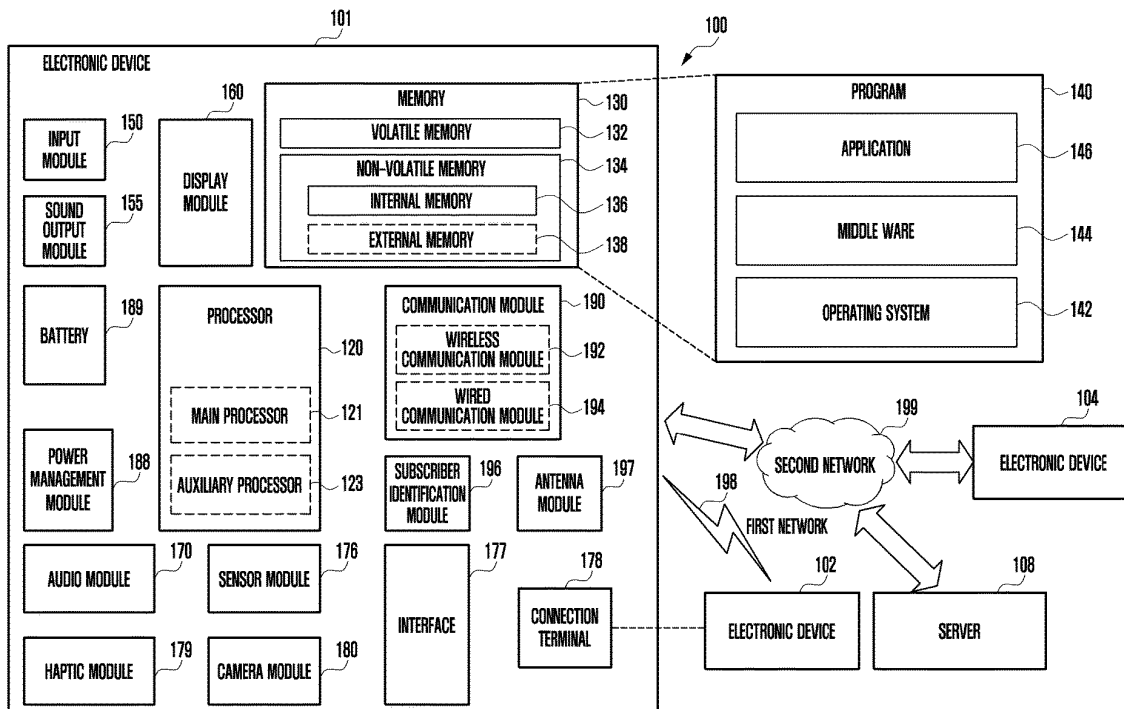
Related U.S. Application Data

(63) Continuation of application No. PCT/KR21/17770, filed on Nov. 29, 2021.

Foreign Application Priority Data

Nov. 30, 2020 (KR) 10-2020-0165013

An electronic device including an antenna is provided. The electronic device includes a housing and a sliding plate, wherein the housing comprises an antenna circuit unit arranged on a side surface corresponding to the sliding operation direction of the sliding plate, and a contact unit for electrically connecting the housing and the sliding plate, wherein the antenna circuit unit further includes, as a radiator, at least one frame arranged on the side surface, wherein the housing and the plate form a space, and wherein the space, the contact unit, and the antenna circuit unit can form a cavity antenna.





US 20240120642A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0120642 A1**

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

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

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 21/24**
(2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Chanju PARK**, Suwon-si (KR);
Junhwa OH, Suwon-si (KR);
Sanghyuk WI, Suwon-si (KR); **Jungi
JEONG**, Suwon-si (KR)

According to various embodiments disclosed in the present document, an antenna module and/or an electronic device including same may comprise: a communication circuit part; an antenna part stacked-up on or above the communication circuit part and comprising multiple antenna elements; and a network part disposed between the communication circuit part and the antenna part. The antenna part may comprise: at least one first subarray formed of a combination of some of the antenna elements; and at least one second subarray formed of a combination another of the antenna elements, and disposed to be point symmetric to the first subarray. The network part may comprise: a first transmission port corresponding to a transmission input terminal of the first subarray; a first reception port corresponding to a reception input terminal of the first subarray; a second transmission port corresponding to a transmission input terminal of the second subarray; and a second reception port corresponding to a reception input terminal of the second subarray. With respect to symmetric points of the first subarray and the second subarray, the first transmission port may be disposed to be point symmetric to the second reception port, and the first reception port may be disposed to be point symmetric to the second transmission port. Various other embodiments are possible.

(21) Appl. No.: **18/272,917**

(22) PCT Filed: **Jan. 26, 2022**

(86) PCT No.: **PCT/KR2022/001376**

§ 371 (c)(1),

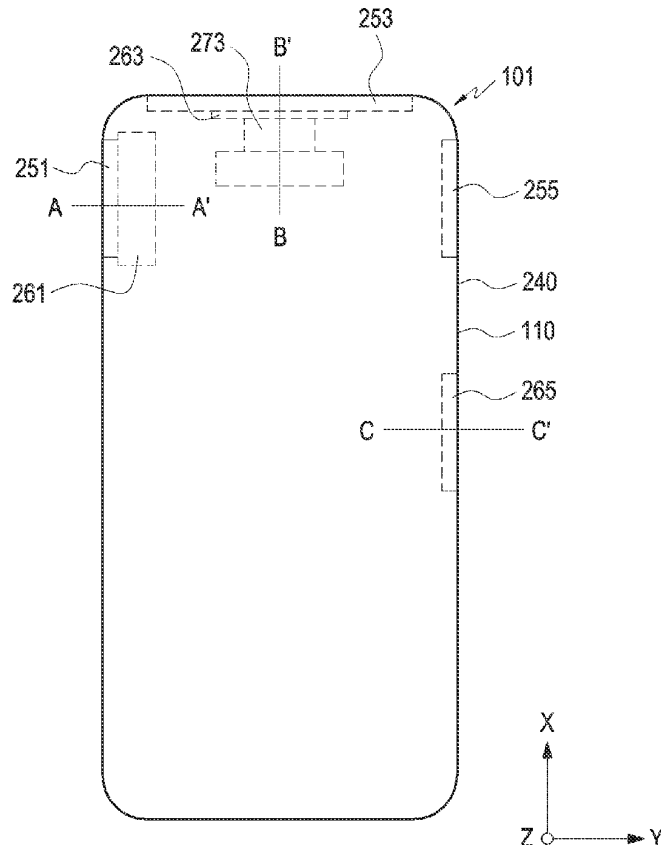
(2) Date: **Jul. 18, 2023**

(30) **Foreign Application Priority Data**

Feb. 2, 2021 (KR) 10-2021-0014879

Publication Classification

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





US 20240120643A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0120643 A1**

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

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

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

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

(72) Inventors: **Sunghyup Lee**, Suwon-si (KR);
Hoonsang Yoo, Suwon-si (KR);
Jungsik Park, Suwon-si (KR)

(73) Assignee: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)

(21) Appl. No.: **18/377,628**

(22) Filed: **Oct. 6, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2023/015437, filed on Oct. 6, 2023.

(30) **Foreign Application Priority Data**

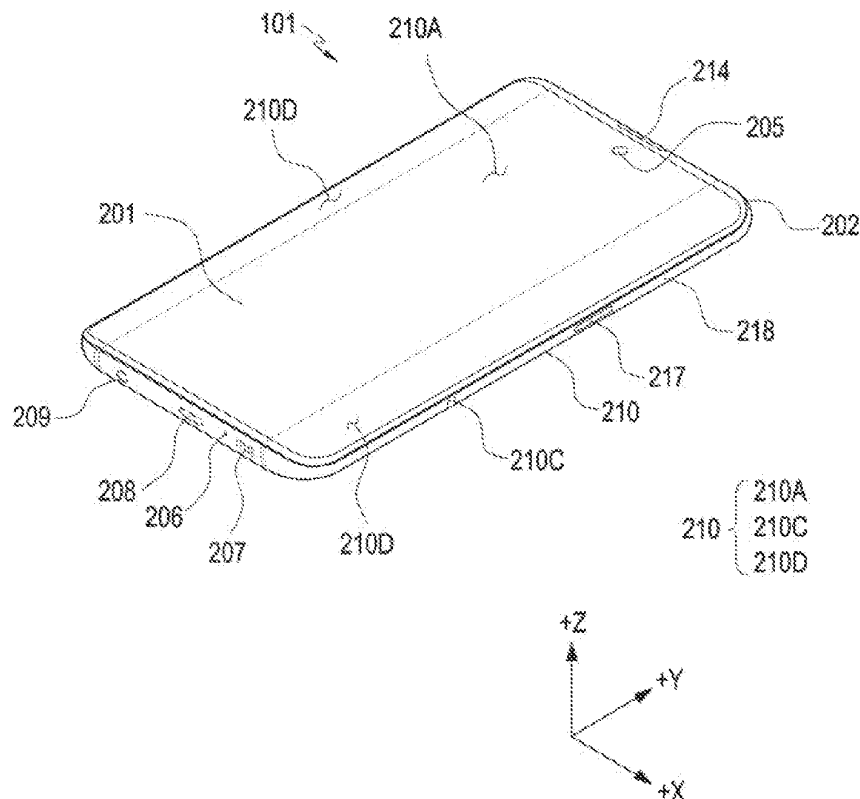
Oct. 6, 2022 (KR) 10-2022-0127899
Nov. 4, 2022 (KR) 10-2022-0146152

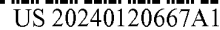
Publication Classification

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

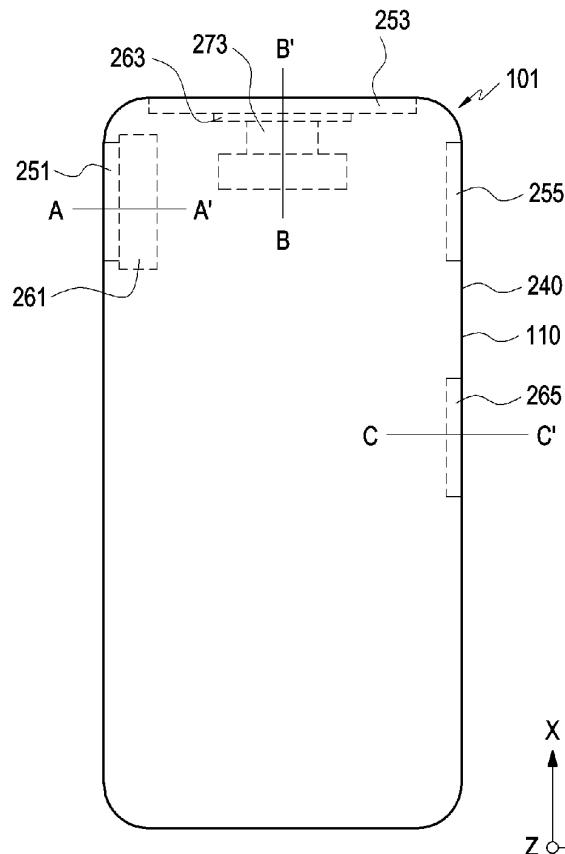
(57) **ABSTRACT**

An electronic device includes: a plate; a side frame provided at an edge of the plate, the side frame including a first sidewall extending in at least one axial direction and including at least one conductive portion; a printed circuit board provided on a surface of the plate and including at least one ground area; a key assembly provided on the side frame and including a first flexible circuit board connected to the printed circuit board; and at least one antenna module including: the at least one conductive portion; a first connection member provided inside the first sidewall, the first connection member being electrically connected to the at least one conductive portion and the first flexible circuit board; a second connection member provided inside the first sidewall and spaced apart from the first connection member, the second connection member being electrically connected to the at least one conductive portion and the first flexible circuit board; and a third connection member between the first connection member and the second connection member, the third connection member being electrically connected to the at least one conductive portion and the at least one ground area.





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





US 20240128634A1

(19) **United States**(12) **Patent Application Publication**
JIANG et al.(10) **Pub. No.: US 2024/0128634 A1**(43) **Pub. Date: Apr. 18, 2024**(54) **ANTENNA STRUCTURE**(52) **U.S. Cl.**(71) Applicant: **ASUSTeK COMPUTER INC.**, Taipei (TW)CPC **H01Q 1/2266** (2013.01); **H01Q 1/48** (2013.01); **H01Q 1/50** (2013.01)(72) Inventors: **Zhen-De JIANG**, Taipei (TW);
Pin-Tang CHIU, Taipei (TW)

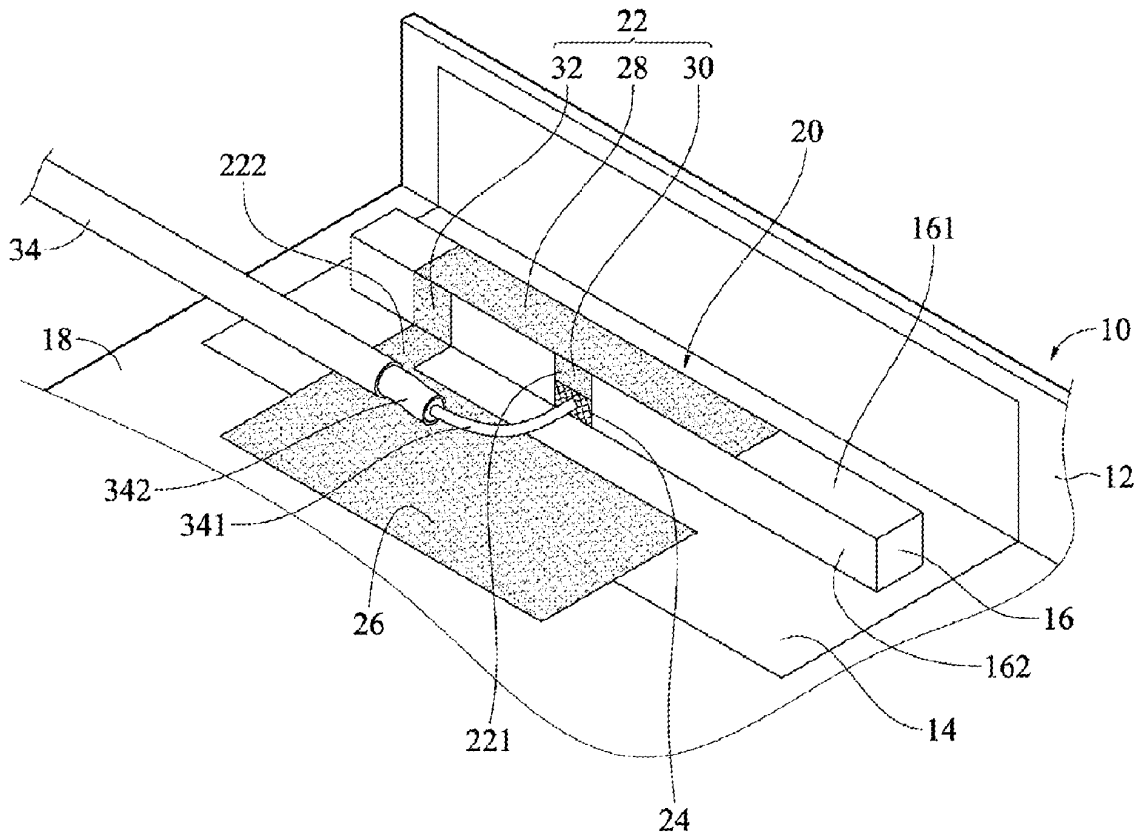
(57)

ABSTRACT(21) Appl. No.: **18/331,410**(22) Filed: **Jun. 8, 2023**(30) **Foreign Application Priority Data**

Oct. 17, 2022 (TW) 111139334

Publication Classification(51) **Int. Cl.****H01Q 1/22** (2006.01)**H01Q 1/48** (2006.01)**H01Q 1/50** (2006.01)

An antenna structure is provided, which is disposed in a clearance area in a casing of an electronic device, and a magnetic element is arranged in the clearance area. The antenna structure includes an antenna radiator, a feeding contact and a grounding portion. The antenna radiator is located on the magnetic element and includes a first connection end and a second connection end. The feeding contact is electrically connected to the first connection end of the antenna radiator to transmit and receive a radio frequency signal. The grounding portion is located in the clearance area and connected to the second connection end of the antenna radiator.





US 20240128641A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0128641 A1**

(43) **Pub. Date: Apr. 18, 2024**

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

Publication Classification

(51) **Int. Cl.**
H01Q 3/12 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 3/12** (2013.01); **H01Q 1/241**
(2013.01)

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

(72) Inventors: **Hyunyoung ROH**, Suwon-si (KR);
Hongchul PARK, Suwon-si (KR)

(21) Appl. No.: **18/521,018**

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

Related U.S. Application Data

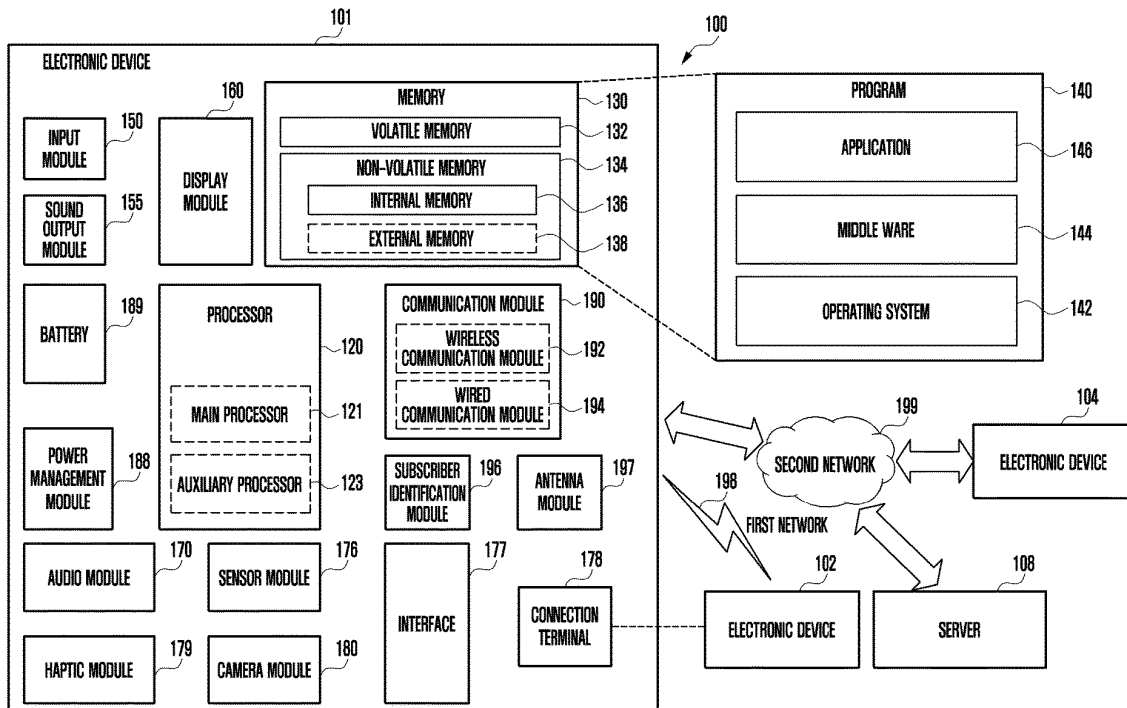
(63) Continuation of application No. PCT/KR2023/
015988, filed on Oct. 17, 2023.

Foreign Application Priority Data

Oct. 17, 2022 (KR) 10-2022-0133392
Nov. 23, 2022 (KR) 10-2022-0158713

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a housing, a support plate comprising a body, a first support substantially protruding from the body in a first direction, and a second support spaced apart from the first support and substantially protruding from the body in the first direction, the support plate disposed in the housing, a flexible printed circuit board comprising a first part, at least a portion of which is disposed between the first support and the second support, and a second part extending from the first part disposed on the body of the support plate such that the first part is vertically disposed with respect to the second part, wherein at least one first conductive member is disposed at the first part, and at least one second conductive member is disposed at the second part.





US 20240128642A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0128642 A1**

(43) **Pub. Date: Apr. 18, 2024**

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

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

(72) Inventors: **TZU-KUAN SUN, HSINCHU (TW);
PAO-CHUAN PENG, HSINCHU
(TW); MENG-KAI WU, HSINCHU
(TW); HONG-JUN JIAN, HSINCHU
(TW)**

(21) Appl. No.: **18/189,249**

(22) Filed: **Mar. 24, 2023**

(30) **Foreign Application Priority Data**

Oct. 14, 2022 (TW) 111138969

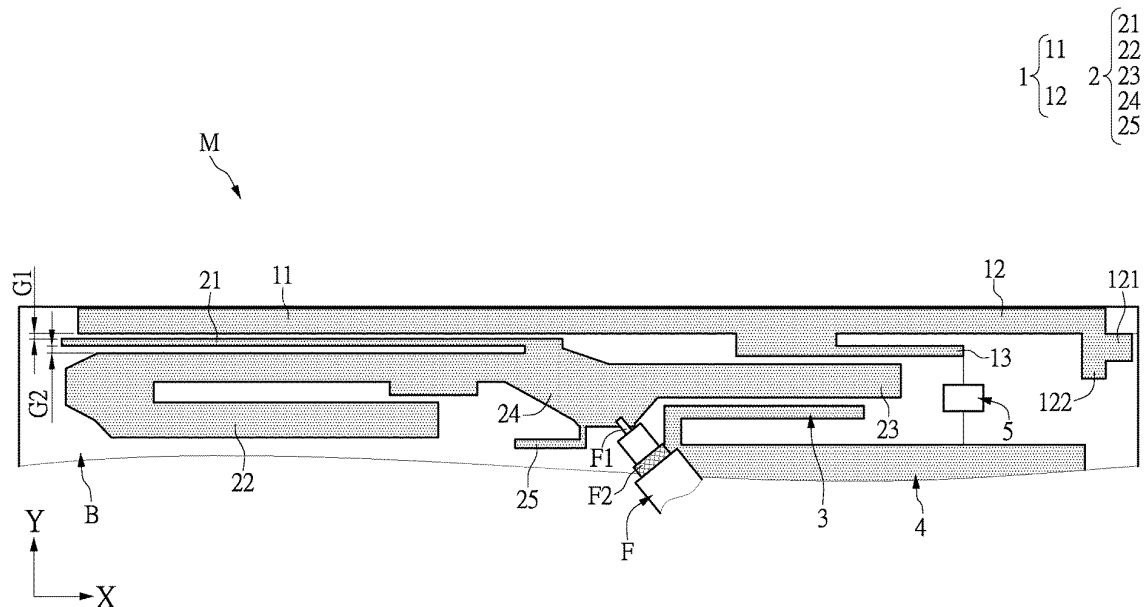
Publication Classification

(51) **Int. Cl.**
H01Q 3/24 (2006.01)
H01Q 3/22 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 3/24** (2013.01); **H01Q 3/22**
(2013.01); **H01Q 1/2291** (2013.01)

(57) **ABSTRACT**

An antenna module and an electronic device are provided. The antenna module is disposed in a housing of the electronic device. The antenna module includes a first radiating element, a second radiating element, a grounding element, and a switching circuit. The first radiating element includes a first radiating portion and a second radiating portion that are connected with each other. The second radiating element includes a third radiating portion, a fourth radiating portion, a fifth radiating portion, and a feeding portion. The switching circuit is electrically connected between the grounding element and the first radiating element or between the grounding element and the feeding portion.





US 20240128646A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0128646 A1**

(43) **Pub. Date: Apr. 18, 2024**

(54) **LOW-SAR ANTENNA AND ELECTRONIC
DEVICE**

(52) **U.S. Cl.**
CPC **H01Q 9/0421** (2013.01); **H01Q 1/243**
(2013.01); **H01Q 1/48** (2013.01)

(71) Applicant: **Honor Device Co., Ltd.**, Shenzhen
(CN)

(72) Inventors: **Yiwu Hu**, Shenzhen (CN); **Aofang
Zhang**, Shenzhen (CN); **Kunpeng Wei**,
Shenzhen (CN)

(57) **ABSTRACT**

(21) Appl. No.: **17/908,153**

(22) PCT Filed: **Mar. 30, 2022**

(86) PCT No.: **PCT/CN2022/084112**

§ 371 (c)(1),

(2) Date: **Aug. 30, 2022**

(30) **Foreign Application Priority Data**

Jun. 25, 2021 (CN) 202110711505.9

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)

Embodiments of this application provide a low-SAR antenna and an electronic device, which relates to the field of electronic devices and can provide good radiation performance at middle/high frequencies and have a low SAR value. The specific solution is as follows. A first radiation structure includes a first radiator, and a second radiation structure includes a second radiator. A first end of the first radiator and a first end of the second radiator form a first gap. A second end of the first radiator is free, and a second end of the second radiator is grounded. A feed point of the antenna is coupled to the first radiator, and the first radiator is divided into a first portion and a second portion that are delimited by the feed point. In a case that the antenna is in operation, the first portion of the first radiator and the second radiator work together in a first frequency band and a second frequency band, and a frequency of the first frequency band is less than a frequency of the second frequency band.

