



US 20240213666A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0213666 A1**

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

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Yuan-Lung LEE**, Taoyuan City (TW);
Chih-Chun LIN, Taoyuan City (TW)

(21) Appl. No.: **18/182,752**

(22) Filed: **Mar. 13, 2023**

(30) **Foreign Application Priority Data**

Dec. 22, 2022 (TW) 111214208

Publication Classification

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 5/307 (2006.01)
H01Q 9/04 (2006.01)

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

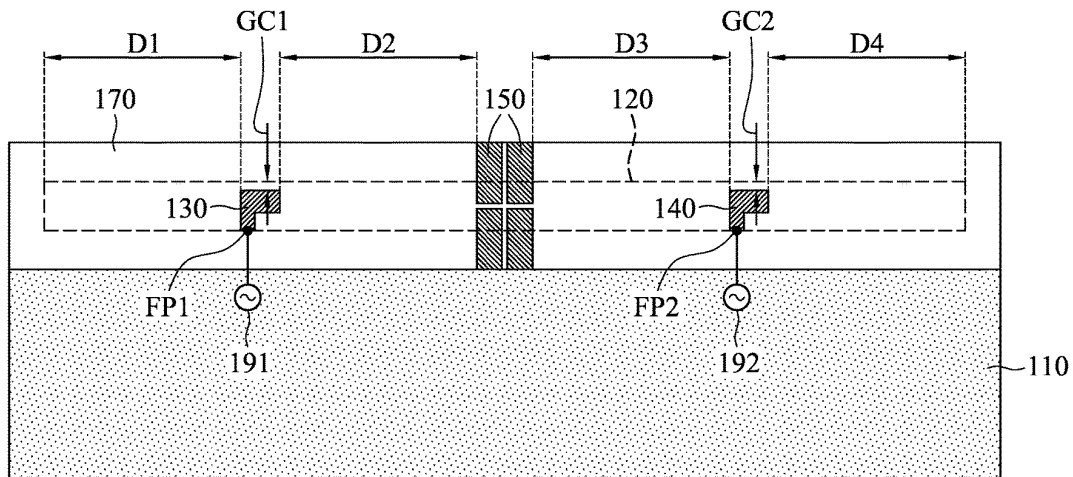
CPC **H01Q 1/521** (2013.01); **H01Q 5/307** (2015.01); **H01Q 9/0407** (2013.01)

(57)

ABSTRACT

An antenna structure includes a metal mechanism element, a first radiation element, a second radiation element, an impedance element, and a dielectric substrate. The metal mechanism element has a slot. The first radiation element has a first feeding point. The second radiation element has a second feeding point. The impedance element is coupled to the metal mechanism element. The impedance element is disposed between the first radiation element and the second radiation element. The dielectric substrate is adjacent to the slot of the metal mechanism element. The first radiation element, the second radiation element, and the impedance element are disposed on the dielectric substrate. The impedance element is configured to increase the isolation between the first radiation element and the second radiation element.

100





US 20240213682A1

(19) **United States**

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

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

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

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

Publication Classification

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

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

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

(57) **ABSTRACT**

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

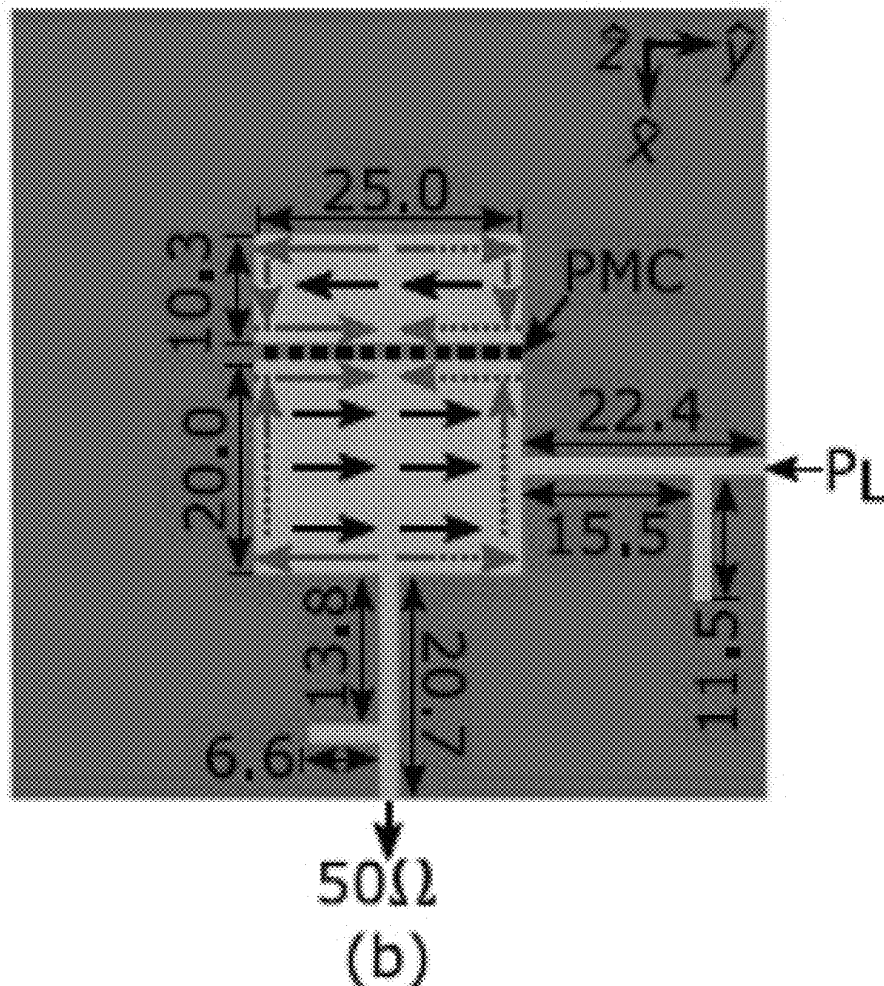
Multi-band, microstrip patch antennas, as well as methods of fabricating the same and methods of using the same, are provided. A decoupling technique can be used where strategically etched slots are provided between the tightly coupled microstrip patch antennas, and the appropriate mode excitation of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

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

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

Related U.S. Application Data

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





US 20240282511A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0282511 A1**

(43) **Pub. Date: Aug. 22, 2024**

(54) **WIRELESS CHARGING COIL,
ELECTRONIC DEVICE, AND ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01F 27/34 (2006.01)
H01F 27/28 (2006.01)
H01F 27/32 (2006.01)
H02J 50/10 (2006.01)

(72) Inventors: **Hua HUANG**, Shenzhen (CN);
Jiaxiang SONG, Shenzhen (CN);
Xialing ZHANG, Shenzhen (CN); **Xing**
WANG, Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H01F 27/34** (2013.01); **H01F 27/2871**
(2013.01); **H01F 27/323** (2013.01); **H02J**
50/10 (2016.02)

(21) Appl. No.: **18/041,158**

(22) PCT Filed: **Aug. 24, 2022**

(86) PCT No.: **PCT/CN2022/114631**

§ 371 (c)(1),

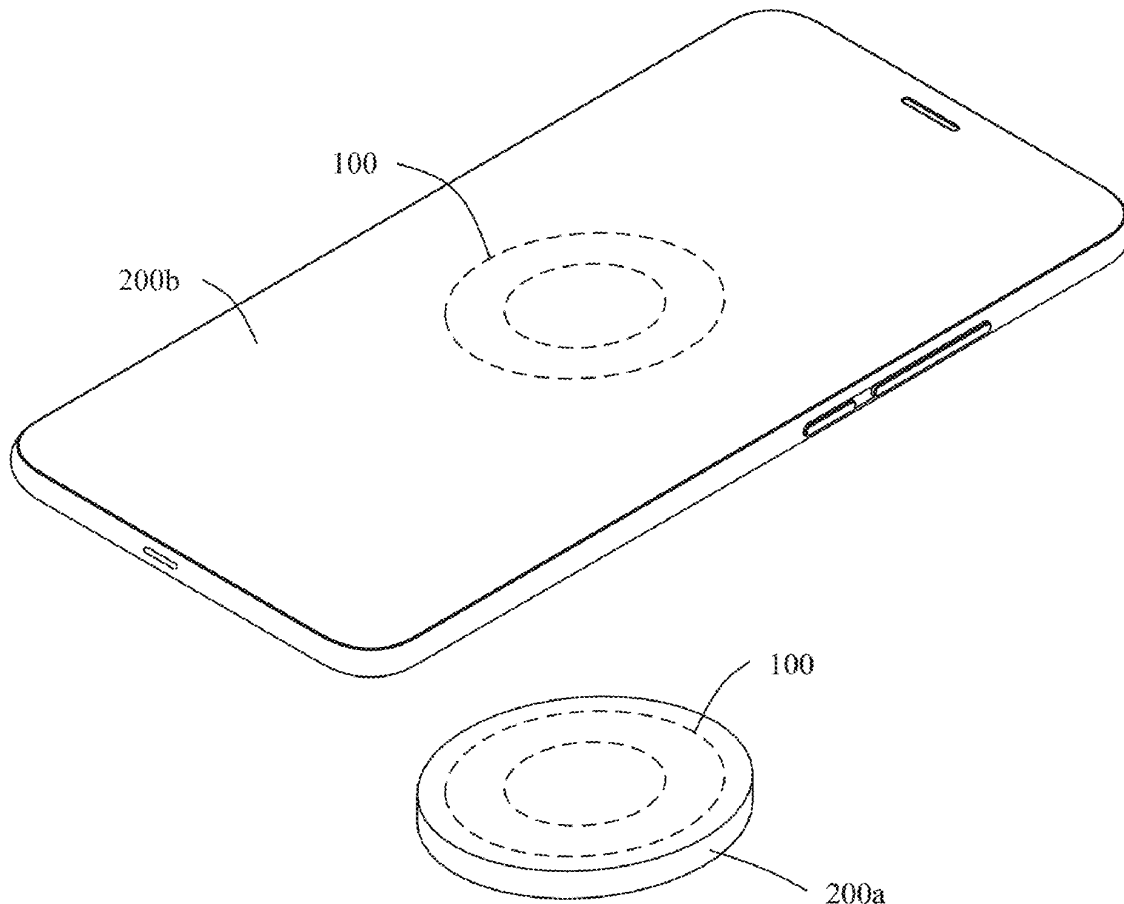
(2) Date: **Feb. 9, 2023**

(30) **Foreign Application Priority Data**

Dec. 1, 2021 (CN) 202111452805.6

(57) **ABSTRACT**

This application provides a wireless charging coil, and an electronic device and an antenna that include the wireless charging coil. The wireless charging coil includes a plurality of coil groups that are at a plurality of layers and that are connected in series, and an insulation layer that is disposed between two layers of the plurality of coil groups. The wireless charging coil includes a first area and a second area that is disposed at an outer periphery of the first area. A plurality of coil groups disposed in the second area are arranged at the plurality of layers, and each coil group includes a plurality of coils wound in parallel at one layer.





US 20240282724A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0282724 A1**

(43) **Pub. Date: Aug. 22, 2024**

(54) **ANTENNA-INTEGRATED
HIGH-FREQUENCY SEMICONDUCTOR
PACKAGE AND METHOD OF
MANUFACTURING SAME**

H01L 23/367 (2006.01)

H01L 23/498 (2006.01)

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

CPC *H01L 23/66* (2013.01); *H01L 23/367*
(2013.01); *H01L 23/49827* (2013.01); *H01L*
24/32 (2013.01); *H01L 2223/6677* (2013.01);
H01L 2224/32225 (2013.01); *H01L 2924/181*
(2013.01)

(71) Applicant: **KOREA ELECTRONICS
TECHNOLOGY INSTITUTE,**
Seongnam-si (KR)

(72) Inventors: **Jong Min YOOK**, Seongnam-si (KR);
Je In YU, Seoul (KR); **Dong Su KIM**

(73) Assignee: **KOREA ELECTRONICS
TECHNOLOGY INSTITUTE,**
Seongnam-si (KR)

(21) Appl. No.: **18/439,938**

(22) Filed: **Feb. 13, 2024**

(30) **Foreign Application Priority Data**

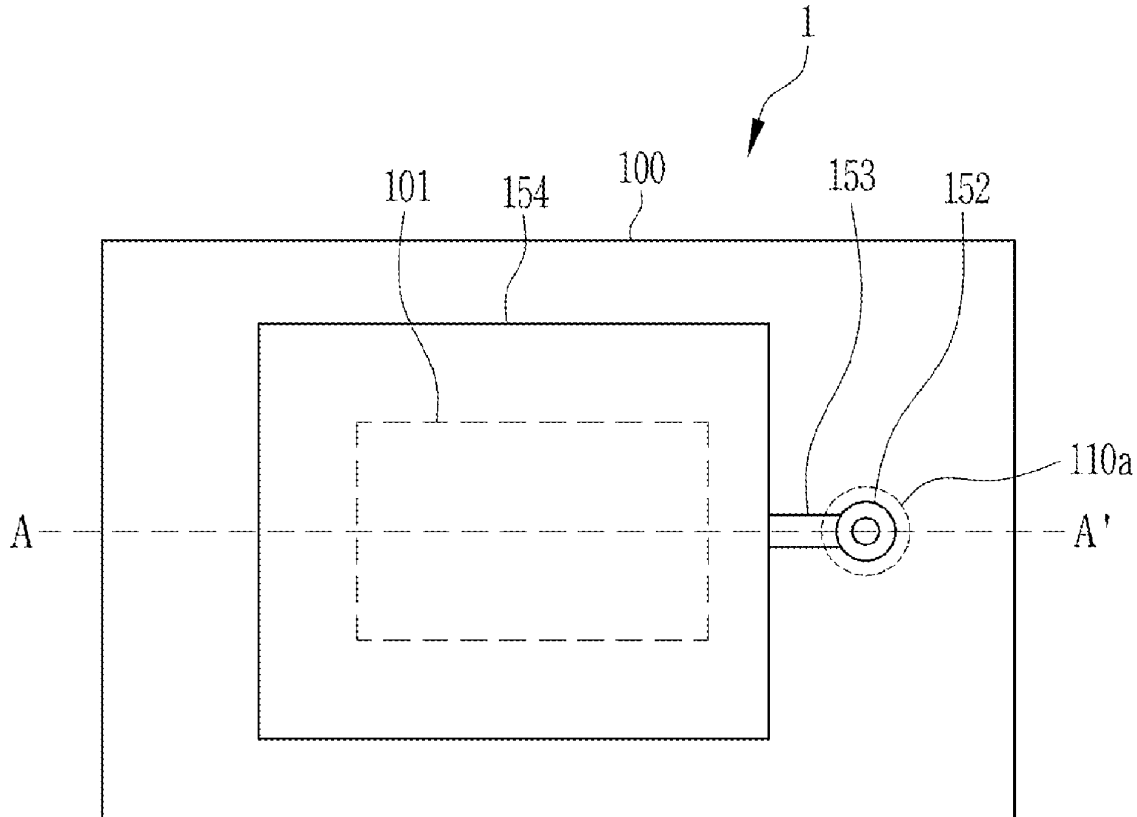
Feb. 16, 2023 (KR) 10-2023-0020767

Publication Classification

(51) **Int. Cl.**
H01L 23/66 (2006.01)
H01L 23/00 (2006.01)

(57) **ABSTRACT**

An antenna-integrated high-frequency semiconductor package, including a substrate including a recess concave on a first surface and a first through-hole penetrating from the first surface to a second surface, a ground layer configured to cover the first surface of the substrate and the recess, a semiconductor chip mounted on the ground layer of the recess, an insulating layer configured to entirely cover the substrate, the ground layer, and the semiconductor chip, and a conductive layer formed on the insulating layer, the conductive layer including an electrode pattern connected to the semiconductor chip, an antenna formed on a second surface of the insulating layer, and a signal via configured to transmit an electrical signal between the electrode pattern and the antenna through a second through-hole formed in the first through-hole to penetrate from the first surface to the second surface of the insulating layer.





US 20240283128A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0283128 A1**

(43) **Pub. Date: Aug. 22, 2024**

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

Publication Classification

(71) Applicants: **Liang-Che Chou**, Taipei City (TW);
Wei-Sen Teng, Taipei City (TW);
Yu-Chun Hsieh, Taipei City (TW);
Guan-Ruei Wu, Taipei City (TW);
Jui-Hung Lai, Taipei City (TW)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/2266** (2013.01); **H01Q 9/0421**
(2013.01); **H01Q 9/0442** (2013.01)

(72) Inventors: **Liang-Che Chou**, Taipei City (TW);
Wei-Sen Teng, Taipei City (TW);
Yu-Chun Hsieh, Taipei City (TW);
Guan-Ruei Wu, Taipei City (TW);
Jui-Hung Lai, Taipei City (TW)

(57) **ABSTRACT**

An antenna module includes a substrate and an antenna structure. The antenna structure is disposed on the substrate and includes a radiating portion, a feeding portion, a ground plane, and an impedance adjustment portion. The feeding portion is coupled to the radiating portion and the ground plane. The impedance adjustment portion has a connection end portion and a ground end portion opposite to each other. The connection end portion is connected to the radiating portion. The impedance adjustment portion is bent relative to the radiating portion to extend from the connection end portion toward the feeding portion along an extending direction. The ground end portion is connected to the ground plane and near the feeding portion. In addition, an electronic device including the antenna module is also provided.

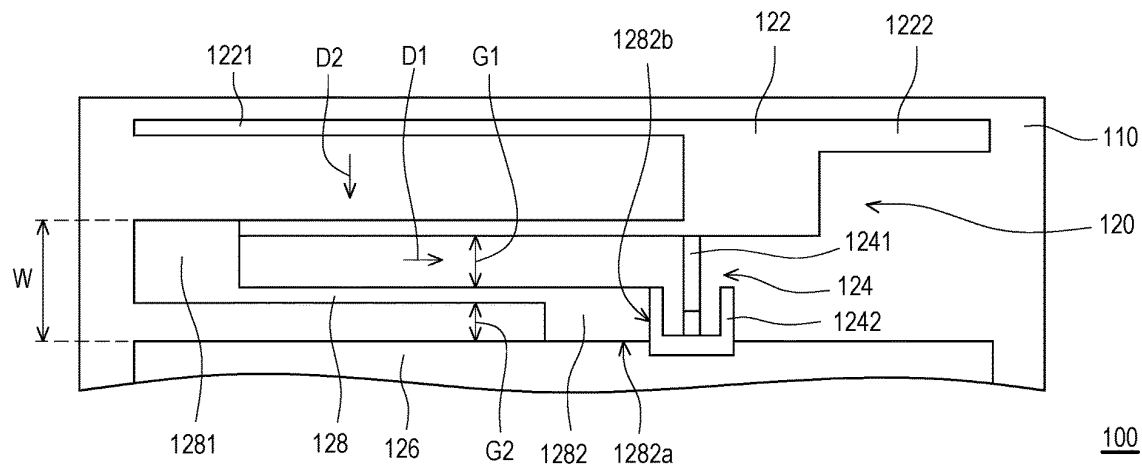
(73) Assignee: **COMPAL ELECTRONICS, INC.**,
Taipei City (TW)

(21) Appl. No.: **18/429,465**

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

Related U.S. Application Data

(60) Provisional application No. 63/446,790, filed on Feb.
17, 2023.





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(19) **United States**

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

(10) **Pub. No.: US 2024/0283129 A1**

(43) **Pub. Date: Aug. 22, 2024**

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

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)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 5/307 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/2266** (2013.01); **H01Q 5/307**
(2015.01)

(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)

(57) **ABSTRACT**

An antenna module includes a metal cover, a substrate, a first radiating element and a second radiating element. The metal cover has a slot. The substrate is disposed corresponding to the slot. The first radiating element is disposed on the substrate, the first radiating element includes an excited section and a first radiating section connected in sequence, and the excited section has a feeding point. The second radiating element is disposed on the substrate, the second radiating element includes the excited section and a second radiating section connected in sequence, and the excited section is located between the first radiating section and the second radiating section. A length of the first radiating section is greater than a length of the second radiating section, the first radiating element is used to excite a first resonant frequency, and the second radiating element is used to excite a second resonant frequency.

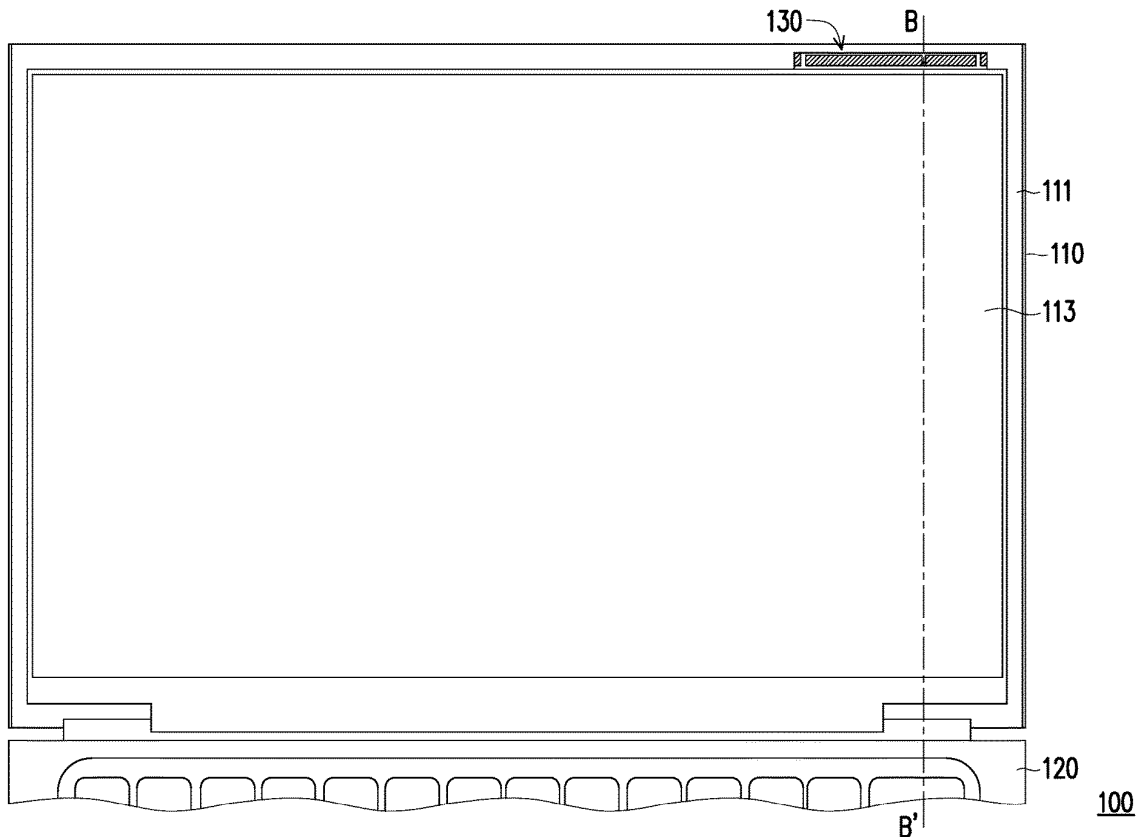
(73) Assignee: **COMPAL ELECTRONICS, INC.**,
Taipei City (TW)

(21) Appl. No.: **18/447,307**

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

(30) **Foreign Application Priority Data**

Feb. 22, 2023 (TW) 112106387





US 20240283149A1

(19) **United States**(12) **Patent Application Publication**
CAO et al.(10) **Pub. No.: US 2024/0283149 A1**(43) **Pub. Date: Aug. 22, 2024**(54) **PHASE SHIFTER AND ANTENNA**(52) **U.S. Cl.**(71) Applicants: **Beijing BOE Sensor Technology Co., Ltd.**, Beijing (CN); **BOE TECHNOLOGY GROUP CO., LTD.**, Beijing (CN)CPC **H01Q 3/36** (2013.01); **H01P 1/18** (2013.01); **H01Q 1/38** (2013.01)(72) Inventors: **Di CAO**, Beijing (CN); **Yan WANG**, Beijing (CN); **Haocheng JIA**, Beijing (CN); **Yan LU**, Beijing (CN); **Guodong FENG**, Beijing (CN); **Zhifeng ZHANG**, Beijing (CN)

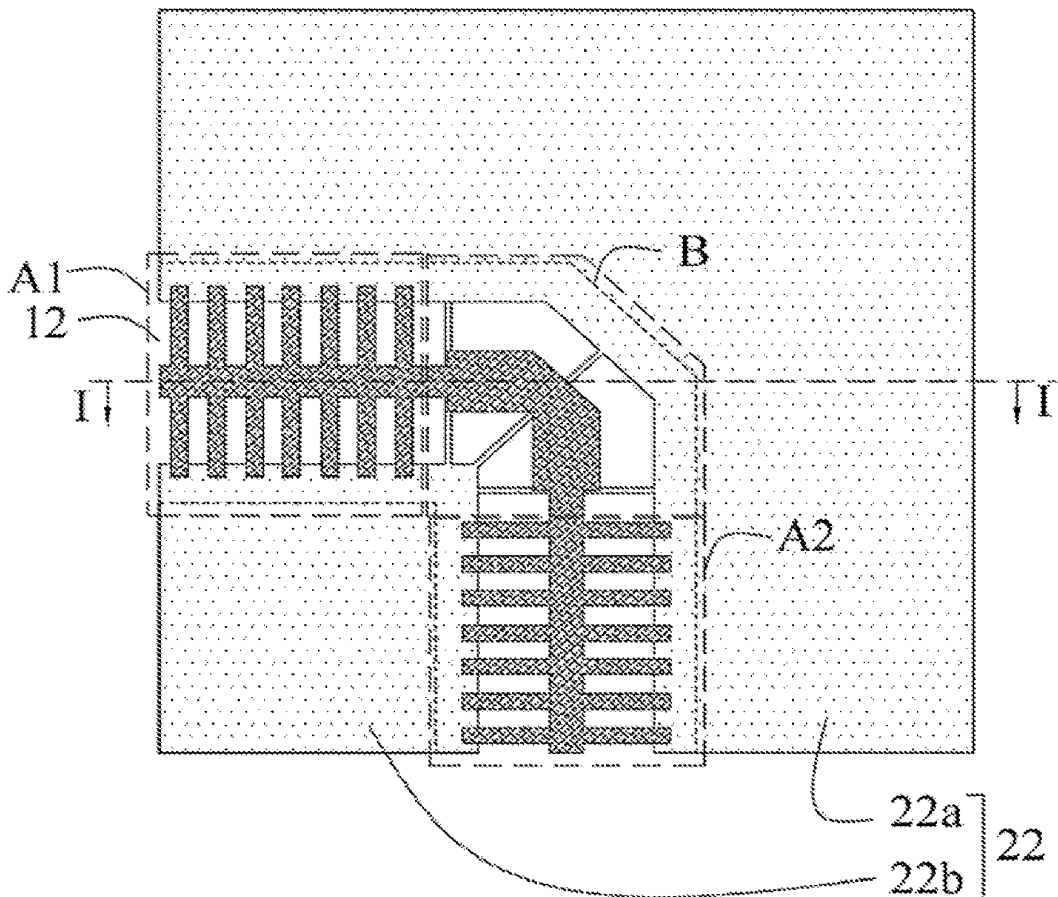
(57)

ABSTRACT(21) Appl. No.: **18/023,984**(22) PCT Filed: **Feb. 28, 2022**(86) PCT No.: **PCT/CN2022/078472**

§ 371 (c)(1),

(2) Date: **Feb. 28, 2023****Publication Classification**(51) **Int. Cl.****H01Q 3/36** (2006.01)**H01P 1/18** (2006.01)**H01Q 1/38** (2006.01)

A phase shifter includes a signal line and a reference electrode respectively disposed on sides of different ones or both disposed on a same side of a same one of a first base plate and a second base plate proximal to a dielectric layer, and includes a straight unit and a bent unit along an extending direction of the signal line. The signal line includes a first signal sub-line corresponding to the straight unit and a second signal sub-line corresponding to the bent unit, and the reference electrode includes a first reference sub-electrode corresponding to the straight unit and a second reference sub-electrode corresponding to the bent unit. The second signal sub-line and the second reference sub-electrode which correspond to the bent unit are configured to make an impedance of the bent unit match to an impedance of the straight unit and/or an impedance of another adjacent bent unit.





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(19) **United States**

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

(10) **Pub. No.: US 2024/0283153 A1**

(43) **Pub. Date: Aug. 22, 2024**

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

Publication Classification

(71) Applicant: **Beijing Xiaomi Mobile Software Co., Ltd.**, Beijing (CN)

(51) **Int. Cl.**
H01Q 5/357 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/50 (2006.01)

(72) Inventors: **Wei WANG**, Beijing (CN);
Ching-Sung WANG, Beijing (CN);
Yueliang LI, Beijing (CN)

(52) **U.S. Cl.**
CPC **H01Q 5/357** (2015.01); **H01Q 1/241** (2013.01); **H01Q 5/50** (2015.01)

(73) Assignee: **Beijing Xiaomi Mobile Software Co., Ltd.**, Beijing (CN)

(57) **ABSTRACT**

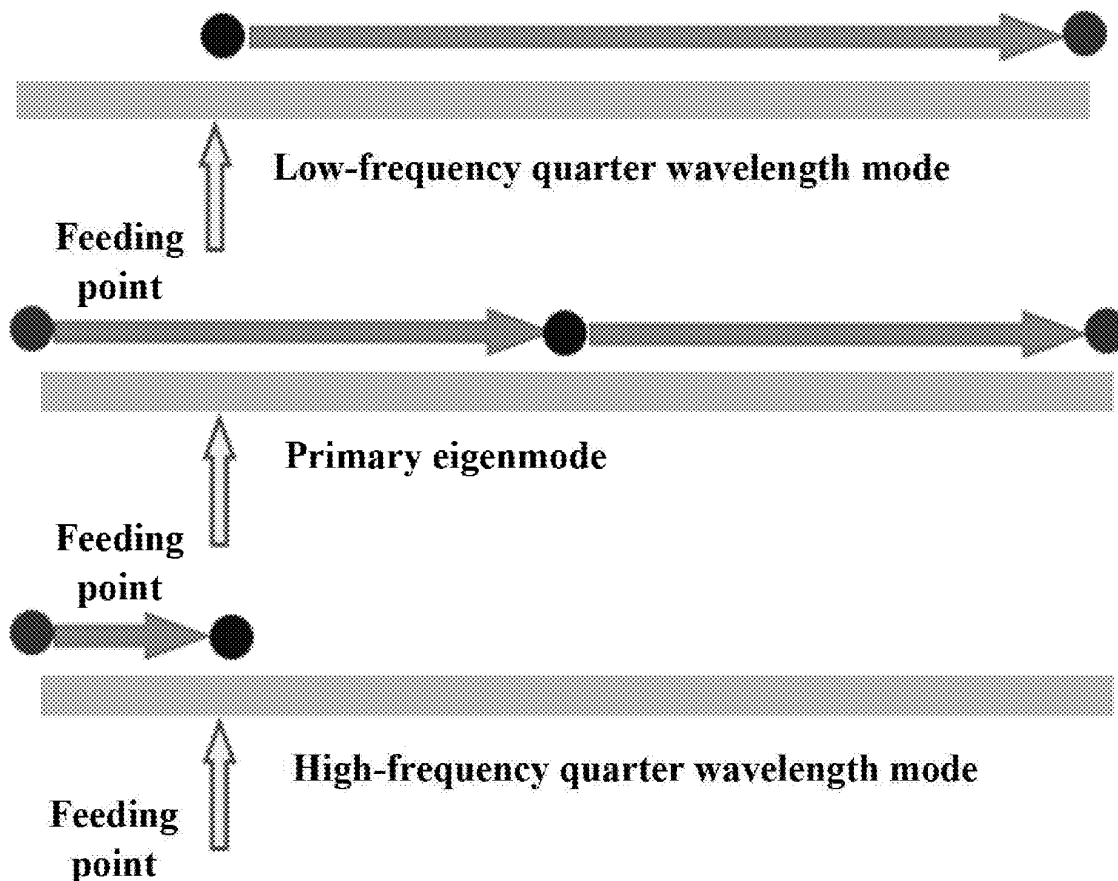
An antenna structure and a terminal device are provided. The antenna structure is applied to a terminal device with a curved screen. The antenna structure includes a radiator and a feeding point. The radiator has a first break and a second break located on different sides, the first break is on one curved side edge, and the second break is on one non-curved side edge. The feeding point is electrically connected to the radiator and located between the first break and the second break. A length of a radiation arm between the feeding point and the first break is less than a length of a radiation arm between the feeding point and the second break. The antenna structure has a low-frequency radiation mode that utilizes the radiation arm between the feeding point and the second break for radiation.

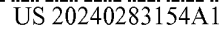
(21) Appl. No.: **18/456,324**

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

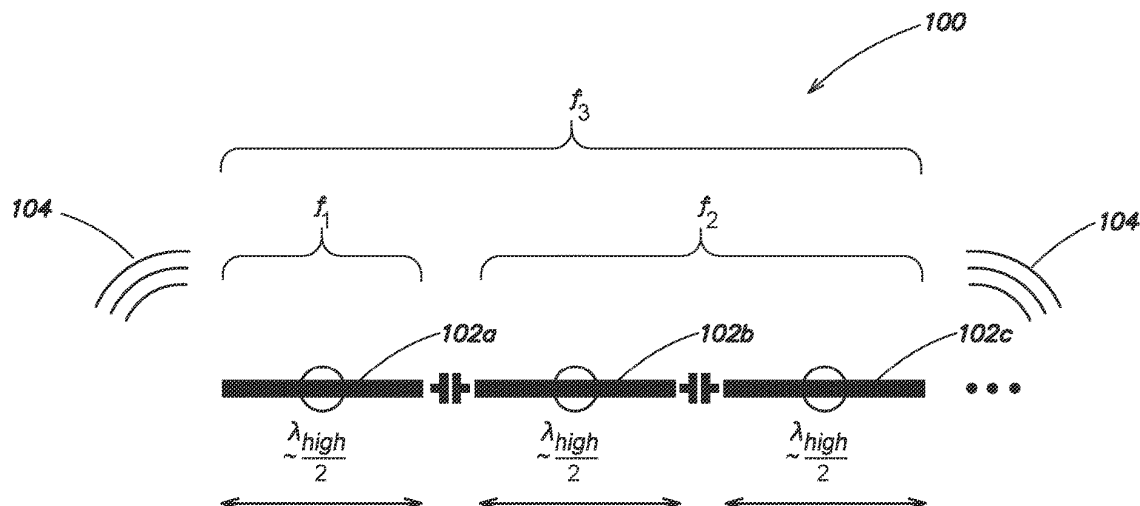
(30) **Foreign Application Priority Data**

Feb. 22, 2023 (CN) 202310188948.3





(43) **Pub. Date:** **Aug. 22, 2024**





US 20240283157A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0283157 A1**

(43) **Pub. Date: Aug. 22, 2024**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/42 (2006.01)
H01Q 21/06 (2006.01)

(72) Inventors: **Yongsang YUN**, Suwon-si (KR);
Seongjin PARK, Suwon-si (KR);
Gunbae LIM, Suwon-si (KR); **Jaebong
CHUN**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 9/045* (2013.01); *H01Q 1/42*
(2013.01); *H01Q 21/065* (2013.01)

(21) Appl. No.: **18/649,244**

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

Related U.S. Application Data

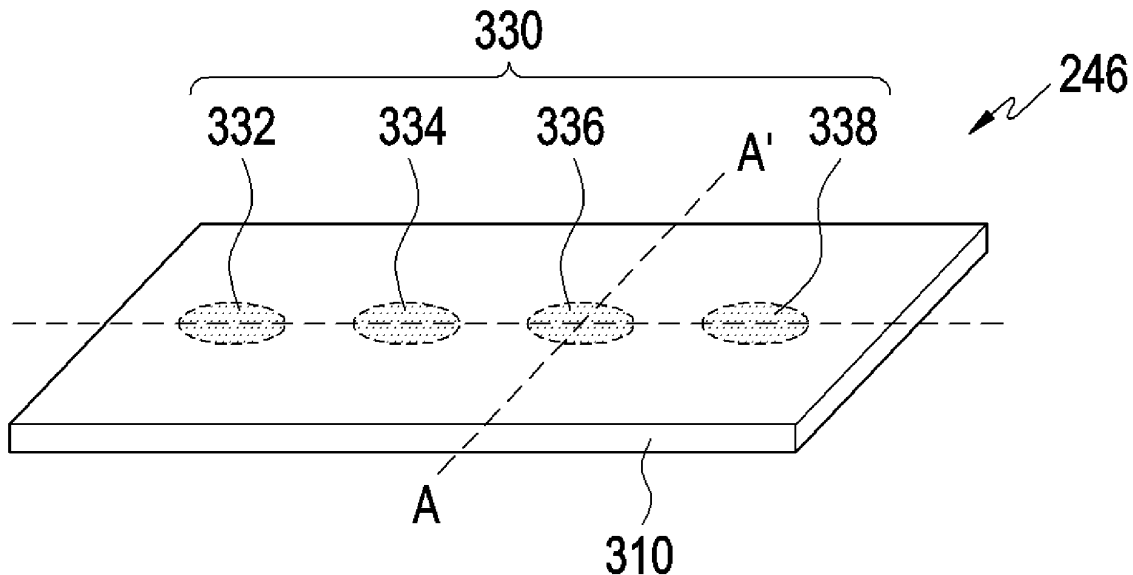
(63) Continuation of application No. PCT/KR2022/
016283, filed on Oct. 24, 2022.

(30) **Foreign Application Priority Data**

Nov. 1, 2021 (KR) 10-2021-0148157

(57) **ABSTRACT**

According to various embodiments of the present disclosure, an electronic device may comprise: a housing; a main circuit board disposed in the housing; an antenna module, comprising an antenna, disposed in the housing and including a first surface facing the outside of the electronic device and having a plurality of conductive patterns arranged on the first surface and a second surface facing a different direction from the first surface; a flexible printed circuit board at least a part of which is disposed at the second surface and which electrically connects the main circuit board and the antenna module to each other; and a cable connected to a seating surface formed by the flexible printed circuit board and is electrically connected to the antenna module.





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(19) **United States**

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

(10) **Pub. No.: US 2024/0283166 A1**

(43) **Pub. Date: Aug. 22, 2024**

(54) **ANTENNA STRUCTURE AND IMAGE
DISPLAY DEVICE INCLUDING THE SAME**

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

(72) Inventors: **KI HUN SUNG**, Jeollabuk-do (KR);
SUNG JOON HONG, Jeollabuk-do
(KR); **DAE KYU KIM**, Jeollabuk-do
(KR); **HEE JUN PARK**, Jeollabuk-do
(KR); **MEE AE HUR**, Jeollabuk-do
(KR)

(21) Appl. No.: **18/582,779**

(22) Filed: **Feb. 21, 2024**

(30) **Foreign Application Priority Data**

Feb. 21, 2023 (KR) 10-2023-0022558

Publication Classification

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
G01S 13/62 (2006.01)

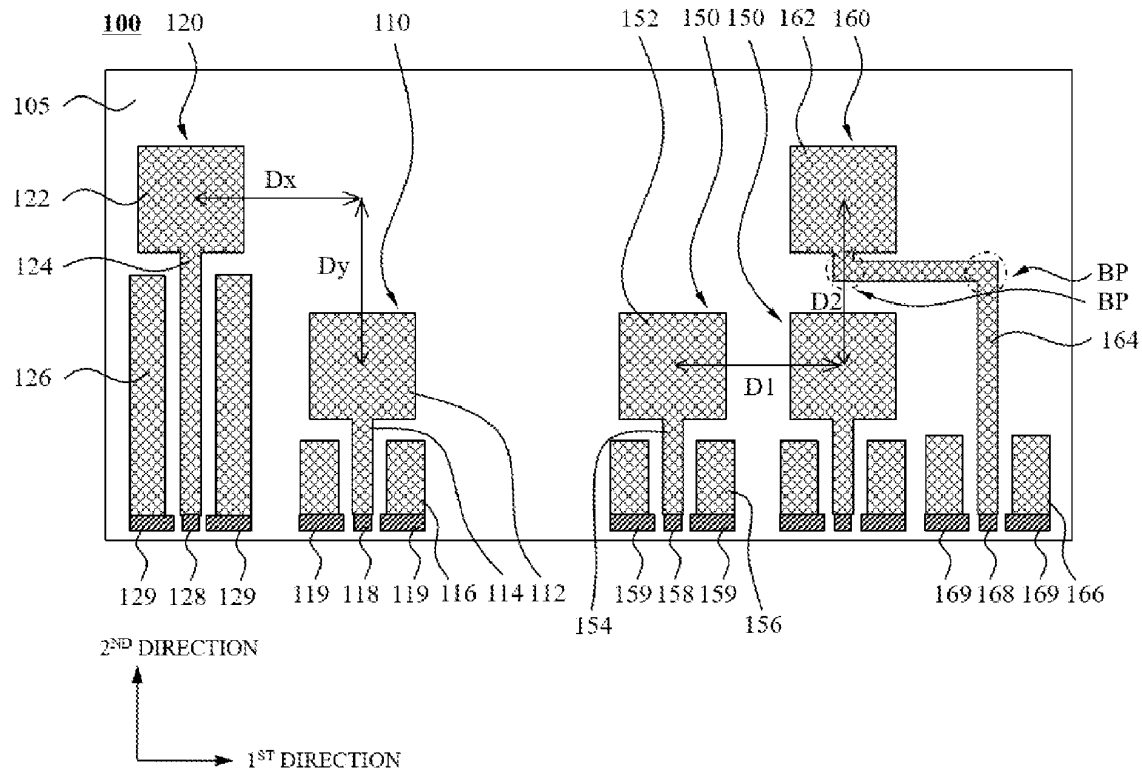
H01Q 1/22 (2006.01)

H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 21/065** (2013.01); **G01S 13/62**
(2013.01); **H01Q 1/22** (2013.01); **H01Q**
9/0407 (2013.01)

(57) **ABSTRACT**

An antenna structure may include a transmission antenna unit group, and a reception antenna unit group spaced apart from the transmission antenna unit group in a first direction. The transmission antenna unit group includes a first transmission antenna unit, and a second transmission antenna unit having a length in a second direction greater than a length of the first transmission antenna unit in the second direction, the second direction being perpendicular to the first direction. The reception antenna unit group includes a first reception antenna unit spaced apart from the first transmission antenna unit in the first direction and including a first reception radiator, and a second reception antenna unit including a second reception radiator spaced apart from the first reception radiator in the second direction.





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(19) **United States**(12) **Patent Application Publication**
KUO et al.(10) **Pub. No.: US 2024/0283169 A1**(43) **Pub. Date: Aug. 22, 2024**(54) **ANTENNA STRUCTURE AND MOBILE
DEVICE**(52) **U.S. Cl.**CPC **H01Q 21/30** (2013.01); **H01Q 9/0421**
(2013.01)(71) Applicant: **Wistron NeWeb Corp.**, Hsinchu (TW)(72) Inventors: **Li-Kai KUO**, Hsinchu (TW); **Wen-Pin
HO**, Hsinchu (TW); **Cheng-Wei
CHIANG**, Hsinchu (TW); **Jia-Le ZHU**,
Hsinchu (TW)

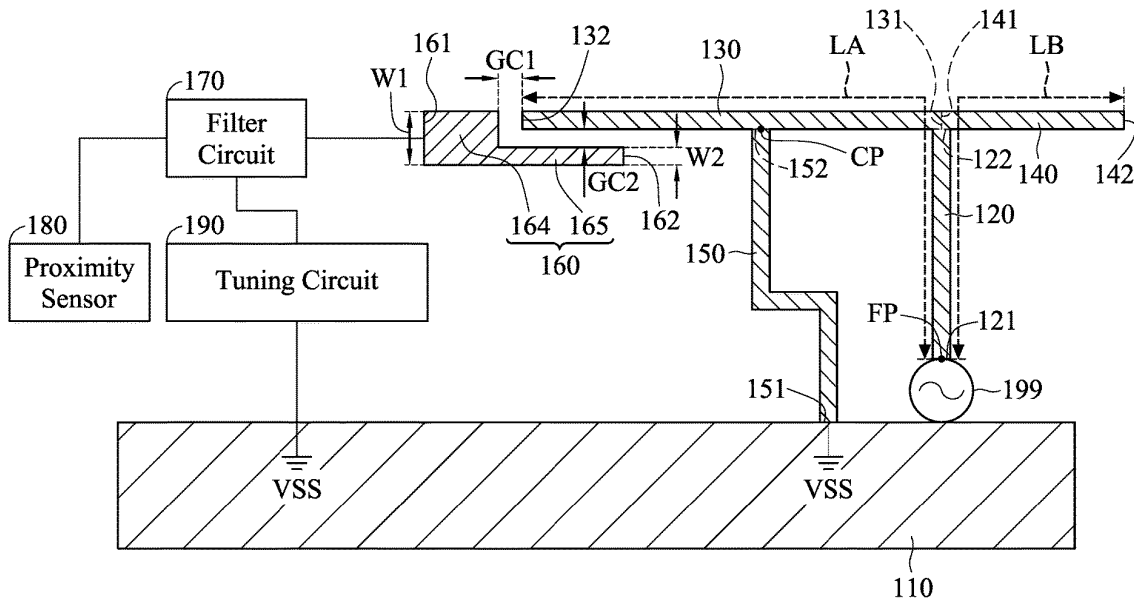
(57)

ABSTRACT

An antenna structure includes a ground element, a feeding radiation element, a first radiation element, a second radiation element, a shorting radiation element, a third radiation element, a filter circuit, a proximity sensor, and a tuning circuit. The ground element provides a ground voltage. The feeding radiation element has a feeding point. The first radiation element and the second radiation element are coupled to the feeding radiation element, or are disposed adjacent to the feeding radiation element. The first radiation element is also coupled through the shorting radiation element to the ground voltage. The third radiation element is disposed adjacent to the first radiation element. The third radiation element is coupled through the filter circuit to the proximity sensor. The filter circuit is also coupled through the tuning circuit to the ground voltage.

(21) Appl. No.: **18/415,825**(22) Filed: **Jan. 18, 2024**(30) **Foreign Application Priority Data**

Feb. 18, 2023 (TW) 112105906

Publication Classification(51) **Int. Cl.****H01Q 21/30** (2006.01)**H01Q 9/04** (2006.01)100



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(19) **United States**

(12) **Patent Application Publication**
Yin

(10) **Pub. No.: US 2024/0283858 A1**

(43) **Pub. Date: Aug. 22, 2024**

(54) **ELECTRONIC DEVICE**

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

(72) Inventor: **Ming Yin**, Shenzhen (CN)

(21) Appl. No.: **18/649,540**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2023/
116545, filed on Sep. 1, 2023.

(30) **Foreign Application Priority Data**

Sep. 8, 2022 (CN) 202211095621.3

Publication Classification

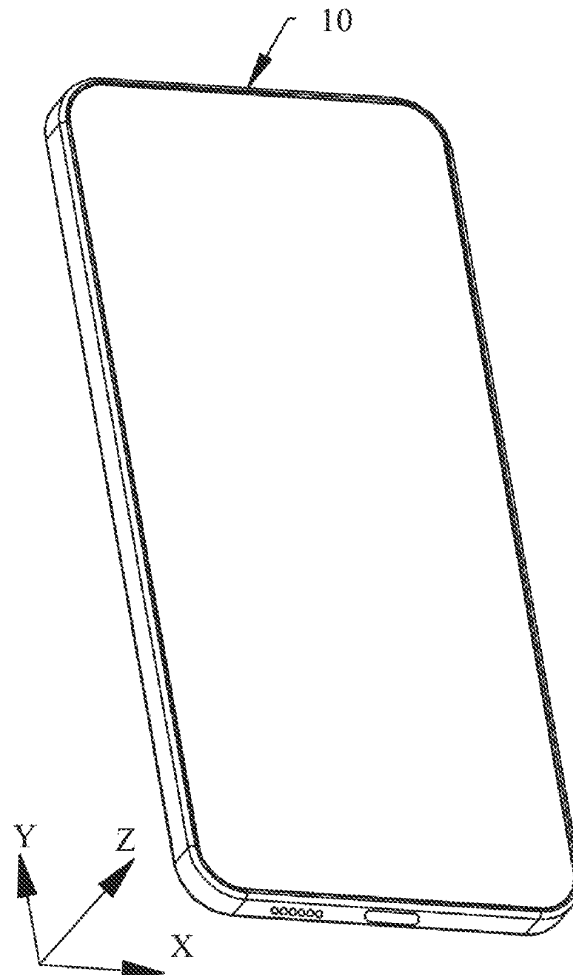
(51) **Int. Cl.**
H04M 1/02 (2006.01)
H05K 7/14 (2006.01)

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

CPC **H04M 1/026** (2013.01); **H05K 7/1427**
(2013.01)

(57) **ABSTRACT**

An electronic device to address interference caused to a signal of an antenna due to a coupling phenomenon in an electronic product. The electronic device includes a middle frame, a display module, a circuit board, an antenna, and a connection structure. The antenna includes a reference point, a region on the middle frame that is within a range from a $\frac{1}{4}$ wavelength to a $\frac{3}{4}$ wavelength from the reference point is a first region in a length direction of the middle frame, and a connection hole is provided in the first region. For the connection structure, one end of the connection structure is electrically connected to the circuit board, and another end of the connection structure passes through the connection hole and is electrically connected to the display module.





US 20240297434A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0297434 A1**

(43) **Pub. Date: Sep. 5, 2024**

(54) **ANTENNA AND ELECTRONIC APPARATUS
COMPRISING SAME**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
B23K 26/364 (2006.01)

(72) Inventors: **Jesun MOON**, Suwon-si (KR);
Kyungbae KO, Suwon-si (KR);
Jaehyung KIM, Suwon-si (KR);
Taegyu KIM, Suwon-si (KR); **Hanbin
LEE**, Suwon-si (KR); **Sangmin HAN**,
Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **B23K 26/364**
(2015.10)

(21) Appl. No.: **18/664,749**

(22) Filed: **May 15, 2024**

Related U.S. Application Data

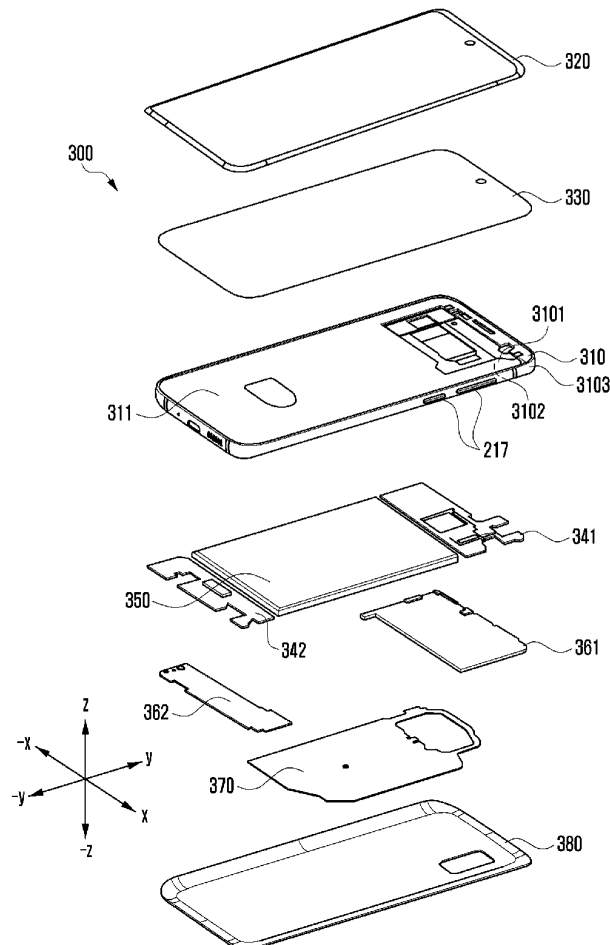
(63) Continuation of application No. PCT/KR2022/
016608, filed on Oct. 27, 2022.

(30) **Foreign Application Priority Data**

Nov. 17, 2021 (KR) 10-2021-0158492
Nov. 26, 2021 (KR) 10-2021-0165058

(57) **ABSTRACT**

An electronic apparatus is provided. The electronic device includes a housing including a conductive member and a non-conductive member coupled to the conductive member, a conductive portion segmented from the conductive member through at least one segmentation unit, an antenna structure arranged in an inner space of the housing to be at least partially capacitively coupled to the conductive portion, and a wireless communication circuit configured to transmit or receive a wireless signal in at least one specified frequency band to or from the antenna structure through the conductive portion, wherein the conductive portion is disposed to be invisible from the outside of the electronic device through the non-conductive member.





US 20240297436A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0297436 A1**

(43) **Pub. Date: Sep. 5, 2024**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/342 (2006.01)
H01Q 1/24 (2006.01)
H01Q 9/42 (2006.01)

(72) Inventors: **Xiaotao CAI**, Shenzhen (CN); **Tiezhu
LIANG**, Shenzhen (CN); **Yafang YU**,
Shenzhen (CN); **Wenlong HU**,
Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H01Q 5/342** (2015.01); **H01Q 1/243**
(2013.01); **H01Q 9/42** (2013.01)

(21) Appl. No.: **18/044,639**

(22) PCT Filed: **Jan. 24, 2022**

(86) PCT No.: **PCT/CN2022/073600**

§ 371 (c)(1),

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

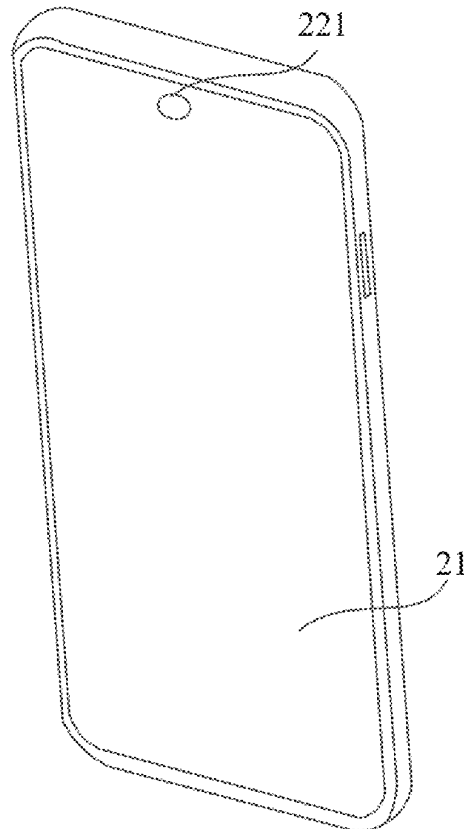
(57) **ABSTRACT**

Embodiments of this application provide an antenna apparatus and an electronic device. The antenna apparatus is provided with a non-resonant unit and a feed unit, to respectively feed a radiation unit and a non-resonant unit. Through feeding power distribution design, the non-resonant unit can assist in exciting a floor characteristic mode. In addition, since a size of the non-resonant unit is much smaller than an electrical length required for resonance of an antenna on this frequency band, the non-resonant unit does not generate a resonance curve on a resonance curve and has no resonance point, to improve radiation efficiency of the antenna without generating new resonance, so as to improve a use effect of a user.

(30) **Foreign Application Priority Data**

Apr. 12, 2021 (CN) 202110391085.0

200





US 20240297437A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0297437 A1**

(43) **Pub. Date: Sep. 5, 2024**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

(52) **U.S. Cl.**
CPC **H01Q 5/357** (2015.01); **H01Q 1/243** (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Sungkoo PARK**, Suwon-si (KR);
Seunghwan KIM, Suwon-si (KR);
Kyungjae LEE, Suwon-si (KR);
Soonho HWANG, Suwon-si (KR)

An electronic device according to various embodiments of the present disclosure may comprise: a first housing; a second housing; a printed circuit board arranged in the space of the first housing or the second housing; a hinge structure comprising a hinge arranged between the first housing and the second housing such that the first housing and the second housing are folded or unfolded; and a wireless communication circuit configured to transmit and/or receive wireless signals in a plurality of frequency bands through at least a part of the first housing and at least a part of the second housing. The first housing includes a first metal frame and the first metal frame can be separated into a plurality of parts through a plurality of first segments. The second housing includes a second metal frame and the second metal frame can be separated into a plurality of parts through a plurality of second segments. The electronic device can include a switch for electrically connecting or disconnecting a first part of the first metal frame and a second part of the first metal frame, which are physically separated from each other. In the electronic device, an antenna can be formed from a part of the first metal frame or the antenna can be formed from the part of the first metal frame and a part of the second metal frame. The disclosure relates to an antenna to which the first and second parts of the first metal frame are electrically connected when the switch is turned on, and enables a new radio (NR) signal in a low band to be transmitted/received to/from the antenna.

(21) Appl. No.: **18/665,042**

(22) Filed: **May 15, 2024**

Related U.S. Application Data

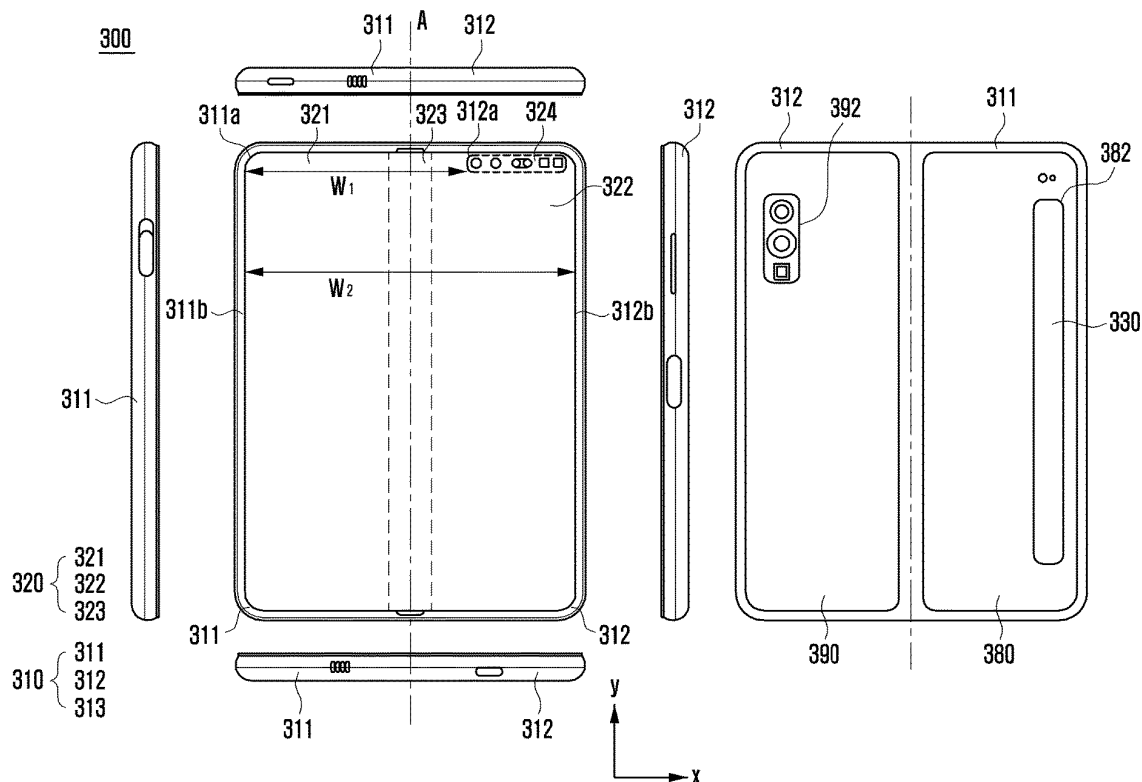
(63) Continuation of application No. PCT/KR2022/017933, filed on Nov. 15, 2022.

(30) **Foreign Application Priority Data**

Nov. 16, 2021 (KR) 10-2021-0157596
Mar. 16, 2022 (KR) 10-2022-0032892

Publication Classification

(51) **Int. Cl.**
H01Q 5/357 (2006.01)
H01Q 1/24 (2006.01)





US 20240297441A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0297441 A1**

(43) **Pub. Date: Sep. 5, 2024**

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

Publication Classification

(71) Applicant: **Wistron NeWeb Corporation**, Hsinchu
(TW)

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/22 (2006.01)
H01Q 21/28 (2006.01)

(72) Inventors: **Ta Wei KUO**, Hsinchu (TW); **I Yuan
LU**, Hsinchu (TW); **Yen Ming HONG**,
Hsinchu (TW)

(52) **U.S. Cl.**
CPC **H01Q 13/10** (2013.01); **H01Q 21/28**
(2013.01); **H01Q 1/2291** (2013.01)

(21) Appl. No.: **18/591,086**

(57) **ABSTRACT**

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

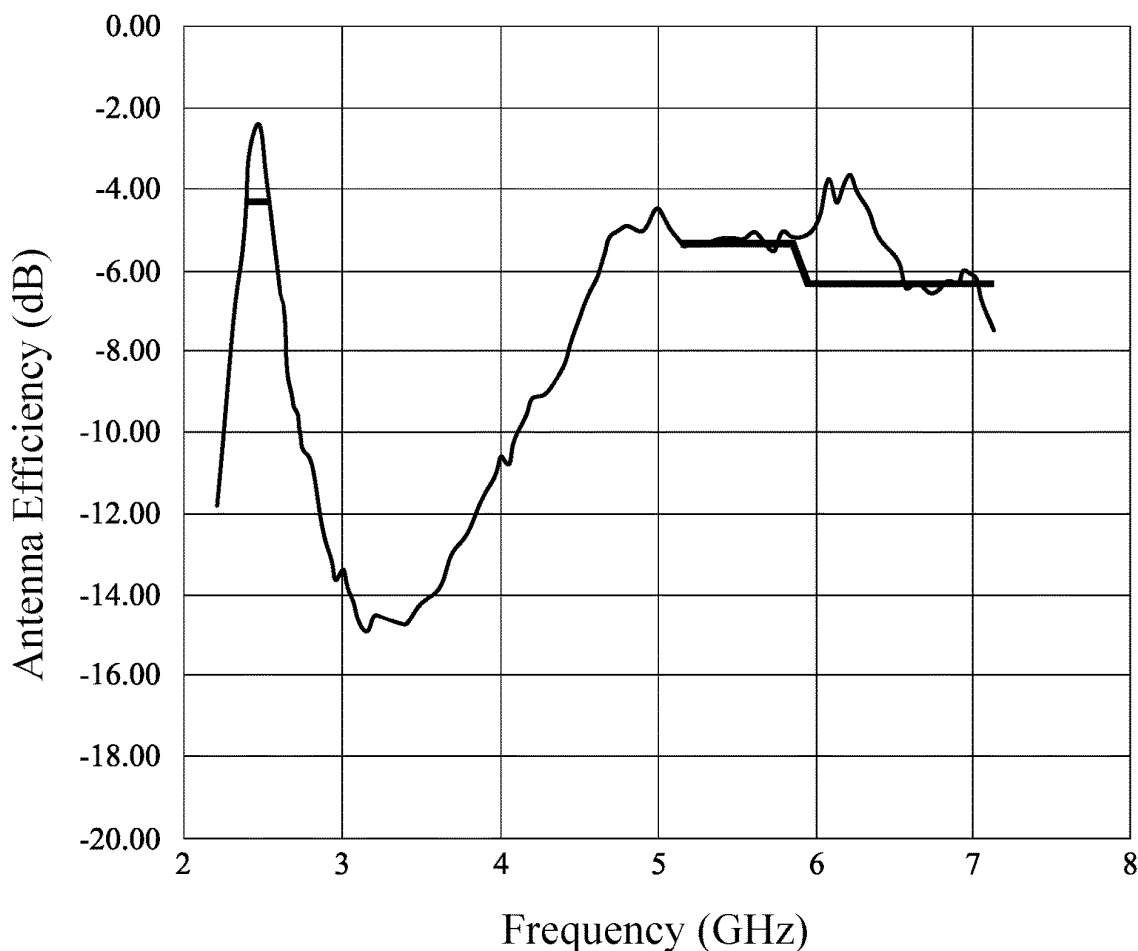
An antenna structure is provided. The antenna structure includes a first metal element and a second metal element. The first metal element includes a first slot that extends along a first direction to form an elongated shape. The second metal element includes a first branch portion including a first open section and a part section. The first open section extends along the first direction to form an open end, and the part section extends along a second direction to form an open end. A projection of the part section and a projection of the first slot are partially overlapped when being observed along a third direction. The first direction, the second direction, and the third direction are perpendicular to one another.

Related U.S. Application Data

(60) Provisional application No. 63/488,208, filed on Mar.
3, 2023.

Foreign Application Priority Data

(30) Feb. 6, 2024 (TW) 113104759





US 20240304981A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0304981 A1**

(43) **Pub. Date: Sep. 12, 2024**

(54) **ANTENNA AND WIRELESS TERMINAL
PROVIDED WITH SAME**

(30) **Foreign Application Priority Data**

Jul. 13, 2021 (JP) 2021-115671

(71) Applicant: **Panasonic Intellectual Property
Management Co., Ltd.**, Kadoma-shi,
Osaka (JP)

Publication Classification

(72) Inventors: **Kota Araki**, OSAKA FU (JP); **Sohui
Jeon**, OSAKA FU (JP); **Kenji Shibata**,
OSAKA FU (JP)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/38 (2006.01)

(73) Assignee: **Panasonic Intellectual Property
Management Co., Ltd.**, Kadoma-shi,
Osaka (JP)

(52) **U.S. Cl.**
CPC **H01Q 1/22** (2013.01); **H01Q 1/38**
(2013.01)

(21) Appl. No.: **18/579,049**

(57) **ABSTRACT**

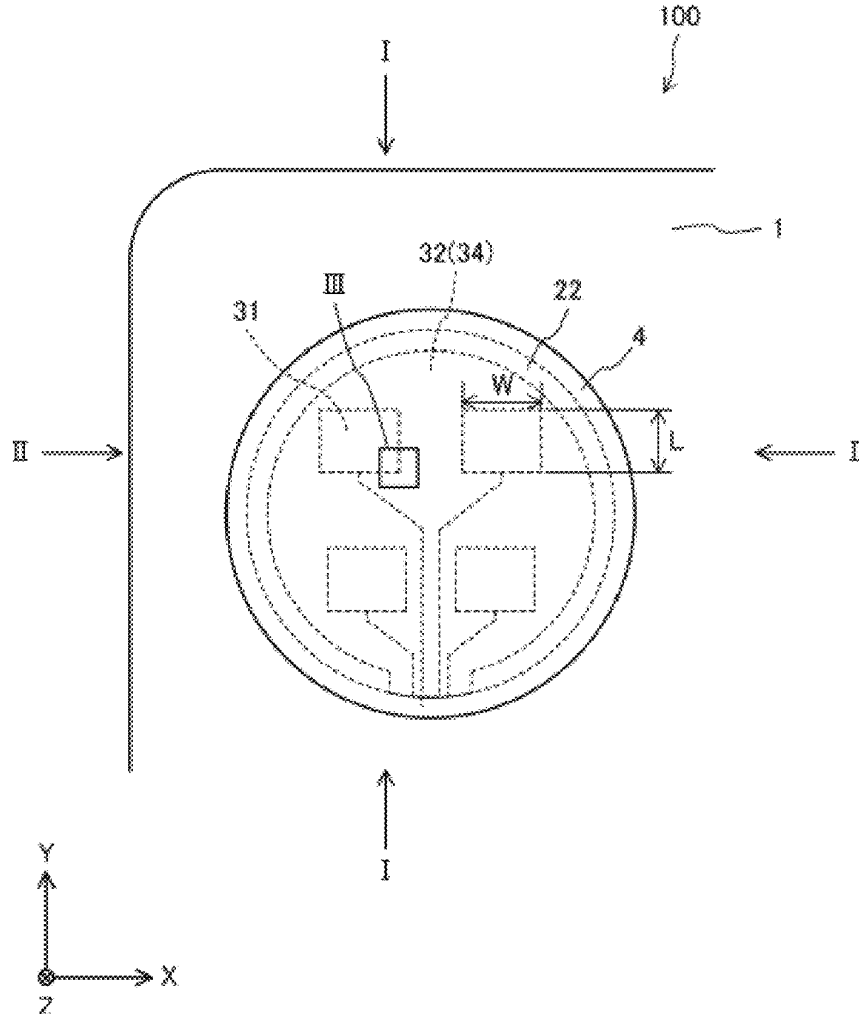
(22) PCT Filed: **Jun. 13, 2022**

A transparent antenna is for use in a wireless terminal (100) including an imaging device having a plurality of pixels (21) arranged in an array and a camera lens (22) arranged above the imaging device. The transparent antenna is formed by an antenna pattern (31) included in an antenna base (32) provided above the camera lens (22).

(86) PCT No.: **PCT/JP2022/023558**

§ 371 (c)(1),

(2) Date: **Jan. 12, 2024**





US 20240304982A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0304982 A1**

(43) **Pub. Date: Sep. 12, 2024**

(54) **ELECTRONIC DEVICE**

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

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

(21) Appl. No.: **18/259,190**

(22) PCT Filed: **Dec. 8, 2021**

(86) PCT No.: **PCT/CN2021/136349**

§ 371 (c)(1),

(2) Date: **Jun. 23, 2023**

(30) **Foreign Application Priority Data**

Dec. 25, 2020 (CN) 202011564230.2

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/38 (2006.01)

H01Q 1/48 (2006.01)

H01Q 1/50 (2006.01)

H01Q 1/52 (2006.01)

H01Q 5/378 (2006.01)

H01Q 13/18 (2006.01)

H01Q 21/28 (2006.01)

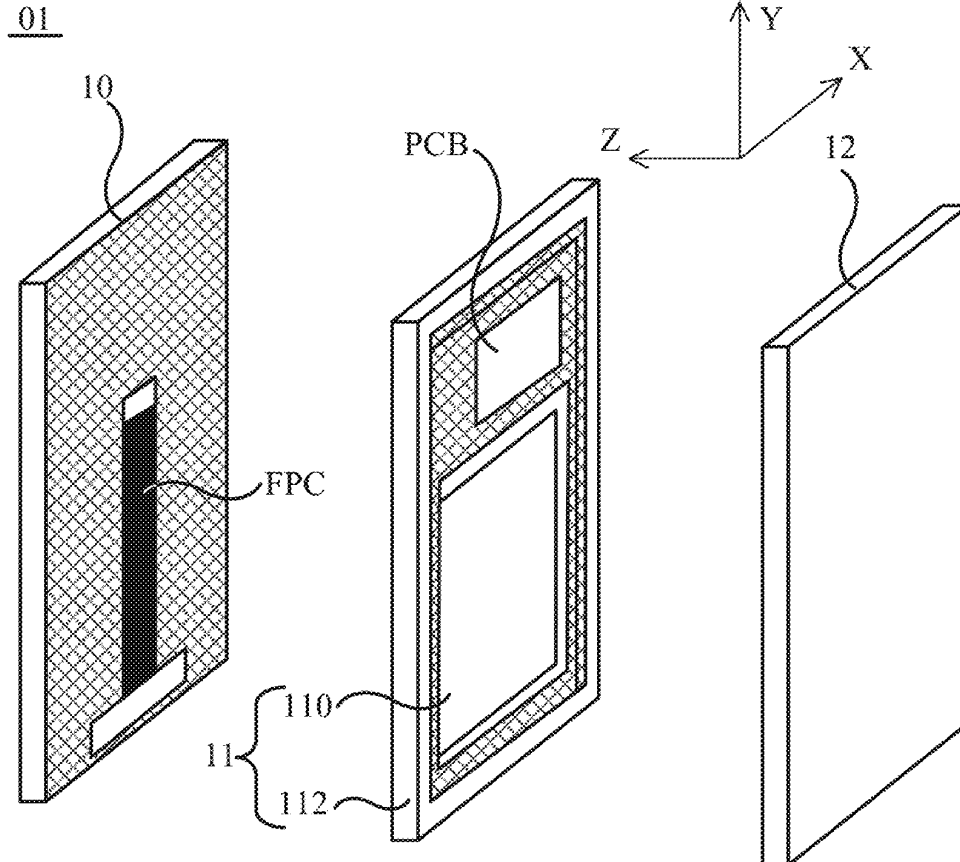
(52) **U.S. Cl.**

CPC **H01Q 1/243** (2013.01); **H01Q 1/38**
(2013.01); **H01Q 1/48** (2013.01); **H01Q 1/50**
(2013.01); **H01Q 1/523** (2013.01); **H01Q**
13/18 (2013.01); **H01Q 21/28** (2013.01);
H01Q 5/378 (2015.01)

(57)

ABSTRACT

An electronic device includes a conductive frame and a first antenna unit. The conductive frame is disposed around a periphery of the electronic device. The first antenna unit includes a first conductive layer and a second conductive layer spaced apart in a thickness direction of the electronic device; a conductive connection portion is configured to connect the first conductive layer and the second conductive layer; and a first conductive frame, is a part of the conductive frame. The conductive connection portion, the first conductive frame, the first conductive layer, and the second conductive layer enclose a first cavity, and the first conductive layer and the first conductive frame are spaced apart to form a first slot of the first cavity.





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(19) **United States**

(12) **Patent Application Publication**
Wang

(10) **Pub. No.: US 2024/0304992 A1**

(43) **Pub. Date: Sep. 12, 2024**

(54) **ANTENNAS INCLUDING A PARASITIC
ELEMENT COUPLED TO AN ACTIVE
ELEMENT**

(71) Applicant: **CommScope Technologies LLC**,
Hickory, NC (US)

(72) Inventor: **Huan Wang**, Richardson, TX (US)

(21) Appl. No.: **18/549,235**

(22) PCT Filed: **Jan. 25, 2022**

(86) PCT No.: **PCT/US2022/013612**

§ 371 (c)(1),

(2) Date: **Sep. 6, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/160,248, filed on Mar.
12, 2021.

Publication Classification

(51) **Int. Cl.**

H01Q 5/385 (2006.01)

H01Q 9/42 (2006.01)

H01Q 19/32 (2006.01)

H01Q 21/24 (2006.01)

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

CPC **H01Q 5/385** (2015.01); **H01Q 9/42**

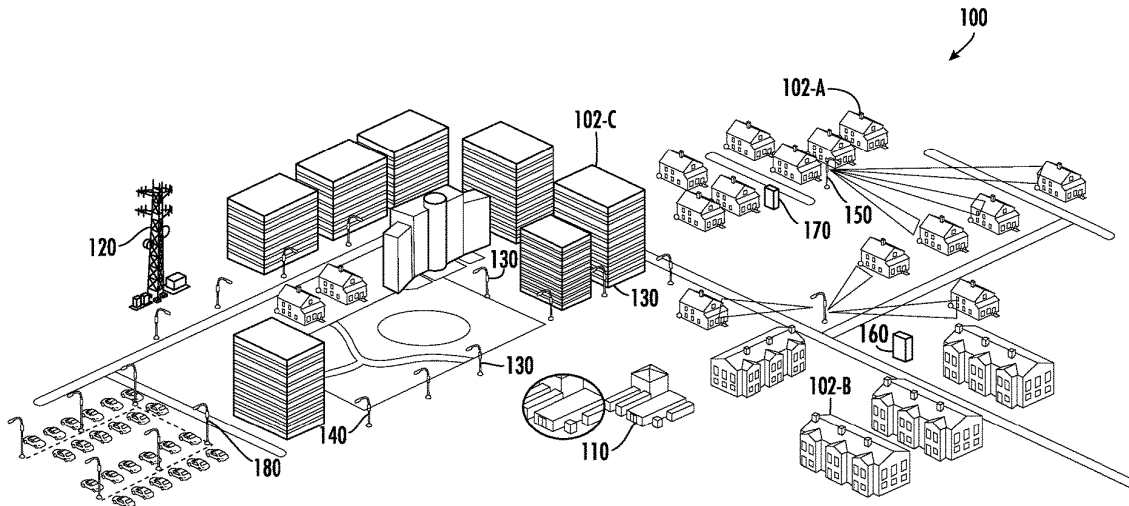
(2013.01); **H01Q 19/32** (2013.01); **H01Q**

21/24 (2013.01)

(57)

ABSTRACT

Antennas are provided herein that include a parasitic element that is coupled to an active element and a ground plane. In some embodiments, the active element is inside an outline provided by a combination of the parasitic element and the ground plane. Moreover, the active element and the parasitic element are, in some embodiments, on opposite surfaces, respectively, of a printed circuit board.





US 20240304997A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0304997 A1**

(43) **Pub. Date: Sep. 12, 2024**

(54) **ANTENNA SYSTEM**

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

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

(21) Appl. No.: **18/417,029**

(22) Filed: **Jan. 19, 2024**

(30) **Foreign Application Priority Data**

Mar. 8, 2023 (TW) 112108508

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)
H01Q 5/30 (2006.01)

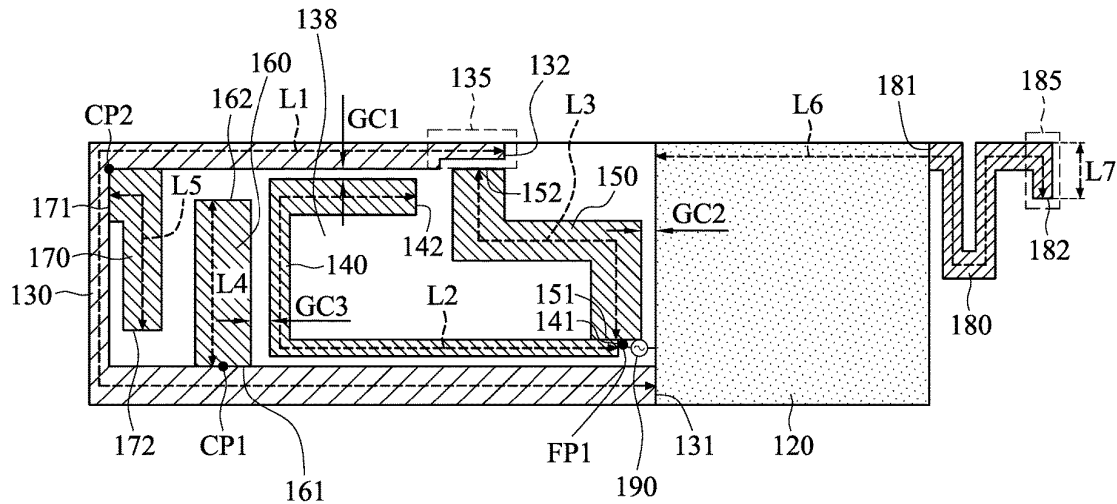
(52) **U.S. Cl.**

CPC **H01Q 9/0421** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/30** (2015.01); **H01Q 1/243**
(2013.01)

(57) **ABSTRACT**

An antenna system includes a first antenna structure which includes a first ground element, a first radiation element, a second radiation element, and a third radiation element. The first radiation element is coupled to the first ground element. A region is defined by the first ground element and the first radiation element. The second radiation element has a first feeding point. The second radiation element is adjacent to the first radiation element. The third radiation element is coupled to the first feeding point. The third radiation element is adjacent to the first ground element. The second radiation element and the third radiation element are disposed inside the aforementioned region.

100(110)





US 20240305006A1

(19) **United States**(12) **Patent Application Publication**
Varheenmaa et al.(10) **Pub. No.: US 2024/0305006 A1**(43) **Pub. Date: Sep. 12, 2024**(54) **ANTENNA ARRANGEMENT**(71) Applicant: **Nokia Technologies Oy**, Espoo (FI)(72) Inventors: **Harri Arttur Varheenmaa**, Helsinki (FI); **Pasi Yla-Oijala**, Vantaa (FI); **Anu Kristiina Lehtovuori**, Espoo (FI); **Ville Viikari**, Espoo (FI)(21) Appl. No.: **18/596,137**(22) Filed: **Mar. 5, 2024**(30) **Foreign Application Priority Data**

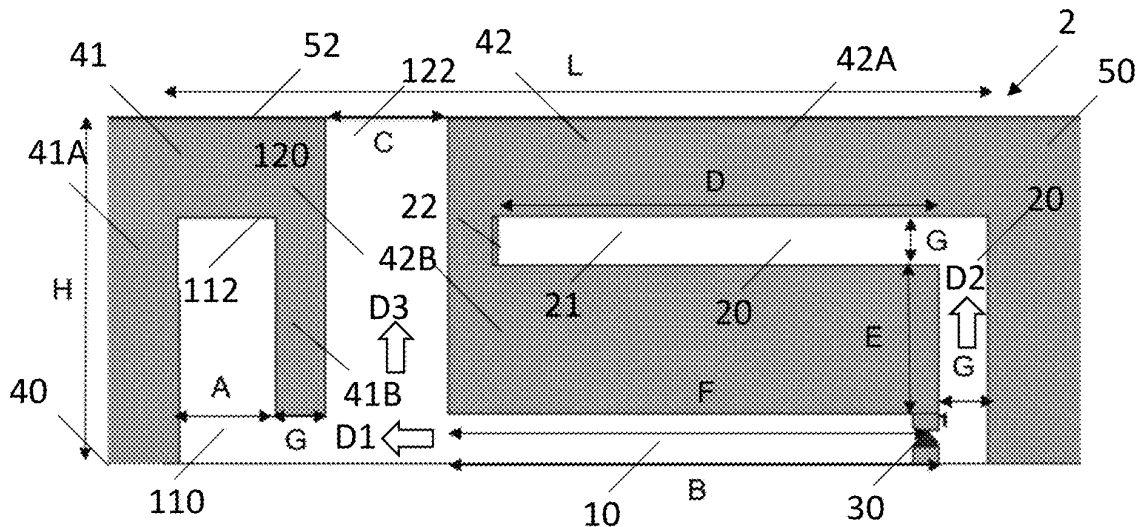
Mar. 9, 2023 (EP) 23160869.6

Publication Classification(51) **Int. Cl.**
H01Q 13/16 (2006.01)
H01Q 21/30 (2006.01)(52) **U.S. Cl.**CPC **H01Q 13/16** (2013.01); **H01Q 21/30** (2013.01)

(57)

ABSTRACT

Antenna arrangement including: a feed; and an electrically conductive portion that terminates at an edge, wherein the electrically conductive portion includes a slot including: an elongate first slot-path extending lengthwise from the feed in a first direction; and an elongate second slot-path extending lengthwise from the feed in a second direction different to the first direction, wherein the elongate first slot-path extends lengthwise a first distance in the first direction from the feed and then bifurcates, into an elongate first bifurcated slot path and an elongate second bifurcated slot path, wherein: the elongate first bifurcated slot path is close-ended and terminates at a first closed end; the elongate second bifurcated slot path is open-ended and terminates at an open end in the edge; and the elongate second slot path is close-ended and terminates at a second closed end.





US 20240305016A1

(19) **United States**

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

(10) **Pub. No.: US 2024/0305016 A1**

(43) **Pub. Date: Sep. 12, 2024**

(54) **HYBRID ANTENNAS**

Publication Classification

(71) Applicant: **Hewlett-Packard Development Company, L.P.**, Spring, TX (US)

(51) **Int. Cl.**
H01Q 21/28 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/40 (2006.01)
H01Q 21/06 (2006.01)

(72) Inventors: **CHIN-HUNG MA**, TAIPEI CITY (TW); **CHIEN-PAI LAI**, TAIPEI CITY (TW); **PAI-CHENG HUANG**, TAIPEI CITY (TW); **TSAI-YUN CHUANG**, TAIPEI CITY (TW)

(52) **U.S. Cl.**
CPC **H01Q 21/28** (2013.01); **H01Q 5/40** (2015.01); **H01Q 21/065** (2013.01); **H01Q 1/243** (2013.01)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Spring, TX (US)

(21) Appl. No.: **18/040,605**

(22) PCT Filed: **Sep. 11, 2020**

(86) PCT No.: **PCT/US2020/050518**

§ 371 (c)(1),

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

(57) **ABSTRACT**

An example apparatus may include a first antenna having a first radiator and a first ground plane and a second antenna having a second radiator and a second ground plane. In some examples, a hybrid antenna may be formed through coupling of the hybrid antenna to components of the first antenna and the second antenna. The hybrid antenna may include a third radiator. In some examples, an electrical interface may be disposed between the first antenna and the second antenna. In this regard, the electrical interface may couple the first ground plane to the second ground plane to form the third radiator.

