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(19) **United States**

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

(10) **Pub. No.: US 2023/0195186 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **ANTENNAS AND ELECTRONIC DEVICE
COMPRISING SAME**

(52) **U.S. Cl.**
CPC **G06F 1/1698** (2013.01); **H01Q 1/38**
(2013.01); **H01Q 1/243** (2013.01); **H01Q 1/48**
(2013.01); **G06F 1/1641** (2013.01)

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

(72) Inventors: **Bomyoung KIM**, Suwon-si (KR);
Jinwoo JUNG, Suwon-si (KR); **Soonho
HWANG**, Suwon-si (KR)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a first housing including first side and second sides facing opposite directions and a first lateral member surrounding a first space between the first and second sides, a second housing foldably connected to the first housing by a hinge, and including a third side facing a same direction as the first side in an unfolded state, a fourth side facing an opposite direction to the third side, and a second lateral member surrounding a second space between the third and fourth sides, a first bendable display extending from the first side to at least a portion of the third side, a second display visible through the fourth side and including a conductive plate on a rear surface thereof, an antenna disposed in the second housing, a wireless communication circuit electrically connected to the antenna through a first electrical path at a first point in the second space, and at least one conductive connection member disposed in the second space and connected to the ground. The conductive plate is electrically connected to ground at a second point spaced apart from the first point through the at least one conductive connection member.

(21) Appl. No.: **18/154,456**

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

Related U.S. Application Data

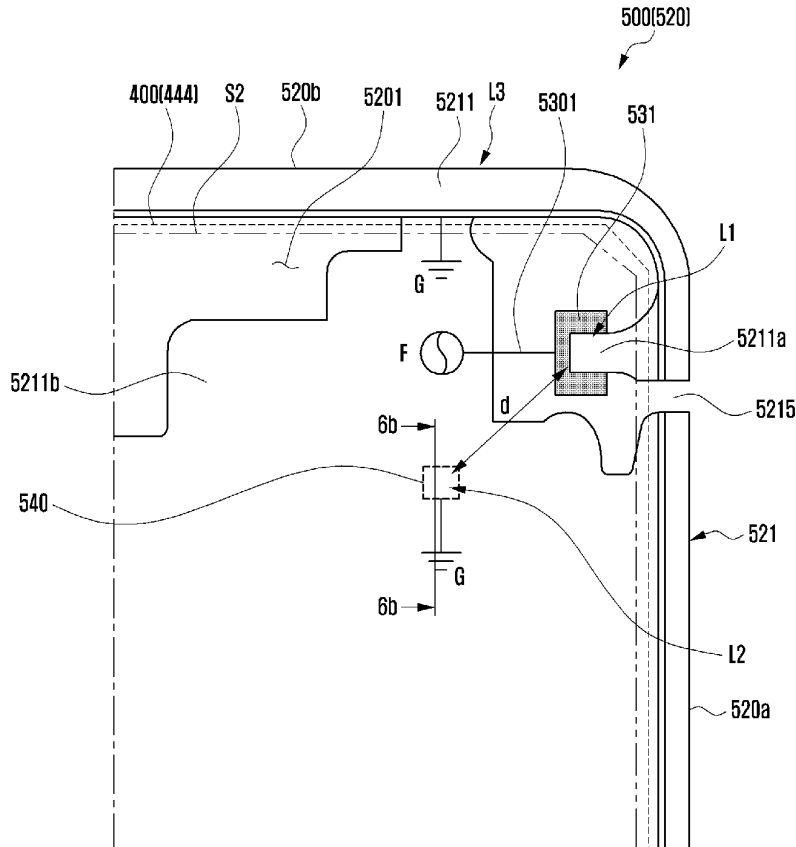
(63) Continuation of application No. PCT/KR2021/
009477, filed on Jul. 22, 2021.

(30) **Foreign Application Priority Data**

Jul. 31, 2020 (KR) 10-2020-0096206

Publication Classification

(51) **Int. Cl.**
G06F 1/16 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)





US 20230198120A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0198120 A1**
RYU et al. (43) **Pub. Date: Jun. 22, 2023**

(54) **ELECTRONIC DEVICE COMPRISING AN ANTENNA AND MICROPHONE**

H05K 1/02 (2006.01)
H01Q 5/314 (2006.01)

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

(52) **U.S. Cl.**
CPC *H01Q 1/22* (2013.01); *H01Q 5/314* (2015.01); *H04R 1/04* (2013.01); *H04R 1/083* (2013.01); *H05K 1/0243* (2013.01)

(72) Inventors: **Cheungwon RYU**, Suwon-si (KR); **Wondo KI**, Suwon-si (KR); **Seongkyoo BYEON**, Suwon-si (KR); **Junyoung YANG**, Suwon-si (KR); **Bonam LEE**, Suwon-si (KR)

(57) **ABSTRACT**

According to an embodiment, an electronic device includes: a housing forming an inner space of the electronic device; a printed circuit board (PCB) disposed in the inner space and including a ground; a microphone module including a microphone housing disposed at a point on the PCB adjacent to a side surface of the housing, the microphone housing being electrically connected with the ground; a conductive member comprising a conductive material disposed, spaced apart from a surface of the microphone housing by a specified distance or less, and overlapping at least part of the microphone housing with reference to a first direction in which a rear surface of the electronic device faces, the conductive member being coupled and electrically connected with the microphone housing; and a wireless communication circuit disposed on the PCB, and the wireless communication circuit is configured to transmit and/or receive a signal of a specified frequency band, based on an electrical path including the conductive member and the microphone housing, by feeding the conductive member.

(21) Appl. No.: **18/107,176**

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

Related U.S. Application Data

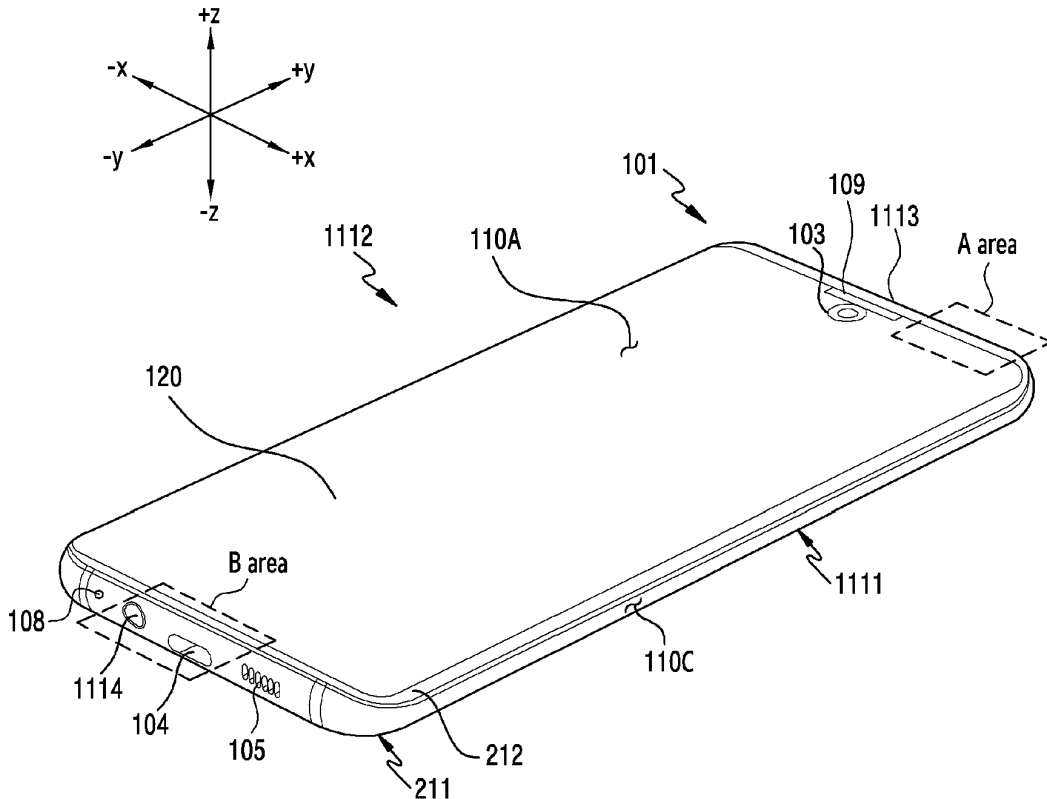
(63) Continuation of application No. PCT/KR2022/012804, filed on Aug. 26, 2022.

Foreign Application Priority Data

Sep. 3, 2021 (KR) 10-2021-0117759

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H04R 1/08 (2006.01)
H04R 1/04 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2023/0198126 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
G01D 5/24 (2006.01)
G01L 1/14 (2006.01)

(72) Inventors: **Sungsoo KIM**, Suwon-si (KR);
Jaehoon JO, Suwon-si (KR);
Yongyoun KIM, Suwon-si (KR);
Dongyoung LEE, Suwon-si (KR);
Woomin JANG, Suwon-si (KR);
Seungbum CHOI, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 9/0407* (2013.01); *G01D 5/24* (2013.01); *G01L 1/142* (2013.01)

(21) Appl. No.: **17/980,128**

(57) **ABSTRACT**

(22) Filed: **Nov. 3, 2022**

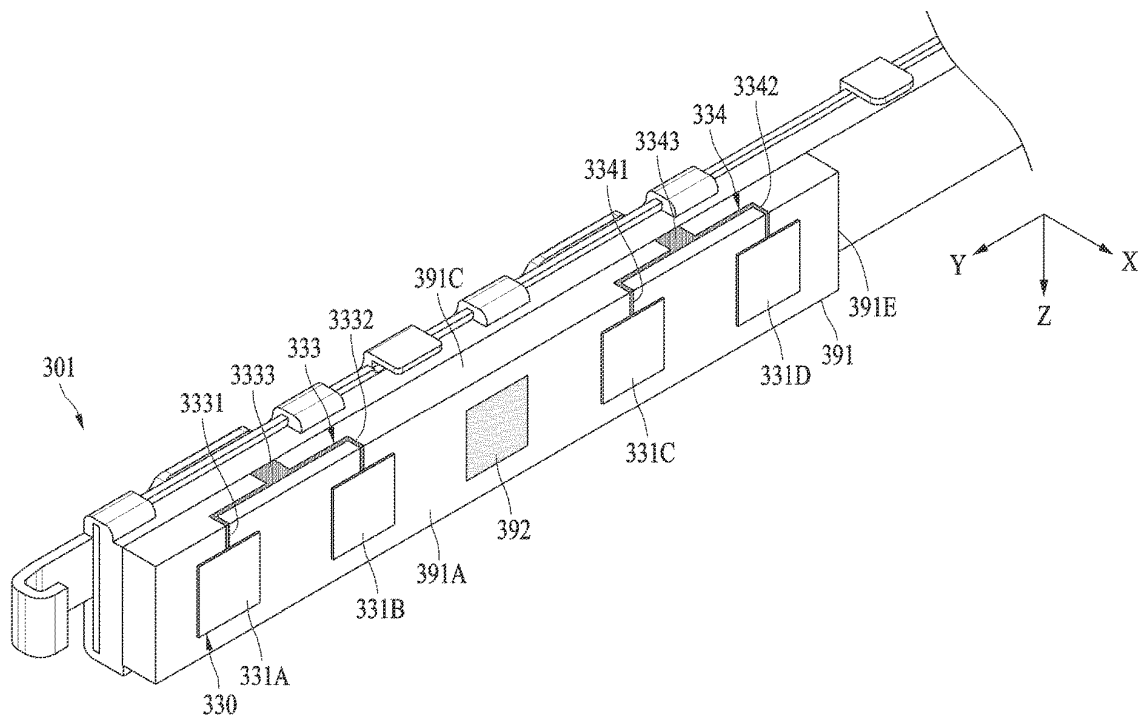
An electronic device is provided. The electronic device includes a housing including a first surface, a second surface opposite to the first surface, and a side surface between the first surface and the second surface, an antenna including a carrier including a first carrier surface facing the side surface, a second carrier surface opposite to the first carrier surface and a plurality of side carrier surfaces between the first carrier surface and the second carrier surface, and a patch positioned on the first carrier surface, a first capacitive sensor positioned between the first carrier surface and the side surface, and a filler positioned between the side surface and the first carrier surface.

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/014212, filed on Sep. 23, 2022.

Foreign Application Priority Data

Dec. 17, 2021 (KR) 10-2021-0181503
Jan. 14, 2022 (KR) 10-2022-0005883





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(19) **United States**

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

(10) **Pub. No.: US 2023/0198128 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

(71) Applicants: **Chanhee OH**, Suwon-si (KR); **Joon HEO**, Suwon-si (KR); **Soon PARK**, Suwon-si (KR)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/52 (2006.01)
H01Q 1/02 (2006.01)
H01Q 1/38 (2006.01)

(72) Inventors: **Chanhee OH**, Suwon-si (KR); **Joon HEO**, Suwon-si (KR); **Soon PARK**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/526* (2013.01); *H01Q 1/02* (2013.01); *H01Q 1/38* (2013.01)

(21) Appl. No.: **18/108,999**

(57) **ABSTRACT**

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

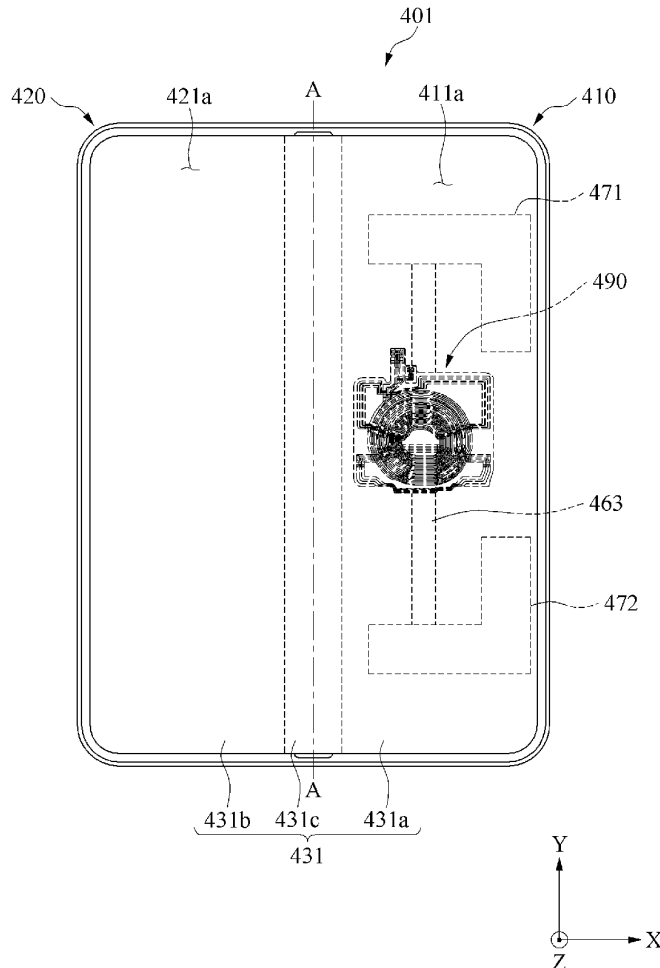
An electronic device is provided. The electronic device includes first and second printed circuit boards (PCBs); a flexible PCB (FPCB) connecting the first and second PCBs; and an antenna module between the first and second PCBs. The antenna module includes: a first pattern layer provided on a first substrate surface and forming a first coil pattern; a second pattern layer provided on a second substrate surface and forming a second coil pattern; an overlapping area in which the FPCB is provided between portions of the second pattern layer; and a plurality of pattern areas in which the portions of the second coil pattern are respectively provided

Related U.S. Application Data

(63) Continuation of application No. PCT/KR22/16114, filed on Oct. 21, 2022.

Foreign Application Priority Data

(30) Dec. 1, 2021 (KR) 10-2021-0169894





US 20230198130A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0198130 A1**
YOON et al. (43) **Pub. Date: Jun. 22, 2023**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

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

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

(52) **U.S. CI.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/307* (2015.01); *H01Q 13/106* (2013.01)

(72) Inventors: **Shinho YOON**, Suwon-si (KR);
Myeongjun KONG, Suwon-si (KR);
Dongjun OH, Suwon-si (KR);
Seunghwan KIM, Suwon-si (KR);
Soonho HWANG, Suwon-si (KR)

(57) **ABSTRACT**

(21) Appl. No.: **18/168,898**

(22) Filed: **Feb. 14, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/012428, filed on Aug. 19, 2022.

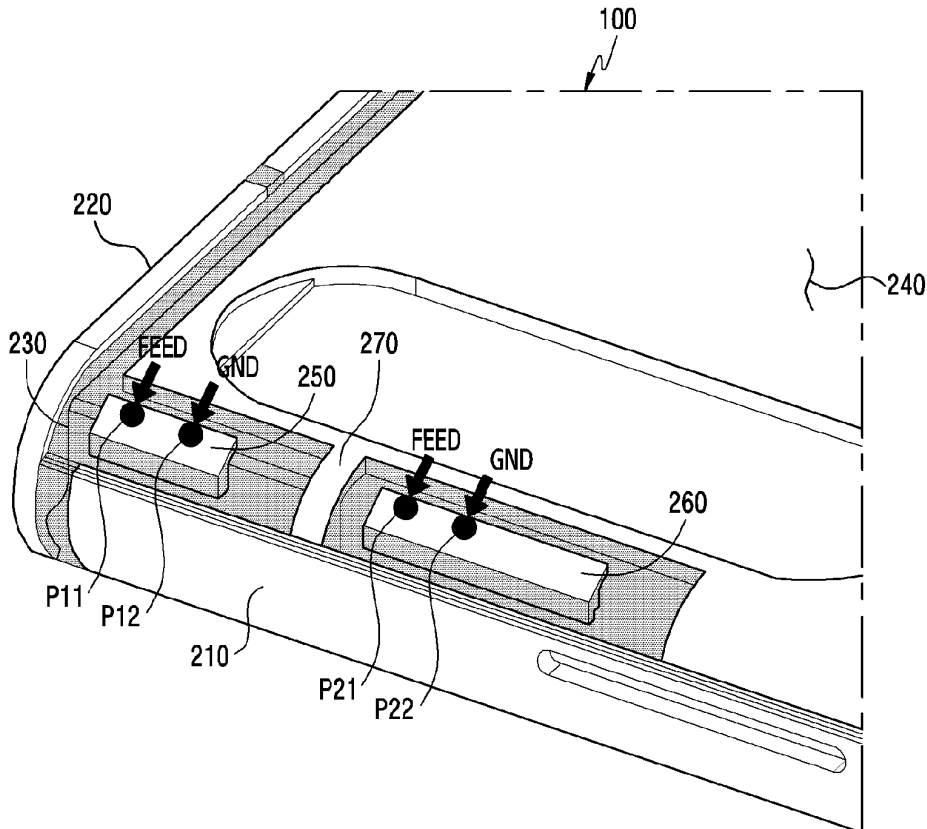
(30) **Foreign Application Priority Data**

Aug. 20, 2021 (KR) 10-2021-0110209

Publication Classification

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

An electronic device is provided. The electronic device includes a first conductive frame, a second conductive frame, a split portion, a conductive structure disposed inside the electronic device, a first conductive member, and a wireless communication circuit electrically connected to the first conductive frame, the second conductive member, a conductive portion, and the first conductive member, and the second conductive member, wherein the wireless communication circuit may be configured to transmit and/or receive a radio signal by using at least a portion of an electric path provided by the first conductive frame, the first conductive member, the second conductive member, the conductive portion, and the conductive structure by feeding power to the first conductive member and/or the second conductive member.





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(19) **United States**

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

(10) **Pub. No.: US 2023/0198131 A1**
(43) **Pub. Date: Jun. 22, 2023**

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

H01Q 1/38 (2006.01)
H01Q 3/30 (2006.01)

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

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *G06F 1/1652*
(2013.01); *H01Q 1/38* (2013.01); *G06F*
1/1616 (2013.01); *G06F 1/1681* (2013.01);
H01Q 3/30 (2013.01)

(72) Inventors: **Kookjoo LEE**, Suwon-si (KR); **Sumin YUN**, Suwon-si (KR); **Chaejun LEE**, Suwon-si (KR); **Jinwoo JUNG**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR); **Hochul HWANG**, Suwon-si (KR)

(57) **ABSTRACT**

(21) Appl. No.: **18/171,897**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/010538, filed on Aug. 10, 2021.

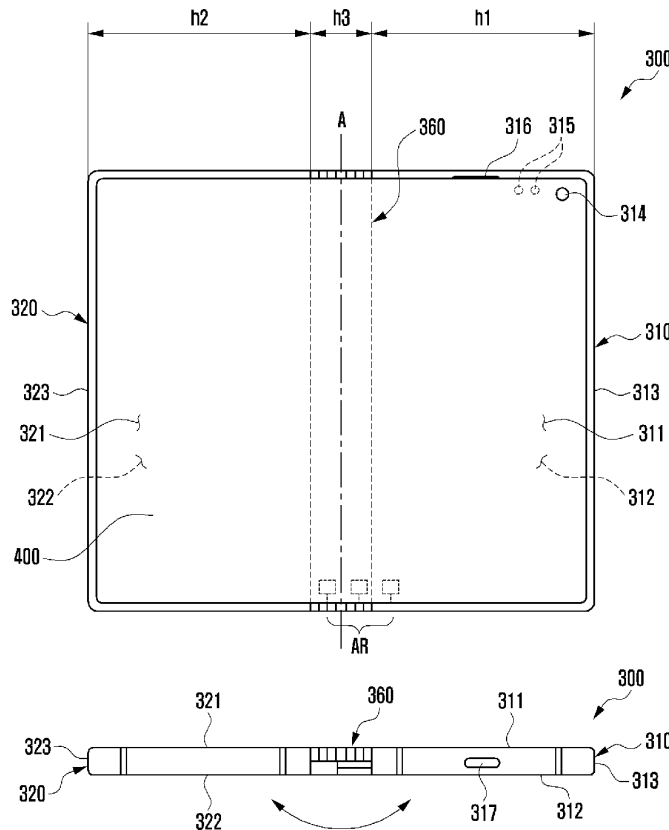
Foreign Application Priority Data

Aug. 25, 2020 (KR) 10-2020-0107192

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
G06F 1/16 (2006.01)

An electronic device is provided. The electronic device includes a flexible display comprising a display panel which includes a first portion, a second portion, and a third portion, and is disposed to be at least partially visible in a folded state, an array antenna which is formed on a dielectric sheet disposed on the display panel and includes a first mesh pattern portion disposed at a position corresponding to the first portion, a second mesh pattern portion disposed at a position corresponding to the third portion, and at least one third mesh pattern portion formed at a position spaced apart from the first mesh pattern portion, at a position corresponding to the first portion, a wireless communication circuit configured to transmit and/or receive a wireless signal through the array antenna, and a phase shifting means disposed in an electrical path between the wireless communication circuit and the array antenna.





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(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0198146 A1**
CHEN (43) **Pub. Date: Jun. 22, 2023**

(54) **ELECTRONIC DEVICE**

(52) **U.S. Cl.**
 CPC *H01Q 3/36* (2013.01);
H01Q 3/267 (2013.01)

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

(57) **ABSTRACT**

(72) Inventor: **HSIEN-TE CHEN**, Taipei City (TW)

An electronic device includes a substrate, plural varactors, a memory element, a driving unit and plural antenna elements. Each varactor is defined with a capacitor-voltage characteristic curve. The memory element is defined with one or more lookup tables for recording the capacitance values and varactor voltage values of the capacitor-voltage characteristic curve. The driving unit outputs plural voltage signals respectively to the varactors, and each voltage signal respectively provided with one varactor voltage value. Each antenna element is provided with various phase values in response to the capacitance values of the corresponding varactor. A selective one of the varactor voltage values in response to the required capacitance value of the corresponding varactor is found out from the lookup table(s) and delivered by the driving unit. The antenna elements are together enabled to form a wave beam with a characteristic wavefront in accordance with the capacitance values

(21) Appl. No.: **18/145,697**

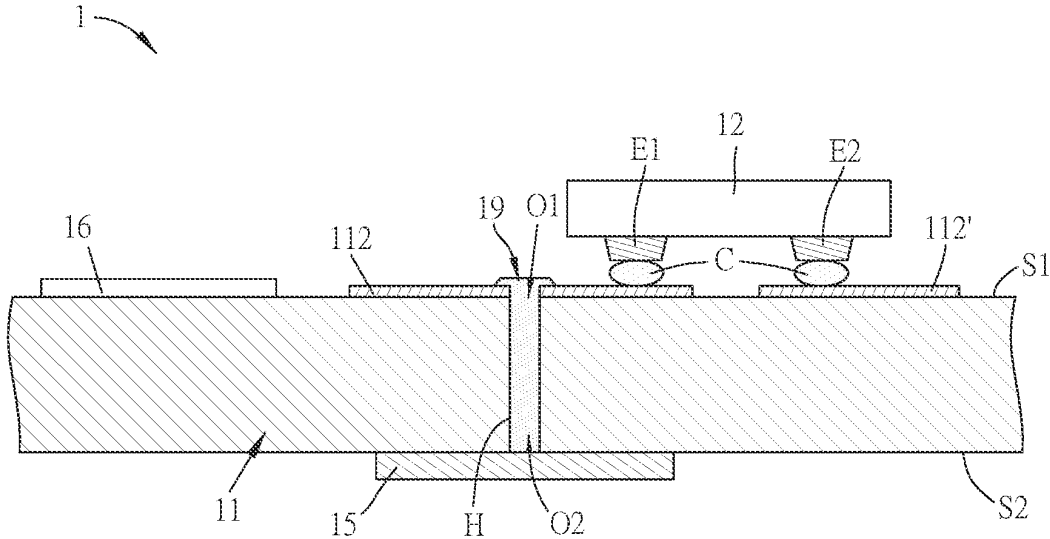
(22) Filed: **Dec. 22, 2022**

Related U.S. Application Data

(60) Provisional application No. 63/292,803, filed on Dec. 22, 2021.

Publication Classification

(51) **Int. Cl.**
H01Q 3/36 (2006.01)
H01Q 3/26 (2006.01)





(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0198148 A1**

Wong et al.

(43) **Pub. Date: Jun. 22, 2023**

(54) **MULTI-FEED ANTENNA**

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

(72) Inventors: **Kin-Lu Wong, Kaohsiung City (TW); Wei-Yu Li, Yilan County (TW); Wei Chung, Hsinchu County (TW)**

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

(21) Appl. No.: **17/555,503**

(22) Filed: **Dec. 20, 2021**

Publication Classification

(51) **Int. Cl.**
H01Q 5/35 (2006.01)
H01Q 5/45 (2006.01)

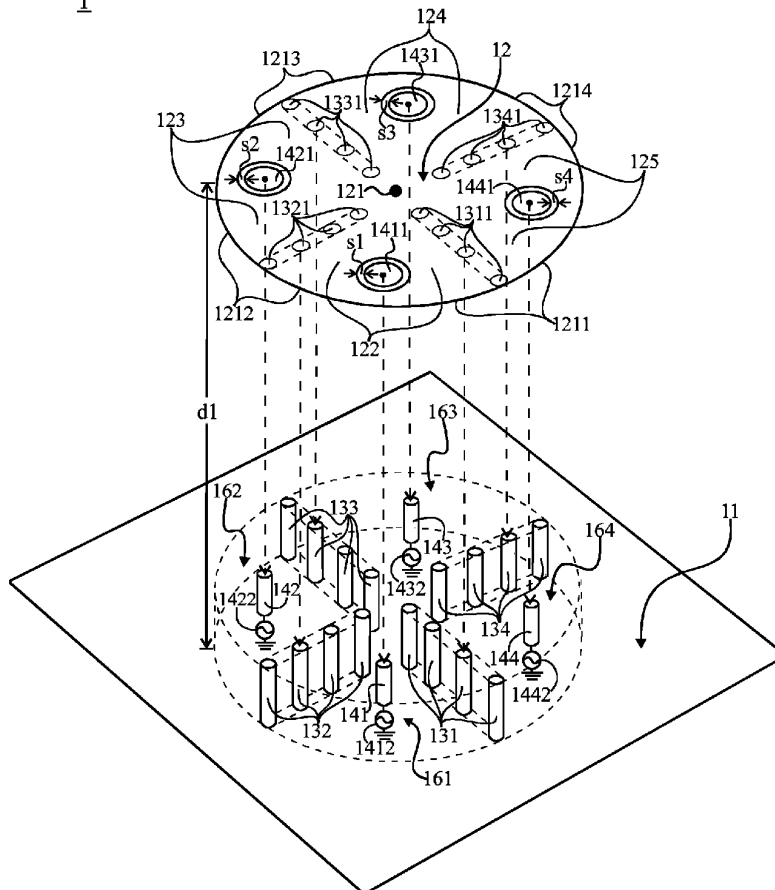
(52) **U.S. Cl.**
CPC **H01Q 5/35** (2015.01); **H01Q 5/45** (2015.01)

(57) **ABSTRACT**

The disclosure provides a multi-feed antenna including a first conductor layer, a second conductor layer, four sup-

porting conductor structures and four feeding conductor lines. The second conductor layer has a first center position and is spaced apart from the first conductor layer at a first interval. The four supporting conductor structures respectively electrically connect the first conductor layer and the second conductor layer and form four electrically connected sections at the second conductor layer. The four electrically connected sections respectively extend from different side edges of the second conductor layer toward the first center position, so that the second conductor layer forms four mutually connected radiating conductor plates. The four feeding conductor lines are all located between the first conductor layer and the second conductor layer. The four feeding conductor lines and the four supporting conductor structures form an interleaved annular arrangement. Each of the feeding conductor lines has one end electrically connected to a coupling conductor plate. Each of the coupling conductor plates is spaced apart from a different one of the radiating conductor plates at a coupling interval. Each of the feeding conductor lines has another end electrically connected to a signal source respectively. The four feeding conductor lines excite the second conductor layer to generate at least four resonant modes. The at least four resonant modes cover at least one identical first communication band.

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(19) **United States**

(12) **Patent Application Publication**
WEI

(10) **Pub. No.: US 2023/0198149 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **ANTENNA STRUCTURE**

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

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

CPC **H01Q 9/0414** (2013.01); **H01Q 5/335** (2015.01)

(72) Inventor: **Shih-Chiang WEI**, Hsinchu (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/811,652**

An antenna structure includes a first ground element, a second ground element, a first radiation element, a second radiation element, a third radiation element, a fourth radiation element, a fifth radiation element, and a first capacitor. The first capacitor is coupled between the first radiation element and the first ground element. The second radiation element and the third radiation element are coupled to the second ground element, and are disposed adjacent to the first radiation element. The first radiation element is disposed between the second radiation element and the third radiation element. The fourth radiation element and the fifth radiation element are coupled between the first ground element and the second ground element. The first radiation element, the second radiation element, and the third radiation element are substantially surrounded by the first ground element, the second ground element, the fourth radiation element, and the fifth radiation element.

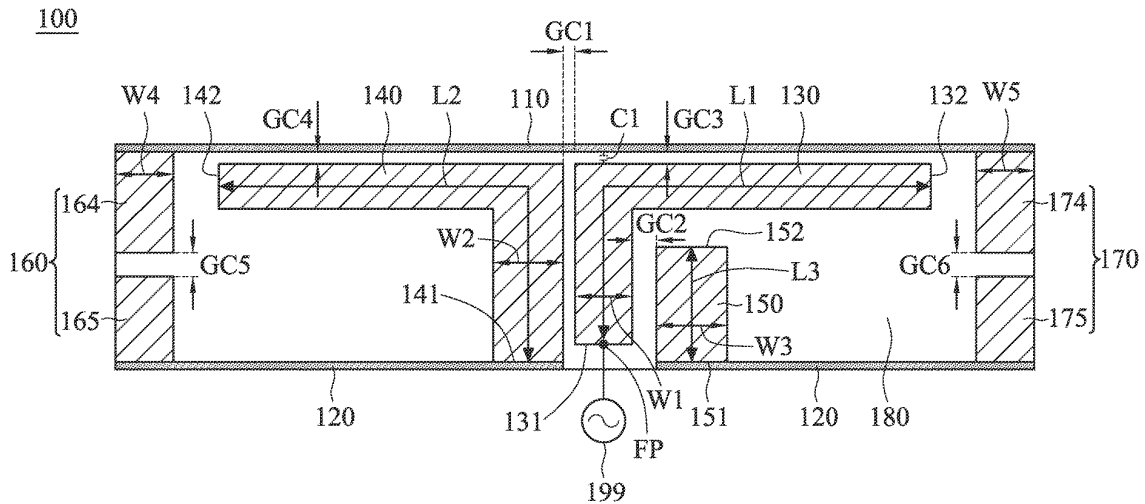
(22) Filed: **Jul. 11, 2022**

(30) **Foreign Application Priority Data**

Dec. 17, 2021 (TW) 110147420

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/335 (2006.01)





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(19) **United States**

(12) **Patent Application Publication**

Feng et al.

(10) **Pub. No.: US 2023/0198150 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **ANTENNA DEVICE**

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

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

CPC **H01Q 9/0414** (2013.01); **H01Q 1/2291** (2013.01)

(72) Inventors: **Zhi-Hua Feng**, Taipei (TW); **Pin-Tang Chiu**, Taipei (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/954,622**

An antenna device disposed on a side frame of a metal case. The antenna device includes a first slot, a dielectric substrate, a feeding metal portion, a ground portion, and a feeding source. The first slot is on the side frame, so that a part of the side frame surrounded by the first slot serves as a radiating metal portion. The dielectric substrate includes a first surface and a second surface and is disposed on the radiating metal portion through the first surface. The feeding metal portion is on the second surface of the dielectric substrate, so that a vertical projection of the feeding metal portion overlaps with the radiating metal portion. The ground portion is on the second surface of the dielectric substrate and connected to the metal case. The feeding source is on the second surface and connected to the feeding metal portion and the ground portion.

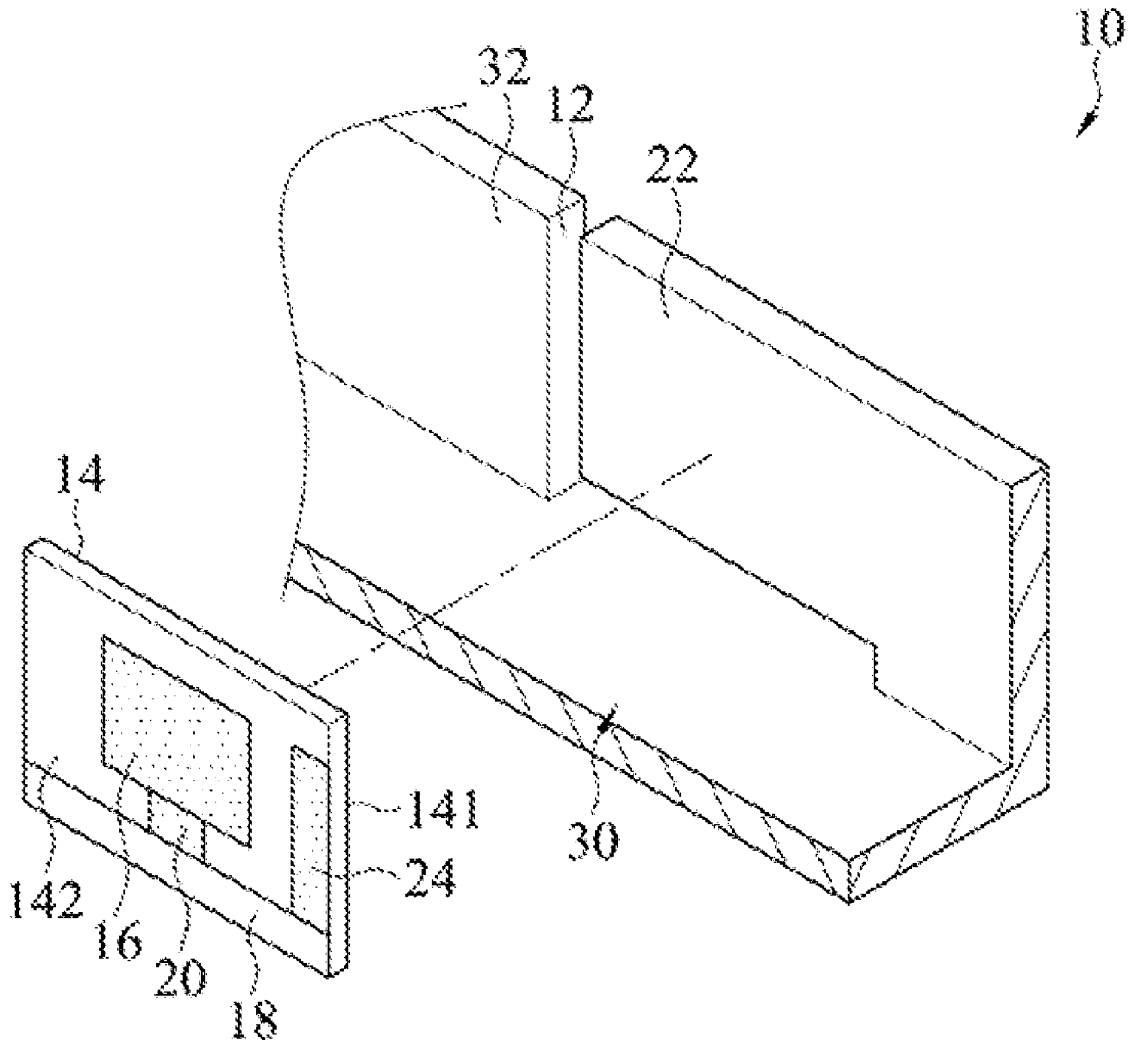
(22) Filed: **Sep. 28, 2022**

(30) **Foreign Application Priority Data**

Dec. 17, 2021 (TW) 110147584

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**
HUSSAIN

(10) **Pub. No.: US 2023/0198155 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **APERTURE SHARED SLOT-BASED SUB-6 GHZ AND MM-WAVE IOT ANTENNA FOR 5G APPLICATIONS**

H01Q 1/50 (2006.01)

H01Q 1/38 (2006.01)

H01P 5/12 (2006.01)

(71) Applicant: **KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS, Dhahran (SA)**

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

CPC *H01Q 9/065* (2013.01); *H01Q 5/371* (2015.01); *H01Q 1/50* (2013.01); *H01Q 1/38* (2013.01); *H01P 5/12* (2013.01)

(72) Inventor: **Rifaqat HUSSAIN, Dhahran (SA)**

(73) Assignee: **KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS, Dhahran (SA)**

(57) **ABSTRACT**

(21) Appl. No.: **17/890,751**

(22) Filed: **Aug. 18, 2022**

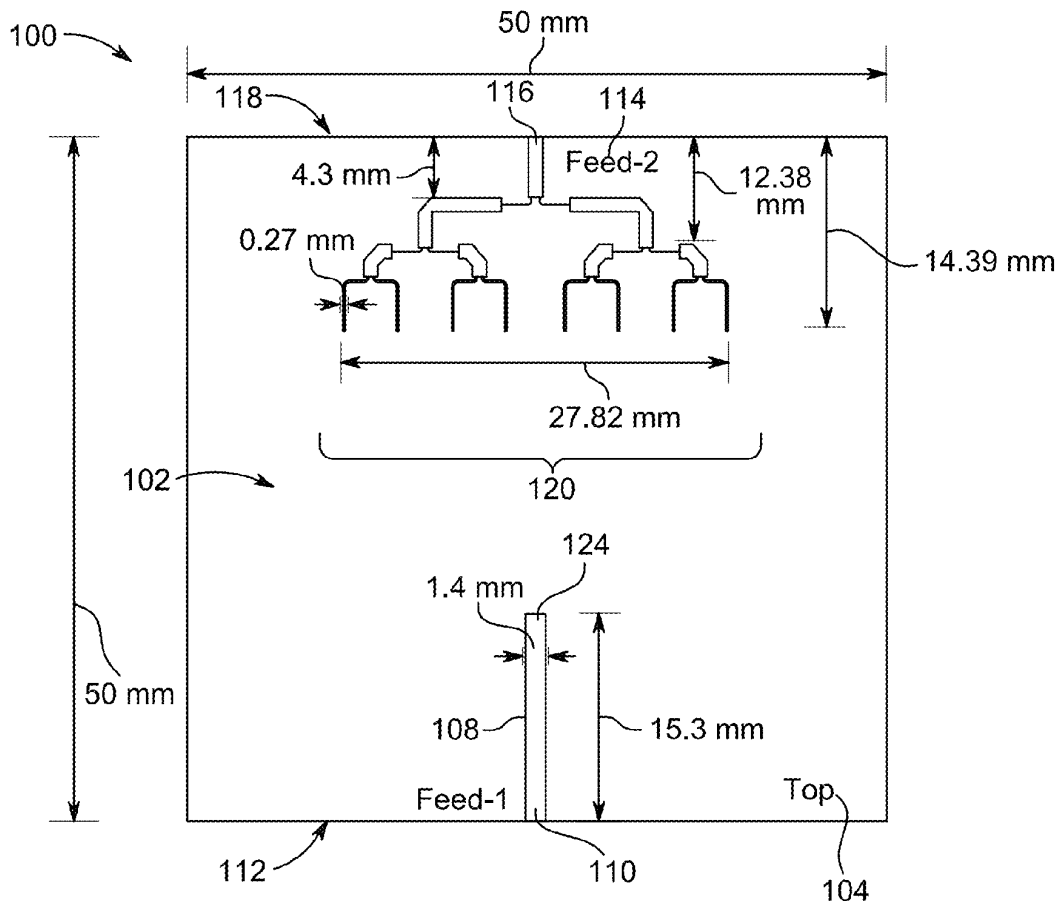
Related U.S. Application Data

(60) Provisional application No. 63/292,100, filed on Dec. 21, 2021.

Publication Classification

(51) **Int. Cl.**
H01Q 9/06 (2006.01)
H01Q 5/371 (2006.01)

An antenna system and a method for fabricating an antenna system are disclosed. The antenna system includes a substrate having a top side and a bottom side, a single straight microstrip line on the top side of the substrate, a microstrip power divider (PD) on the top side of the substrate, and a ground plane on the bottom side. An input end of the single straight microstrip line is adjacent and vertical to a first edge of the substrate, and an output end of the single straight microstrip line is open. An input end of the microstrip PD is adjacent and vertical to a second edge of the substrate, and eight output ends of the microstrip PD are open. The first edge is parallel to the second edge. Further, three concentric square slots are etched on the ground plane.





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(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0198156 A1**
ONKURA (43) **Pub. Date: Jun. 22, 2023**

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

H01Q 19/26 (2006.01)
H01Q 1/48 (2006.01)

(71) Applicant: **NEC Platforms, Ltd.**, Kawasaki-shi, Kanagawa (JP)

(52) U.S. Cl. CPC *H01Q 9/26* (2013.01); *H01Q 1/24* (2013.01); *H01Q 1/48* (2013.01); *H01Q 19/26* (2013.01)

(72) Inventor: **Yu ONKURA**, Kanagawa (JP)

(73) Assignee: **NEC Platforms, Ltd.**, Kawasaki-shi, Kanagawa (JP)

(57) **ABSTRACT**

(21) Appl. No.: **17/918,357**

Provided are an antenna device and a wireless communication device that are small in size and capable of transmitting and receiving vertically polarized waves without requiring an additional noise countermeasure. The antenna device (100) includes: a feeding antenna element (101) having an element section (101A) parallel to a ground surface, one end of which is electrically connected to a supply source (203) supplying a wireless communication signal; and a parasitic antenna element (102) having a vertical element section disposed perpendicular to the ground surface, and being disposed near another end of the feeding antenna element (101). The wireless communication device (200) includes: a substrate (201) on which a ground layer (202) having a reference potential and a supply source (203) supplying a wireless communication signal are formed; and the antenna device (100).

(22) PCT Filed: **Mar. 3, 2021**

(86) PCT No.: **PCT/JP2021/008212**

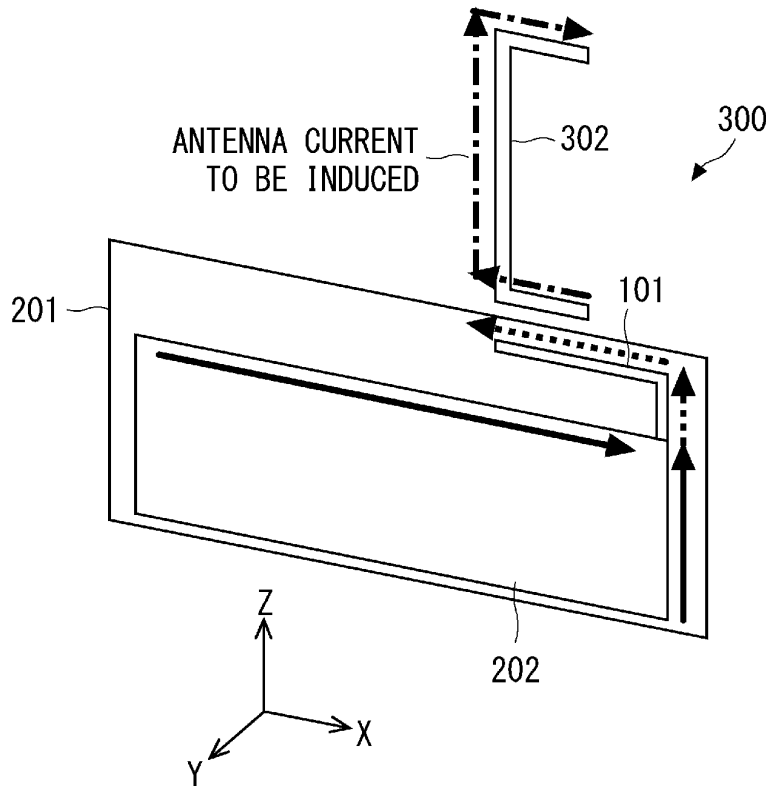
§ 371 (c)(1),
(2) Date: **Oct. 12, 2022**

(30) **Foreign Application Priority Data**

Apr. 22, 2020 (JP) 2020-075850

Publication Classification

(51) **Int. Cl.**
H01Q 9/26 (2006.01)
H01Q 1/24 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2023/0198161 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **ANTENNA MODULE CAPABLE OF SUPPORTING BROADBAND AND BASE STATION COMPRISING SAME**

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/00 (2006.01)
H01Q 5/307 (2006.01)
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
H01Q 21/26 (2006.01)

(72) Inventors: **Jungmin PARK**, Suwon-si (KR);
Hyunjin KIM, Suwon-si (KR);
Seungtae KO, Suwon-si (KR);
Yoongeon KIM, Suwon-si (KR);
Bumhee LEE, Suwon-si (KR); **Jungi JEONG**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 21/0006* (2013.01); *H01Q 5/307* (2015.01); *H01Q 1/246* (2013.01); *H01Q 9/0421* (2013.01); *H01Q 21/26* (2013.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **18/102,497**

An antenna module includes: a first antenna unit, a second antenna unit, and a third antenna unit, each of the first antenna unit, the second antenna unit, and the third antenna unit including a first antenna element and a second antenna element that are crossed diagonally with each other; a first signal distributor configured to distribute a first radio frequency (RF) signal to the first antenna element of each of the first antenna unit, the second antenna unit, and the third antenna unit; a second signal distributor configured to distribute a second RF signal to the second antenna element of each of the first antenna unit, the second antenna unit, and the third antenna unit; and first stub circuits connected to line tracks of the first signal distributor connected to the first antenna unit, the second antenna unit, and the third antenna unit.

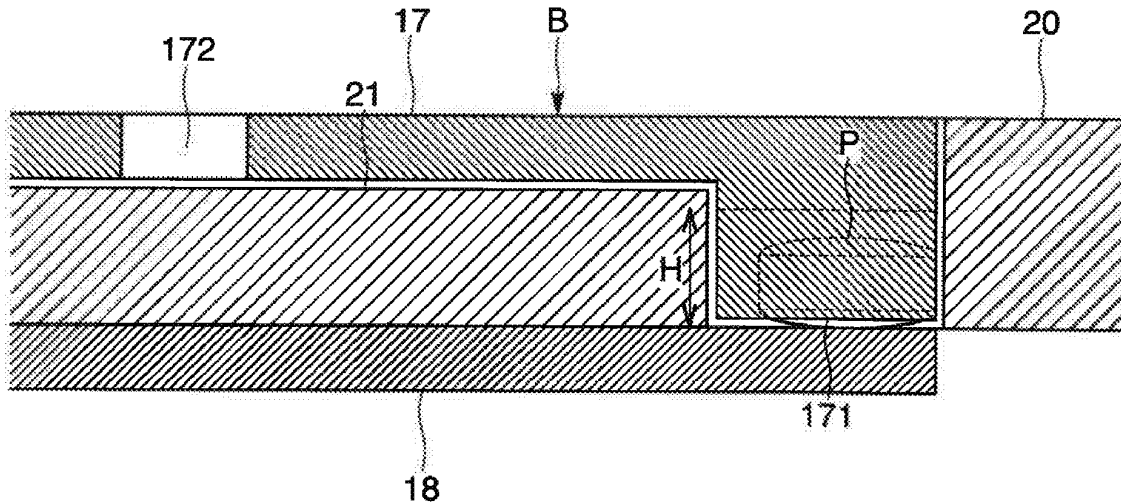
(22) Filed: **Jan. 27, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/009876, filed on Jul. 29, 2021.

Foreign Application Priority Data

(30) Jul. 29, 2020 (KR) 10-2020-0094284





US 20230198165A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0198165 A1**

(43) **Pub. Date: Jun. 22, 2023**

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

H01Q 1/42 (2006.01)

H01Q 1/22 (2006.01)

H01Q 9/04 (2006.01)

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

H01Q 13/18 (2006.01)

H01Q 21/28 (2006.01)

H01L 23/66 (2006.01)

H01L 23/00 (2006.01)

(72) Inventors: **Je Sang PARK**, Suwon-si (KR); **Yang Je LEE**, Suwon-si (KR); **Hyun Kyung PARK**, Suwon-si (KR); **Chang Gun OH**, Suwon-si (KR)

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

CPC *H01Q 21/065* (2013.01); *H01Q 1/38*

(2013.01); *H01Q 1/422* (2013.01); *H01Q*

1/2283 (2013.01); *H01Q 9/0407* (2013.01);

H01Q 13/18 (2013.01); *H01Q 21/28*

(2013.01); *H01L 23/66* (2013.01); *H01L 24/16*

(2013.01); *H01L 2223/6622* (2013.01); *H01L*

2223/6677 (2013.01); *H01L 2924/2027*

(2013.01); *H01L 2924/1421* (2013.01); *H01L*

2224/16235 (2013.01)

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

(21) Appl. No.: **17/747,246**

(22) Filed: **May 18, 2022**

(57) **ABSTRACT**

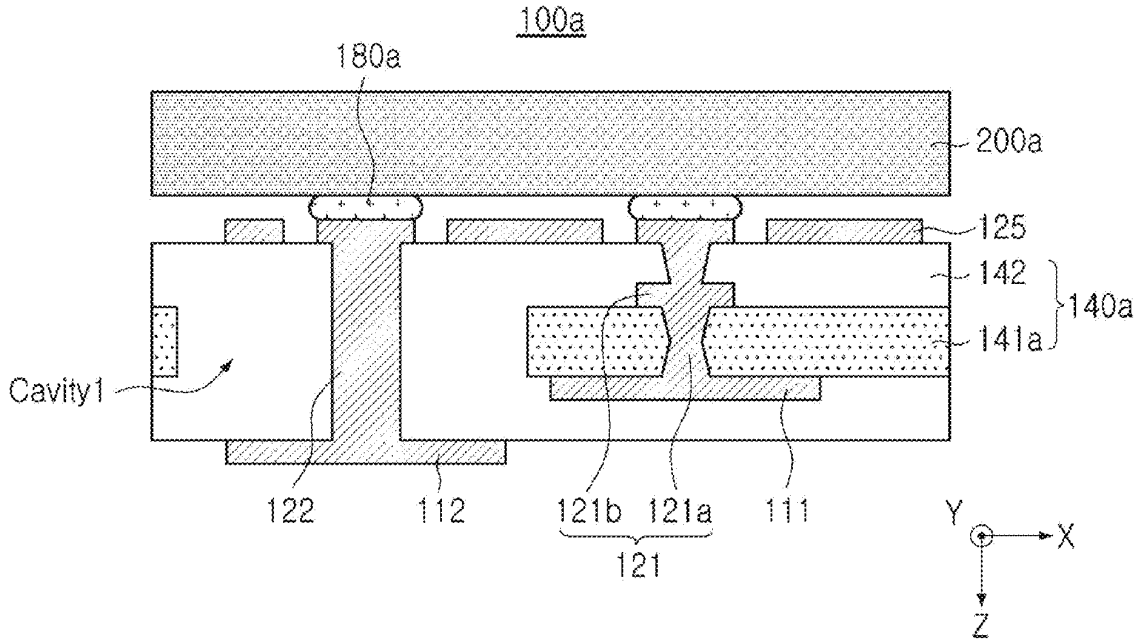
(30) **Foreign Application Priority Data**

An antenna substrate includes: a first insulating layer surrounding a cavity; a second insulating layer of which at least a portion is disposed in the cavity and containing an insulating material different from an insulating material of the first insulating layer; a first patch antenna having one surface facing the first insulating layer by an amount greater than half of an area of the first patch antenna; and a second patch antenna having one surface facing the cavity by an amount greater than half of an area of the second patch antenna.

Dec. 20, 2021 (KR) 10-2021-0182705

Publication Classification

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 1/38 (2006.01)





US 20230199096A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0199096 A1**
YUN et al. (43) **Pub. Date: Jun. 22, 2023**

(54) **ANTENNA AND ELECTRONIC DEVICE INCLUDING SAME** *H01Q 3/36* (2006.01)

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR) (52) **U.S. CI.**
 CPC *H04M 1/0266* (2013.01); *H01Q 1/243* (2013.01); *H01Q 3/36* (2013.01); *H04M 2250/22* (2013.01)

(72) Inventors: **Sumin YUN**, Suwon-si (KR); **Kookjoo LEE**, Suwon-si (KR); **Minwoo LEE**, Suwon-si (KR); **Juseok LEE**, Suwon-si (KR); **Jinwoo JUNG**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR); **Wonhee CHOE**, Suwon-si (KR); **Hochul HWANG**, Suwon-si (KR) (57) **ABSTRACT**

(21) Appl. No.: **18/108,868**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/010537, filed on Aug. 10, 2021.

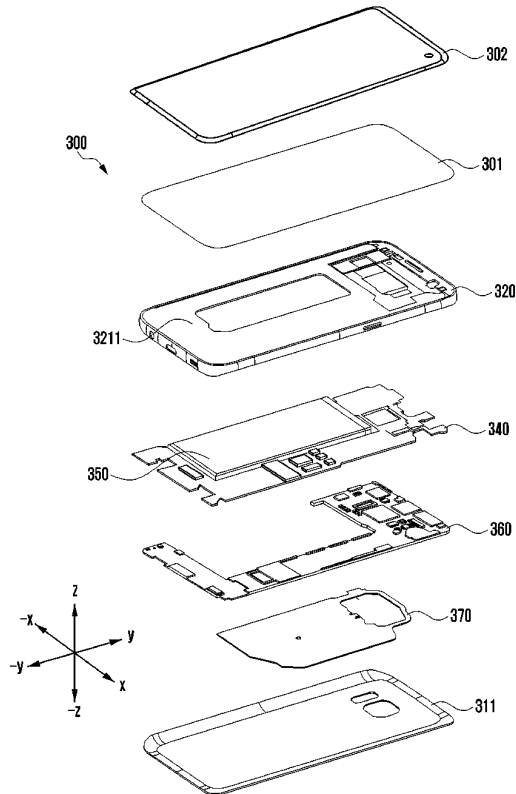
(30) **Foreign Application Priority Data**

Aug. 14, 2020 (KR) 10-2020-0102171

Publication Classification

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

According to various embodiments of the present disclosure, an electronic device comprises: a dielectric sheet disposed between a display panel and at least one portion of a housing and includes a conductive mesh comprising a plurality of conductive lines, the dielectric sheet including at least one first mesh pattern part disposed in a first region of the dielectric sheet, a second mesh pattern part disposed in a second region at least partially surrounding the first region, and at least one dummy pattern part which segments the at least one first mesh pattern part and the second mesh pattern part in a third region between the first region and the second region; and a wireless communication circuit disposed in the housing and electrically connected to the at least one first mesh pattern part, wherein the at least one dummy pattern part may include a plurality of segments formed in the third region by partially removing the plurality of conductive lines.





(19) **United States**

(12) **Patent Application Publication**
CHOE

(10) **Pub. No.: US 2023/0205371 A1**

(43) **Pub. Date: Jun. 29, 2023**

(54) **ELECTRONIC DEVICE COMPRISING CAPACITANCE SENSOR**

Publication Classification

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

(51) **Int. Cl.**
G06F 3/044 (2006.01)
H01Q 1/24 (2006.01)
H03H 7/38 (2006.01)

(72) Inventor: **Jaewon CHOE**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *G06F 3/044* (2013.01); *H01Q 1/243*
(2013.01); *H03H 7/38* (2013.01)

(21) Appl. No.: **18/178,214**

(57) **ABSTRACT**

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

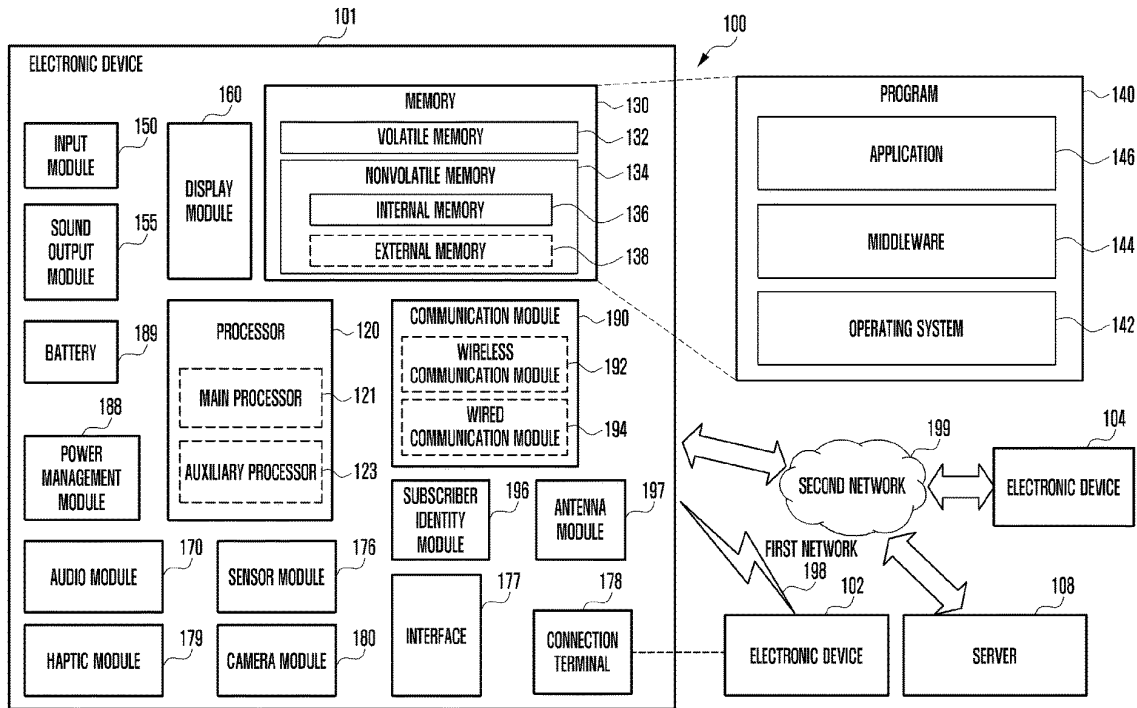
An electronic device is provided. The electronic device includes a first antenna, a second antenna, a communication circuit set to transmit and/or receive a signal in the frequency band selected or designated via the first antenna and/or the second antenna, a sensor integrated circuit (IC) which is electrically connected to the first antenna and the second antenna and measures a capacitance, a first capacitor connected to a first electrical path between the first antenna and the sensor IC, and a second capacitor connected to a second electrical path between the second antenna and the sensor IC.

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/011958, filed on Sep. 3, 2021.

Foreign Application Priority Data

(30) Sep. 4, 2020 (KR) 10-2020-0113279





US 20230208027A1

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

(10) **Pub. No.: US 2023/0208027 A1**
(43) **Pub. Date: Jun. 29, 2023**

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

Publication Classification

(71) Applicant: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)
(72) Inventor: **Shen WANG**, Dongguan (CN)
(73) Assignee: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(51) **Int. Cl.**
H01Q 3/26 (2006.01)
H01Q 5/35 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 3/2694* (2013.01);
H01Q 5/35 (2015.01)

(21) Appl. No.: **18/118,117**
(22) Filed: **Mar. 6, 2023**

(57) **ABSTRACT**

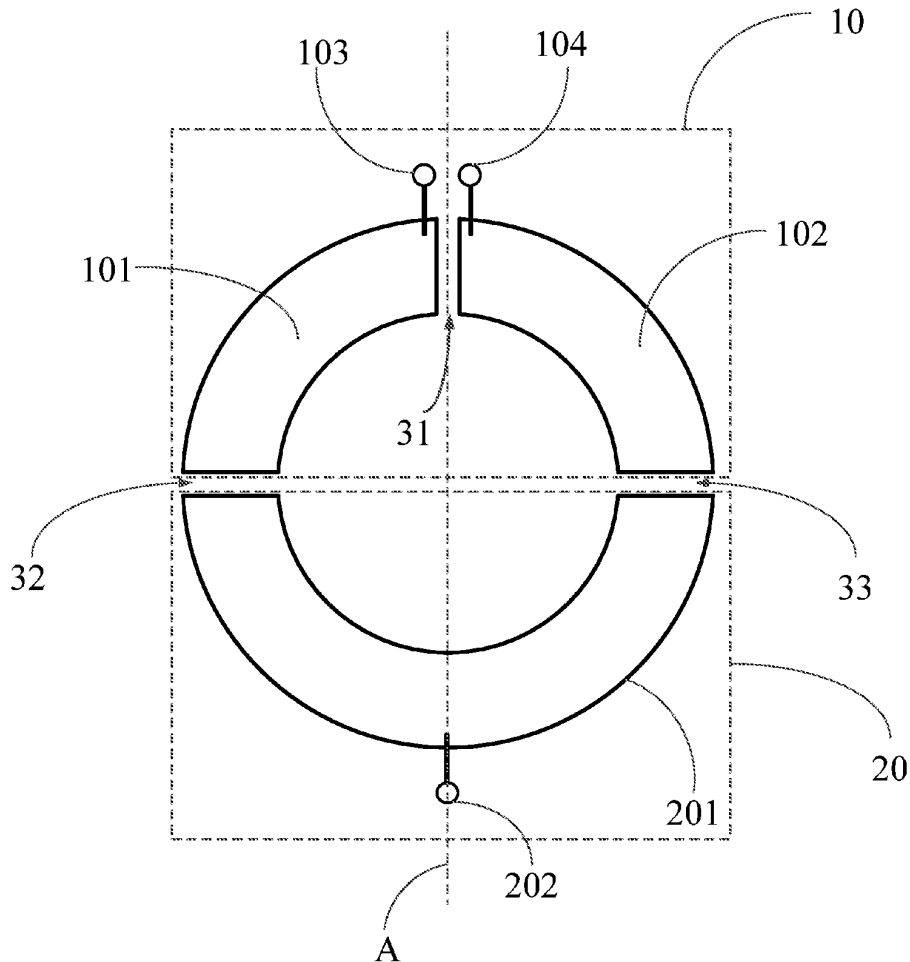
Related U.S. Application Data

An antenna structure and an electronic device, are provided. The antenna structure includes a first antenna and a second antenna, the first antenna includes a first radiator, a second radiator, a first port, and a second port, and the second antenna includes a third radiator and a third port. The first radiator, the second radiator, and the third radiator jointly constitute a ring structure, and there is a first gap between the first radiator and the second radiator, a second gap between the first radiator and the third radiator, and a third gap between the second radiator and the third radiator.

(63) Continuation of application No. PCT/CN2021/115320, filed on Aug. 30, 2021.

Foreign Application Priority Data

(30) Sep. 4, 2020 (CN) 202010923239.1





US 20230208032A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0208032 A1**

(43) **Pub. Date: Jun. 29, 2023**

(54) **ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/307 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/04 (2006.01)
H01Q 5/50 (2006.01)

(72) Inventors: **Jiaming Wang**, Shanghai (CN); **Liang Xue**, Shanghai (CN); **Dong Yu**, Shanghai (CN); **Jikang Wang**, Shanghai (CN); **Jiaqing You**, Shanghai (CN); **Yiwen Gong**, Shanghai (CN); **Fangchao Zhao**, Shanghai (CN)

(52) **U.S. Cl.**
CPC *H01Q 5/307* (2015.01); *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01); *H01Q 9/0407* (2013.01); *H01Q 5/50* (2015.01)

(21) Appl. No.: **17/927,937**

(22) PCT Filed: **Apr. 28, 2021**

(86) PCT No.: **PCT/CN2021/090440**

§ 371 (c)(1),

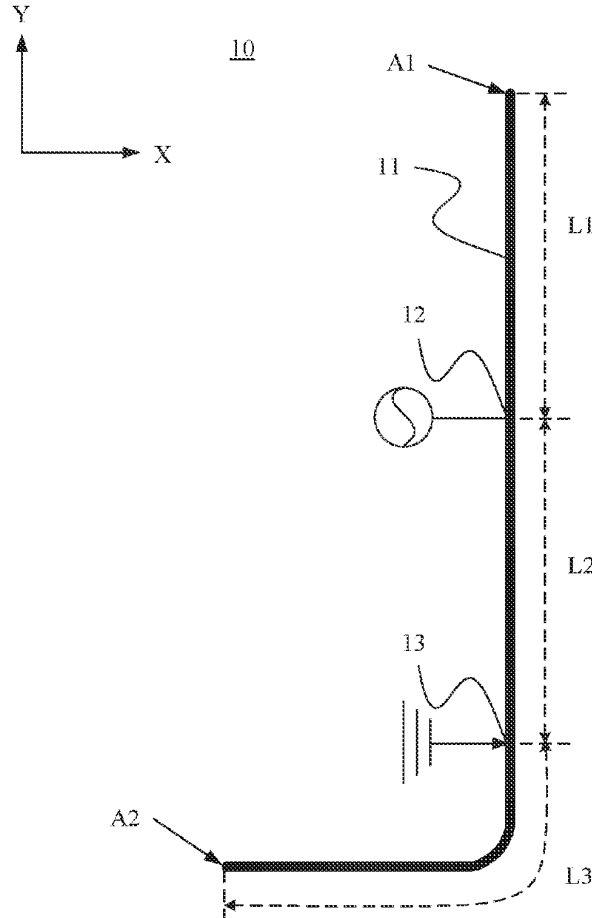
(2) Date: **Nov. 28, 2022**

(57) **ABSTRACT**

An electronic device includes an antenna unit having an antenna body having a feed point and a ground point between a first end and a second end. The antenna body has an operating band with a resonance of a first wavelength. An electrical length of the antenna body from the feed point to the ground point is greater than or equal to $\frac{1}{4}$ and less than $\frac{1}{2}$ of the first wavelength. An electrical length from the first end to the feed point is greater than or equal to $\frac{1}{8}$ and less than or equal to $\frac{1}{4}$ of the first wavelength. An electrical length from the second end to the ground point is greater than or equal to $\frac{1}{8}$ and less than or equal to $\frac{1}{4}$ of the first wavelength. The antenna body is adapted to operate in a slot mode and in a wire mode.

(30) **Foreign Application Priority Data**

May 27, 2020 (CN) 202010463851.5





US 20230208035A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0208035 A1**
JI et al. (43) **Pub. Date: Jun. 29, 2023**

(54) **ANTENNA APPARATUS**

(30) **Foreign Application Priority Data**

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

Dec. 24, 2021 (KR) 10-2021-0187402

Publication Classification

(72) Inventors: **Hwan JI**, Suwon-si (KR); **Jungil KIM**,
Suwon-si (KR); **Hyunjun CHOI**,
Suwon-si (KR); **Chin Mo KIM**,
Suwon-si (KR); **Won Cheol LEE**,
Suwon-si (KR)

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 9/0414** (2013.01); **H01Q 9/045**
(2013.01); **H01Q 21/08** (2013.01)

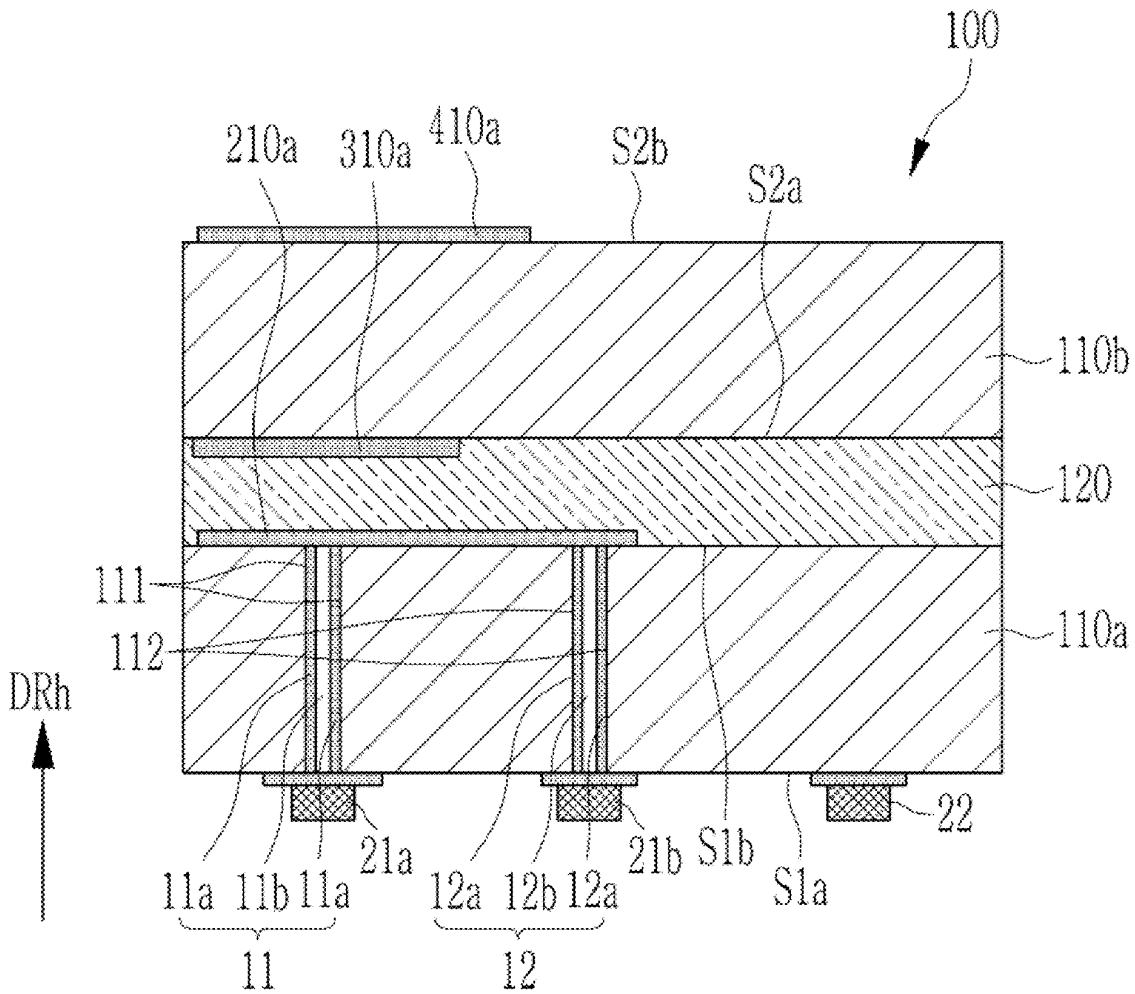
(73) Assignee: **Samsung Electro-Mechanics Co., Ltd.**,
Suwon-si (KR)

(57) **ABSTRACT**

An antenna apparatus includes a dielectric layer; and a via that extends through the dielectric layer, the via includes a conductive first portion and a non-conductive second portion surrounded by the conductive first portion. An antenna of the antenna apparatus is fed through the via.

(21) Appl. No.: **17/981,668**

(22) Filed: **Nov. 7, 2022**





US 20230208040A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0208040 A1**

(43) **Pub. Date: Jun. 29, 2023**

(54) **ANTENNA AND ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/42 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/50 (2006.01)

(72) Inventors: **Junhong Zhang**, Dongguan (CN); **Yao Lan**, Dongguan (CN); **Jun Li**, Dongguan (CN); **Yuan Zhou**, Shanghai (CN)

(52) **U.S. Cl.**
CPC **H01Q 9/42** (2013.01); **H01Q 1/38** (2013.01); **H01Q 1/50** (2013.01)

(21) Appl. No.: **17/928,515**

(22) PCT Filed: **Mar. 16, 2021**

(86) PCT No.: **PCT/CN2021/081113**

§ 371 (c)(1),

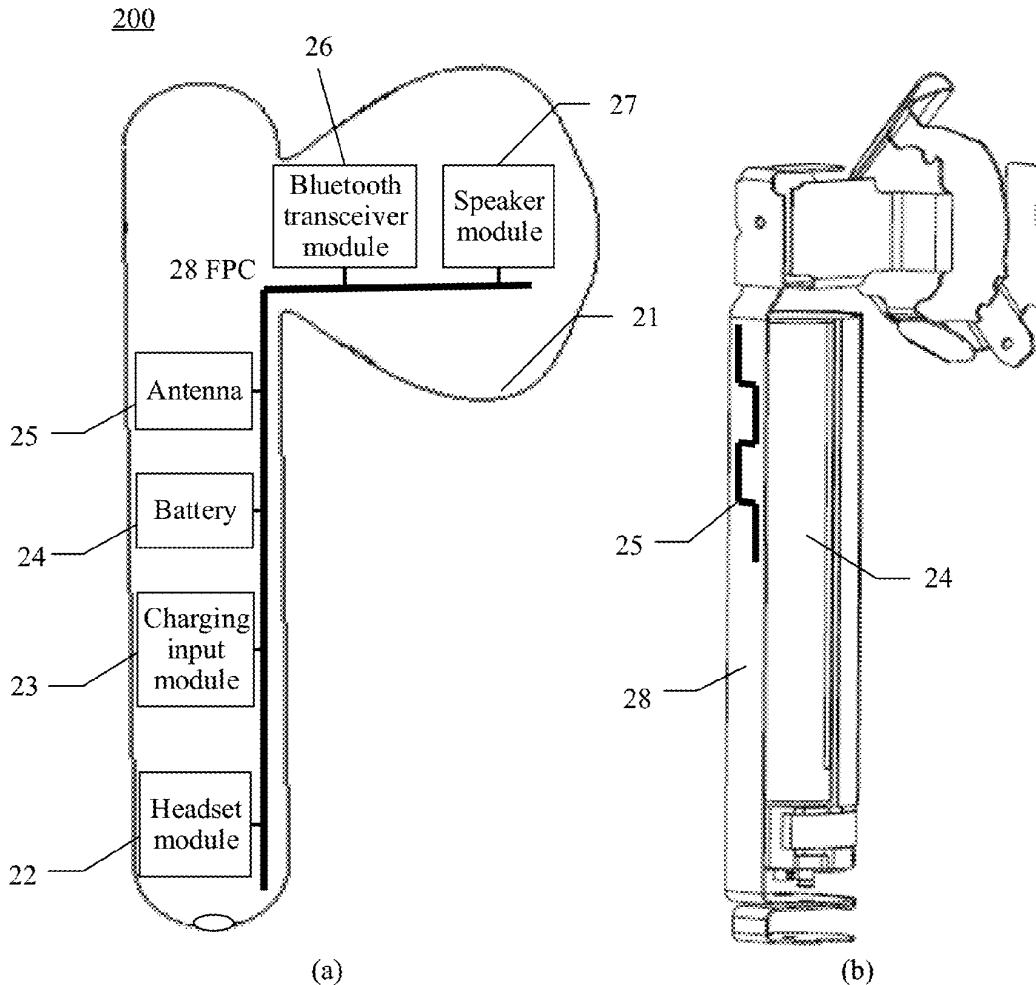
(2) Date: **Nov. 29, 2022**

(57) **ABSTRACT**

One example antenna includes a radiator, and a first feed point and a second feed point that are disposed on the radiator. One end of the radiator is an open end, and the first feed point is located between the open end and the second feed point. The radiator includes a first position and a second position, where a distance between the first position and the open end along the radiator is a quarter of a target wavelength, and a distance between the second position and the first feed point along the radiator is a half of the target wavelength. The first feed point is disposed at a position that deviates from the first position by a first preset value. The second feed point is disposed at a position that deviates from the second position by a second preset value.

(30) **Foreign Application Priority Data**

May 29, 2020 (CN) 202010471429.4





US 20230208049A1

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

(10) **Pub. No.: US 2023/0208049 A1**
(43) **Pub. Date: Jun. 29, 2023**

(54) **DUAL-FREQUENCY AND DUAL-POLARIZATION ANTENNA AND ELECTRONIC DEVICE**

H01Q 5/28 (2006.01)

(71) Applicant: **HONG FU JIN PRECISION INDUSTRY (WuHan) CO., LTD.**

(52) U.S. Cl.
CPC *H01Q 21/24* (2013.01); *H01Q 1/241* (2013.01); *H01Q 5/28* (2015.01)

(72) Inventor: **HSIN-NAN HU, New Taipei (TW)**

(57) **ABSTRACT**

(73) Assignee: **HONG FU JIN PRECISION INDUSTRY (WuHan) CO., LTD., Wuhan (CN)**

A dual-frequency and dual-polarization antenna for simultaneously transmitting and receiving dual-frequency 5G signals comprises a first substrate; a first polarization antenna comprising a first radiation portion disposed on a first surface of the first substrate and a second radiation portion disposed on a second surface of the first substrate; a second polarization antenna comprising a third radiation portion disposed on the first surface of the first substrate and a fourth radiation portion disposed on the second surface of the first substrate; a second substrate located in a side of the second surface of the first substrate, a surface of the second substrate close to the first substrate is a copper-clad surface; and layout directions of the first polarization antenna and the second polarization antenna are orthogonal to each other in the first substrate. An electronic device comprising the dual-frequency and dual-polarization antenna is also provided.

(21) Appl. No.: **17/631,055**

(22) PCT Filed: **Apr. 26, 2021**

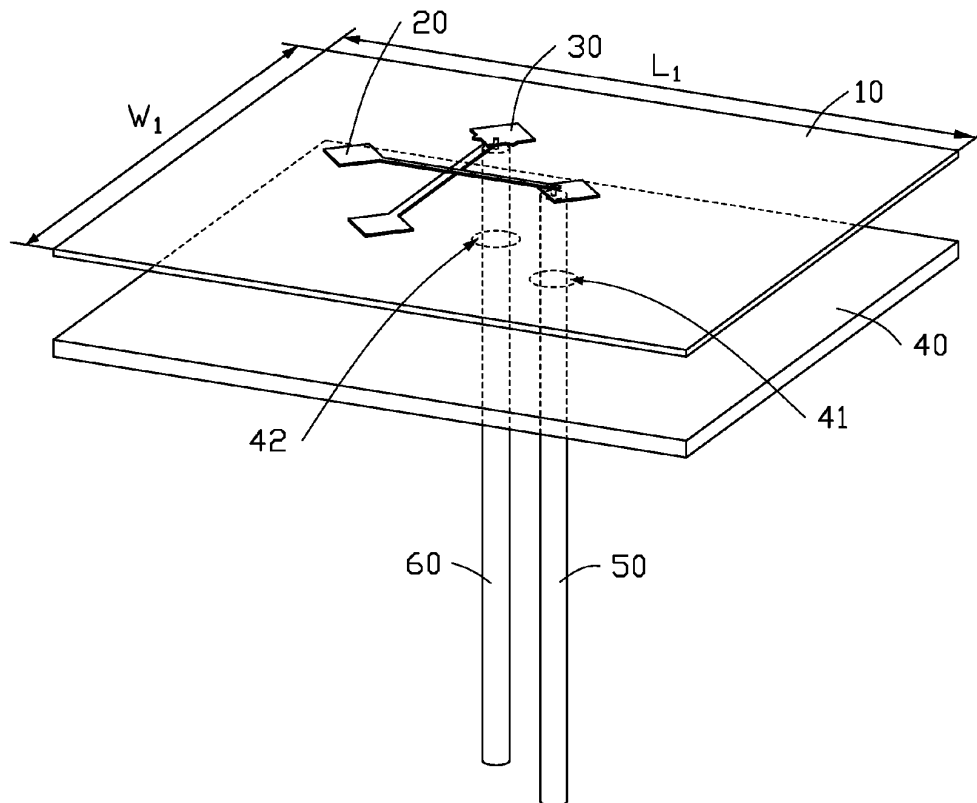
(86) PCT No.: **PCT/CN2021/089997**

§ 371 (c)(1),
(2) Date: **Jan. 28, 2022**

Publication Classification

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

100





US 20230216177A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0216177 A1**

(43) **Pub. Date: Jul. 6, 2023**

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

(52) **U.S. Cl.**
CPC **H01Q 1/2291** (2013.01); **H01Q 5/357** (2015.01)

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

(57) **ABSTRACT**

(72) Inventors: **Meng-Kai WU**, HSINCHU (TW);
Hong-Jun JIAN, HSINCHU (TW)

An electronic device is provided. The electronic device includes an antenna structure and a housing. The antenna structure includes a first radiating element, a grounding element, and a second radiating element. The first radiating element includes a first radiating portion and a grounding portion. Two ends of the grounding portion are respectively connected with the first radiating portion and the grounding element. The first radiating portion, the grounding portion and the grounding element form a surrounding structure. The second radiating element includes a second radiating portion, a third radiating portion, a fourth radiating portion, and a feeding portion connected between the second radiating portion, the third radiating portion and the fourth radiating portion. The second radiating portion and the first radiating portion are separated from each other and couple to each other.

(21) Appl. No.: **17/834,002**

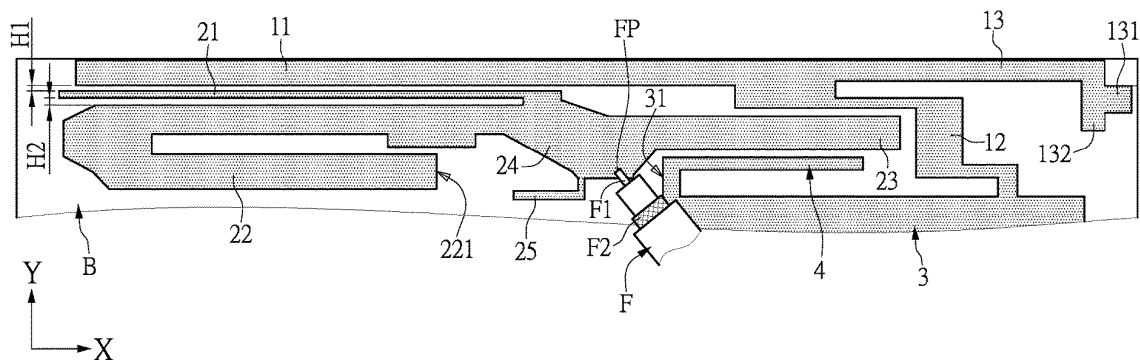
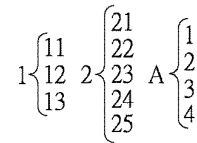
(22) Filed: **Jun. 7, 2022**

(30) **Foreign Application Priority Data**

Jan. 3, 2022 (TW) 111100008

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 5/357 (2006.01)





US 20230216204A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0216204 A1**

(43) **Pub. Date: Jul. 6, 2023**

(54) **SMALL CELL ACCESS NODE AND ANTENNA SUPPORT BRACKET FOR USE THEREIN**

(52) **U.S. Cl.**
CPC **H01Q 1/12** (2013.01); **H01Q 13/0266** (2013.01); **H01Q 13/065** (2013.01)

(71) Applicant: **UBICQUIA, INC.**, FORT LAUDERDALE, FL (US)

(57) **ABSTRACT**

(72) Inventors: **Claudio Santiago Ribeiro**, Evanston, IL (US); **Cesar Eduardo Nunez**, Miramar, FL (US)

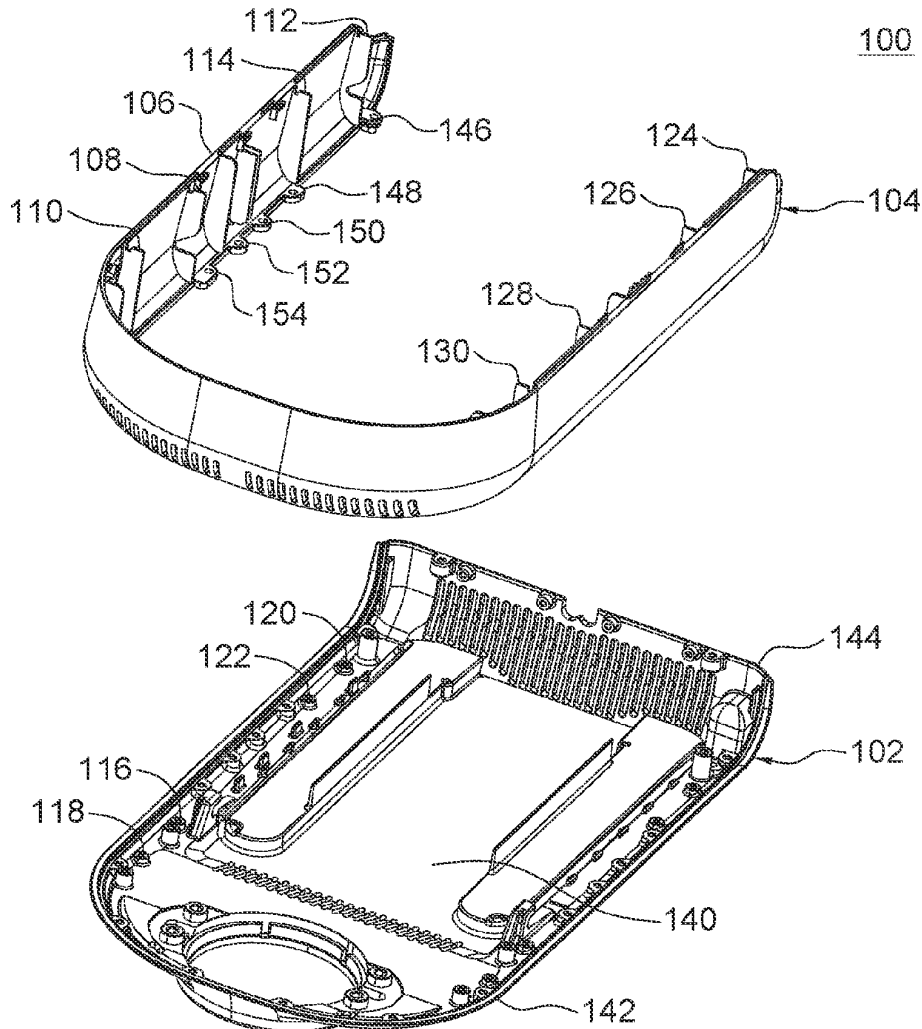
A small cell includes a housing and an antenna support bracket mountable within the housing. The bracket includes a base member and a flange member. The base member supports a substrate of an antenna. The flange member is positioned along a first edge of the base member and extends away from the base member in a first direction. The flange member includes at least one generally hook-shaped arm member configured to engage a hook receiving element integrated with or attached to a sidewall of the small cell housing. The antenna support bracket may further include a second flange member positioned along a second edge of the base member and extending in a second direction opposite to the first direction. A non-conductive spacer may be adhered to a surface of the second flange member to provide electrical isolation between an electrically conductive fastener and the surface of the second flange member.

(21) Appl. No.: **17/566,653**

(22) Filed: **Dec. 30, 2021**

Publication Classification

(51) **Int. Cl.**
H01Q 1/12 (2006.01)
H01Q 13/02 (2006.01)
H01Q 13/06 (2006.01)





US 20230221775A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0221775 A1**

(43) **Pub. Date: Jul. 13, 2023**

(54) **ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
G06F 1/16 (2006.01)
H01Q 1/22 (2006.01)
H01Q 1/36 (2006.01)

(72) Inventors: **Jangsun YOO**, Suwon-si (KR);
Kwanghyun KIM, Suwon-si (KR);
Myeonggil LEE, Suwon-si (KR); **Jihye**
MOON, Suwon-si (KR); **Kyueun**
PARK, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *G06F 1/1688* (2013.01); *H01Q 1/2266*
(2013.01); *G06F 1/1656* (2013.01); *G06F*
1/1698 (2013.01); *H01Q 1/36* (2013.01)

(21) Appl. No.: **18/188,057**

(57) **ABSTRACT**

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

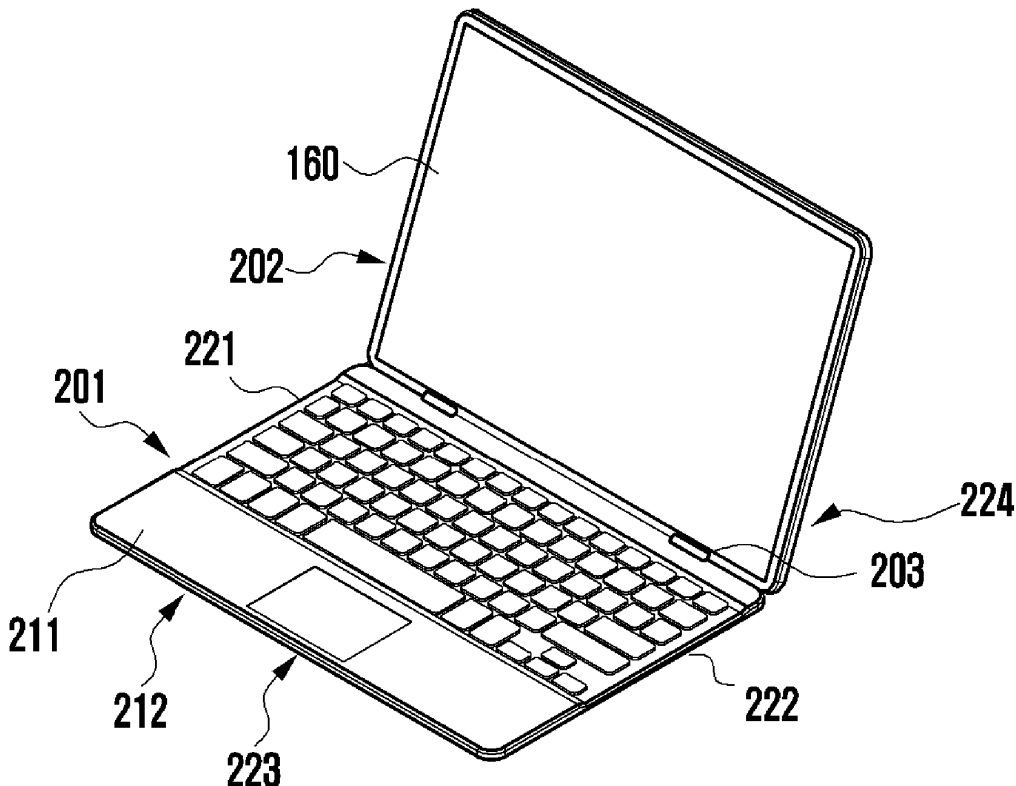
An electronic device including a housing is provided. The electronic device includes a display module, a communication module, a processor, and a speaker, wherein the speaker includes a speaker enclosure in which a first case and a second case are combined, and the speaker enclosure is arranged in the inner space of the housing and spaced apart from the housing at a predetermined interval, a first antenna pattern is arranged on the surface of the first case, a second antenna pattern is arranged on the surface of the second case, the first antenna pattern and the second antenna pattern are electrically coupled to each other, and the first antenna pattern and the second antenna pattern may be arranged to prevent overlapping with a speaker component arranged inside the speaker enclosure.

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/012992, filed on Sep. 24, 2021.

Foreign Application Priority Data

(30) Sep. 24, 2020 (KR) 10-2020-0124270





US 20230223675A1

(19) **United States**
(12) **Patent Application Publication**
YOO et al.

(10) **Pub. No.: US 2023/0223675 A1**
(43) **Pub. Date: Jul. 13, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNAS**

Publication Classification

(71) Applicant: **Samsung Electronics Co., Ltd.**, Suwon-si (KR)
(72) Inventors: **Jangsun YOO**, Suwon-si (KR); **Myeonggil LEE**, Suwon-si (KR); **Donguk CHOI**, Suwon-si (KR); **Gun LIM**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 5/307 (2006.01)
H01Q 1/48 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/2266* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/307* (2015.01)

(21) Appl. No.: **18/122,767**

(57) **ABSTRACT**

(22) Filed: **Mar. 17, 2023**

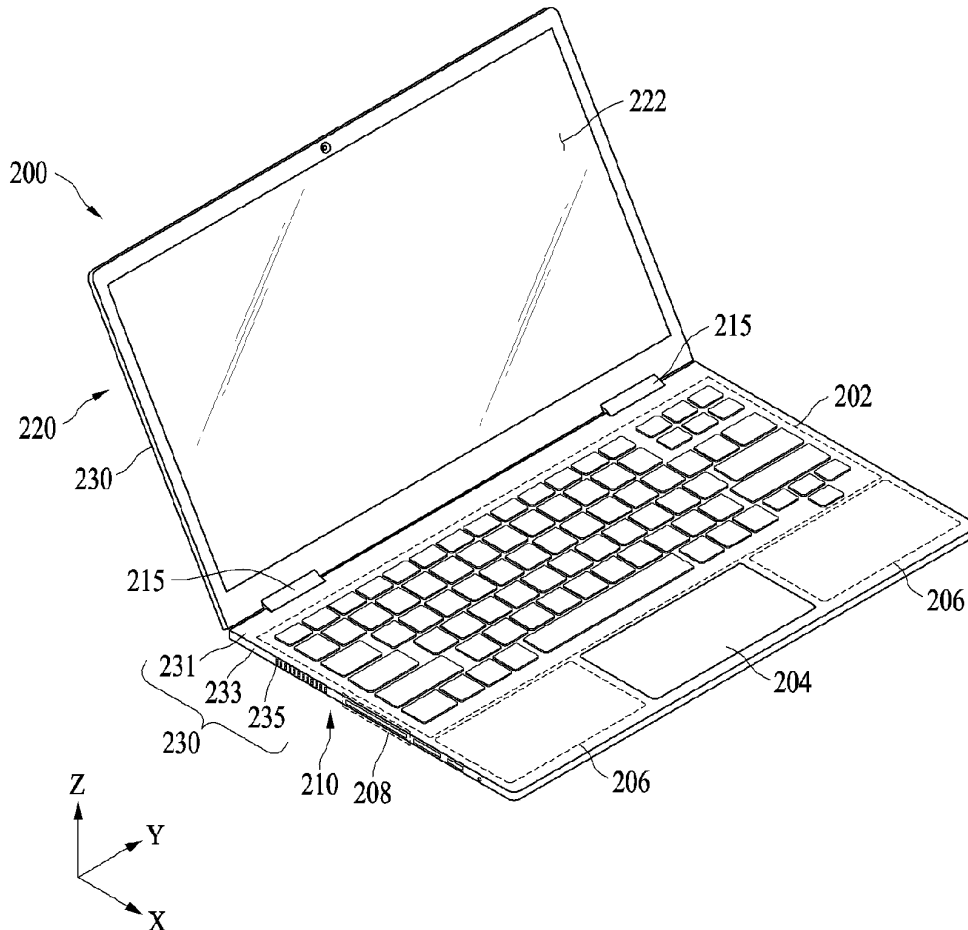
Related U.S. Application Data

An electronic device may include a housing including a first cover, a second cover, and a slot positioned in a first side surface. A first antenna is positioned between a first inner surface and a second inner surface, facing the slot, and configured to operate in a first frequency band, and a second antenna is positioned between the first inner surface and the second inner surface, facing the first antenna, and configured to operate in a second frequency band different from the first frequency band.

(63) Continuation of application No. PCT/KR2022/016079, filed on Oct. 20, 2022.

(30) **Foreign Application Priority Data**

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Dec. 2, 2021 (KR) 10-2021-0170555





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(19) **United States**

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

(10) **Pub. No.: US 2023/0223677 A1**

(43) **Pub. Date: Jul. 13, 2023**

(54) **ANTENNA AND TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/328 (2006.01)
H01Q 5/50 (2006.01)
H01Q 9/42 (2006.01)

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

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 5/328* (2015.01); *H01Q 5/50* (2015.01); *H01Q 9/42* (2013.01)

(21) Appl. No.: **17/915,763**

(57) **ABSTRACT**

(22) PCT Filed: **Mar. 31, 2021**

An antenna includes a first radiator, a second radiator, and a feed. The first radiator has a first feed point and a first ground point. The second radiator has a second feed point and a second ground point. The antenna further includes a connection line. The connection line has a first end and a second end that are opposite to each other. The first end is coupled to the first feed point of the first radiator, and the second end is coupled to the second feed point of the second radiator. A feeding point is disposed on the connection line, and the feeding point is coupled to the feed.

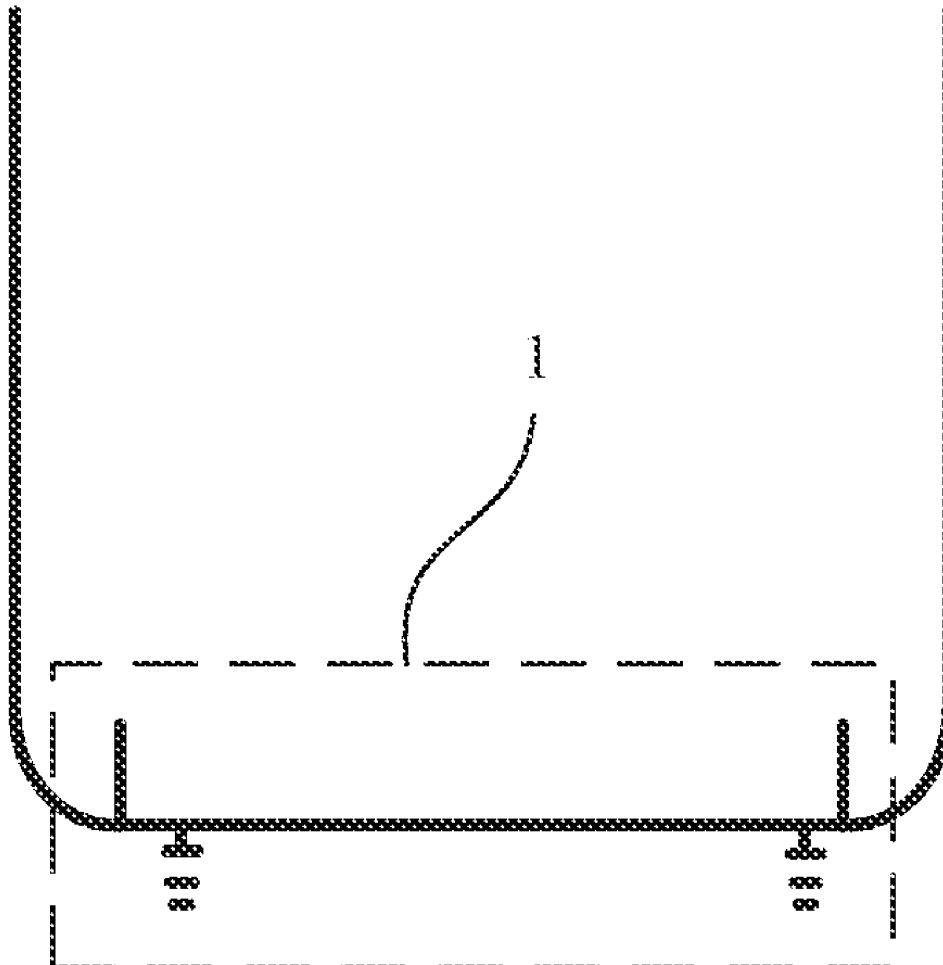
(86) PCT No.: **PCT/CN2021/084786**

§ 371 (c)(1),

(2) Date: **Sep. 29, 2022**

(30) **Foreign Application Priority Data**

Mar. 31, 2020 (CN) 202010247465.2





US 20230223689A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0223689 A1**

(43) **Pub. Date: Jul. 13, 2023**

(54) **ANTENNA SYSTEM**

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

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

CPC **H01Q 5/307** (2015.01); **H01Q 9/42** (2013.01); **H01Q 1/48** (2013.01)

(72) Inventors: **Wei-Tung YANG**, Hsinchu (TW);
Tsun-Che HUANG, Hsinchu (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/818,063**

An antenna system includes a dielectric substrate, a ground element, and a first antenna element. The dielectric substrate has a first surface and a second surface, which are opposite to each other. The ground element is disposed on the first surface of the dielectric substrate. The first antenna element includes a first radiation element, a feeding radiation element, a second radiation element, and a shorting radiation element. The first radiation element has a feeding point, and is disposed on the second surface of the dielectric substrate. The feeding radiation element is adjacent to the first radiation element. The second radiation element is coupled to the feeding radiation element. The second radiation element is further coupled through the shorting radiation element to the ground element.

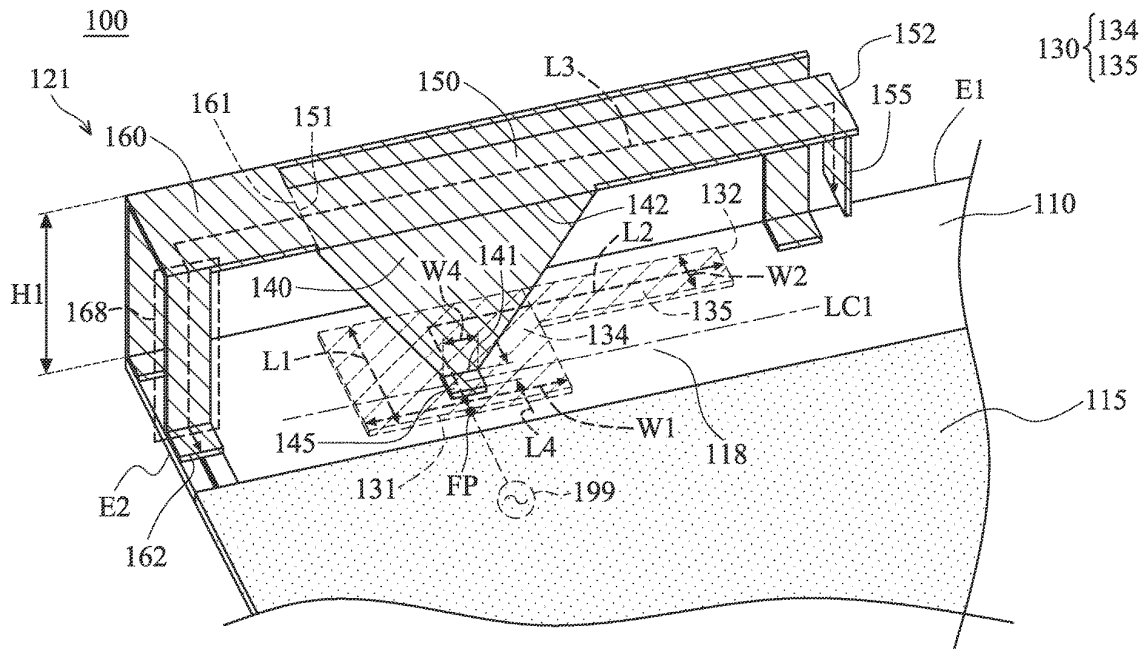
(22) Filed: **Aug. 8, 2022**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**
H01Q 5/307 (2006.01)
H01Q 9/42 (2006.01)
H01Q 1/48 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2023/0223690 A1**

(43) **Pub. Date: Jul. 13, 2023**

(54) **ANTENNA MODULE AND COMMUNICATION DEVICE INCORPORATING THE SAME**

Publication Classification

(71) Applicant: **Murata Manufacturing Co., Ltd.**,
Kyoto (JP)

(51) **Int. Cl.**
H01Q 5/314 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/52 (2006.01)
H01Q 1/24 (2006.01)
H01Q 13/10 (2006.01)

(72) Inventors: **Yasuo TANBO**, Kyoto (JP); **Masahiro IZAWA**, Kyoto (JP)

(52) **U.S. Cl.**
CPC **H01Q 5/314** (2015.01); **H01Q 1/48** (2013.01); **H01Q 1/521** (2013.01); **H01Q 1/24** (2013.01); **H01Q 13/106** (2013.01)

(21) Appl. No.: **18/184,061**

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

(57) **ABSTRACT**

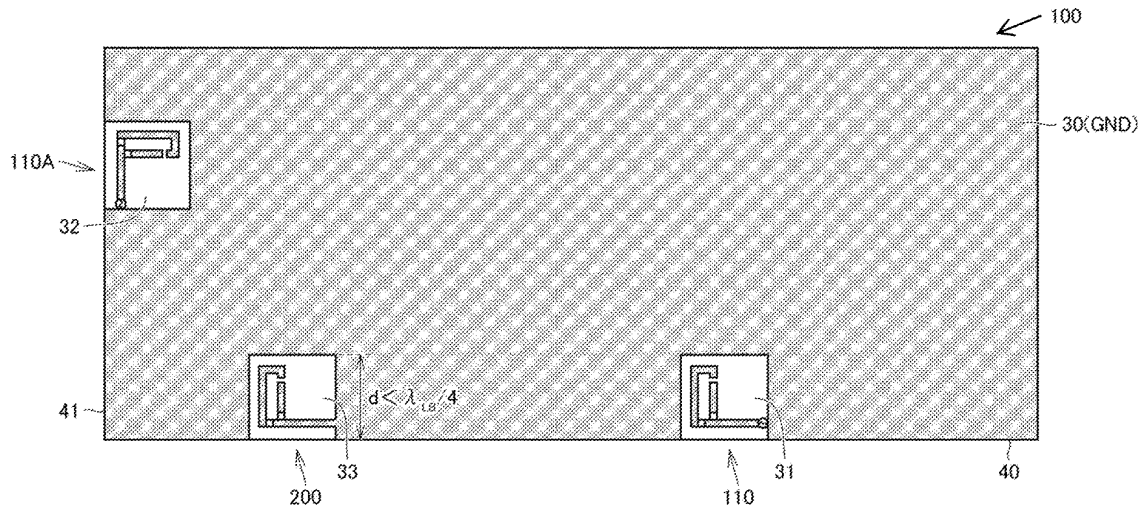
An antenna module (10) includes a ground electrode (30) in which a slit (33) is formed in such a manner as to form an opening along a perimeter of the ground electrode, a first antenna (110) and a second antenna (110A) arranged in or on the ground electrode (30), and a coupling reducing electrode (200) connected to the ground electrode (30) within the slit (33). The slit (33) is formed on a path leading from the first antenna (110) to the second antenna (110A) along the perimeter of the ground electrode. The coupling reducing electrode (200) includes a first conductor (220) having a length corresponding to a first frequency and a second conductor (230) having a length corresponding to a second frequency, which is higher than the first frequency.

Related U.S. Application Data

(63) Continuation-in-part of application No. 17/369,370, filed on Jul. 7, 2021, which is a continuation of application No. PCT/JP2020/002728, filed on Jan. 27, 2020.

Foreign Application Priority Data

(30) Feb. 1, 2019 (JP) 2019-016980





US 20230223693A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0223693 A1**

(43) **Pub. Date: Jul. 13, 2023**

(54) **ELECTRONIC DEVICE COMPRISING
PATCH ANTENNA AND COIL ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/25 (2006.01)
H01Q 1/24 (2006.01)
H01Q 7/00 (2006.01)

(72) Inventors: **Woosup LEE**, Suwon-si (KR); **Seho
PARK**, Suwon-si (KR); **Soon PARK**,
Suwon-si (KR); **Jungoh SUNG**,
Suwon-si (KR); **Haekwon LEE**,
Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 9/0407* (2013.01); *H01Q 5/25*
(2015.01); *H01Q 1/243* (2013.01); *H01Q 7/00*
(2013.01)

(21) Appl. No.: **18/121,906**

(57) **ABSTRACT**

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

An electronic device, according to various embodiments of the present disclosure, may comprise: a first layer including a first antenna having a patch shape, and a second antenna at least partially surrounding the first antenna and having a coil shape; a second layer including a first pattern disposed at a position corresponding to the first antenna and configured to operate as a ground of the first antenna, and a second pattern electrically connected to the second antenna; a dielectric disposed between the first layer and the second layer; and a magnetic material disposed under the dielectric at a position corresponding to the second antenna.

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/
011603, filed on Aug. 30, 2021.

Foreign Application Priority Data

(30) Sep. 16, 2020 (KR) 10-2020-0118847

