



(19) **United States**

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

(10) **Pub. No.: US 2022/0019261 A1**

(43) **Pub. Date: Jan. 20, 2022**

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

Publication Classification

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

(51) **Int. Cl.**
G06F 1/16 (2006.01)
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC **G06F 1/1624** (2013.01); **H01Q 1/243**
(2013.01); **H04M 1/0277** (2013.01); **H04M**
1/0237 (2013.01); **H04M 1/0268** (2013.01);
G06F 1/1652 (2013.01)

(72) Inventors: **Jooyoung KANG**, Suwon-si (KR);
Yeonggyu YOON, Suwon-si (KR);
Inkuk YUN, Suwon-si (KR); **Wonho**
LEE, Suwon-si (KR); **Joungmin CHO**,
Suwon-si (KR); **Junyoung CHOI**,
Suwon-si (KR); **Yangwook KIM**,
Suwon-si (KR); **Byounguk YOON**,
Suwon-si (KR); **Hyunju HONG**,
Suwon-si (KR)

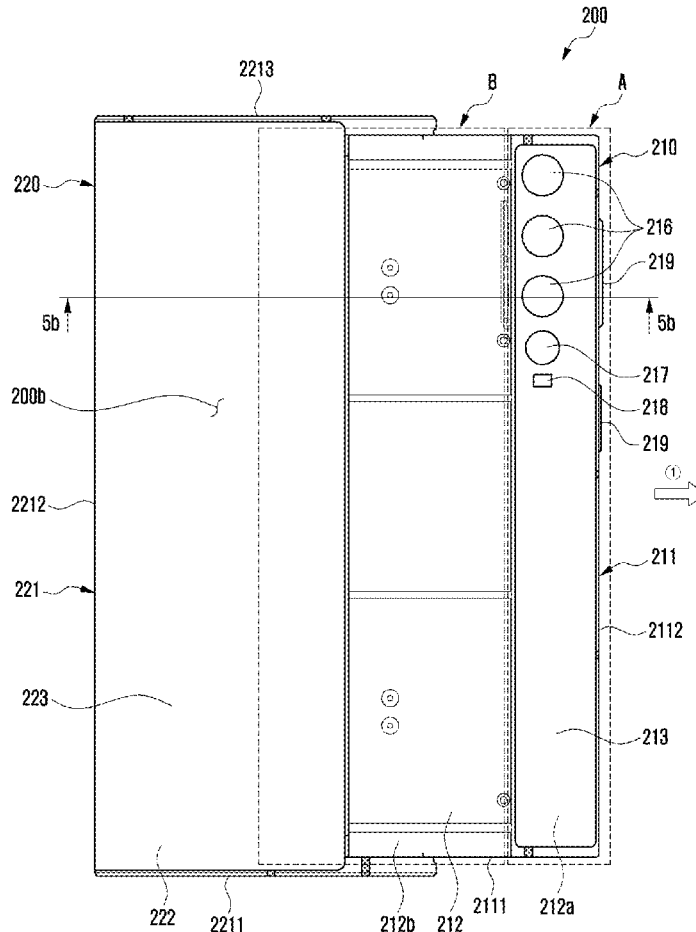
(57) **ABSTRACT**
An electronic device includes a first housing including a first space and including a first support member. The device includes a second housing including a second space, including a second support member, and slidably combined with the first housing. The device includes a bendable member connected to the first housing, being at least partly accommodated in a second space in a slide-in state, and at least partly forming the same plane with the first housing in a slide-out state. The device includes a flexible display including a first part disposed to be seen from an outside in the slide-in state, and a second part not seen from the outside. The device includes at least one first antenna and a wireless communication circuit configured to transmit or receive a wireless signal. The first support member includes a non-overlapping part not overlapping the second support member in the slide-in state.

(21) Appl. No.: **17/375,894**

(22) Filed: **Jul. 14, 2021**

(30) **Foreign Application Priority Data**

Jul. 14, 2020 (KR) 10-2020-0086795
Dec. 30, 2020 (KR) 10-2020-0187278





US 20220021105A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0021105 A1**

(43) **Pub. Date: Jan. 20, 2022**

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

H01Q 9/04 (2006.01)

H01Q 23/00 (2006.01)

(71) Applicant: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)

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

CPC *H01Q 1/243* (2013.01); *H01Q 23/00* (2013.01); *H01Q 9/0407* (2013.01); *H01Q 13/085* (2013.01)

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

(57)

ABSTRACT

An antenna module includes a substrate, a radiation portion, and an active circuit. The radiation portion and the active circuit are both arranged on the substrate. The radiation portion is a complete sheet body made of conductive material, at least one signal feed point is arranged on one side of the radiation portion to feed electrical signals to the radiation portion. The radiation portion defines at least one slot, the slot divides the radiation portion into radiation branches arranged at intervals. Each radiation branch is electrically connected to a signal feeding point, so as to feed electric signals to the radiation branch. The active circuit is electrically connected to the radiation portion to switch radiation modes of the radiation portion. The application also provides an electronic device with the antenna module.

(21) Appl. No.: **17/378,920**

(22) Filed: **Jul. 19, 2021**

Related U.S. Application Data

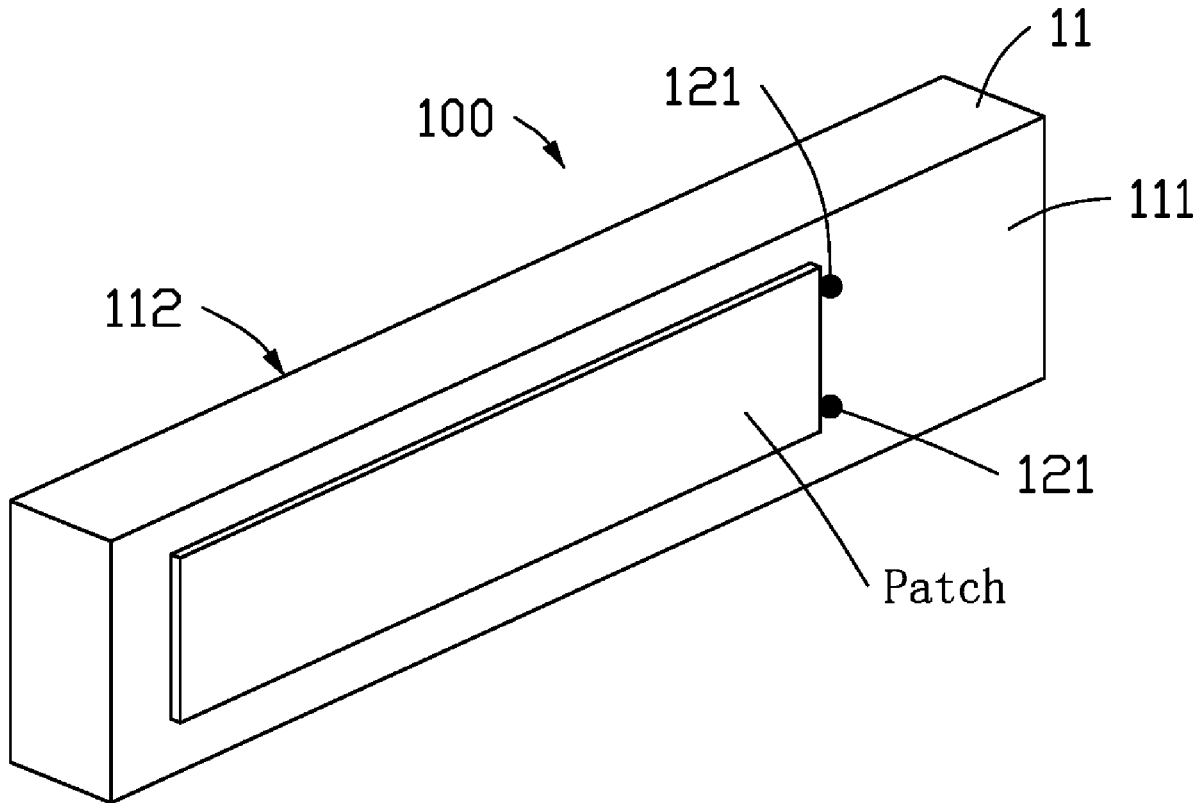
(60) Provisional application No. 63/052,611, filed on Jul. 16, 2020.

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 13/08 (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2022/0021108 A1**

(43) **Pub. Date: Jan. 20, 2022**

(54) **RADIATING ELEMENT OF ANTENNA AND ANTENNA**

(52) **U.S. Cl.**
CPC **H01Q 1/38** (2013.01); **H01Q 1/48** (2013.01); **H01Q 19/10** (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Aiguo WU**, Shenzhen (CN); **Hong FUWEN**, Shenzhen (CN); **Zhuo CHEN**, Shenzhen (CN)

The disclosure relates to a pre-5th-Generation (5G) or 5G communication system to be provided for supporting higher data rates Beyond 4th-generation (4G) communication system, such as long term evolution (LTE). A radiating element of an antenna is provided. The radiating element includes a vibrator radiating circuit board, wherein vibrator radiating arms arranged in pairs are printed on the vibrator radiating circuit board, a width of the vibrator radiating arms is less than one-half of a wavelength, a vibrator balun circuit board, configured to support the vibrator radiating circuit board, wherein a vibrator balun is printed on the vibrator balun circuit board, a height of the vibrator balun is at least less than one-fifth of the wavelength, the vibrator balun comprises at least one first slot. Based on the disclosure, especially for a large array base station and micro base station of 5G-massive multiple-input multiple-output (MIMO), the overall performance of the antenna, such as bandwidth, isolation, gain, cross polarization, or the like, may be improved, and the volume of the antenna is reduced with relatively small performance loss.

(21) Appl. No.: **17/492,164**

(22) Filed: **Oct. 1, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2020/004411, filed on Mar. 31, 2020.

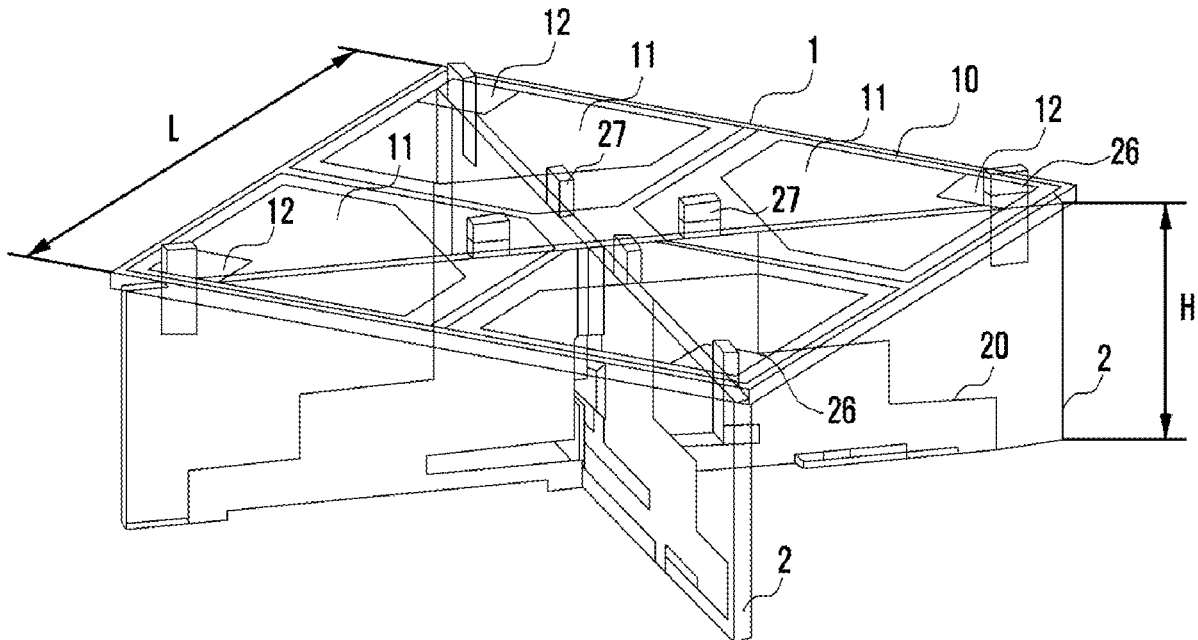
Foreign Application Priority Data

Apr. 1, 2019 (CN) 201910256652.4

Publication Classification

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 19/10 (2006.01)

100





(19) **United States**

(12) **Patent Application Publication**

WEN et al.

(10) **Pub. No.: US 2022/0021116 A1**

(43) **Pub. Date: Jan. 20, 2022**

(54) **SINGLE ANTENNA STRUCTURE CAPABLE OF OPERATING IN MULTIPLE BANDWIDTHS**

(71) Applicants: **Futaijing Precision Electronics (Yantai) Co., Ltd.**, Yantai (CN); **FIH (HONG KONG) LIMITED**, Kowloon (HK)

(72) Inventors: **HSIANG-NENG WEN**, New Taipei (TW); **CHI-SHENG LIU**, New Taipei (TW); **YUNG-YU TAL**, New Taipei (TW); **CHING-LING WU**, New Taipei (TW)

(21) Appl. No.: **17/105,958**

(22) Filed: **Nov. 27, 2020**

(30) **Foreign Application Priority Data**

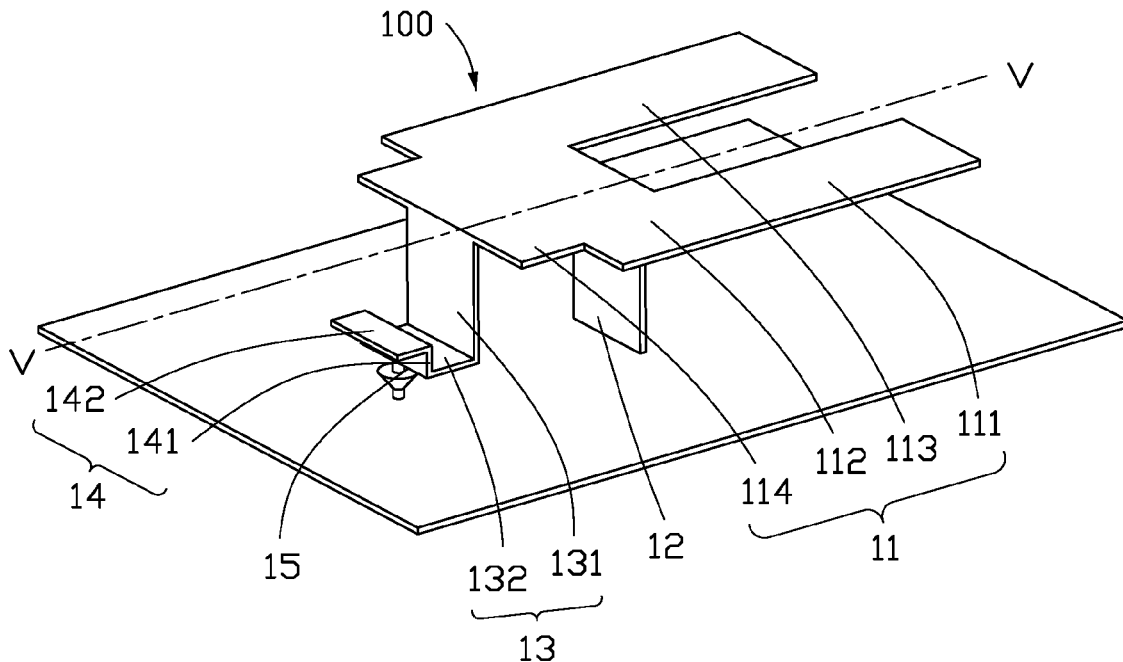
Jul. 14, 2020 (CN) 202010676482.8

Publication Classification

(51) **Int. Cl.**
H01Q 5/364 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/42 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
 CPC *H01Q 5/364* (2015.01); *H01Q 1/241* (2013.01); *H01Q 9/42* (2013.01); *H01Q 1/48* (2013.01)

(57) **ABSTRACT**
 An antenna structure with wide radiation bandwidth includes a first radiation portion, a ground portion, a connection portion, a second radiation portion, and a feed portion. The ground portion is positioned at a plane perpendicular to plane of the first radiation portion. The ground portion is grounded. The connection portion connects to one side of the first radiation portion. The second radiation portion connects to one side of the connection portion away from the first radiation portion. The feed portion is electrically connected to the connection portion and the second radiation portion for feeding current and signals to the antenna structure.





(19) **United States**

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

(10) **Pub. No.: US 2022/0021117 A1**

(43) **Pub. Date: Jan. 20, 2022**

(54) **SIGNAL FEEDING ASSEMBLY, ANTENNA
MODULE AND ELECTRONIC EQUIPMENT**

H01Q 25/04 (2006.01)

H01Q 1/24 (2006.01)

(71) Applicant: **Chiun Mai Communication Systems,
Inc.**, New Taipei (TW)

(52) **U.S. Cl.**
CPC *H01Q 5/371* (2015.01); *H01Q 1/243*
(2013.01); *H01Q 25/04* (2013.01); *H01Q 3/24*
(2013.01)

(72) Inventors: **Cho-Kang HSU**, New Taipei (TW);
Min-Hui HO, New Taipei (TW);
Yen-Hui LIN, New Taipei (TW);
Wei-Cheng SU, New Taipei (TW)

(57) **ABSTRACT**

A signal feeding assembly to a radiating element which is not formed from a metal frame or casing includes a substrate, a signal coupling unit, a switching unit, and a transmission unit. The switching unit includes at least two switching output ends. The transmission unit can transmit and receive a baseband signal and an RF signal. The signal coupling unit is spaced from a radiation element and can generate a plurality of radiation modes. The signal coupling unit includes at least two coupling pieces. Each coupling piece is electrically connected to a switching output end. The switching unit controls switching of the coupling pieces through the switching output ends and can switch a plurality of radiation modes. The application also provides an antenna module and an electronic device.

(21) Appl. No.: **17/374,020**

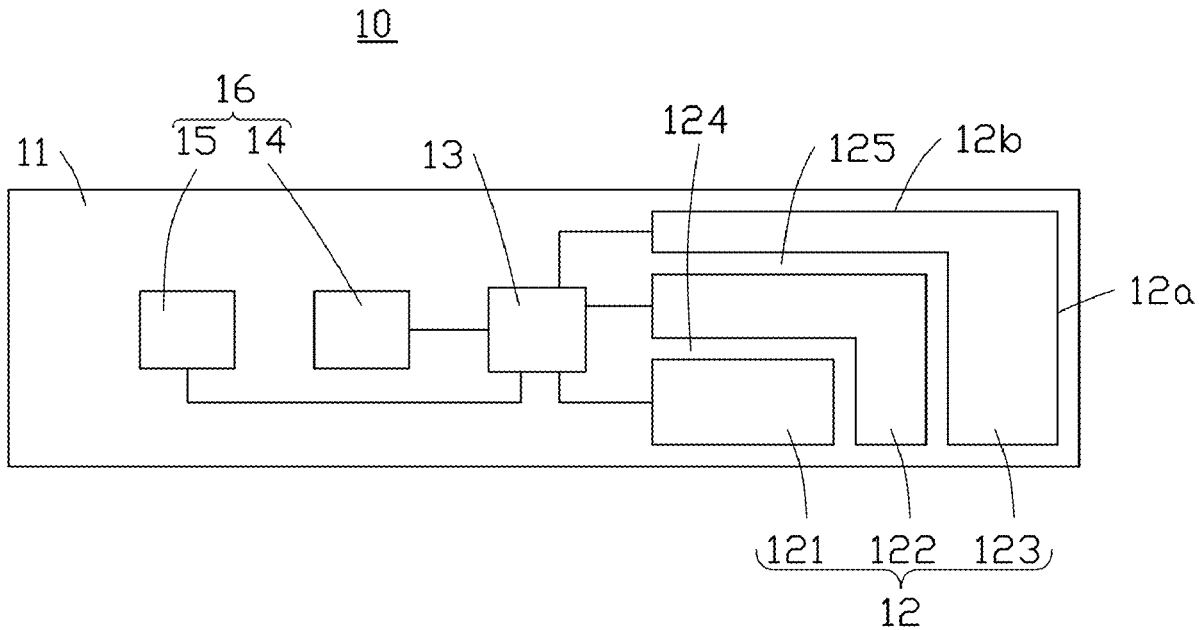
(22) Filed: **Jul. 13, 2021**

Related U.S. Application Data

(60) Provisional application No. 63/052,611, filed on Jul. 16, 2020.

Publication Classification

(51) **Int. Cl.**
H01Q 5/371 (2006.01)
H01Q 3/24 (2006.01)





(19) **United States**

(12) **Patent Application Publication**
HUANG

(10) **Pub. No.: US 2022/0021118 A1**

(43) **Pub. Date: Jan. 20, 2022**

(54) **ANTENNA STRUCTURE**

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

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

CPC **H01Q 7/04** (2013.01); **H01Q 9/42** (2013.01); **H01Q 13/10** (2013.01)

(72) Inventor: **Chun-Lin HUANG**, Hsinchu (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/335,329**

An antenna structure includes a loop radiation element, a balance radiation element, a first additional radiation element, and a second additional radiation element. The loop radiation element has a first feeding point. The balance radiation element has a second feeding point. The balance radiation element is coupled to at least a first connection point on the loop radiation element. The balance radiation element is substantially surrounded by the loop radiation element. The first additional radiation element is coupled to a second connection point on the loop radiation element. The second additional radiation element is coupled to a third connection point on the loop radiation element. The loop radiation element is disposed between the first additional radiation element and the second additional radiation element.

(22) Filed: **Jun. 1, 2021**

(30) **Foreign Application Priority Data**

Jul. 20, 2020 (TW) 109124394

Publication Classification

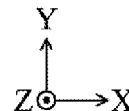
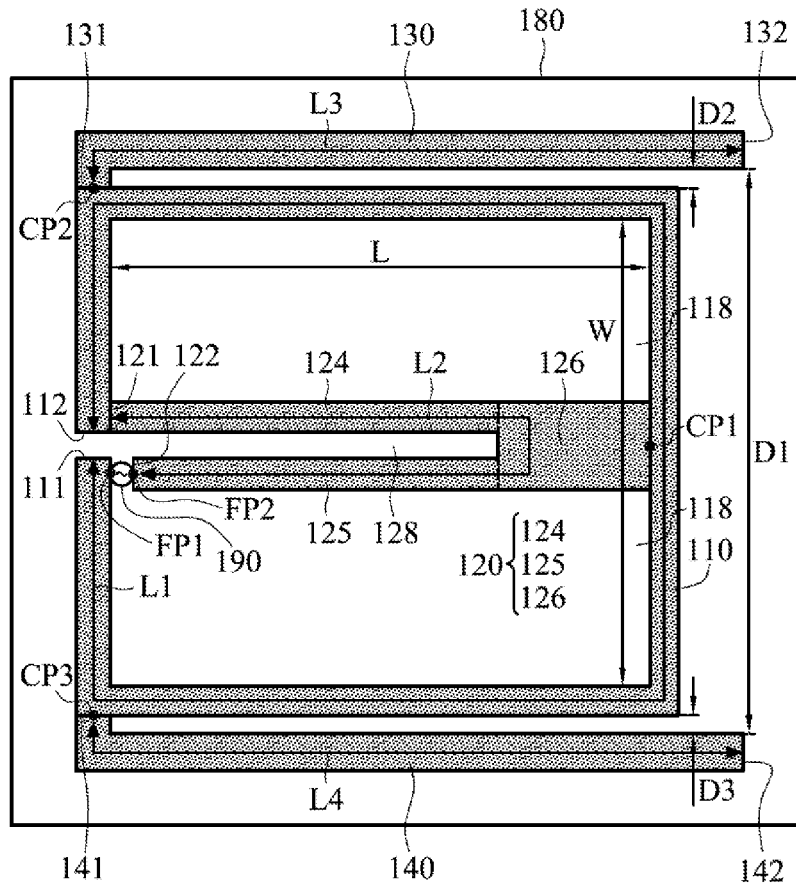
(51) **Int. Cl.**

H01Q 7/04 (2006.01)

H01Q 13/10 (2006.01)

H01Q 9/42 (2006.01)

100





US 20220021127A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0021127 A1**

(43) **Pub. Date: Jan. 20, 2022**

(54) **ELECTRONIC DEVICE WITH HIGH FREQUENCY MODULE**

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

(72) Inventors: **Dooil KIM**, Suwon-si (KR); **Sungyoul CHOI**, Suwon-si (KR); **Jung-Sun KWON**, Suwon-si (KR)

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

(21) Appl. No.: **17/230,124**

(22) Filed: **Apr. 14, 2021**

(30) **Foreign Application Priority Data**

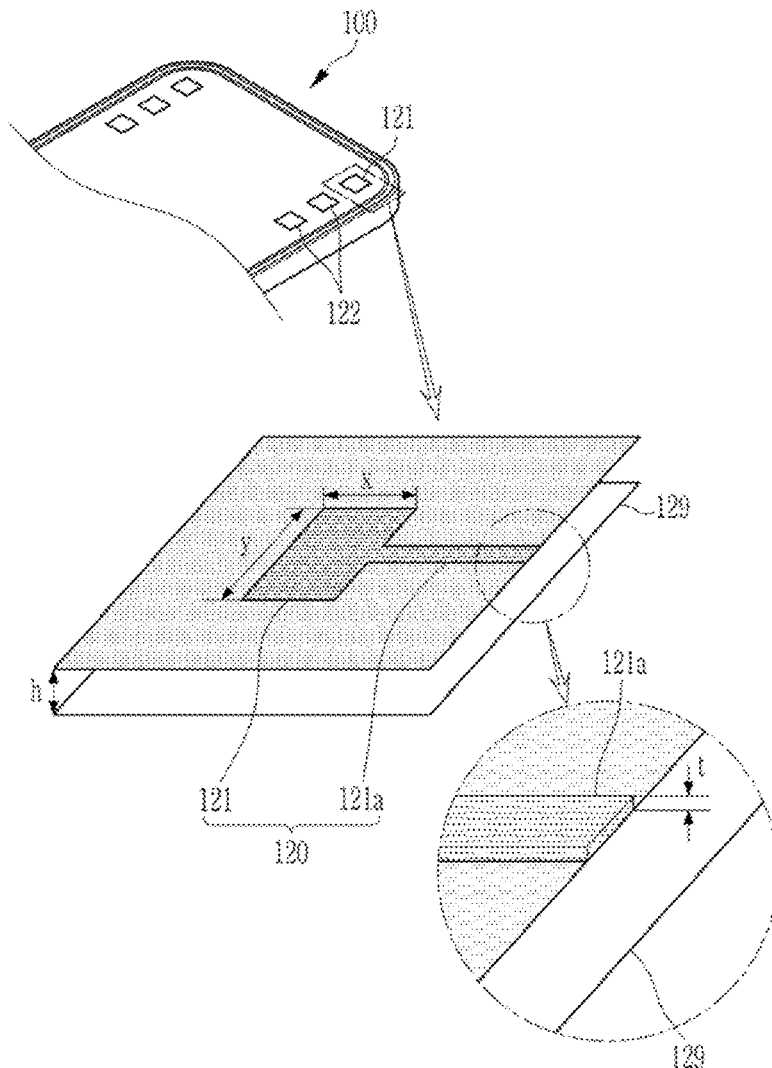
Jul. 15, 2020 (KR) 10-2020-0087627

Publication Classification

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 1/27 (2006.01)
G06F 3/041 (2006.01)
G06F 3/01 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 21/065* (2013.01); *G06F 3/017* (2013.01); *G06F 3/041* (2013.01); *H01Q 1/273* (2013.01)

(57) **ABSTRACT**

An electronic device including a high frequency module is disclosed. The electronic device includes a display panel configured to display an image; a first connecting member positioned on a lateral side or a rear side of the display panel; a radio frequency integrated circuit (RFIC) chip mounted on the first connecting member; an antenna disposed on a front side of the display panel; and a second connecting member configured to electrically connect the first connecting member and the antenna, and formed to be more flexible than the first connecting member.





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(19) **United States**

(12) **Patent Application Publication**
KIM

(10) **Pub. No.: US 2022/0021128 A1**

(43) **Pub. Date: Jan. 20, 2022**

(54) **ANTENNA APPARATUS**

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 21/00 (2006.01)
H01Q 5/35 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventor: **Sang Hyun KIM**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 21/065* (2013.01); *H01Q 21/0025*
(2013.01); *H01Q 1/241* (2013.01); *H01Q 1/48*
(2013.01); *H01Q 5/35* (2015.01)

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

(21) Appl. No.: **17/489,919**

(57) **ABSTRACT**

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

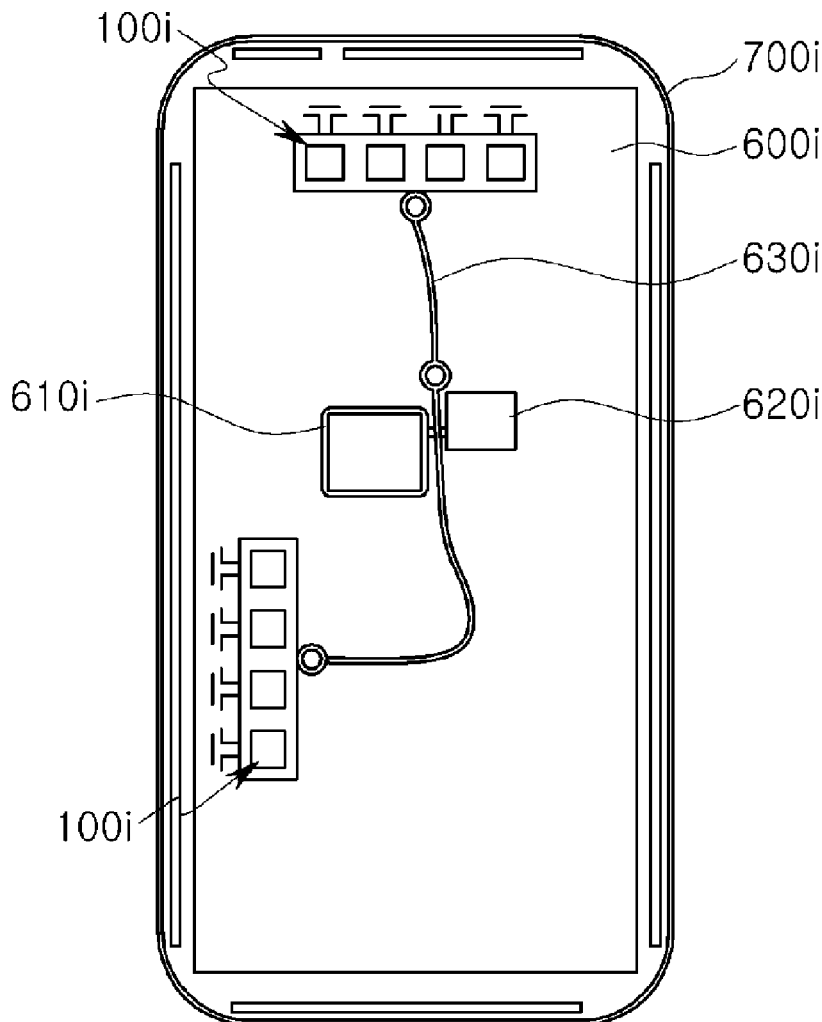
An antenna apparatus includes a ground plane; a first patch antenna pattern having a first bandwidth and spaced apart from the ground plane; a second patch antenna pattern spaced apart from the ground plane and the first patch antenna and overlapping at least a portion of the first patch antenna pattern; and guide vias disposed between the first patch antenna pattern and the ground plane and electrically connecting the first patch antenna pattern to the ground plane. The second patch antenna pattern has a second bandwidth corresponding a frequency higher than a frequency of the first bandwidth. The guide vias are disposed along a first side of the first patch antenna pattern.

Related U.S. Application Data

(63) Continuation of application No. 16/737,129, filed on
Jan. 8, 2020, now Pat. No. 11,165,168.

Foreign Application Priority Data

Jul. 31, 2019 (KR) 10-2019-0093172





US 20220029292A1

(19) **United States**

(12) **Patent Application Publication**
TAI

(10) **Pub. No.: US 2022/0029292 A1**

(43) **Pub. Date: Jan. 27, 2022**

(54) **DIPOLE ANTENNA**

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

CPC **H01Q 5/357** (2015.01); **H01Q 1/2291**
(2013.01)

(71) Applicants: **FOXCONN (KUNSHAN)**
COMPUTER CONNECTOR CO.,
LTD., Kunshan (CN); **FOXCONN**
INTERCONNECT TECHNOLOGY
LIMITED, Grand Cayman (KY)

(57) **ABSTRACT**

(72) Inventor: **LUNG-SHENG TAI,** New Taipei (TW)

A dipole antenna includes an elongate substrate and a first, second, and third conductive pieces on the substrate, the first conductive piece having a main part, a straight part, and a bent part, a free end of the straight part defining a feeding point, the second conductive piece having a bent portion, two U-shaped portions, and a ground portion, wherein the main part of the first conductive piece includes a connecting portion connected to the straight part, a meander portion connected at one end thereof to the connecting portion, and an end portion connected to an opposite end of the meander portion, and the straight part of the first conductive piece is disposed between the two U-shaped portions of the second conductive piece.

(21) Appl. No.: **17/381,450**

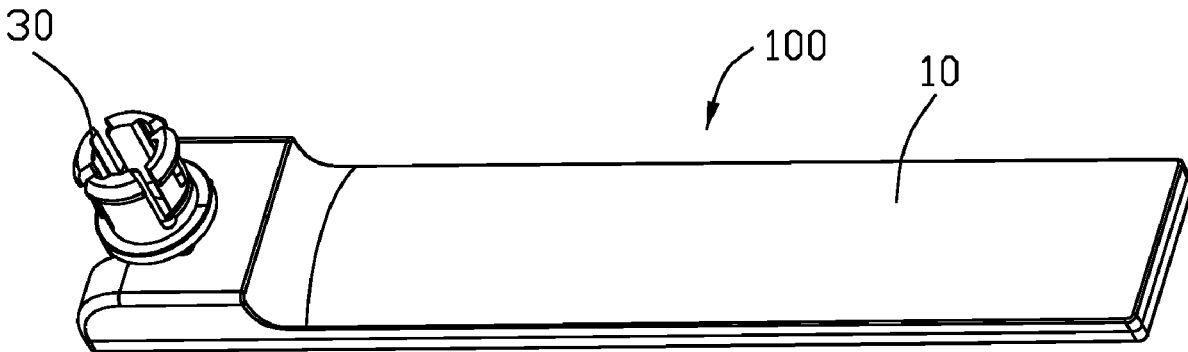
(22) Filed: **Jul. 21, 2021**

(30) **Foreign Application Priority Data**

Jul. 21, 2020 (CN) 202010702457.2

Publication Classification

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





(19) **United States**

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

(10) **Pub. No.: US 2022/0029294 A1**

(43) **Pub. Date: Jan. 27, 2022**

(54) **ANTENNA**

H01Q 9/40 (2006.01)

(71) Applicant: **FUJIKURA LTD.**, Tokyo (JP)

H01Q 21/29 (2006.01)

(72) Inventors: **Shailendra Kaushal**, Sakura-shi (JP);
Ning Guan, Sakura-shi (JP); **Asahi Kan**, Sakura-shi (JP)

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

H01Q 9/28 (2006.01)

CPC **H01Q 9/045** (2013.01); **H01Q 21/08** (2013.01); **H01Q 9/28** (2013.01); **H01Q 21/29** (2013.01); **H01Q 9/40** (2013.01)

(73) Assignee: **FUJIKURA LTD.**, Tokyo (JP)

(21) Appl. No.: **17/430,811**

(57) **ABSTRACT**

(22) PCT Filed: **Jul. 8, 2020**

(86) PCT No.: **PCT/JP2020/026674**

§ 371 (c)(1),

(2) Date: **Aug. 13, 2021**

(30) **Foreign Application Priority Data**

Jul. 29, 2019 (JP) 2019-138885

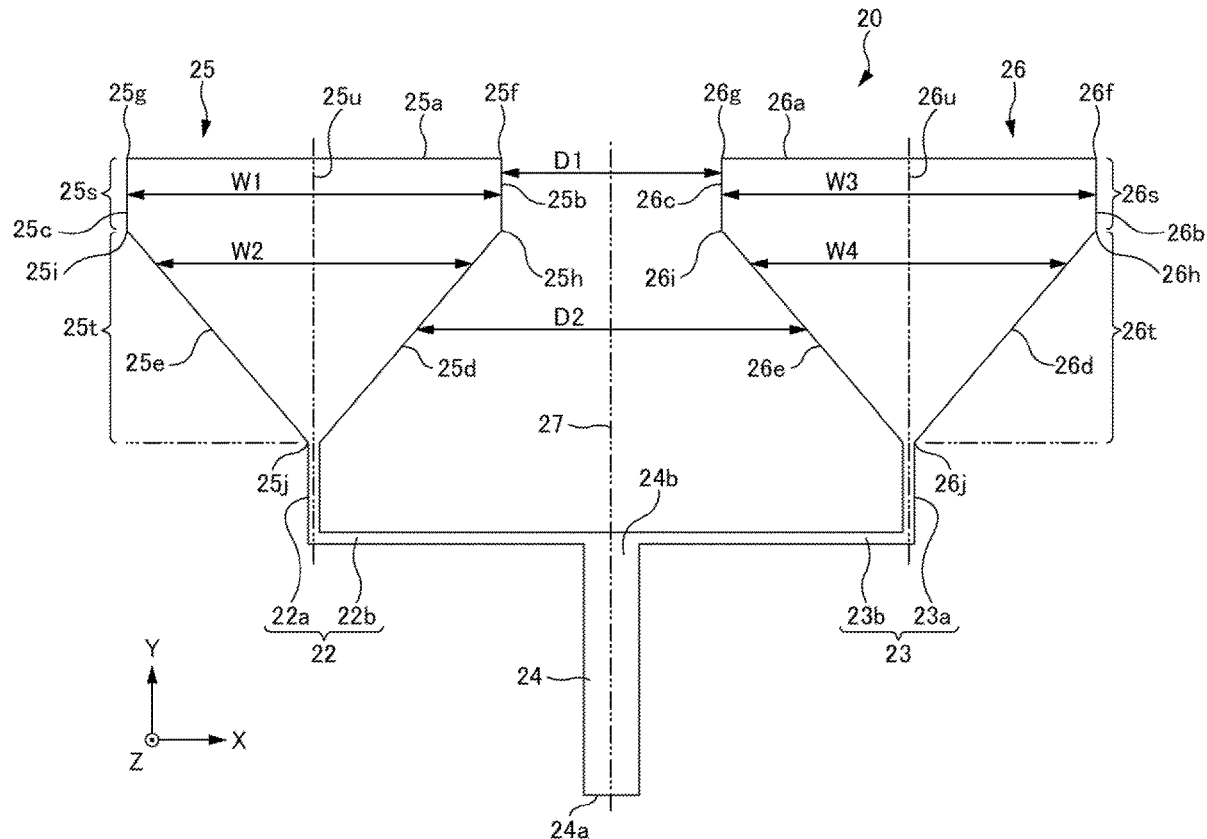
Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 21/08 (2006.01)

An antenna includes a dielectric layer, a conductive ground layer formed on a first main surface of the dielectric layer, and radiation elements formed on a second main surface of the dielectric layer and are conductive. The first radiation element includes a first non-uniform width part that has a width in a direction parallel to a first side in a linear shape opposed to a first vertex, and the width of the first non-uniform width part gradually decreases in a direction from the first side to the first vertex. The second radiation element includes a second non-uniform width part that has a width in a direction parallel to a second side in a linear shape opposed to a second vertex, and the width of the second non-uniform width part gradually decreases in a direction from the second side to the second vertex.





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(19) **United States**

(12) **Patent Application Publication**

JIN et al.

(10) **Pub. No.: US 2022/0029295 A1**

(43) **Pub. Date: Jan. 27, 2022**

(54) **PATCH ANTENNA STRUCTURE, AN ANTENNA FEEDER PLATE AND A BASE STATION TRANSCEIVER**

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

(72) Inventors: **Lukui JIN**, Guangzhou (CN); **Lei CAI**,
Guangzhou (CN); **Bingjian NIU**,
Guangzhou (CN)

(21) Appl. No.: **17/280,490**

(22) PCT Filed: **Nov. 9, 2018**

(86) PCT No.: **PCT/KR2018/013631**

§ 371 (c)(1),

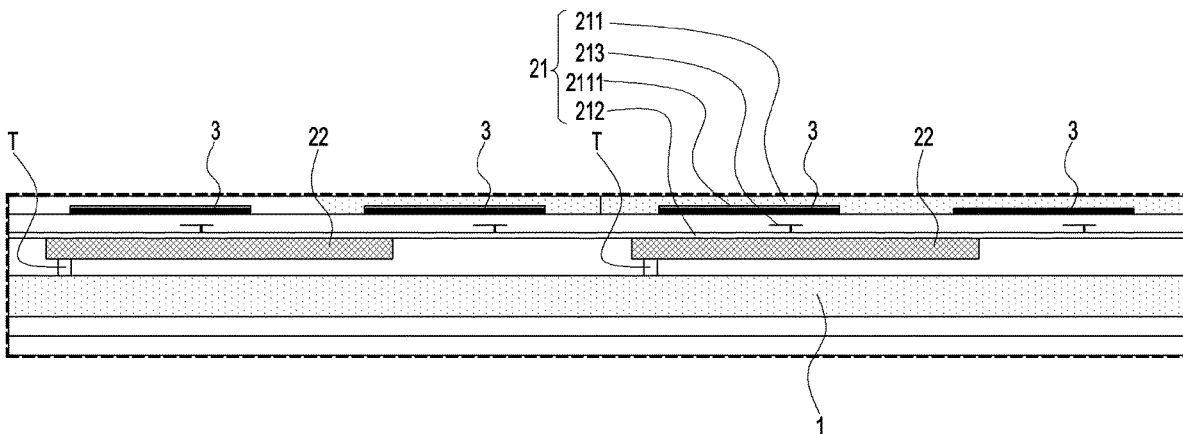
(2) Date: **Mar. 26, 2021**

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/42 (2006.01)
H01Q 1/24 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 9/0407* (2013.01); *H01Q 1/246*
(2013.01); *H01Q 1/42* (2013.01)

(57) **ABSTRACT**

A patch antenna structure is disclosed. The patch antenna structure includes a radome; a metal substrate disposed on one side of the radome and kept at a distance from the radome, a side wall of the radome facing to the metal substrate connecting with a feeding patch, or a side wall of the metal substrate facing to the radome connecting with a feeding patch; an antenna radiating patch attached to a side wall of the radome facing to the metal substrate, wherein the antenna radiating patch is kept at a certain distance from the metal substrate to maintain the radio frequency characteristics of the patch antenna.





US 20220029296A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0029296 A1**

(43) **Pub. Date: Jan. 27, 2022**

(54) **ANTENNA AND COMMUNICATION DEVICE**

(86) PCT No.: **PCT/JP2019/047901**

(71) Applicant: **JAPAN AVIATION ELECTRONICS
INDUSTRY, LIMITED**, Shibuya-ku,
Tokyo (JP)

§ 371 (c)(1),

(2) Date: **May 28, 2021**

Publication Classification

(72) Inventors: **Keishi KOSAKA**, Tokyo (JP); **Hiroshi
TOYAO**, Tokyo (JP); **Eiji HANKUI**,
Tokyo (JP); **Yasuhiko MATSUNAGA**,
Tokyo (JP)

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

(52) **U.S. Cl.**
CPC **H01Q 9/0457** (2013.01)

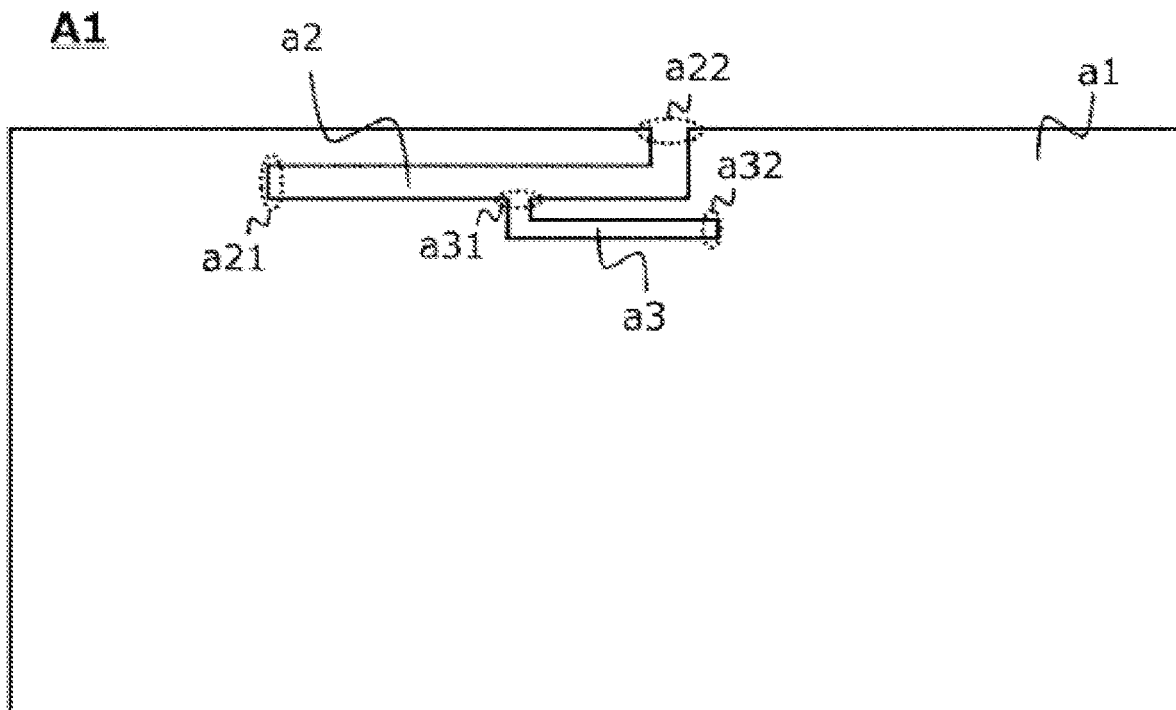
(73) Assignee: **JAPAN AVIATION ELECTRONICS
INDUSTRY, LIMITED**, Shibuya-ku,
Tokyo (JP)

(57) **ABSTRACT**

An antenna includes a conductor plate, for example. The conductor plate has a slot and a branch slot, wherein the branch slot has one end connected to the slot and another end which, when viewed from the one end, extends along the slot in an antinode direction of an electric field at the lowest-order resonant frequency of the antenna, and is closed in the conductor plate.

(21) Appl. No.: **17/298,288**

(22) PCT Filed: **Dec. 6, 2019**





US 20220029299A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0029299 A1**

(43) **Pub. Date: Jan. 27, 2022**

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

Publication Classification

(71) Applicant: **Realtek Semiconductor Corp.,**
HsinChu (TW)

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

(72) Inventors: **Ching-Wei Ling,** HsinChu (TW);
Chih-Pao Lin, HsinChu (TW)

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

(73) Assignee: **Realtek Semiconductor Corp.,**
HsinChu (TW)

(57) **ABSTRACT**

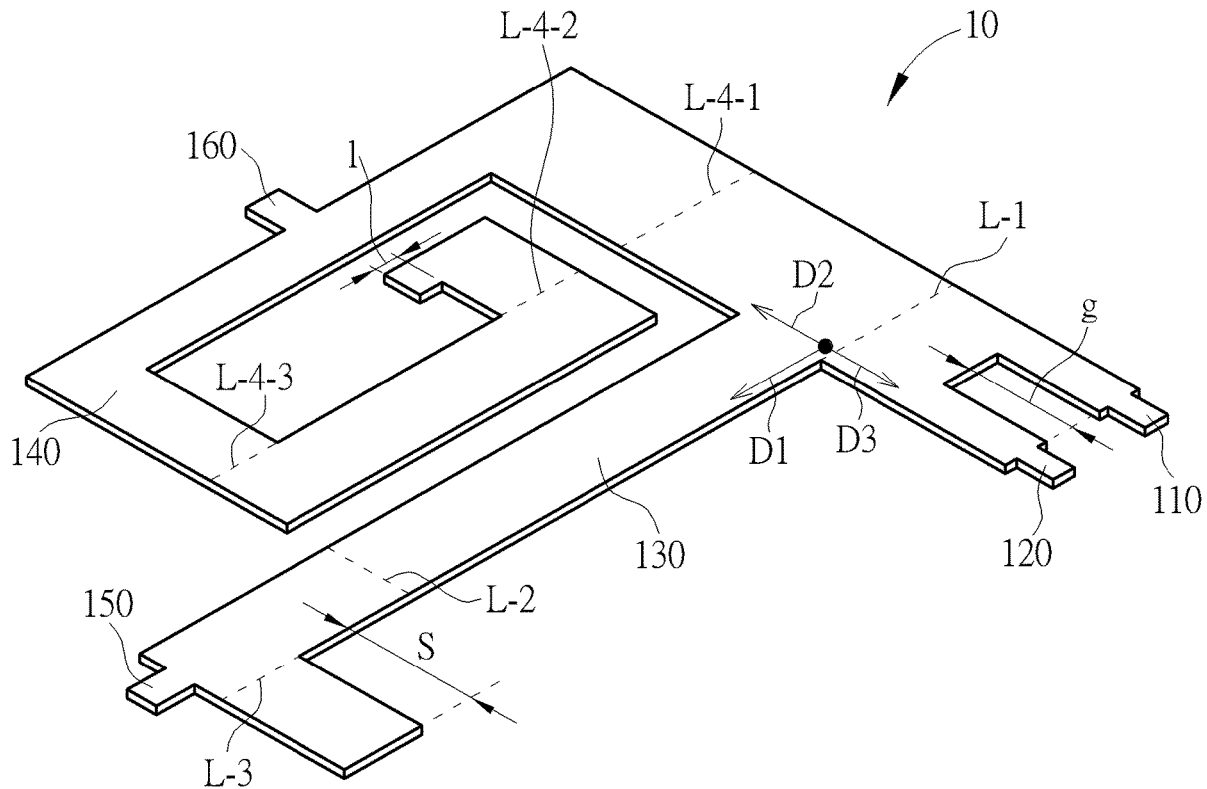
(21) Appl. No.: **17/349,864**

An antenna includes a radiation body and a feed pin. The radiation body includes a first radiation branch and a second radiation branch. The first radiation branch extends along a first direction. The second radiation branch extends along a second direction. The feed pin extends outward from the radiation body along a third direction. The first direction is perpendicular to the second direction and the third direction.

(22) Filed: **Jun. 16, 2021**

(30) **Foreign Application Priority Data**

Jul. 21, 2020 (TW) 109124589





US 20220029306A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0029306 A1**

(43) **Pub. Date: Jan. 27, 2022**

(54) **MICROSTRIP ANTENNA AND INFORMATION APPARATUS**

Publication Classification

(71) Applicants: **Space Power Technologies Inc.**,
Kyoto-shi (JP); **National University Corporation Saitama University**,
Saitama-shi (JP)

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 13/08 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 21/065* (2013.01); *H01Q 13/08* (2013.01)

(72) Inventors: **Minoru FURUKAWA**, Kyoto-shi (JP);
Zhewang MA, Saitama-shi (JP)

(57) **ABSTRACT**

(73) Assignees: **Space Power Technologies Inc.**,
Kyoto-shi (JP); **National University Corporation Saitama University**,
Saitama-shi (JP)

A microstrip antenna corresponds to a rectangular resonator. The resonator has first and second sides being parallel to a first direction and having a length corresponding to $\frac{3}{2}$ wavelength, and has a shape notched from each of the first and second sides toward a center of the resonator. The antenna includes: a first portion constituting a periphery of the notched shape; and second and third portions facing each other across the first portion. The notched shape allows the first portion to contribute to a radiation characteristic. The first, second, and third portions each have a length corresponding to $\frac{1}{2}$ wavelength in the first direction. The first portion has a width in the second direction that is narrower because of the notched shape than that of the second and third portions. The second or third portion is provided with a feeding point.

(21) Appl. No.: **17/494,237**

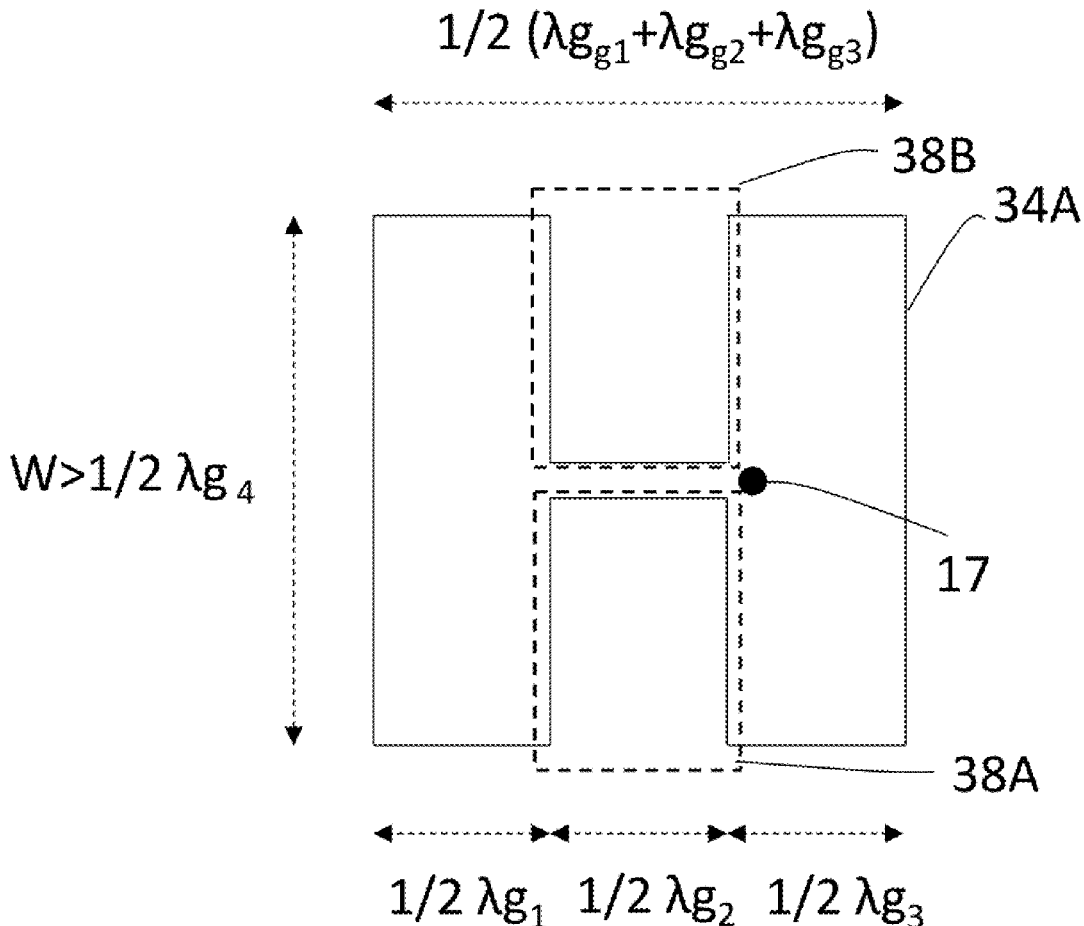
(22) Filed: **Oct. 5, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2020/035353, filed on Sep. 17, 2020.

Foreign Application Priority Data

Nov. 21, 2019 (JP) 2019-210671





US 20220037762A1

(19) **United States**

(12) **Patent Application Publication**
HAMABE

(10) **Pub. No.: US 2022/0037762 A1**

(43) **Pub. Date: Feb. 3, 2022**

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

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

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

(72) Inventor: **Taichi HAMABE**, Kanagawa (JP)

(57) **ABSTRACT**

(21) Appl. No.: **17/373,133**

(22) Filed: **Jul. 12, 2021**

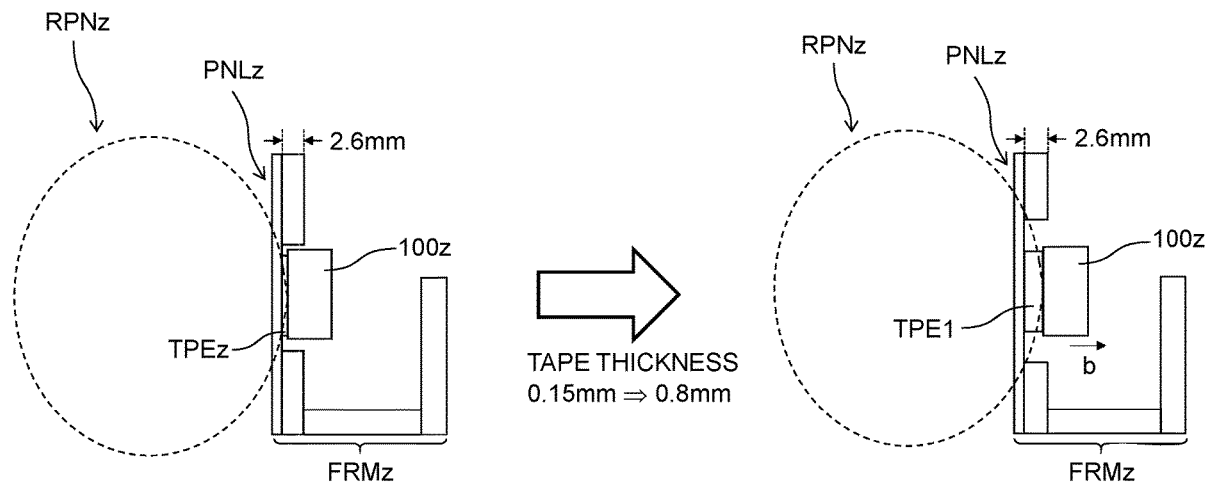
(30) **Foreign Application Priority Data**

Jul. 31, 2020 (JP) 2020-131023

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/24 (2006.01)

An antenna device includes: a feeding antenna conductor; a non-feeding antenna conductor; a ground conductor; a first artificial magnetic conductor disposed between the feeding antenna conductor and the non-feeding antenna conductor, and the ground conductor; and a second artificial magnetic conductor disposed side by side with the first artificial magnetic conductor and electrically connected to the ground conductor. The feeding antenna conductor and the non-feeding antenna conductor are disposed on the first artificial magnetic conductor.





US 20220037763A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0037763 A1**

(43) **Pub. Date: Feb. 3, 2022**

(54) **ANTENNA MODULE WHICH INCLUDES SIGNAL LINE EXPOSED TO OUTSIDE THROUGH ONE FACE OF PRINTED CIRCUIT BOARD AND INCLUDES CONDUCTIVE MEMBER ELECTRICALLY CONNECTED TO SIGNAL LINE, AND ELECTRONIC DEVICE INCLUDING SAME**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 21/06 (2006.01)
H01Q 1/38 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/38* (2013.01); *H01Q 21/06* (2013.01)

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

(72) Inventors: **Jihoon KIM**, Gyeonggi-do (KR);
Hyoseok NA, Gyeonggi-do (KR);
Jongin LEE, Gyeonggi-do (KR)

(57) **ABSTRACT**

An electronic device according to an embodiment disclosed herein includes a housing and a plurality of antenna modules disposed adjacent to an edge of the housing, wherein the plurality of antenna modules may include: a first antenna array including a printed circuit board, which includes a first face, a second face facing away from the first face, and a side face disposed between the first face and the second face, and a plurality of first antenna elements extending from a point on the first face to a point on the second face through the side face; and a second antenna array including a plurality of antenna elements disposed on the first face. In addition, various embodiments conceived through the specification are possible.

(21) Appl. No.: **17/297,868**

(22) PCT Filed: **Dec. 5, 2019**

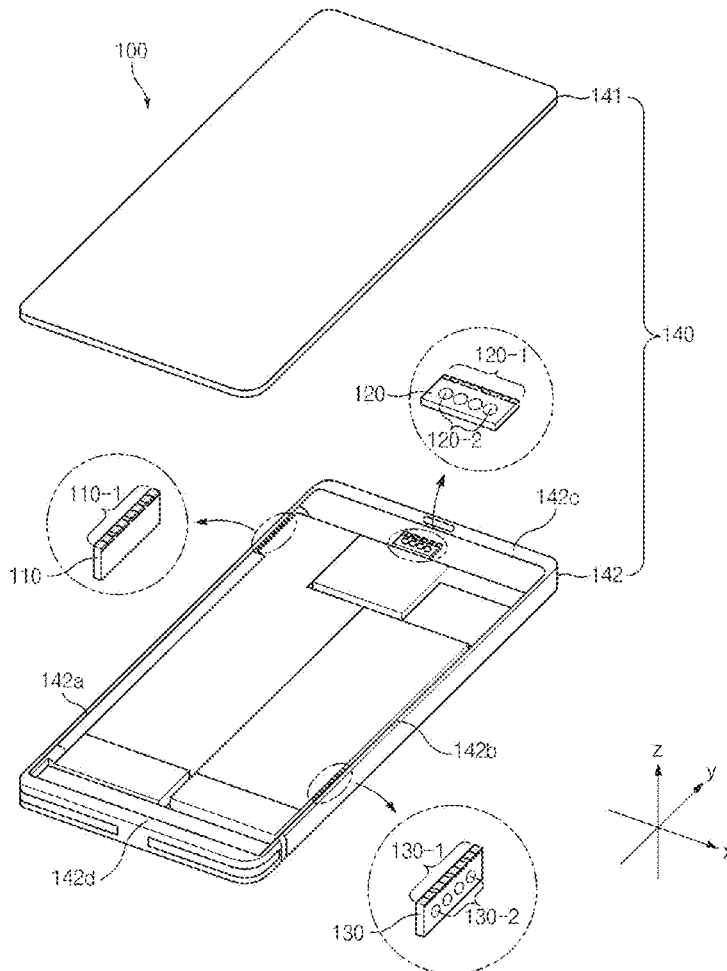
(86) PCT No.: **PCT/KR2019/017120**

§ 371 (c)(1),

(2) Date: **May 27, 2021**

(30) **Foreign Application Priority Data**

Dec. 5, 2018 (KR) 10-2018-0155141





US 20220037764A1

(19) **United States**

(12) **Patent Application Publication**

HSU et al.

(10) **Pub. No.: US 2022/0037764 A1**

(43) **Pub. Date: Feb. 3, 2022**

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

H01Q 1/36 (2006.01)

H01Q 1/50 (2006.01)

(71) Applicant: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 21/30* (2013.01); *H01Q 1/50* (2013.01); *H01Q 1/36* (2013.01); *H01Q 9/0421* (2013.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **17/355,564**

An antenna structure with multiple frequency and MIMO capabilities applied to an electronic device includes back board, side frame, first feed point, second feed point, and first ground point. The side frame defines at least a first gap and a second gap. The first and second gaps create first and second radiation portions from the side frame. The first feed point from a source feeds current and signal to the first radiation portion. The second feed point from a source feeds current and signal to the second radiation portion. The first ground point is positioned between the first and second feed points. When the first feed point and the second feed point supply current, the first radiation portion and the second radiation generate at least one common radiation frequency band together with others.

(22) Filed: **Jun. 23, 2021**

(30) **Foreign Application Priority Data**

Jul. 30, 2020 (CN) 202010754642.6

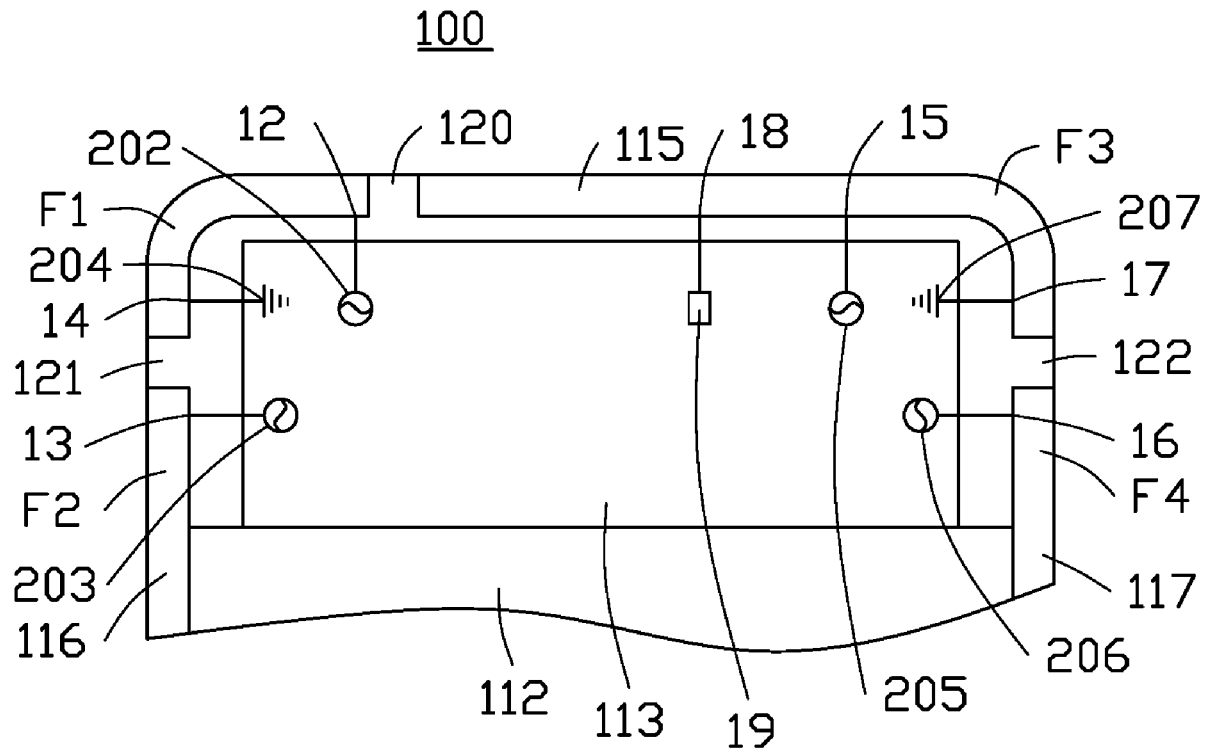
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 21/30 (2006.01)

H01Q 9/04 (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2022/0037787 A1**

(43) **Pub. Date: Feb. 3, 2022**

(54) **COMPACT ANTENNA, ANTENNA ARRAY AND TERMINAL**

Publication Classification

(71) Applicant: **OnePlus Technology (Shenzhen) Co., Ltd.**, Shenzhen (CN)

(51) **Int. Cl.**
H01Q 5/378 (2006.01)
H01Q 5/50 (2006.01)

(72) Inventors: **Yongwei ZHONG**, Shenzhen (CN);
CHENCHUNG WU, Shenzhen (CN)

(52) **U.S. Cl.**
CPC *H01Q 5/378* (2015.01); *H01Q 9/0407* (2013.01); *H01Q 5/50* (2015.01)

(21) Appl. No.: **17/505,295**

(57) **ABSTRACT**

(22) Filed: **Oct. 19, 2021**

Related U.S. Application Data

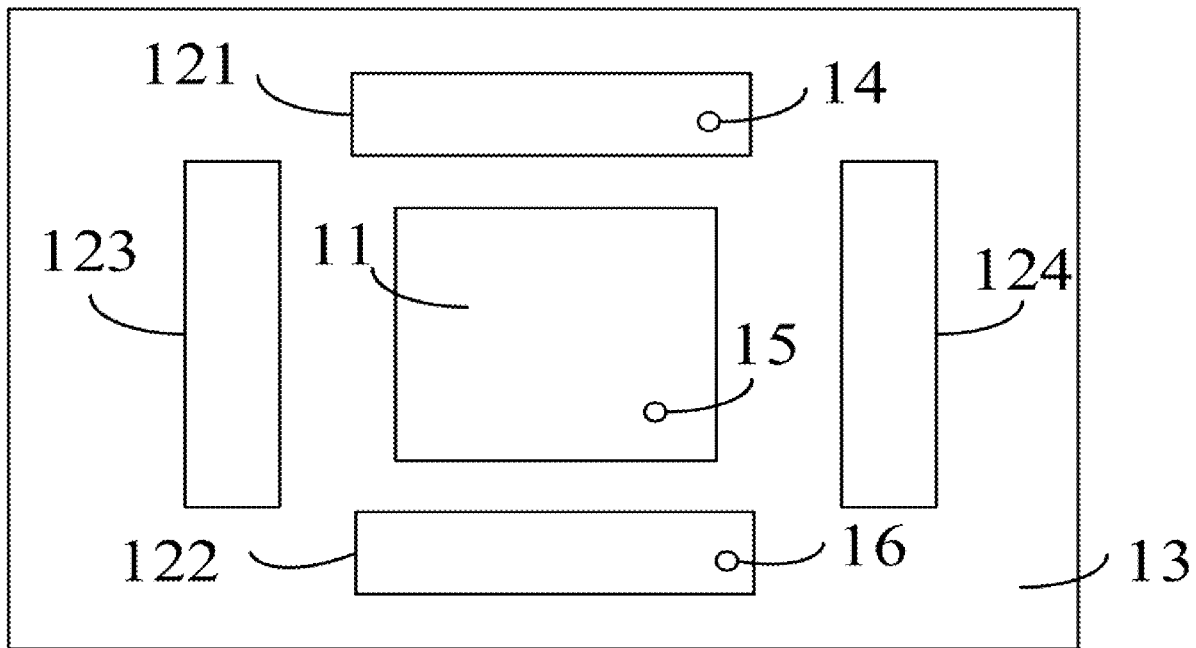
(63) Continuation of application No. PCT/CN2020/086089, filed on Apr. 22, 2020.

Foreign Application Priority Data

Apr. 22, 2019 (CN) 201910324106.X

A compact antenna, an antenna array and a terminal are provided. The compact antenna includes: a predetermined antenna and at least one parasitic unit corresponding to the predetermined antenna. A feed point is configured in the at least one parasitic unit. The corresponding at least one parasitic unit is fed through the feed point, such that the at least one parasitic unit has an independent antenna function.

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US 20220037788A1

(19) **United States**

(12) **Patent Application Publication**
Pajona

(10) **Pub. No.: US 2022/0037788 A1**

(43) **Pub. Date: Feb. 3, 2022**

(54) **MULTIFEED ANTENNA SYSTEM WITH CAPACITIVELY COUPLED FEED ELEMENTS**

Publication Classification

(51) **Int. Cl.**
H01Q 7/00 (2006.01)
H01Q 1/48 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 7/005* (2013.01); *H01Q 1/48* (2013.01)

(71) Applicant: **AVX Antenna, Inc. d/b/a Ethertronics, Inc.**, San Diego, CA (US)

(72) Inventor: **Olivier Pajona**, Antibes (FR)

(21) Appl. No.: **17/358,379**

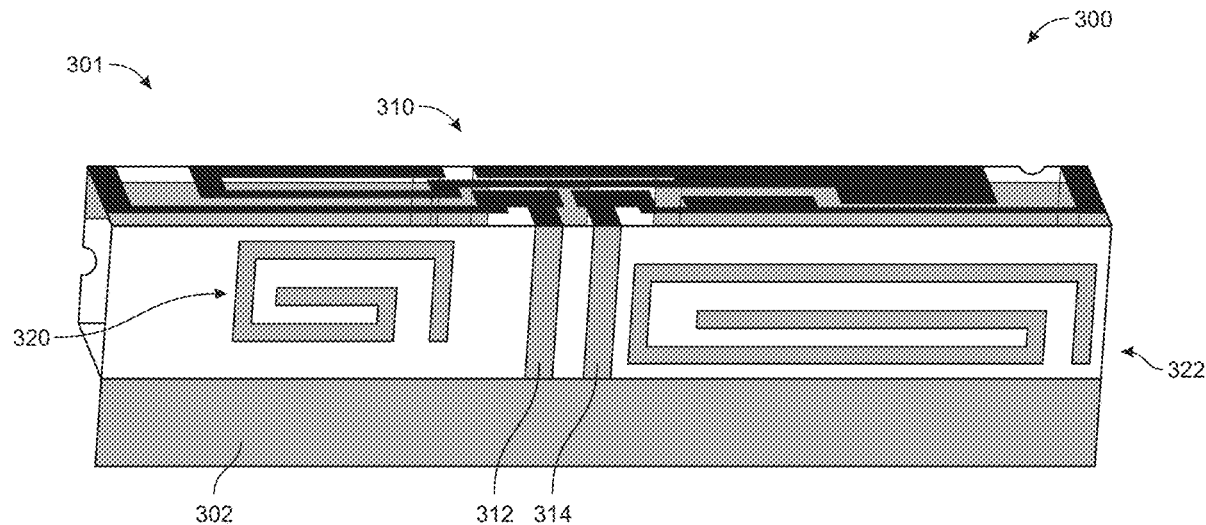
(22) Filed: **Jun. 25, 2021**

(57) **ABSTRACT**

An antenna system, such as a multifeed antenna system, can include at least one antenna feed element. The antenna system can include an antenna loop element. The at least one antenna feed element can be capacitively coupled to the antenna loop element. The at least one antenna feed element can include one or more capacitively coupled regions. The one or more capacitively coupled regions can form at least a portion of the capacitive coupling of the at least one antenna feed element to the antenna loop element.

Related U.S. Application Data

(60) Provisional application No. 63/057,308, filed on Jul. 28, 2020.





(19) **United States**

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

(10) **Pub. No.: US 2022/0037790 A1**

(43) **Pub. Date: Feb. 3, 2022**

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

(52) **U.S. Cl.**
CPC *H01Q 9/0414* (2013.01); *H01Q 1/2291* (2013.01); *H01Q 9/0464* (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Yarui ZHAO**, Beijing (CN); **Mingming ZHOU**, Beijing (CN); **Yuchuan SU**, Beijing (CN)

An antenna structure includes: a branching radiator, including a plurality of first radiation modes; a ring-shaped radiator surrounding the branching radiator, and including a plurality of second radiation modes; a feeding point and a grounding point, one of which is connected to the ring-shaped radiator, and the other is connected to the branching radiator; an antenna gap, which is provided between the branching radiator and the ring-shaped radiator. The ring-shaped radiator and the branching radiator are coupled through the antenna gap to form coupled radiation modes. A coupling among the first radiation modes, the second radiation modes and the coupled radiation modes broaden a radiation bandwidth of the antenna structure. The antenna structure may be incorporated in an electronic device.

(21) Appl. No.: **17/204,043**

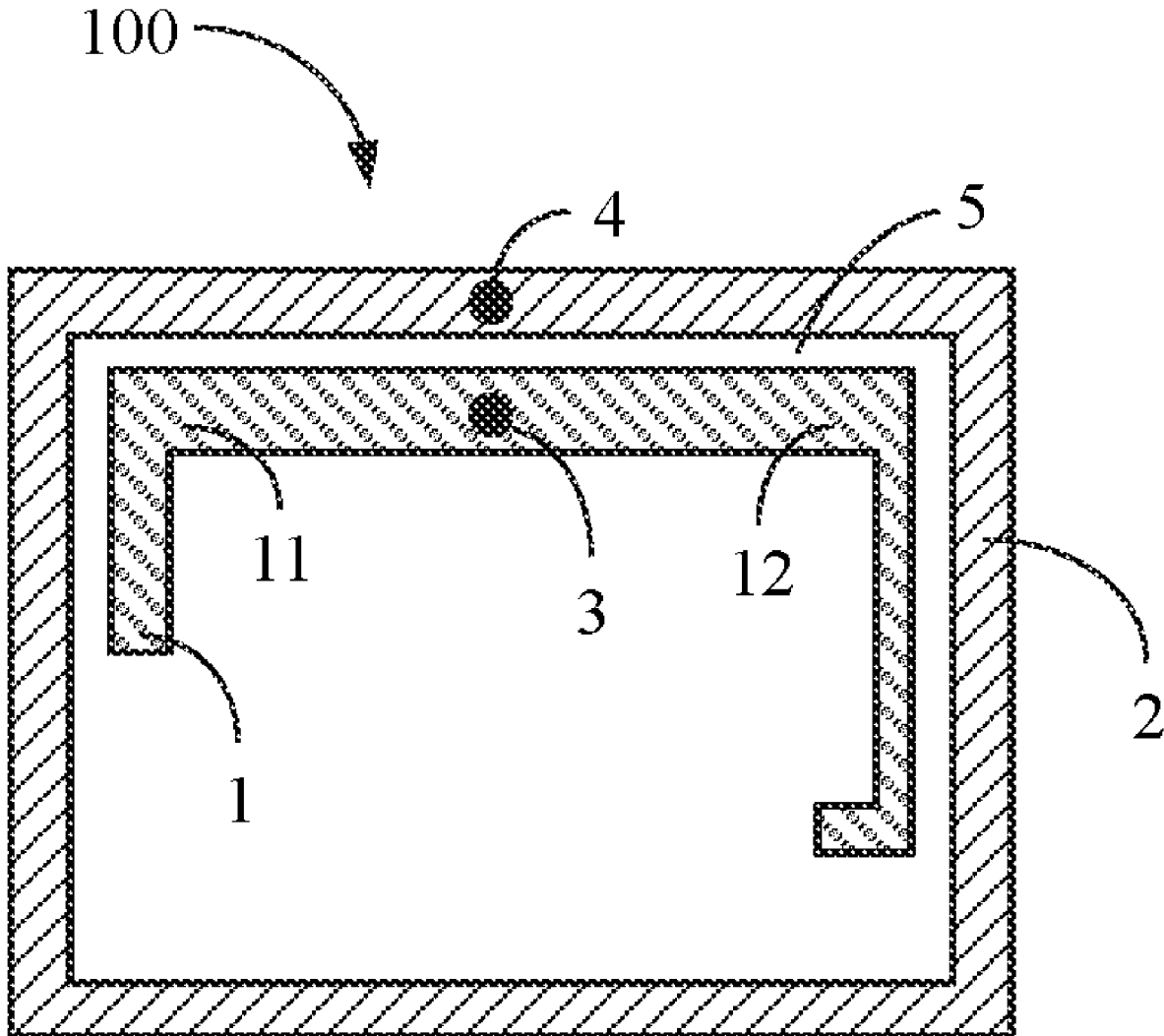
(22) Filed: **Mar. 17, 2021**

(30) **Foreign Application Priority Data**

Jul. 29, 2020 (CN) 202010746041.0

Publication Classification

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





US 20220037794A1

(19) **United States**

(12) **Patent Application Publication**

JAN et al.

(10) **Pub. No.: US 2022/0037794 A1**

(43) **Pub. Date: Feb. 3, 2022**

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

(52) **U.S. Cl.**
CPC *H01Q 15/14* (2013.01); *H01Q 13/106* (2013.01)

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

(72) Inventors: **Cheng-Geng JAN**, Hsinchu (TW);
Yu-Hsin YE, Hsinchu (TW);
Kuang-Yuan KU, Hsinchu (TW)

(21) Appl. No.: **17/351,482**

(22) Filed: **Jun. 18, 2021**

(30) **Foreign Application Priority Data**

Jul. 30, 2020 (TW) 109125869

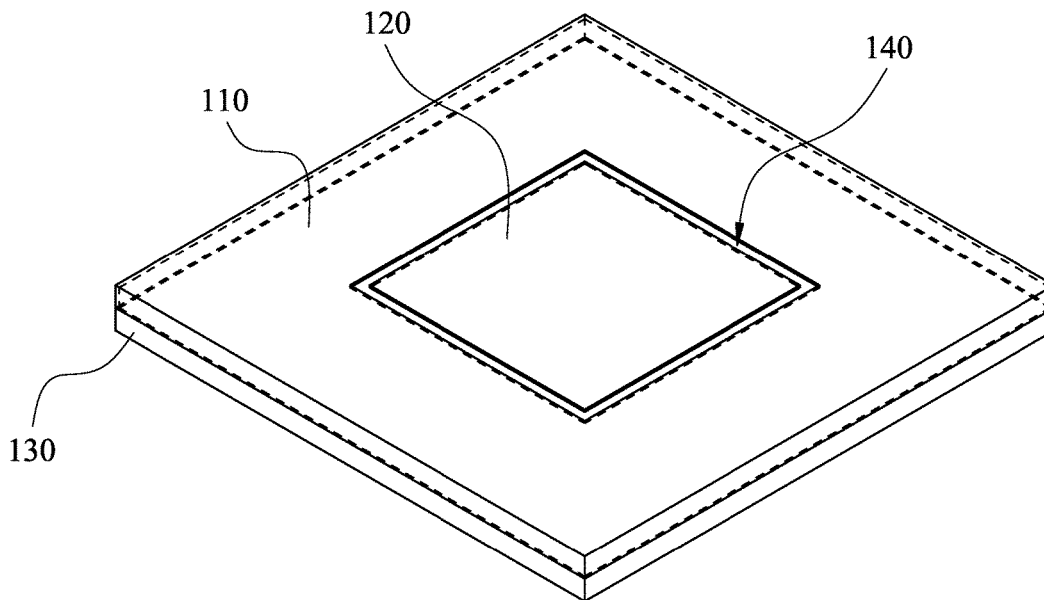
Publication Classification

(51) **Int. Cl.**
H01Q 15/14 (2006.01)
H01Q 13/10 (2006.01)

(57) **ABSTRACT**

A reflector structure is configured to connect an antenna. The antenna has an excitation source. The reflector structure includes a metal substrate, at least one first flat plate and a second flat plate. The metal substrate is configured to reflect the radiation of the antenna. The at least one first flat plate is disposed on the metal substrate. The second flat plate is floated to the metal substrate along a virtual normal and completely separated from the at least one first plate to form a closed slot. A cavity is formed by the metal substrate, the at least one first flat plate and the second flat plate and communicated with the closed slot. The excitation source is projected onto a plane to form an excitation source region. The excitation source region is located in the second flat plate.

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(19) **United States**

(12) **Patent Application Publication**
Seo

(10) **Pub. No.: US 2022/0037805 A1**

(43) **Pub. Date: Feb. 3, 2022**

(54) **DUAL POLARIZED ANTENNA AND DUAL POLARIZED ANTENNA ASSEMBLY COMPRISING SAME**

Publication Classification

(51) **Int. Cl.**
H01Q 21/26 (2006.01)

(52) **U.S. Cl.**
CPC *H01Q 21/26* (2013.01); *H01Q 1/48* (2013.01)

(71) Applicant: **KMW INC.**, Hwaseong-si (KR)

(72) Inventor: **Yong Won Seo**, Daejeon-si (KR)

(73) Assignee: **KMW INC.**, Hwaseong-si (KR)

(57) **ABSTRACT**

A dual-polarized antenna and a dual-polarized antenna assembly including the same are provided. A dual-polarized antenna includes a base board, feeding unit supported on the base board, and radiation plate supported on the feeding unit. The feeding unit includes a first and a second feeding boards arranged to cross each other on the base board. The first feeding board includes a first feed line configured to supply a first reference-phase signal to a first point on the radiation plate and supply a first antiphase signal having an antiphase relative to the first reference-phase signal to a second point on the radiation plate. The second feeding board includes a second feed line configured to supply a second reference-phase signal to a third point on the radiation plate and supply a second antiphase signal having an antiphase relative to the second reference-phase signal to a fourth point on the radiation plate.

(21) Appl. No.: **17/503,319**

(22) Filed: **Oct. 17, 2021**

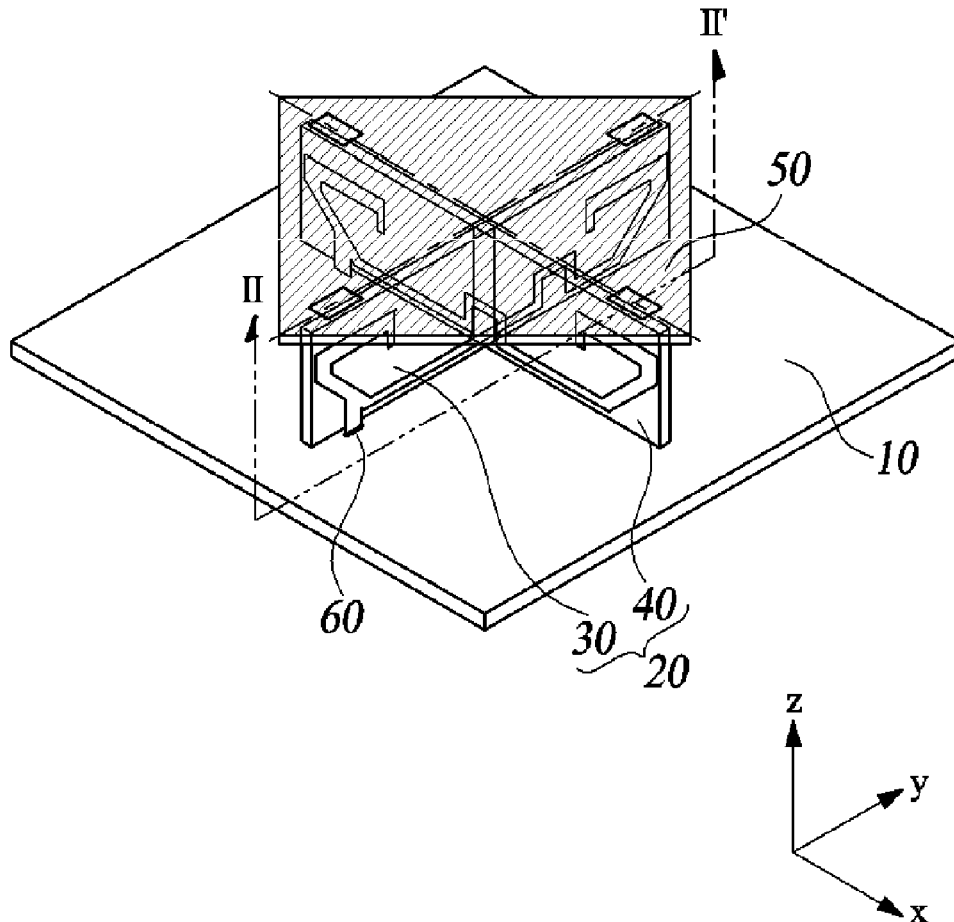
Related U.S. Application Data

(63) Continuation of application No. 16/905,940, filed on Jun. 19, 2020, now Pat. No. 11,177,582, which is a continuation of application No. PCT/KR2018/015629, filed on Dec. 10, 2018.

Foreign Application Priority Data

(30) Dec. 19, 2017 (KR) 10-2017-0175432

1





(19) **United States**

(12) **Patent Application Publication**

LEE et al.

(10) **Pub. No.: US 2022/0045426 A1**

(43) **Pub. Date: Feb. 10, 2022**

(54) **INTERLACED ARRAY ANTENNA**

(71) Applicant: **Alpha Networks Inc.**, Hsinchu (TW)

(72) Inventors: **YI JU LEE**, Hsinchu (TW);
RONG-FA KUO, Hsinchu (TW)

(21) Appl. No.: **17/034,199**

(22) Filed: **Sep. 28, 2020**

(30) **Foreign Application Priority Data**

Aug. 5, 2020 (TW) 109126480

Publication Classification

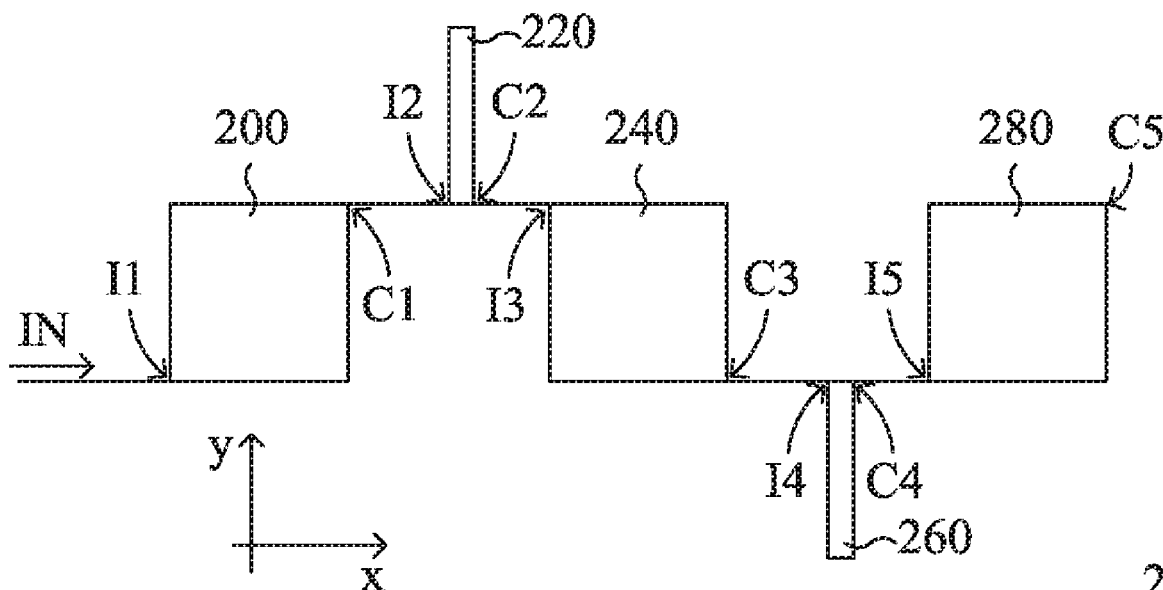
(51) **Int. Cl.**
H01Q 5/42 (2006.01)
H01Q 5/50 (2006.01)
H01Q 21/28 (2006.01)

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

CPC **H01Q 5/42** (2015.01); **H01Q 21/28**
(2013.01); **H01Q 5/50** (2015.01)

(57) **ABSTRACT**

An interlaced array antenna includes first and second groups of antenna units, which are of the same size in the same group and different sizes in different groups. Each antenna unit is polygon-shaped with even-numbered edges, and has feed-in terminal and coupling terminal at two corners. A preceding one and a succeeding one of the antenna units included in the first group are interconnected via a specified one of the antenna units in the second group. An input signal is transmitted through the feed-in terminal and then the coupling terminal of the preceding antenna unit, the feed-in terminal and then the coupling terminal of the specified antenna unit, and the feed-in terminal and then the coupling terminal of the succeeding antenna unit in sequence. Configurations of adjacent two antenna units in the same group are identical once one of them is flipped about the x-axis.





US 20220045428A1

(19) **United States**

(12) **Patent Application Publication**
SUDO

(10) **Pub. No.: US 2022/0045428 A1**

(43) **Pub. Date: Feb. 10, 2022**

(54) **ANTENNA MODULE AND COMMUNICATION DEVICE EQUIPPED WITH THE SAME**

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/328 (2006.01)
H01Q 9/28 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 9/0457* (2013.01); *H01Q 9/285* (2013.01); *H01Q 5/328* (2015.01)

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

(72) Inventor: **Kaoru SUDO**, Nagaokakyo-shi (JP)

(73) Assignee: **Murata Manufacturing Co., Ltd.**,
Nagaokakyo-shi (JP)

(21) Appl. No.: **17/507,843**

(57) **ABSTRACT**

(22) Filed: **Oct. 22, 2021**

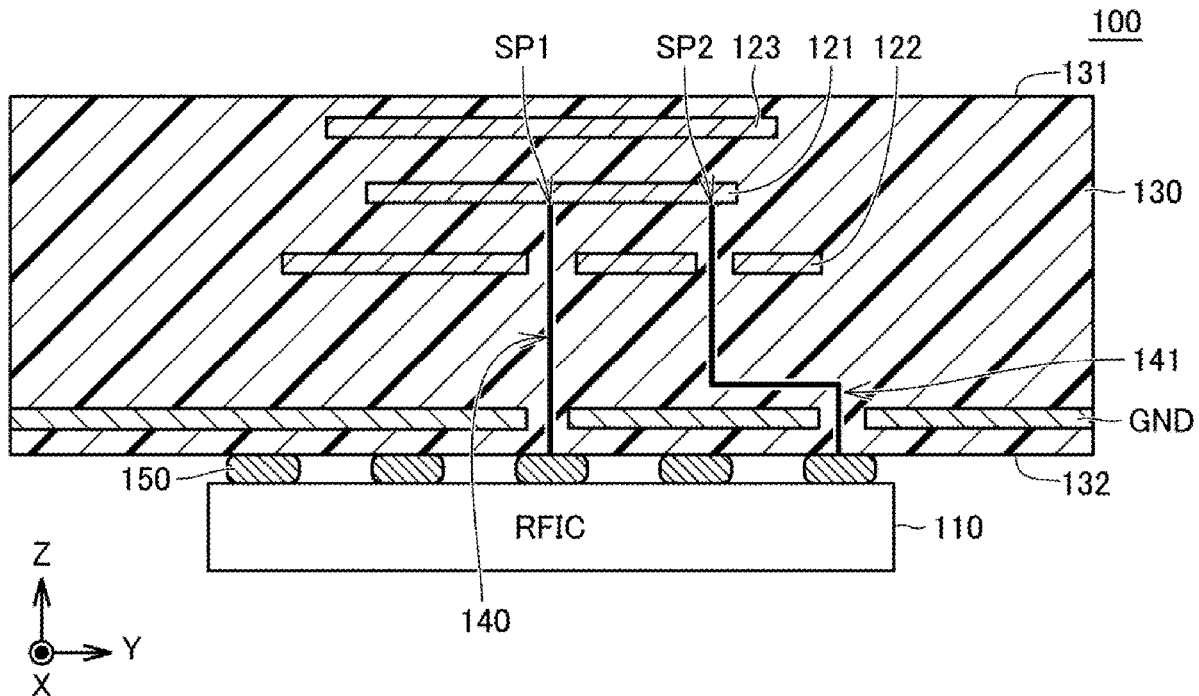
An antenna module includes a ground electrode, a fed element, unfed elements, and feed lines. The unfed element is formed in a planar shape and disposed facing the ground electrode. The fed element is formed in a planar shape and disposed between the unfed element and the ground electrode. The unfed element is formed in a planar shape and disposed between the fed element and the ground electrode. The feed lines extend through the unfed element and are used to transfer radio-frequency signals to the fed element.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2020/007307, filed on Feb. 25, 2020.

Foreign Application Priority Data

(30) Apr. 24, 2019 (JP) 2019-082696





US 20220045441A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0045441 A1**

(43) **Pub. Date: Feb. 10, 2022**

(54) **ANTENNA MODULE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/28 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/35 (2006.01)

(72) Inventors: **Po-Tsang Lin**, New Taipei City (TW);
Ying-Sheng Fang, New Taipei City (TW); **Cheng-Wei Chen**, New Taipei City (TW)

(52) **U.S. Cl.**
CPC **H01Q 21/28** (2013.01); **H01Q 5/35** (2015.01); **H01Q 1/243** (2013.01)

(73) Assignee: **Wistron Corporation**, New Taipei City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/013,819**

An antenna module includes first and second antennas. The first antenna includes first, second and third radiators. A first end of the first antenna is a first feed-in end. The second and third radiators are connected to a second end of the first radiator. The second radiator has a first ground. The second antenna includes fourth, fifth and sixth radiators. The fifth radiator is connected to a second feed-in end of the fourth radiator. A second ground is located at an intersection between the fifth and sixth radiators. The antenna module covers first, second and third frequency bands.

(22) Filed: **Sep. 7, 2020**

(30) **Foreign Application Priority Data**

Aug. 7, 2020 (TW) 109126837

