



US 20240021974A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0021974 A1**

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

(54) **ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/42 (2006.01)
H01Q 21/30 (2006.01)

(72) Inventors: **Dawei Zhou**, Shenzhen (CN); **Hanyang Wang**, Reading (GB); **Xiaotao Cai**,
Shenzhen (CN); **Wenlong Hu**,
Shenzhen (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/244* (2013.01); *H01Q 1/38*
(2013.01); *H01Q 1/422* (2013.01); *H01Q*
21/30 (2013.01)

(21) Appl. No.: **18/255,014**

(57) **ABSTRACT**

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

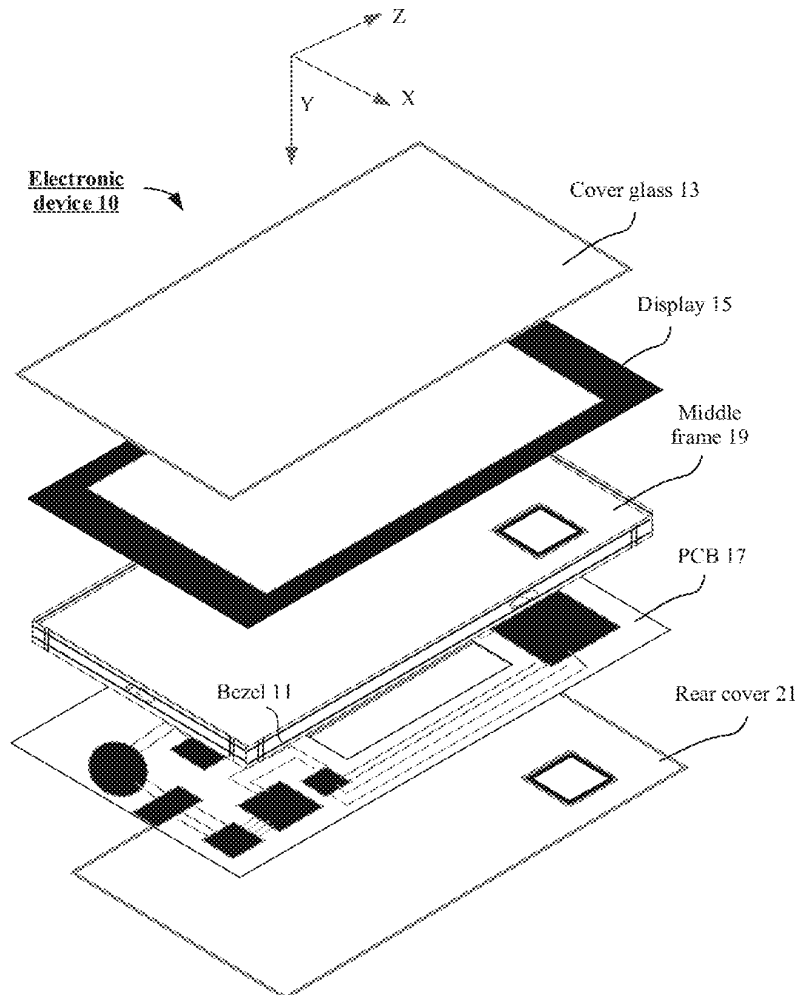
An electronic device includes an antenna structure. The electronic device includes a bezel and a dielectric layer. The bezel has a first position and a second position, and a bezel between the first position and the second position is configured as an antenna radiator. A first dielectric is disposed on at least a part of an inner surface of the bezel besides the bezel between the first position and the second position. A second dielectric is disposed on at least a part of a surface of the antenna radiator. The first dielectric is different from the second dielectric.

(86) PCT No.: **PCT/CN2021/134207**

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

(30) **Foreign Application Priority Data**

Nov. 30, 2020 (CN) 202011378857.9





US 20240021982A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0021982 A1**

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

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/36 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/22 (2006.01)

(72) Inventors: **Pengfei Wu**, Shanghai (CN); **Jiahui Chu**, Shanghai (CN); **Hanyang Wang**, Reading (GB); **Meng Hou**, Shanghai (CN); **Chien-Ming Lee**, Shenzhen (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/52* (2013.01); *H01Q 1/36* (2013.01); *H01Q 9/0421* (2013.01); *H01Q 1/22* (2013.01)

(21) Appl. No.: **18/256,238**

(57) **ABSTRACT**

(22) PCT Filed: **Dec. 2, 2021**

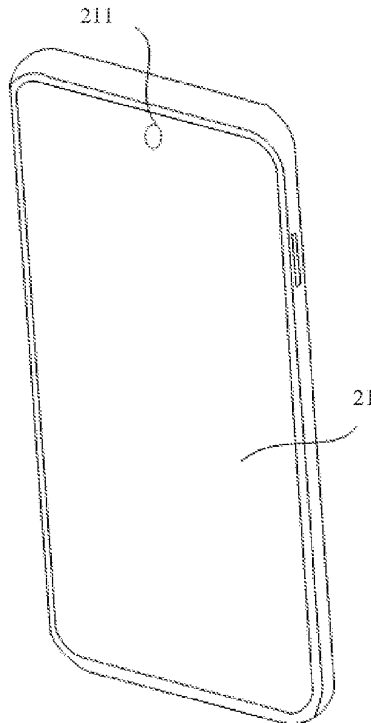
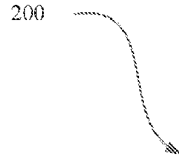
An antenna apparatus for an electronic device having a middle frame, a cover, and a battery located between the middle frame and the cover. The antenna apparatus includes at least one group of coupling feeding elements and at least one group of radiation elements. A first radiator and a second radiator in each group of radiation elements are arranged on an inner surface of a cover. The first radiator and the second radiator are respectively located on two sides of a coupling feeding element, and the coupling feeding element is separately coupled to feed the first radiator and the second radiator.

(86) PCT No.: **PCT/CN2021/135167**

§ 371 (c)(1),
(2) Date: **Jun. 7, 2023**

(30) **Foreign Application Priority Data**

Dec. 8, 2020 (CN) 202011423001.9





(19) **United States**

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

(10) **Pub. No.: US 2024/0021988 A1**

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

(54) **ANTENNA STRUCTURE**

H01Q 1/48 (2006.01)

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

H01Q 5/25 (2006.01)

(52) **U.S. Cl.**
CPC *H01Q 5/30* (2015.01); *H01Q 5/50* (2015.01); *H01Q 1/48* (2013.01); *H01Q 5/25* (2015.01)

(72) Inventors: **Yu-Chen ZHAO**, Taoyuan City (TW); **Chung-Ting HUNG**, Taoyuan City (TW); **Chin-Lung TSAI**, Taoyuan City (TW); **Ying-Cong DENG**, Taoyuan City (TW); **Kuan-Hsien LEE**, Taoyuan City (TW); **Yi-Chih LO**, Taoyuan City (TW); **Kai-Hsiang CHANG**, Taoyuan City (TW); **Chun-I CHENG**, Taoyuan City (TW); **Yan-Cheng HUANG**, Taoyuan City (TW)

(57) **ABSTRACT**

An antenna structure includes a ground element, a first radiation element, a second radiation element, a third radiation element, and a nonconductive support element. The first radiation element is coupled to a first grounding point on the ground element. The second radiation element has a feeding point. The second radiation element is adjacent to the first radiation element. The third radiation element is coupled to a second grounding point on the ground element. The third radiation element is adjacent to the second radiation element. The first radiation element, the second radiation element, and the third radiation element are disposed on the nonconductive support element. The second radiation element is at least partially surrounded by the first radiation element. The third radiation element is at least partially surrounded by the second radiation element.

(21) Appl. No.: **17/929,342**

(22) Filed: **Sep. 2, 2022**

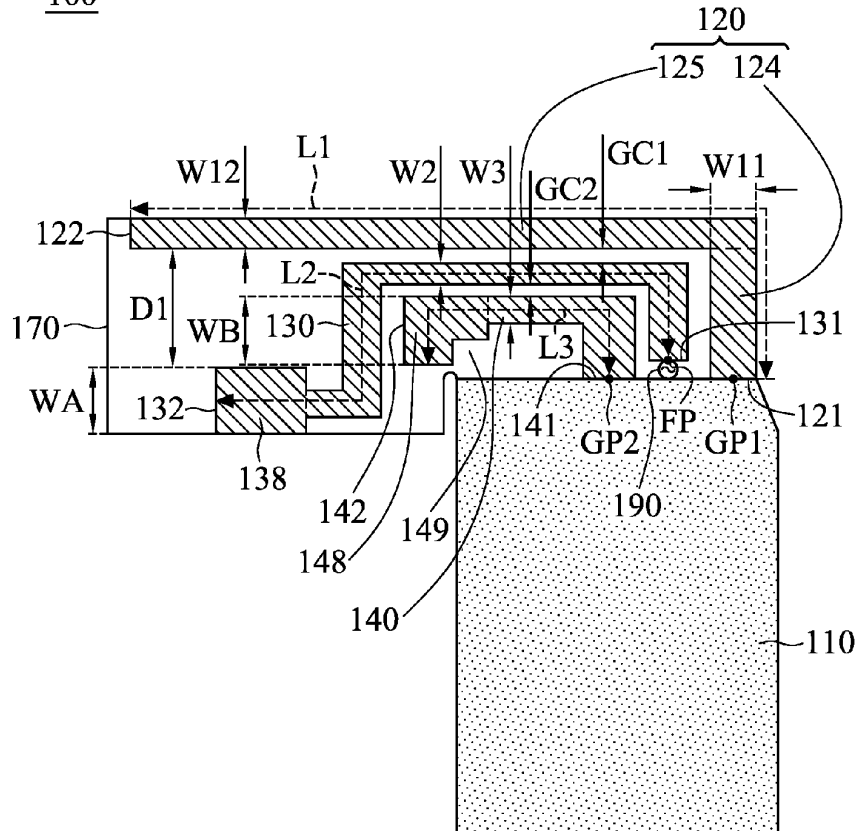
(30) **Foreign Application Priority Data**

Jul. 13, 2022 (TW) 111126333

Publication Classification

(51) **Int. Cl.**
H01Q 5/30 (2006.01)
H01Q 5/50 (2006.01)

100





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(19) **United States**

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

(10) **Pub. No.: US 2024/0021993 A1**

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

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/35 (2006.01)
H01Q 1/22 (2006.01)

(72) Inventors: **Dong Yu**, Shanghai (CN); **Zhijun Huang**, Shanghai (CN); **Kexin Liu**, Shanghai (CN); **Fangchao Zhao**, Shanghai (CN); **Peng Huang**, Shanghai (CN); **Hanyang Wang**, Reading (GB)

(52) **U.S. Cl.**
CPC *H01Q 9/0407* (2013.01); *H01Q 5/35* (2015.01); *H01Q 1/22* (2013.01)

(21) Appl. No.: **18/254,992**

(22) PCT Filed: **Nov. 29, 2021**

(86) PCT No.: **PCT/CN2021/134016**

§ 371 (c)(1),

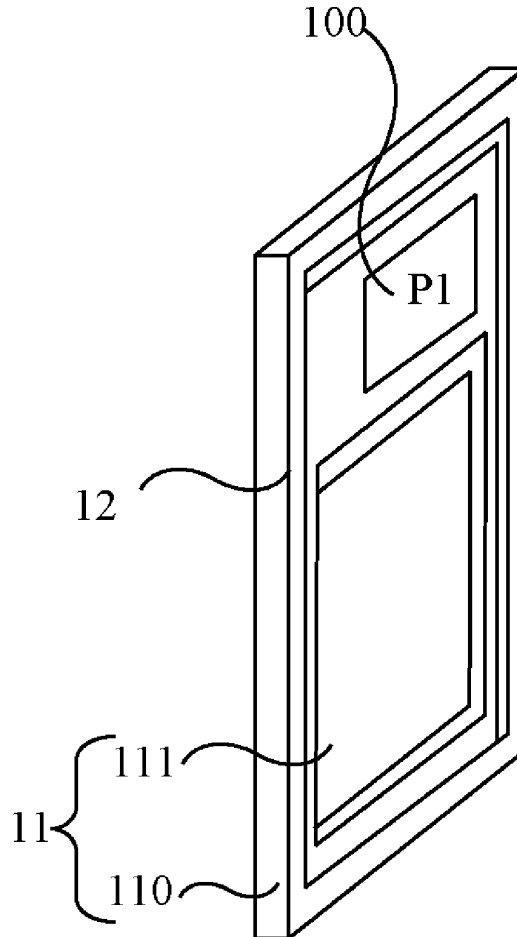
(2) Date: **May 30, 2023**

(57) **ABSTRACT**

An antenna apparatus includes a first branch, a frame branch, and a second branch. The frame branch is provided with a first gap, and the frame branch is divided into a first frame branch and a second frame branch by the first gap. The first branch, the second branch, the first frame branch and the second frame branch are conductive, not in contact with each other and are insulated from each other. A first feeding circuit is electrically connected to the second frame branch, configured to transmit a first excitation signal to the second frame branch, and excite the second frame branch to radiate a first radio wave. A second feeding circuit is electrically connected to the second branch, configured to transmit a second excitation signal to the second branch, and excite the second branch to radiate a second radio wave.

(30) **Foreign Application Priority Data**

Nov. 30, 2020 (CN) 202011380031.6





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(19) **United States**

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

(10) **Pub. No.: US 2024/0021996 A1**

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

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

Publication Classification

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

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

(72) Inventors: **Doo Hyun YANG**, Suwon-si (KR);
Doo Seok CHOI, Suwon-si (KR); **Sang Hyun BAEK**, Suwon-si (KR); **Young Ki LEE**, Suwon-si (KR); **Joon Hoi HUR**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 9/0414** (2013.01); **H01Q 9/045** (2013.01); **H01Q 1/2283** (2013.01)

(73) Assignee: **Samsung Electronics Co., Ltd.**,
Suwon-si (KR)

(57) **ABSTRACT**

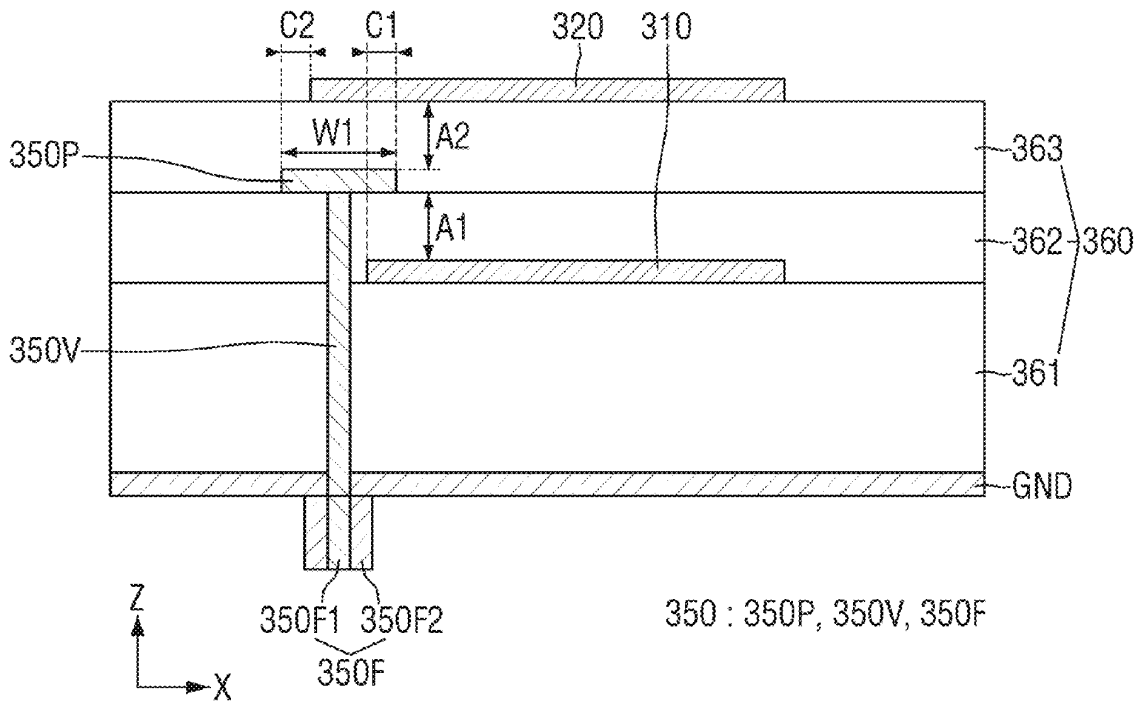
Provided is an antenna module including a first antenna patch for radiating electromagnetic energy of a first frequency band, a second antenna patch for radiating electromagnetic energy of a second frequency band different from the first frequency band, and both the first antenna patch and the second antenna patch spaced apart from a ground structure in a first direction, and a feed structure spaced apart from each of the first antenna patch and the second antenna patch, the feed structure being between the first antenna patch and the second antenna patch, the feed structure being connected to the ground structure, and the feed structure being configured to provide an RF signal to the first antenna patch and second antenna patch, and the feed structure including a horizontal feed line extending in a second direction intersecting the first direction, and a vertical feed line extending in the first direction.

(21) Appl. No.: **18/351,200**

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

(30) **Foreign Application Priority Data**

Jul. 18, 2022 (KR) 10-2022-0088030





US 20240021998A1

(19) **United States**

(12) **Patent Application Publication**
WANG

(10) **Pub. No.: US 2024/0021998 A1**

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

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

(52) **U.S. Cl.**
CPC **H01Q 9/0442** (2013.01); **H01Q 1/243** (2013.01); **H01Q 5/371** (2015.01)

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

(57) **ABSTRACT**

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

(21) Appl. No.: **18/476,118**

(22) Filed: **Sep. 27, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2022/077946, filed on Feb. 25, 2022.

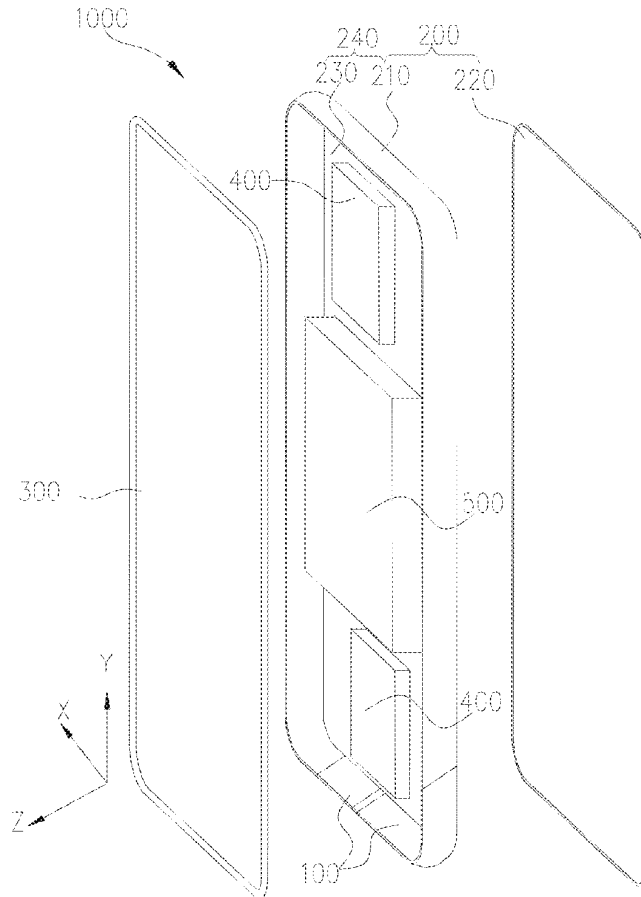
Foreign Application Priority Data

Mar. 30, 2021 (CN) 202110343970.1

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/371 (2006.01)

An antenna assembly and an electronic device are provided. A first antenna element includes a first radiator, a ground branch, and a first signal source. A joint of a first radiating branch and a second radiating branch is a first feed point. The first signal source is electrically connected to the first feed point. The ground branch, the first signal source, and the first radiating branch form a first sub-antenna. The ground branch, the first signal source, and the second radiating branch form a second sub-antenna. The first sub-antenna is configured to transmit/receive electromagnetic wave signals of a first target band under excitation of the first signal source. The second sub-antenna is configured to transmit/receive electromagnetic wave signals of a second target band under excitation of the first signal source. The first target band at least partially overlaps with the second target band.





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(19) **United States**

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

(10) **Pub. No.: US 2024/0030588 A1**

(43) **Pub. Date: Jan. 25, 2024**

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

Publication Classification

(71) Applicant: **JRD COMMUNICATION (SHENZHEN) LTD.**, Shenzhen, Guangdong (CN)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 7/00 (2006.01)
H01Q 21/28 (2006.01)

(72) Inventors: **Zhengkun LU**, Shenzhen, Guangdong (CN); **Xinrong AN**, Shenzhen, Guangdong (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 7/005* (2013.01); *H01Q 21/28* (2013.01)

(73) Assignee: **JRD COMMUNICATION (SHENZHEN) LTD.**, Shenzhen, Guangdong (CN)

(57) **ABSTRACT**

(21) Appl. No.: **18/255,505**

An antenna structure includes a middle frame body. The middle frame body includes a main board and an embedded metal, the embedded metal includes a metal body part and a metal extension part, the metal main body part and the metal extension part are an integral structure, the main board includes a first main board and a second main board, the first main board is electrically connected to the metal extension part, the first main board is configured to introduce a radio frequency signal into the metal extension part, the second main board is electrically connected to the metal extension part, and the second main board is configured to ground the metal extension part.

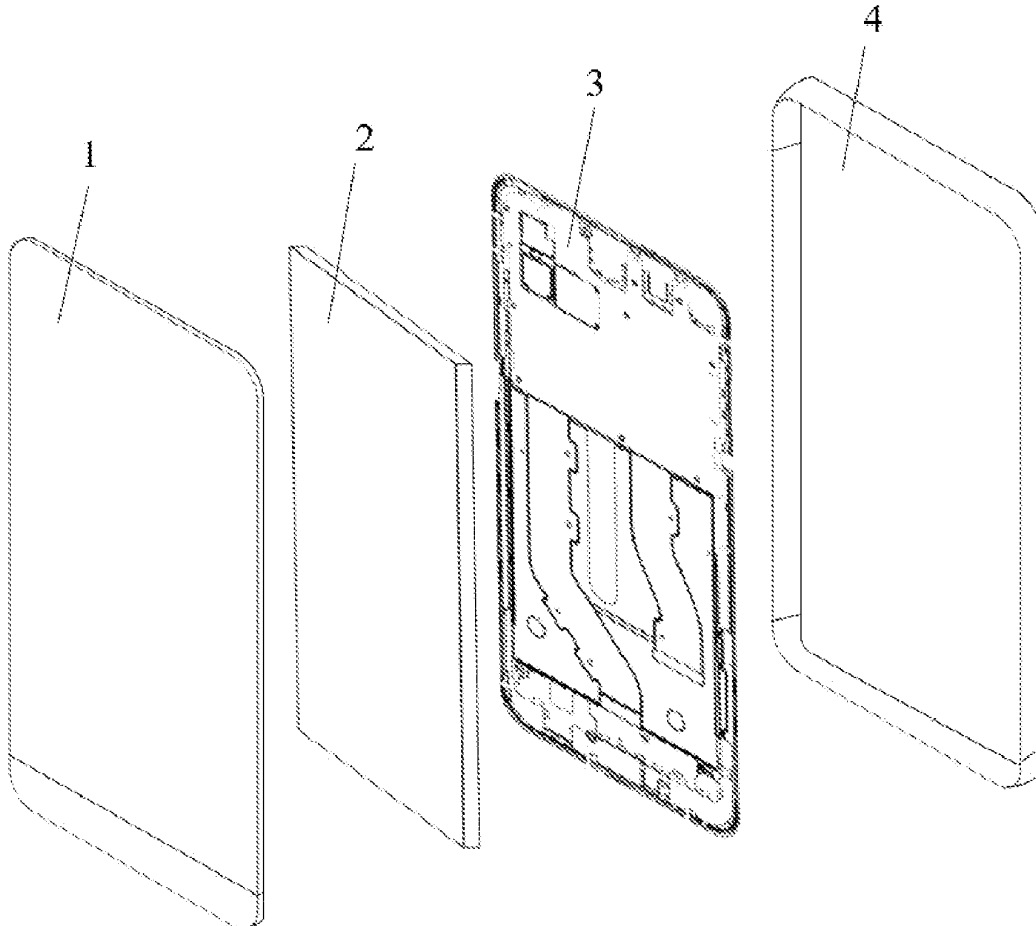
(22) PCT Filed: **Dec. 14, 2020**

(86) PCT No.: **PCT/CN2020/136013**

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

(30) **Foreign Application Priority Data**

Dec. 2, 2020 (CN) 202011386269.X





(19) **United States**
(12) **Patent Application Publication**
HONG

(10) **Pub. No.: US 2024/0030589 A1**
(43) **Pub. Date: Jan. 25, 2024**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventor: **Eunseok HONG**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/38* (2013.01); *H01Q 9/0407* (2013.01)

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

(57) **ABSTRACT**

Disclosed is an electronic device including a housing, a support member, a printed circuit board, an antenna, and a processor. The antenna structure comprises: a first conductive patch disposed on a first layer and electrically connected to the first transmission line; a second conductive patch disposed to be spaced apart from the first conductive patch in the first layer and electrically connected to the second transmission line; a third conductive patch disposed spaced apart from the first conductive patch and the second conductive patch in the first layer and electrically connected to the third transmission line; and a shielding member disposed on the second layer, and the processor may be set to receive a wireless signal of a designated band by supplying power to the first conductive patch, the second conductive patch, and the third conductive patch by using a wireless communication circuit.

(21) Appl. No.: **18/374,388**

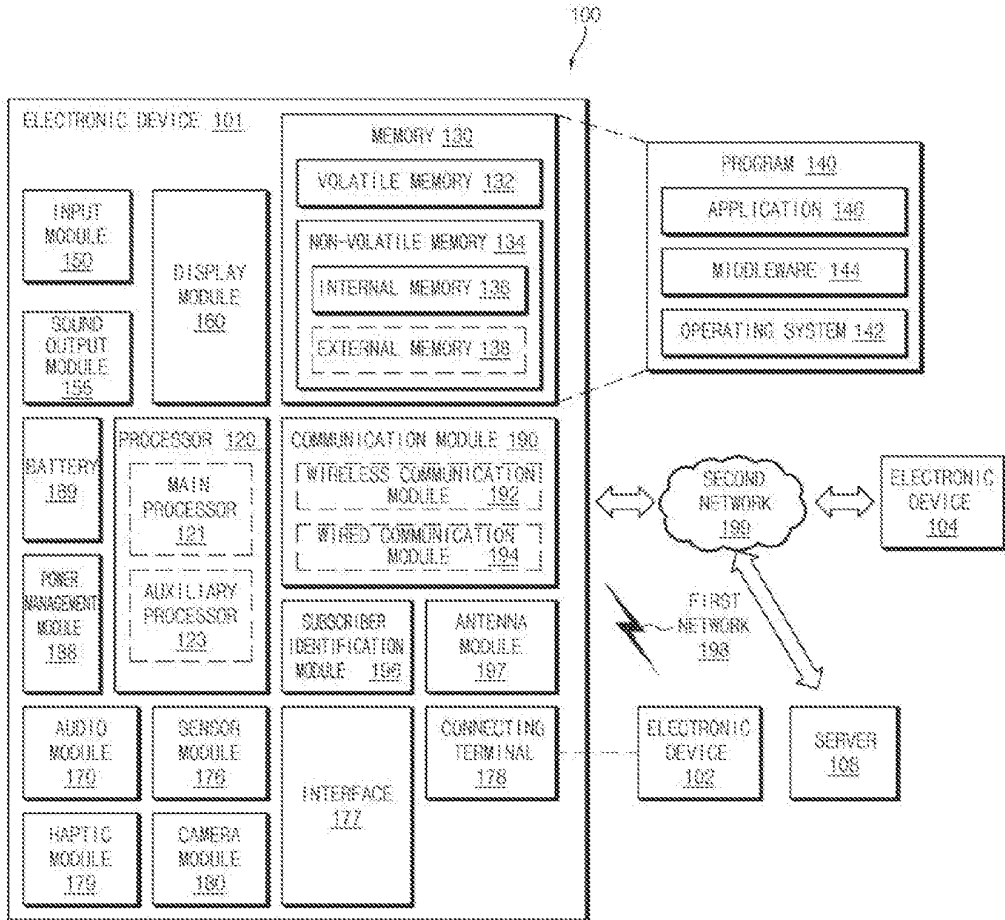
(22) Filed: **Sep. 28, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR22/04735, filed on Apr. 1, 2022.

Foreign Application Priority Data

Apr. 5, 2021 (KR) 10-2021-0044120





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(19) **United States**

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

(10) **Pub. No.: US 2024/0030607 A1**

(43) **Pub. Date: Jan. 25, 2024**

(54) **ANTENNA FOR FOLDABLE ELECTRONIC DEVICE AND FOLDABLE ELECTRONIC DEVICE**

H01Q 1/48 (2006.01)

H01Q 1/50 (2006.01)

G06F 1/16 (2006.01)

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

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

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

(2013.01); *H01Q 1/48* (2013.01); *H01Q 1/50*

(2013.01); *G06F 1/1698* (2013.01); *G06F*

1/1616 (2013.01)

(72) Inventors: **Yuan Zhou**, Shanghai (CN); **Xiaopeng Liu**,
Shenzhen (CN); **Meng Hou**, Shanghai (CN); **Dong Yu**,
Shanghai (CN)

(57)

ABSTRACT

(21) Appl. No.: **18/044,303**

A foldable electronic device includes a first housing and a second housing that are rotationally connected to each other by means of rotating shafts located on two sides, and an antenna. The first housing can switch between an unfolded state and a folded state relative to the second housing, and the antenna is disposed in a closed slot. The antenna includes a first antenna segment and a second antenna segment that are sequentially connected and disposed in a length direction of the antenna. One end of the first antenna segment is connected to a ground plate of the first housing. The first antenna segment extends from one end toward a direction in which an opening/closing region of the first housing and the second housing in the unfolded state is away from the first housing.

(22) PCT Filed: **Aug. 5, 2021**

(86) PCT No.: **PCT/CN2021/110863**

§ 371 (c)(1),

(2) Date: **Mar. 7, 2023**

(30) **Foreign Application Priority Data**

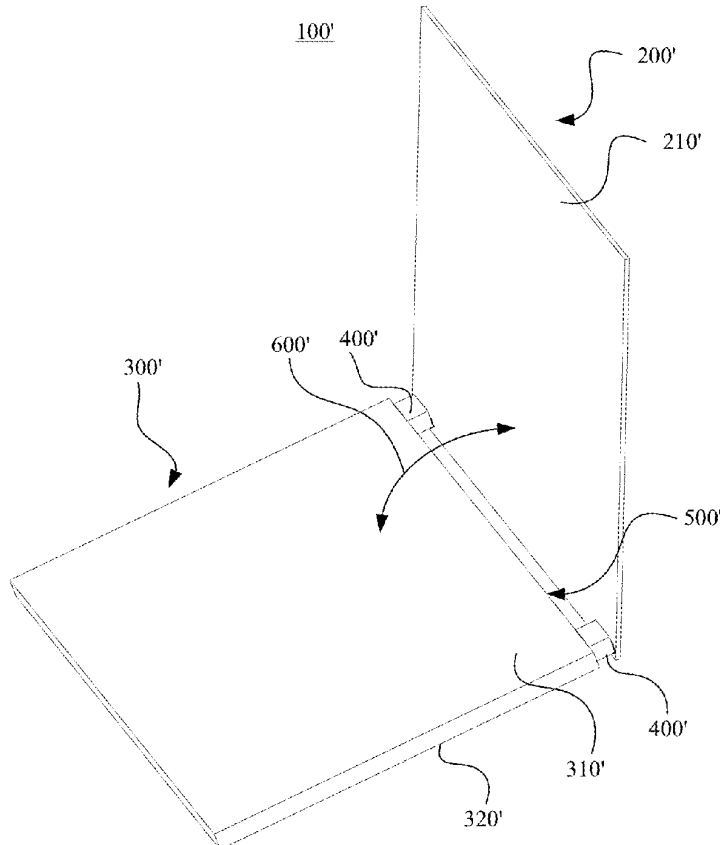
Sep. 10, 2020 (CN) 202010945216.0

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 1/22 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2024/0030608 A1**

(43) **Pub. Date: Jan. 25, 2024**

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

G01V 3/12 (2006.01)

H01Q 5/307 (2006.01)

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

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

CPC *H01Q 9/0442* (2013.01); *H01Q 1/48*

(2013.01); *H01Q 1/2266* (2013.01); *H01Q*

9/045 (2013.01); *G01V 3/12* (2013.01); *H01Q*

5/307 (2015.01)

(72) Inventors: **CHIA-HAO CHANG, HSINCHU (TW); CHUNG-CHE LIEN, HSINCHU (TW); TING-HAN SHIH, HSINCHU (TW)**

(57)

ABSTRACT

An antenna structure and an electronic device are provided. The antenna structure includes a substrate with opposing first and second surfaces, a first radiating element with a first radiating portion and a second radiating portion, a third radiating portion, a feeding portion, and a grounding portion that are connected to the first radiating portion, a second radiating element separate from but coupling with the first radiating portion, a grounding element connected to the grounding portion, and a feeding element. The first radiating portion, the feeding portion, and the grounding portion are disposed on the first surface. The second radiating portion and the third radiating portion are disposed on the second surface. A projected area of the second radiating portion onto the first surface partially overlaps with the feeding portion. A projected area of the third radiating portion onto the first surface partially overlaps with the grounding portion.

(21) Appl. No.: **18/045,840**

(22) Filed: **Oct. 12, 2022**

(30) **Foreign Application Priority Data**

Jul. 19, 2022 (TW) 111126939

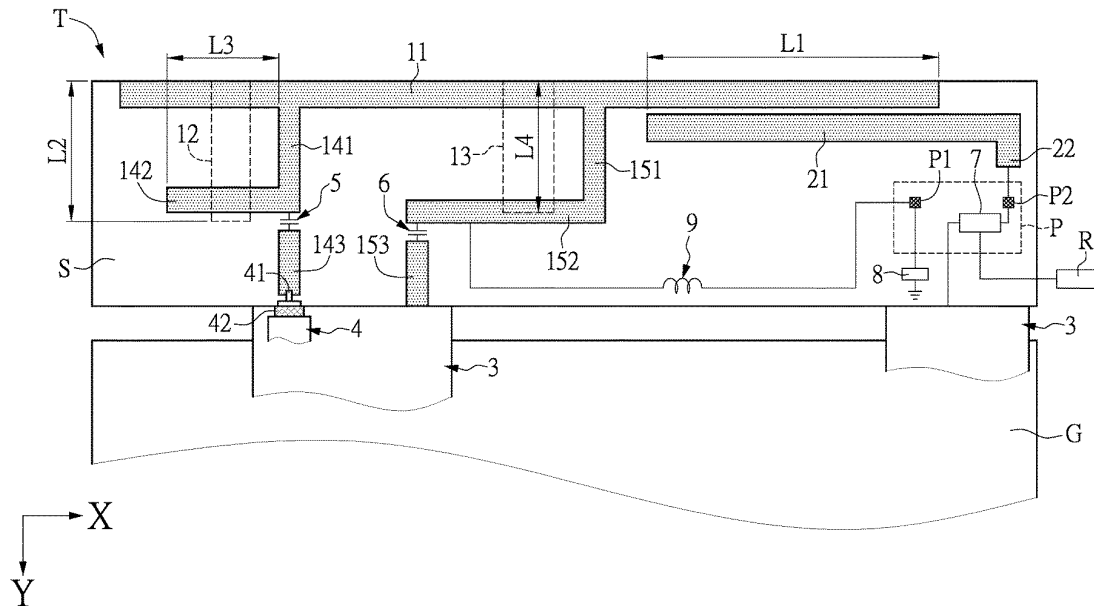
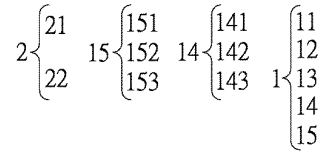
Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 1/48 (2006.01)

H01Q 1/22 (2006.01)





US 20240039164A1

(19) **United States**

(12) **Patent Application Publication**
Wu

(10) **Pub. No.: US 2024/0039164 A1**

(43) **Pub. Date: Feb. 1, 2024**

(54) **ULTRA-WIDEBAND ANTENNA DEVICE**

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

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

CPC **H01Q 13/10** (2013.01); **H01Q 15/10** (2013.01)

(72) Inventor: **Yu-Ching Wu**, Taipei (TW)

(57) **ABSTRACT**

(21) Appl. No.: **18/181,839**

(22) Filed: **Mar. 10, 2023**

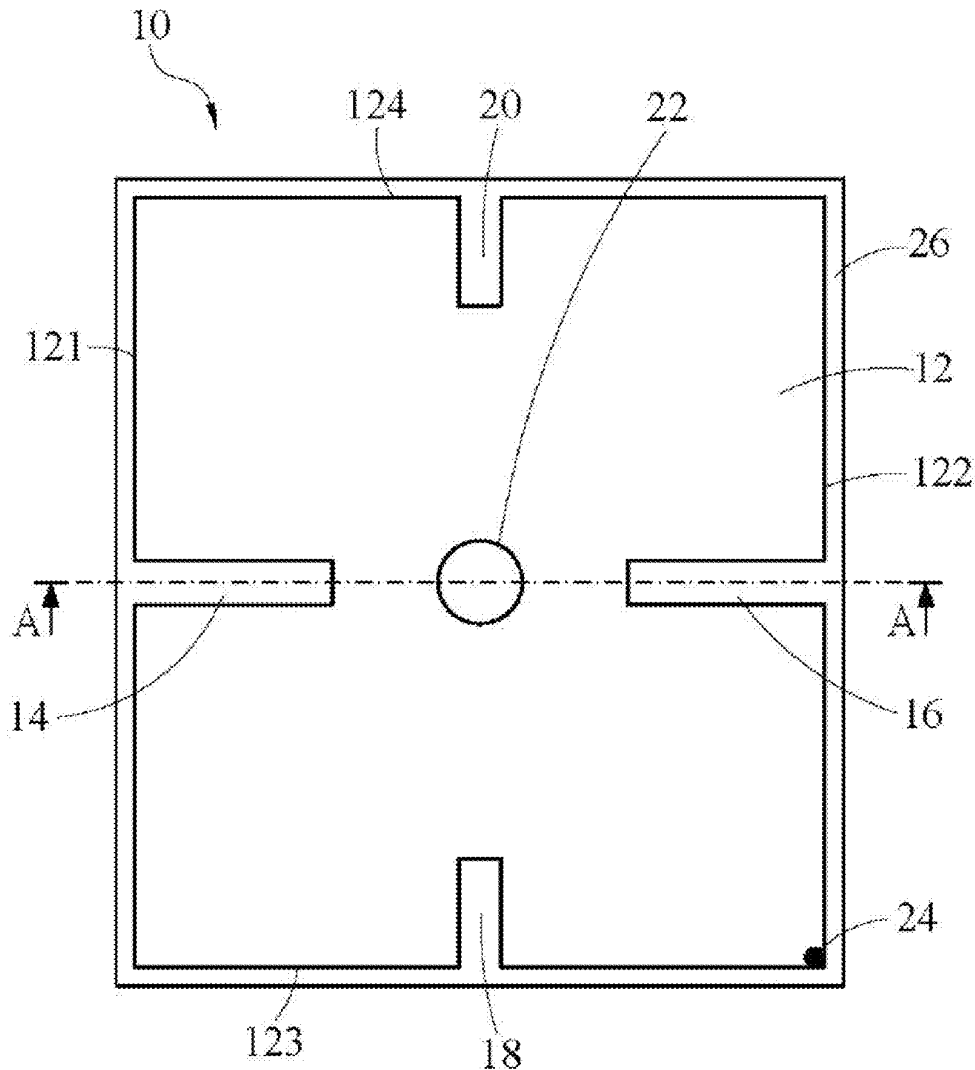
An ultra-wideband antenna device includes a radiation metal body, a first slotted hole, a second slotted hole, a third slotted hole, a fourth slotted hole, a ground point, and a feeding source. The radiation metal body includes a first side edge and a second side edge opposite to each other and a third side edge and a fourth side edge opposite to each other, the first slotted hole extends inward from the first side edge, the second slotted hole extends inward from the second side edge, the third slotted hole extends inward from the third side edge, and the fourth slotted hole extends inward from the fourth side edge. The ground point is located at a middle position of the radiation metal body, and the feeding source is located on the radiation metal body and away from the middle position.

(30) **Foreign Application Priority Data**

Jul. 27, 2022 (TW) 111128216

Publication Classification

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 15/10 (2006.01)





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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0040020 A1**
HWANG et al. (43) **Pub. Date: Feb. 1, 2024**

(54) **FOLDABLE ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

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

(72) Inventors: **Soonho HWANG**, Suwon-si (KR); **Himchan YUN**, Suwon-si (KR); **Kookjoo LEE**, Suwon-si (KR); **Hojung NAM**, Suwon-si (KR); **Sungkoo PARK**, Suwon-si (KR); **Kyungjae LEE**, Suwon-si (KR); **Donguk CHOI**, Suwon-si (KR); **Seunghwan KIM**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H04M 1/0214** (2013.01); **H01Q 1/243** (2013.01); **H04M 1/0268** (2013.01)

(57) **ABSTRACT**

A foldable electronic device is provided that includes a hinge module, a first housing coupled to a first side of the hinge module, a first printed circuit board disposed inside the first housing and including a first wireless communication module, a processor, and a first ground, and a second housing coupled to a second side of the hinge module, in which the first housing includes a first segmenting portion, a second segmenting portion, a first conductive portion, and a second conductive portion, in which the second housing includes a second wireless communication module, a third segmenting portion, a fourth segmenting portion, a third conductive portion, and a fourth conductive portion, and in which a matching circuit is disposed between the first conductive portion and the first ground, and a first filter circuit is connected to a signal path between the first conductive portion and the matching circuit.

(21) Appl. No.: **18/483,995**

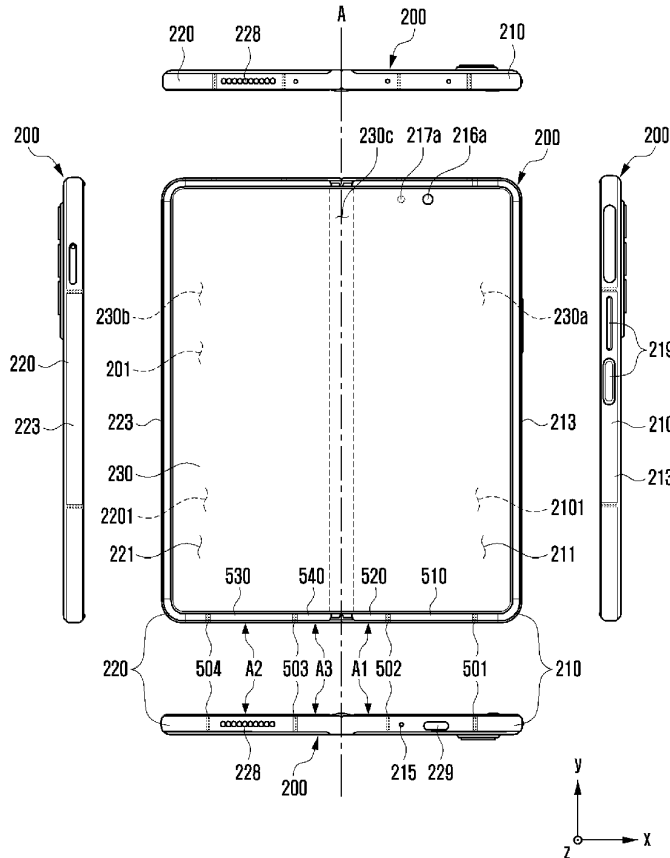
(22) Filed: **Oct. 10, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2023/010308, filed on Jul. 18, 2023.

(30) **Foreign Application Priority Data**

Jul. 26, 2022 (KR) 10-2022-0092782
Sep. 16, 2022 (KR) 10-2022-0116818





US 20240055750A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0055750 A1**

(43) **Pub. Date: Feb. 15, 2024**

(54) **TERMINAL DEVICE**

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

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

CPC **H01Q 1/22** (2013.01); **H01Q 1/48** (2013.01); **H01Q 9/045** (2013.01)

(72) Inventors: **Wanbo XIE**, Beijing (CN); **Shaoshu SHA**, Beijing (CN); **Tao JIAO**, Beijing (CN)

(57) **ABSTRACT**

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

(21) Appl. No.: **18/070,360**

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

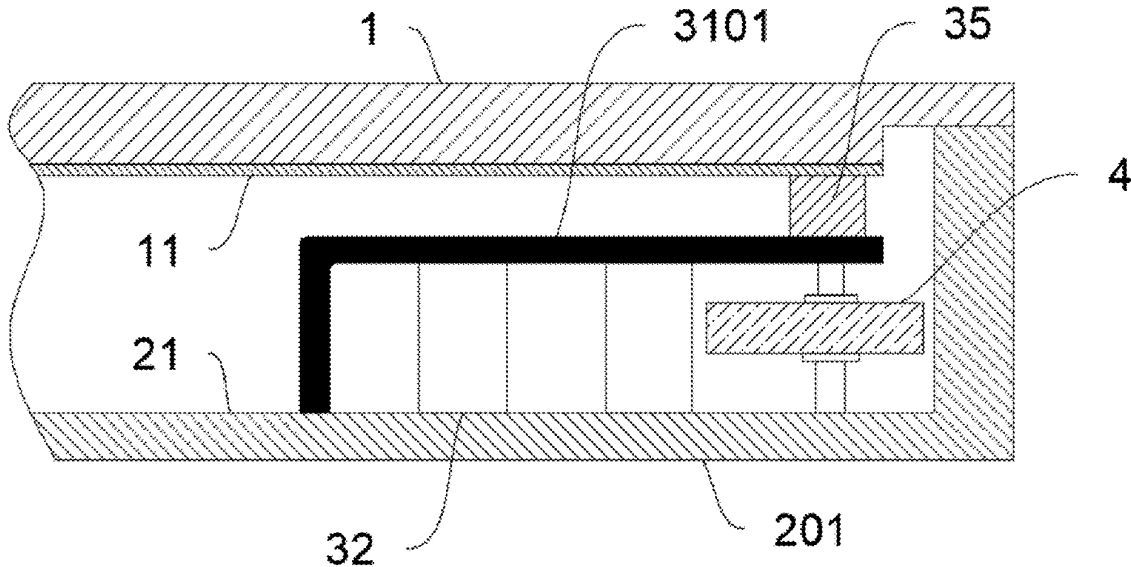
(30) **Foreign Application Priority Data**

Aug. 11, 2022 (CN) 202210964319.0

Publication Classification

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

A terminal device includes a display component, a housing component, and an antenna component. The display component is connected with the housing component, and the antenna component is located inside the housing component. The antenna component includes a radiating metal sheet, at least one first grounding structure and at least one feeding point. The radiating metal sheet includes a first radiating part that extends parallel to the display component and a second radiating part that extends away from the display component. The second radiating part is connected to at least part of a circumferential edge of the first radiating part. The at least one feeding point is located on a surface of the first radiating part. The at least one first grounding structure is located at an end of the second radiating part.





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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0055762 A1**
Cai et al. (43) **Pub. Date: Feb. 15, 2024**

(54) **ELECTRONIC DEVICE**

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

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

CPC **H01Q 5/10** (2015.01); **H01Q 5/378** (2015.01); **H01Q 5/328** (2015.01)

(72) Inventors: **Xiaotao Cai**, Shenzhen (CN); **Dawei Zhou**, Shenzhen (CN); **Wei Xiong**, Shenzhen (CN); **Yuanpeng Li**, Shenzhen (CN)

(57) **ABSTRACT**

This application provides an electronic device, relates to the field of electronic device technologies, and can improve radiation efficiency of an antenna in the electronic device. The electronic device includes a reference ground layer, a first radiator, and a second radiator, where the reference ground layer has a first edge, and a second edge and a third edge that are respectively connected to two ends of the first edge. The first radiator has a first ground point and a first feed point that are disposed at an interval, and the first ground point is electrically connected to the reference ground layer. The second radiator is electrically connected to the first edge of the reference ground layer, or an end section that is of the second edge and that is connected to the first edge, or an end section that is of the third edge and that is connected to the first edge. An electrical length of the reference ground layer in a first direction is a 1/2 wavelength of a main resonant band of the first radiator, and a parasitic resonant band generated by the second radiator when a radio frequency signal is fed at the first feed point is lower than the main resonant band generated by the first radiator when the radio frequency signal is fed at the first feed point. The electronic device provided in this application is used for a communication system.

(21) Appl. No.: **18/258,158**

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

(86) PCT No.: **PCT/CN2021/139063**

§ 371 (c)(1),

(2) Date: **Jun. 16, 2023**

(30) **Foreign Application Priority Data**

Dec. 18, 2020 (CN) 202011507812.7

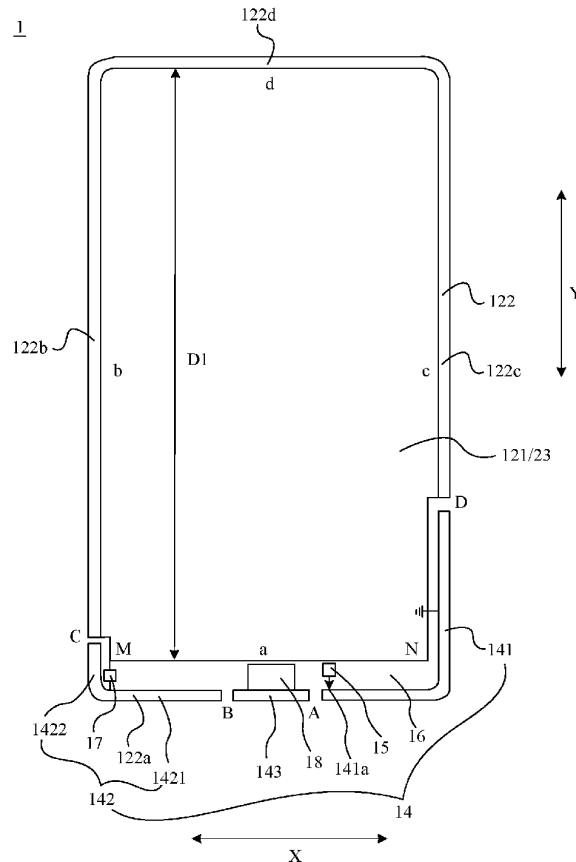
Publication Classification

(51) **Int. Cl.**

H01Q 5/10 (2006.01)

H01Q 5/378 (2006.01)

H01Q 5/328 (2006.01)





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(19) **United States**

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

(10) **Pub. No.:** US 2024/0055766 A1

(43) **Pub. Date:** Feb. 15, 2024

(54) **ANTENNA DEVICE**

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

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

CPC **H01Q 9/045** (2013.01); **H01Q 9/0442**
(2013.01)

(72) Inventors: **Takafumi NASU**, Nagaokakyo-shi (JP);
Toumu TANABE, Nagaokakyo-shi (JP)

(57) **ABSTRACT**

(21) Appl. No.: **18/383,059**

An antenna device includes a feeder circuit, a patch antenna, an antenna, a first coil connected between the feeder circuit and the patch antenna, and a second coil connected to the antenna and magnetically coupled to the first coil. The patch antenna resonates in a first frequency range in a first direction and in a second frequency range in a second direction. The antenna resonates in a third frequency range. A first center frequency refers to the center frequency of the first frequency range, a second center frequency refers to the center frequency of the second frequency range, a third center frequency refers to the center frequency of the third frequency range, and an absolute value of a difference between the first center frequency and the third center frequency is less than an absolute value of a difference between the second center frequency and the third center frequency.

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

Related U.S. Application Data

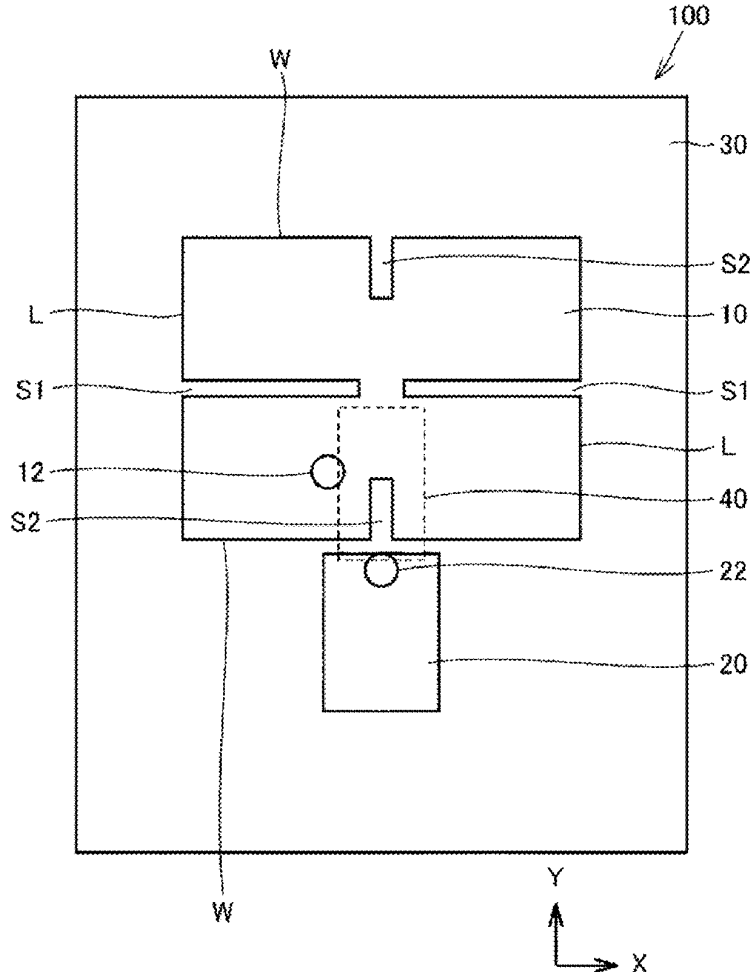
(63) Continuation of application No. PCT/JP2022/010019, filed on Mar. 8, 2022.

(30) **Foreign Application Priority Data**

Apr. 28, 2021 (JP) 2021-076534

Publication Classification

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





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(19) **United States**

(12) **Patent Application Publication**
Pourghorban Saghati et al.

(10) **Pub. No.: US 2024/0055768 A1**

(43) **Pub. Date: Feb. 15, 2024**

(54) **ANTENNA FEED STRUCTURE**

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

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

CPC **H01Q 13/10** (2013.01); **H01Q 9/045** (2013.01)

(72) Inventors: **Alireza Pourghorban Saghati**, San Jose, CA (US); **Jerzy S Guterman**, Sunnyvale, CA (US); **Jue Wang**, San Jose, CA (US)

(57) **ABSTRACT**

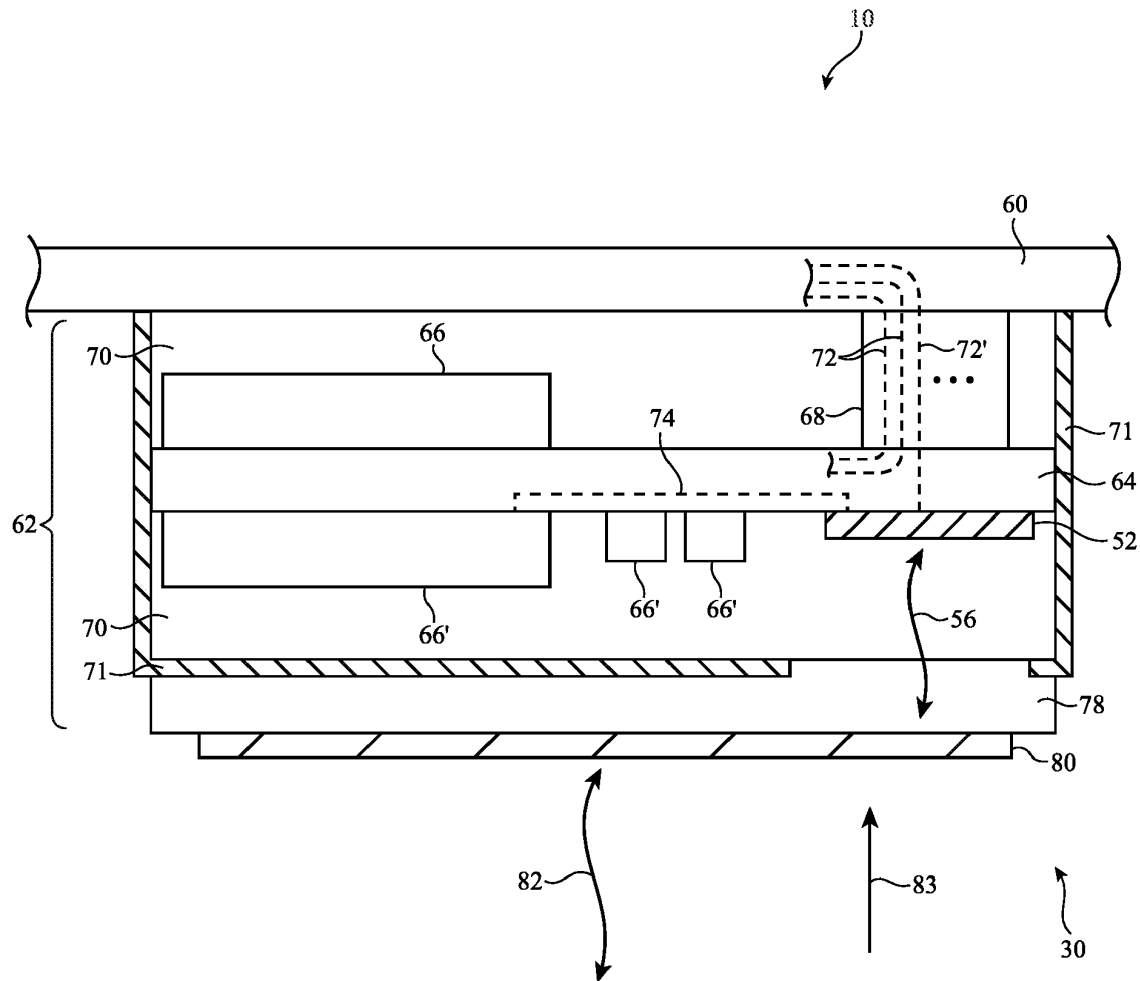
An electronic device may include one or more radios and one or more antennas. Radio-frequency transmission lines may couple a radio to an antenna feed structure. The antenna feed structure may be wireless coupled to one or more antenna resonating elements. An intervening slot element may be disposed between the antenna feed structure and the one or more antenna resonating elements. The antenna feed structure may be disposed on a package substrate forming an integrated circuit package. The one or more antenna resonating elements may be disposed on an antenna support structure. The integrated circuit package and the antenna support structure may be mounted to the same side or opposing sides of a system substrate.

(21) Appl. No.: **17/886,678**

(22) Filed: **Aug. 12, 2022**

Publication Classification

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 9/04 (2006.01)





US 20240055778A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0055778 A1**

Wang et al.

(43) **Pub. Date: Feb. 15, 2024**

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

(30) **Foreign Application Priority Data**

Dec. 30, 2020 (CN) 202011628760.9

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

Publication Classification

(72) Inventors: **Jikang Wang**, Shanghai (CN); **Laiwei Shen**, Shanghai (CN); **Jiaming Wang**, Shanghai (CN); **Liang Xue**, Shanghai (CN)

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

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

(73) Assignee: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen,Guangdong (CN)

(57) **ABSTRACT**

A foldable electronic device having a primary screen portion with a primary-screen antenna, and a secondary screen portion with a secondary-screen antenna. Positions of the primary-screen antenna and the secondary-screen antenna overlap when the electronic device is folded. The primary-screen antenna and the secondary-screen antenna may excite two antenna patterns of high isolation. In this way, even if the primary-screen antenna and the secondary-screen antenna operate on a same frequency band and overlap, good isolation performance can also be obtained.

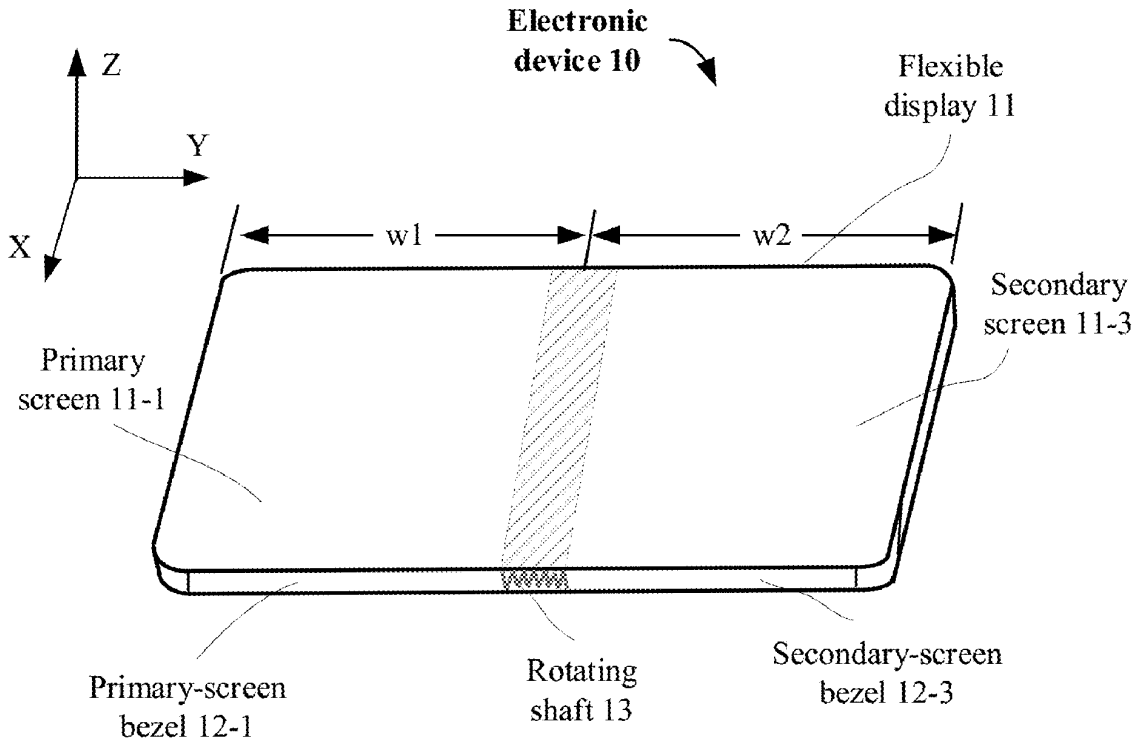
(21) Appl. No.: **18/259,581**

(22) PCT Filed: **Dec. 29, 2021**

(86) PCT No.: **PCT/CN2021/142660**

§ 371 (c)(1),

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





US 20240055779A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0055779 A1**

(43) **Pub. Date: Feb. 15, 2024**

(54) **COMBINED ANTENNA STRUCTURE**

(30) **Foreign Application Priority Data**

(71) Applicant: **Intel Corporation**, Santa Clara, CA (US)

Aug. 9, 2022 (IN) 202241045519

Publication Classification

(72) Inventors: **Maruti TAMRAKAR**, Durg (IN);
Prathibha PEDDIREDDY, Bangalore (IN); **Jayprakash THAKUR**, Bangalore (IN); **Anoop PARCHURU**, Bangalore (IN); **Prasanna PICHUMANI**, Bangalore (IN)

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

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

(57) **ABSTRACT**

A circuitry including a first antenna configured to communicate via a first RAT; including a substrate; and a second antenna located on the substrate of the first antenna configured to communicate via a second RAT, wherein communication via the first RAT does not interfere with communication via the second RAT.

(21) Appl. No.: **18/347,587**

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

