US 20210226319A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0226319 A1**

SUNG et al. (43) **Pub. Date: Jul. 22, 2021**

(54) **ANTENNA STRUCTURE AND WIRELESS COMMUNICATION DEVICE USING SAME**

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

(72) Inventors: **KUN-LIN SUNG**, New Taipei (TW); **YUNG-CHIN CHEN**, New Taipei (TW); **YI-CHIEH LEE**, New Taipei (TW)

(21) Appl. No.: **17/150,214**

(22) Filed: **Jan. 15, 2021**

(30) **Foreign Application Priority Data**

Jan. 17, 2020 (CN) 202010051202.4

Publication Classification

(51) **Int. Cl.**

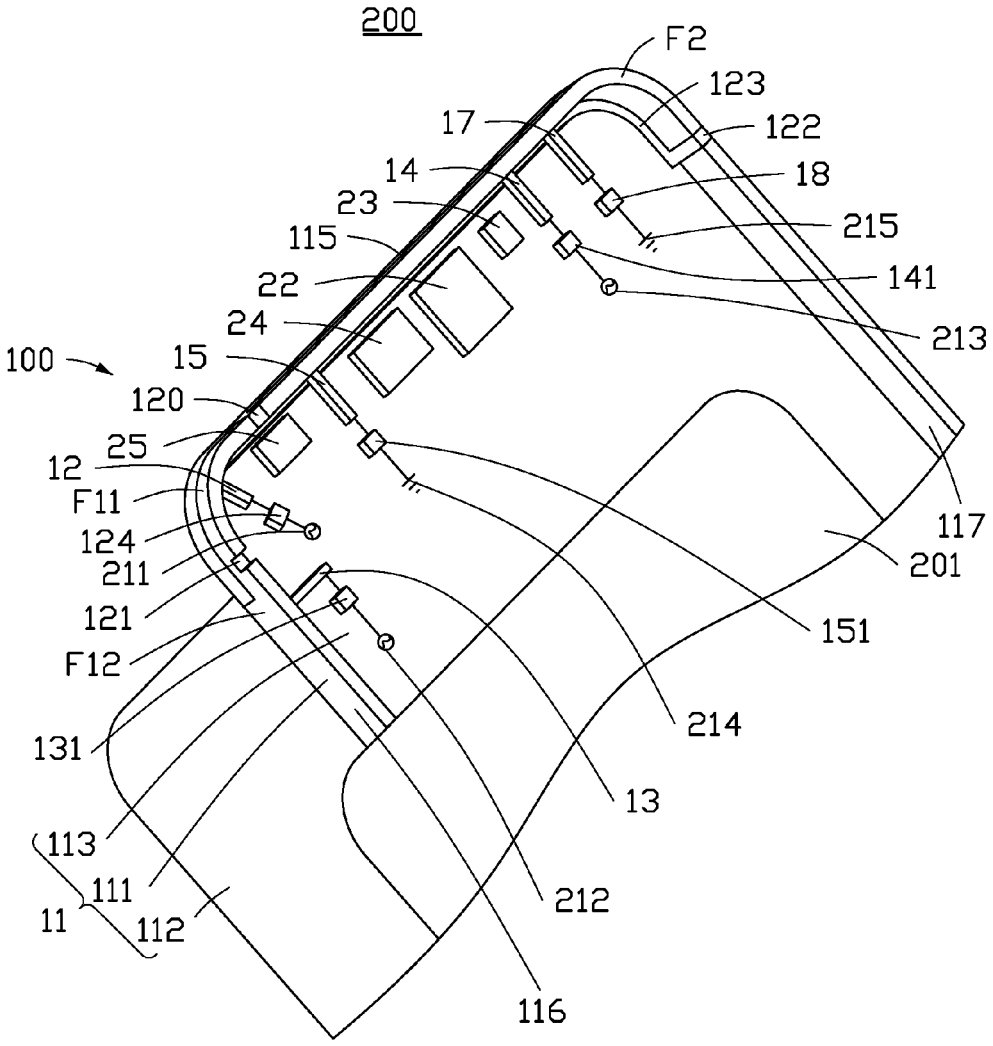
H01Q 1/24	(2006.01)
H04B 1/00	(2006.01)
H01Q 13/10	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 13/10*** (2013.01); ***H04B 1/006*** (2013.01)

(57) **ABSTRACT**

An antenna structure with wide radiation bandwidth in a reduced physical space includes a metallic housing, a first feed portion, and a second feed portion. The metallic housing includes a metallic side frame and a metallic back board. The metallic side frame defines a slot, and first and second gaps. The metallic side frame between the first gap and one end of the slot forms a first radiation portion. The second gap divides the first radiation portion into first and second radiation sections. The first feed portion feeds current and signal to the first radiation section, and the first radiation section works in a GPS mode and a WIFI 2.4 GHz mode. The second feed portion feeds current and signal to the second radiation section, and the second radiation section works in a WIFI 5 GHz mode.



US 20210226321A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0226321 A1**

(43) **Pub. Date: Jul. 22, 2021**

ZHANG et al.

(54) **ANTENNA OF MOBILE TERMINAL, AND MOBILE TERMINAL**

(71) Applicant: **ZTE Corporation**, Shenzhen (CN)

(72) Inventors: **Peng ZHANG**, Shenzhen (CN); **Wei HU**, Shenzhen (CN); **Feifei ZHANG**, Shenzhen (CN)

(21) Appl. No.: **17/256,056**

(22) PCT Filed: **Apr. 24, 2019**

(86) PCT No.: **PCT/CN2019/084145**

§ 371 (c)(1),
(2) Date: **Dec. 24, 2020**

(30) **Foreign Application Priority Data**

Jun. 26, 2018 (CN) 201810672340.7

Publication Classification

(51) **Int. Cl.**

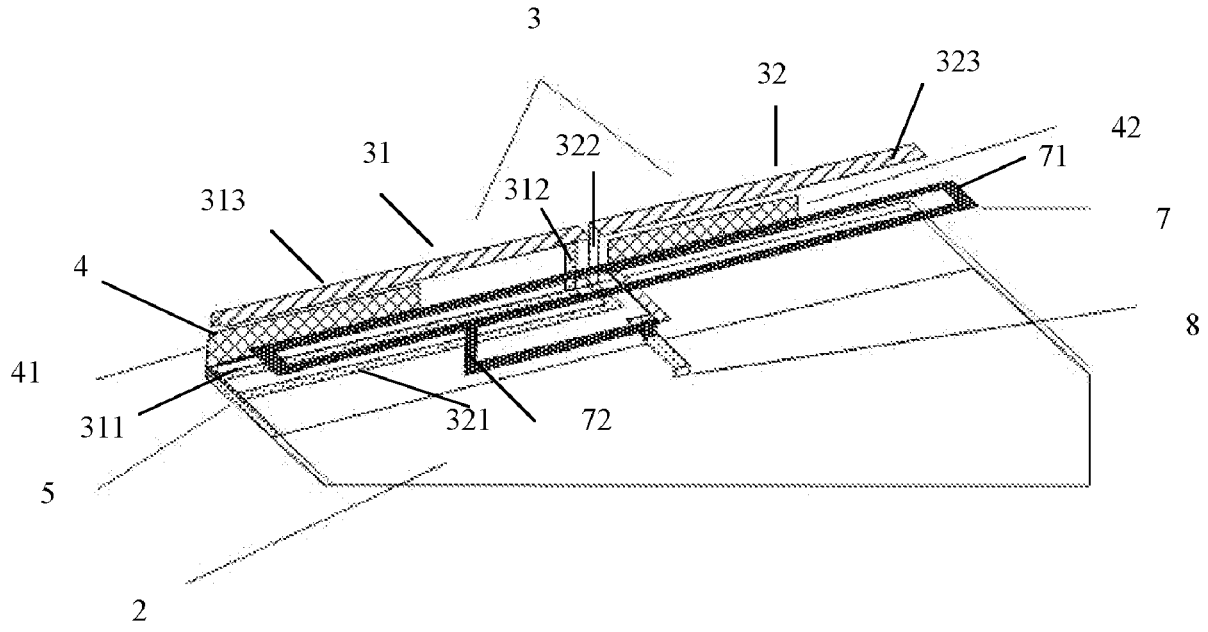
H01Q 1/24	(2006.01)
H01Q 1/48	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

Provided are an antenna of a mobile terminal, and a mobile terminal. The antenna includes a dielectric substrate, a ground plate located on one side of the dielectric substrate, and a near-feed unit, a near-ground unit and a coupling unit that are arranged on the other side of the dielectric substrate; the near-ground unit has one end connected to the coupling unit and the other end connected to the ground plate; the coupling unit and the near-ground unit are equivalent to a Left-Handed (LH) inductor; the near-feed unit is equivalent to a Right-Handed (RH) inductor; the coupling unit is coupled to the near-feed unit and is equivalent to an LH capacitor; the coupling unit is coupled to the ground plate and is equivalent to an RH capacitor; and the near-feed unit, the near-ground unit, the coupling unit and the ground plate form a Composite Right-Left-Handed Transmission Line (CRLH-TL) structure.



US 20210226324A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0226324 A1**

Mannan (43) **Pub. Date: Jul. 22, 2021**

(54) **ANTENNA**

(71) Applicant: **Michael Mannan**, Harrow, Middlesex (GB)

(72) Inventor: **Michael Mannan**, Harrow, Middlesex (GB)

(21) Appl. No.: **17/055,373**

(22) PCT Filed: **May 7, 2019**

(86) PCT No.: **PCT/GB2019/051249**

§ 371 (c)(1),
(2) Date: **Nov. 13, 2020**

(30) **Foreign Application Priority Data**

May 15, 2018 (GB) 1807833.7
Feb. 12, 2019 (GB) 1901912.4

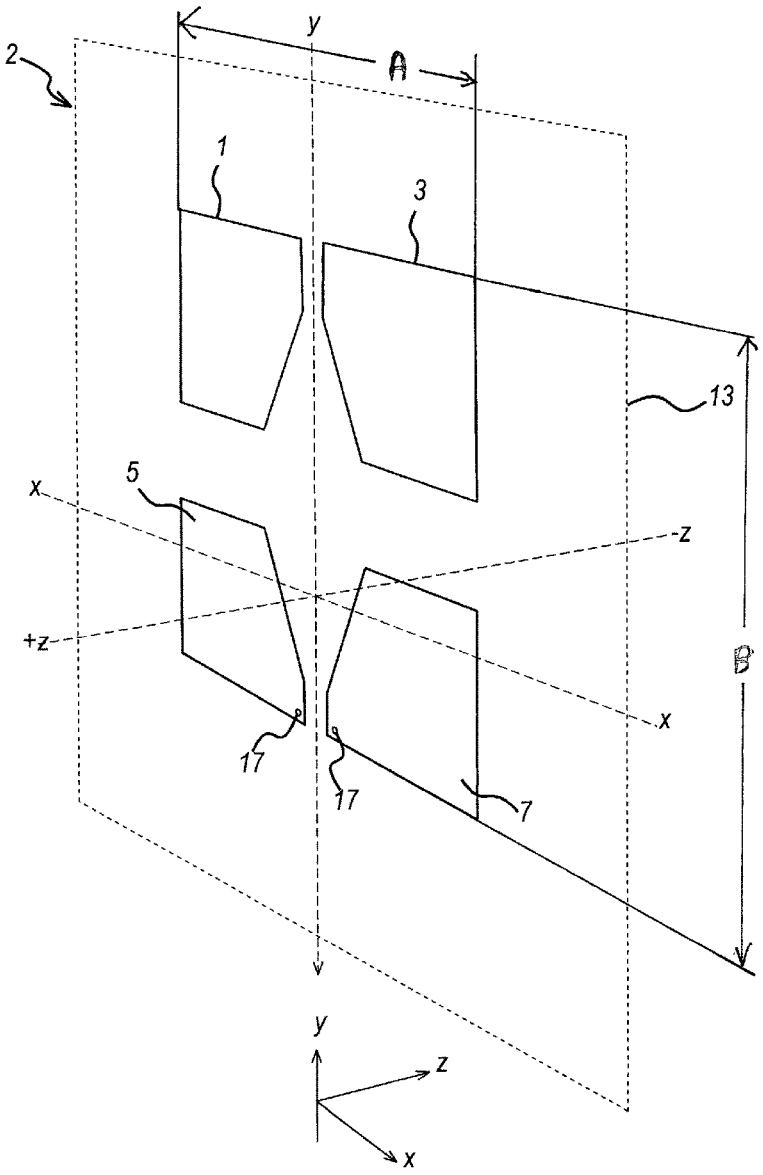
Publication Classification

(51) **Int. Cl.**
H01Q 1/32 (2006.01)
H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 1/3266*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 1/3283*** (2013.01)

(57) **ABSTRACT**

An antenna with at least one pair of electrically conducting lands, and a second pair of spaced-apart electrically conducting lands or a single land, wherein the lands are parallel with respect to a first electrically conductive sheet is disclosed.



US 20210226327A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0226327 A1**

LEE et al. (43) **Pub. Date: Jul. 22, 2021**

(54) **ANTENNA DEVICE AND ELECTRONIC DEVICE HAVING THE SAME**

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

(72) Inventors: **Young-Ju LEE**, Seoul (KR); **Hyun-Jin KIM**, Seoul (KR); **Jung-Min PARK**, Seoul (KR)

(21) Appl. No.: **17/223,740**

(22) Filed: **Apr. 6, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/736,453, filed on Jan. 7, 2020, now Pat. No. 10,971,810, which is a continuation of application No. 15/411,568, filed on Jan. 20, 2017, now Pat. No. 10,530,066.

(30) **Foreign Application Priority Data**

Jan. 21, 2016 (KR) 10-2016-0007714

Publication Classification

(51) **Int. Cl.**

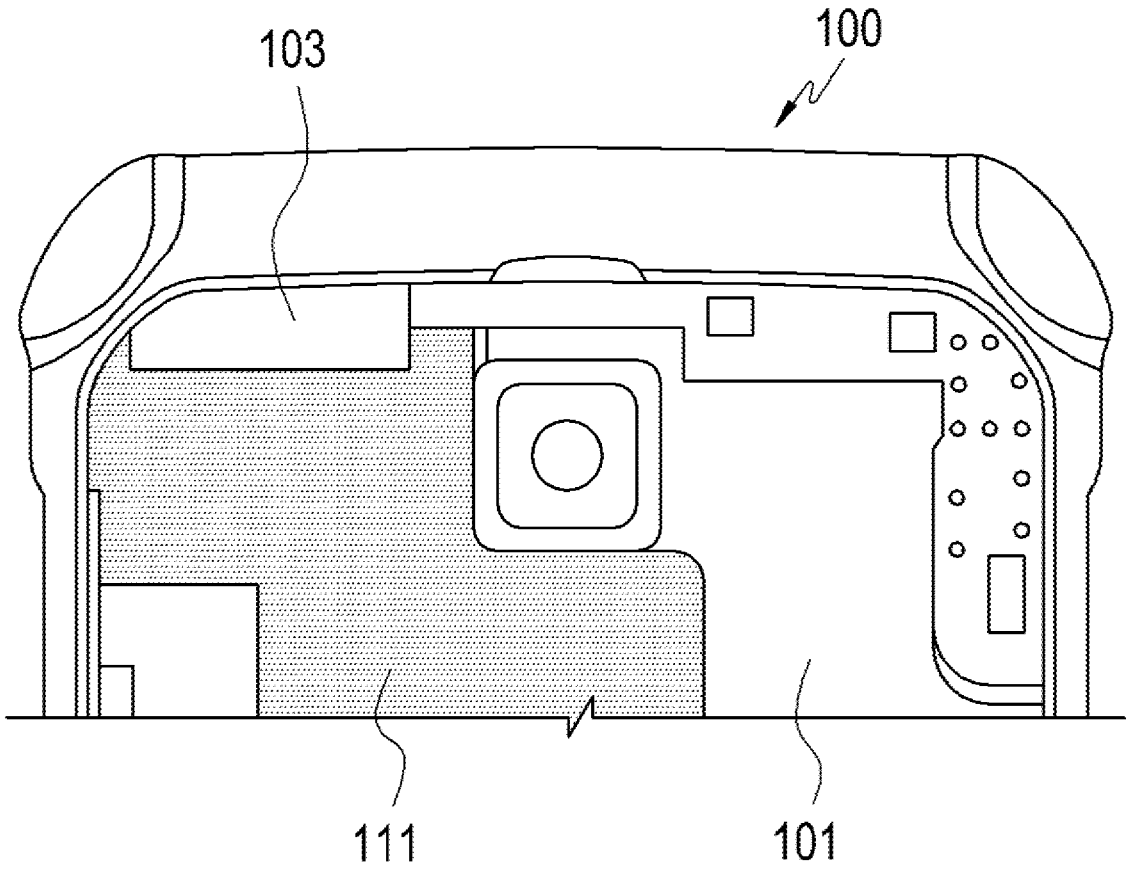
H01Q 1/38	(2006.01)
H01Q 21/29	(2006.01)
H01Q 5/42	(2006.01)
H01Q 21/28	(2006.01)
H01Q 9/04	(2006.01)
H01Q 9/42	(2006.01)
H01Q 3/24	(2006.01)
H01Q 1/52	(2006.01)
H01Q 21/06	(2006.01)
H01Q 5/40	(2006.01)
H01Q 1/22	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 1/38*** (2013.01); ***H01Q 21/293*** (2013.01); ***H01Q 5/42*** (2015.01); ***H01Q 21/28*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 9/42*** (2013.01); *H01Q 21/064* (2013.01); ***H01Q 1/523*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 5/40*** (2015.01); ***H01Q 1/2291*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 3/24*** (2013.01)

(57) **ABSTRACT**

An electronic device may include a circuit board, radiators disposed on the circuit board, and provided with a first feeding signal to transmit or receive a wireless signal in a first frequency band; and a ground disposed on the circuit board to provide a reference potential for the radiators. The radiators and a whole or a portion of the ground may be provided with an additional feeding signal to transmit or receive a wireless signal in various frequency bands that are lower than the first frequency band.



US 20210226328A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0226328 A1**

Kim et al. (43) **Pub. Date: Jul. 22, 2021**

(54) **ANTENNA MODULE**

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

(72) Inventors: **Doo li Kim**, Suwon-si (KR); **Dae Kwon Jung**, Suwon-si (KR); **Young Sik Hur**, Suwon-si (KR); **Won Wook So**, Suwon-si (KR); **Yong Ho Baek**, Suwon-si (KR); **Woo Jung Choi**, Suwon-si (KR)

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

(21) Appl. No.: **17/225,790**

(22) Filed: **Apr. 8, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/112,432, filed on Aug. 24, 2018, now Pat. No. 10,985,451.

(30) **Foreign Application Priority Data**

Mar. 12, 2018 (KR) 10-2018-0028802

Publication Classification

(51) **Int. Cl.**

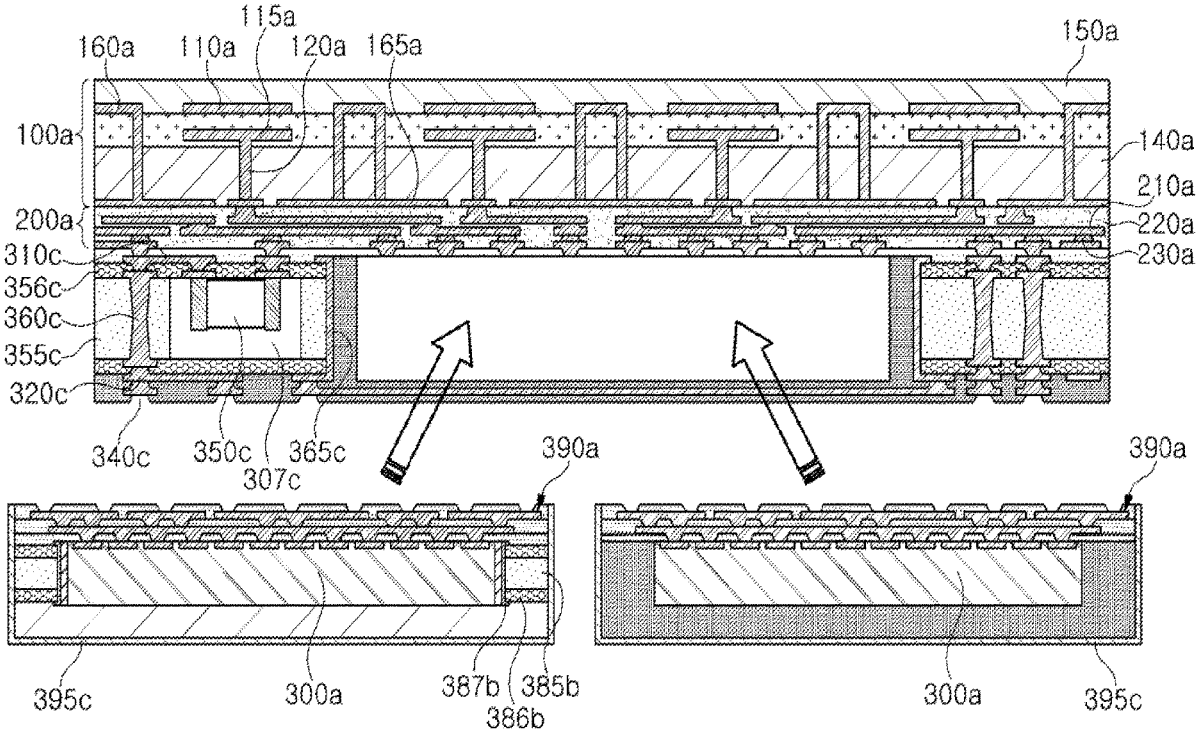
H01Q 1/38	(2006.01)
H01L 23/31	(2006.01)
H01L 23/538	(2006.01)
H01L 23/552	(2006.01)
H01L 23/66	(2006.01)
H01L 21/48	(2006.01)
H01L 21/56	(2006.01)
H01L 23/00	(2006.01)
H05K 1/11	(2006.01)

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

CPC ***H01Q 1/38*** (2013.01); *H01Q 9/16* (2013.01); ***H01L 23/5383*** (2013.01); ***H01L 23/5386*** (2013.01); ***H01L 23/5389*** (2013.01); ***H01L 23/552*** (2013.01); ***H01L 23/66*** (2013.01); ***H01L 21/4857*** (2013.01); ***H01L 21/4853*** (2013.01); ***H01L 21/568*** (2013.01); ***H01L 21/565*** (2013.01); ***H01L 24/19*** (2013.01); ***H01L 24/20*** (2013.01); ***H05K 1/115*** (2013.01); *H01L 2924/3025* (2013.01); ***H01L 23/3121*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a first connection member including at least one first wiring layer and at least one first insulating layer; an antenna package disposed on a first surface of the first connection member, and including a plurality of antenna members and a plurality of feed vias; an integrated circuit (IC) disposed on a second surface of the first connection member and electrically connected to the corresponding wire of at least one first wiring layer; and a second connection member including at least one second wiring layer electrically connected to the IC and at least one second insulating layer, and disposed between the first connection member and the IC, wherein the second connection member has a third surface facing the first connection member and having an area smaller than that of the second surface, and a fourth surface facing the IC.



US 20210226338A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0226338 A1**

(43) **Pub. Date: Jul. 22, 2021**

CHO et al.

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

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

(72) Inventors: **Namjun CHO**, Gyeonggi-do (KR); **Hyoseok NA**, Gyeonggi-do (KR)

(21) Appl. No.: **17/226,845**

(22) Filed: **Apr. 9, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/985,674, filed on Aug. 5, 2020.

(30) **Foreign Application Priority Data**

Aug. 5, 2019 (KR) 10-2019-0094745
Jul. 29, 2020 (KR) 10-2020-0094609

Publication Classification

(51) **Int. Cl.**

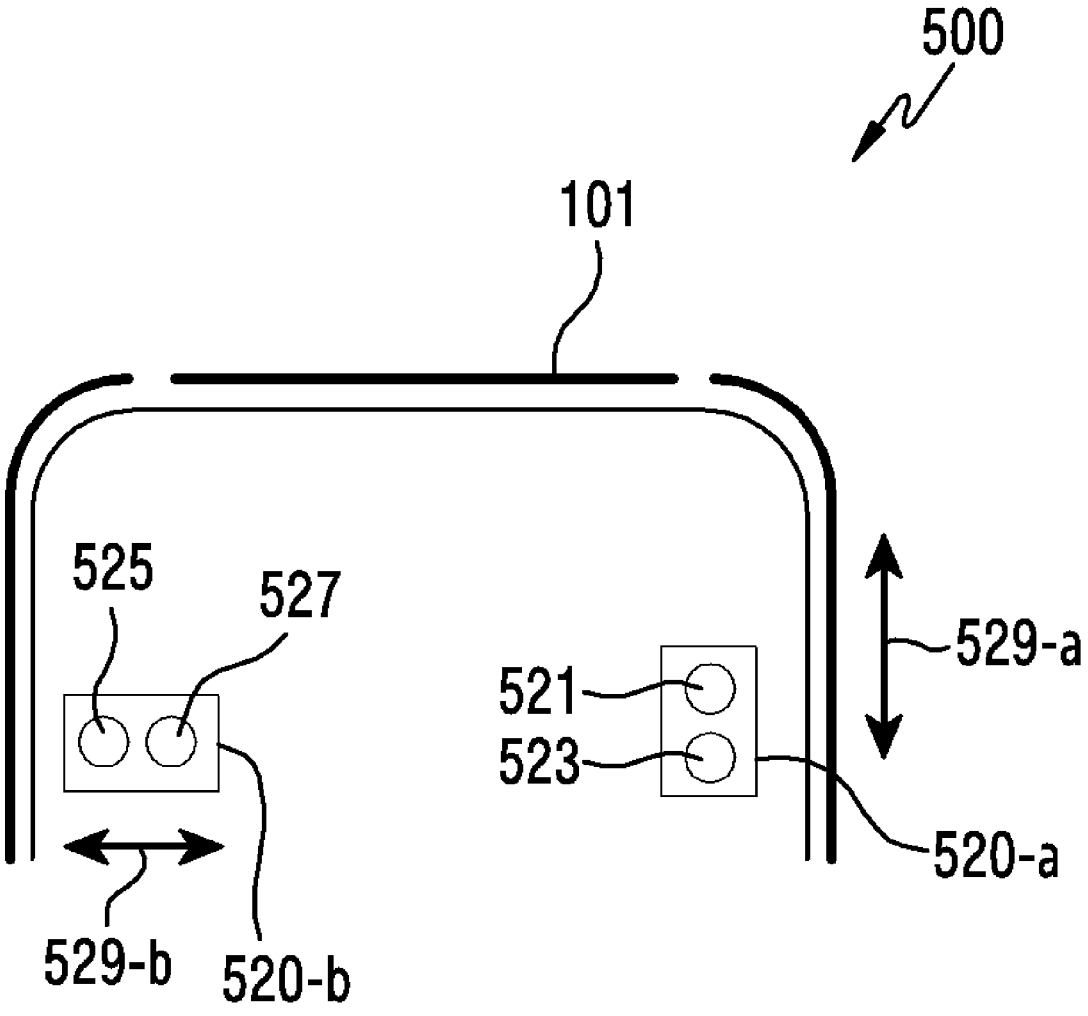
H01Q 21/00	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/38	(2006.01)
H01Q 21/24	(2006.01)
H04B 7/0404	(2006.01)

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

CPC ***H01Q 21/0025*** (2013.01); ***H01Q 1/245*** (2013.01); ***H04B 7/0404*** (2013.01); ***H01Q 21/24*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

A mobile communication device includes a processor positioned on a first printed circuit board, a radio frequency integrated circuit (RFIC), and an antenna module. The antenna module includes a second printed circuit board, a first antenna and a second antenna positioned on the second printed circuit board, and a plurality of front-end chips positioned on the second printed circuit board. The plurality of front-end chips include a first front-end chip electrically connecting the RFIC and the first antenna, and a second front-end chip electrically connecting the RFIC and the second antenna.



US 20210226339A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0226339 A1**

CHO et al. (43) **Pub. Date: Jul. 22, 2021**

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

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

(72) Inventors: **Namjun CHO**, Gyeonggi-do (KR); **Hyoseok Na**, Gyeonggi-do (KR)

(21) Appl. No.: **17/226,912**

(22) Filed: **Apr. 9, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/985,674, filed on Aug. 5, 2020.

(30) **Foreign Application Priority Data**

Aug. 5, 2019 (KR) 10-2019-0094745
Jul. 29, 2020 (KR) 10-2020-0094609

Publication Classification

(51) **Int. Cl.**

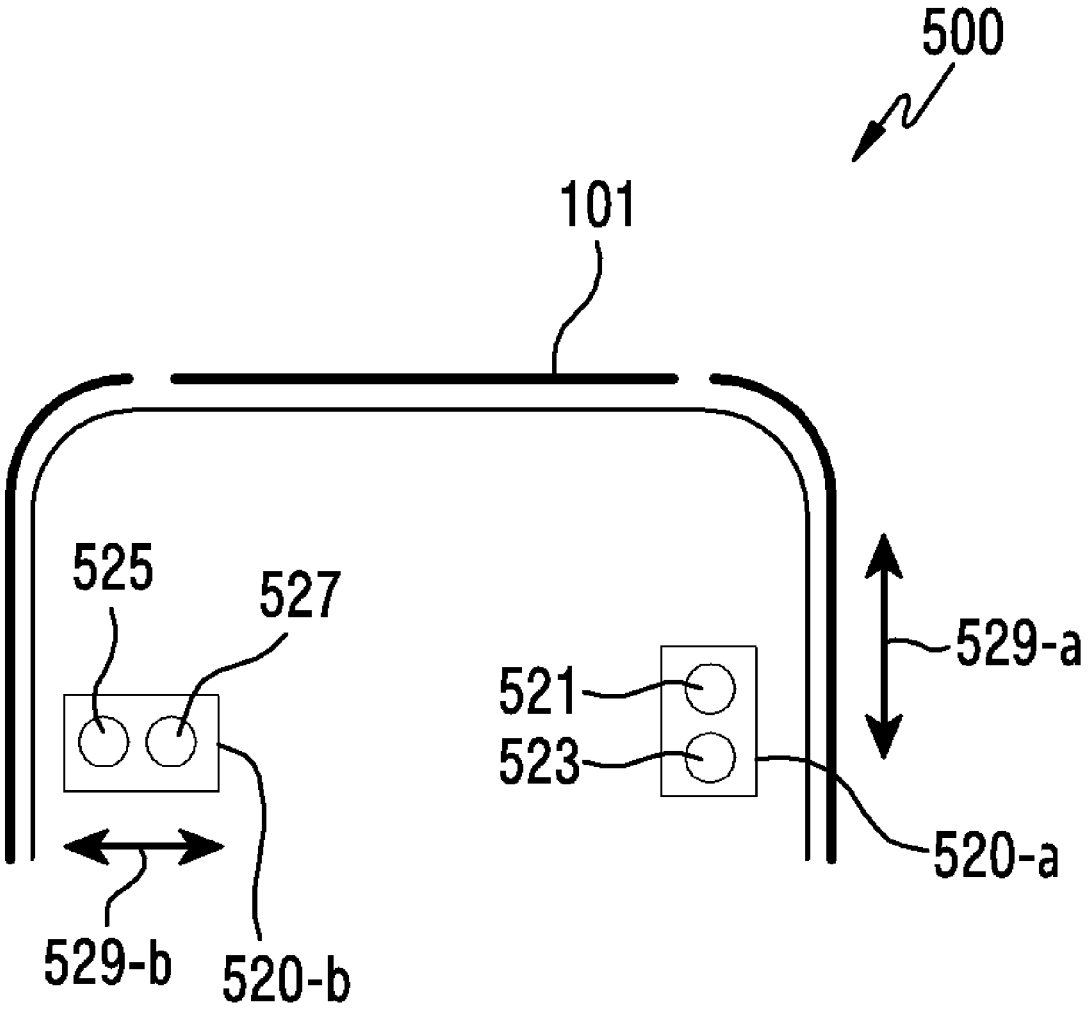
H01Q 21/00	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/38	(2006.01)
H01Q 21/24	(2006.01)
H04B 7/0404	(2006.01)

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

CPC ***H01Q 21/0025*** (2013.01); ***H01Q 1/245*** (2013.01); ***H04B 7/0404*** (2013.01); ***H01Q 21/24*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

A mobile communication device includes a processor positioned on a first printed circuit board, a radio frequency integrated circuit (RFIC), and an antenna module. The antenna module includes a second printed circuit board, a first antenna and a second antenna positioned on the second printed circuit board, and a plurality of front-end chips positioned on the second printed circuit board. The plurality of front-end chips include a first front-end chip electrically connecting the RFIC and the first antenna, and a second front-end chip electrically connecting the RFIC and the second antenna.



US 20210234255A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0234255 A1**

NISHIKAWA et al. (43) **Pub. Date: Jul. 29, 2021**

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

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

(72) Inventors: **Kenji NISHIKAWA**, Hyogo (JP); **Yu ONO**, Miyagi (JP); **Shingo SUMI**, Miyagi (JP); **Yasunori KOMUKAI**, Miyagi (JP); **Yukinari TAKAHASHI**, Miyagi (JP); **Toshiharu ISHIMURA**, Osaka (JP)

(21) Appl. No.: **17/233,495**

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

Related U.S. Application Data

(60) Continuation of application No. 16/840,703, filed on Apr. 6, 2020, now Pat. No. 11,011,824, which is a division of application No. 15/818,933, filed on Nov. 21, 2017, now Pat. No. 10,651,540, which is a continuation of application No. PCT/JP2017/001158, filed on Jan. 16, 2017.

(30) **Foreign Application Priority Data**

Feb. 18, 2016 (JP) 2016-029293

Publication Classification

(51) **Int. Cl.**

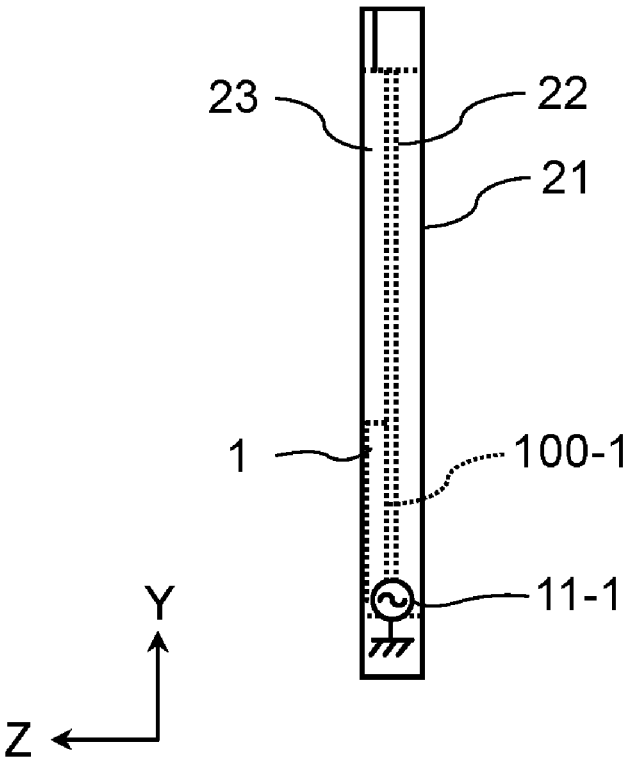
H01Q 1/22	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/44	(2006.01)
H01Q 1/24	(2006.01)
H01Q 9/30	(2006.01)
H01Q 5/385	(2006.01)
H01Q 9/42	(2006.01)
H01Q 1/38	(2006.01)
H01Q 7/00	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 1/2258*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/44*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 9/30*** (2013.01); ***H01Q 9/0421*** (2013.01); ***H01Q 1/245*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 7/00*** (2013.01); ***H01Q 5/385*** (2015.01)

(57) **ABSTRACT**

An antenna unit includes a plate-shaped dielectric substrate, as well as an antenna element and a stub element. The dielectric substrate has a first edge extending along a longitudinal direction of the dielectric substrate and a second edge extending along the longitudinal direction of the dielectric substrate, and the second edge is opposite to the first edge. The antenna element is disposed along the longitudinal direction of the dielectric substrate. The Antenna element has a first end containing a feedpoint and a second end containing an open end. The stub element is disposed between a section of the antenna element having a predetermined length containing the first end of the antenna element and the first edge of the dielectric substrate along the longitudinal direction of the dielectric substrate. The stub element has a first end connected to a reference potential and a second end containing an open end.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0234260 A1**

Thai et al. (43) **Pub. Date: Jul. 29, 2021**

(54) **ANTENNA BOARDS AND COMMUNICATION DEVICES**

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

(72) Inventors: **Trang Thai**, Hillsboro, OR (US); **Sidharth Dalmia**, Portland, OR (US); **Raanan Sover**, Haifa (IL); **Josef Hagn**, Taufkirchena (DE); **Omer Asaf**, Oranit M (IL); **Simon Svendsen**, Aalborg (DK)

(73) Assignee: **Intel IP Corporation**, Santa Clara, CA (US)

(21) Appl. No.: **17/231,051**

(22) Filed: **Apr. 15, 2021**

Related U.S. Application Data

(63) Continuation of application No. 15/977,612, filed on May 11, 2018, now Pat. No. 11,011,827.

Publication Classification

(51) **Int. Cl.**

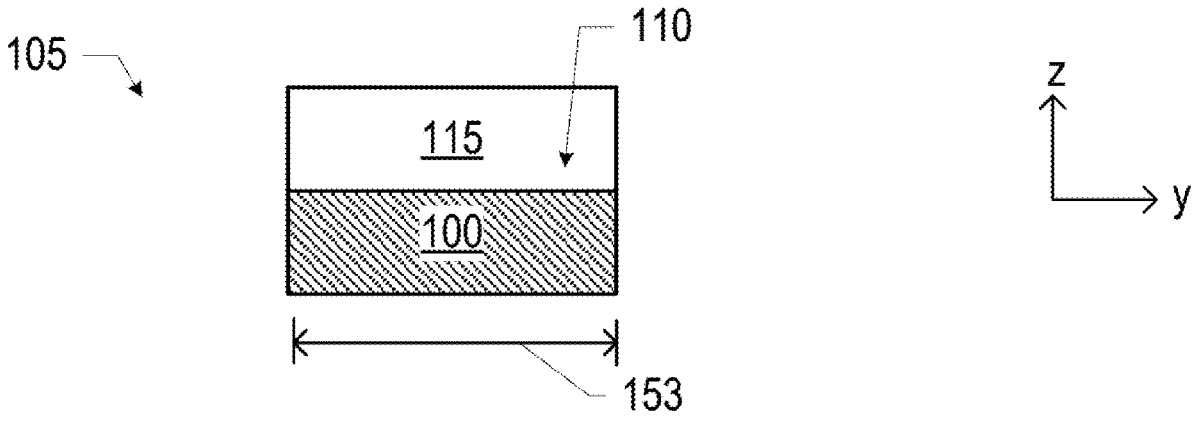
H01Q 1/24	(2006.01)
H01L 23/64	(2006.01)
H01L 23/66	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01L 23/66*** (2013.01); ***H01L 23/645*** (2013.01)

(57) **ABSTRACT**

Disclosed herein are antenna boards, antenna modules, and communication devices. For example, in some embodiments, an antenna board may include: an antenna feed substrate including an antenna feed structure, wherein the antenna feed substrate includes a ground plane, the antenna feed structure includes a first portion perpendicular to the ground plane and a second portion parallel to the ground plane, and the first portion is electrically coupled between the second portion and the first portion; and a millimeter wave antenna patch.



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(19) **United States**

(12) **Patent Application Publication**

DOUMANIS et al.

(10) **Pub. No.: US 2021/0234271 A1**

(43) **Pub. Date: Jul. 29, 2021**

(54) **ANTENNA SYSTEM**

(71) Applicant: **NOKIA SOLUTIONS AND NETWORKS OY**, Espoo (FI)

(72) Inventors: **Efstratios DOUMANIS**, Helsinki (FI); **Murat Emre ERMUTLU**, Helsinki (FI)

(73) Assignee: **NOKIA SOLUTIONS AND NETWORKS OY**, Espoo (FI)

(21) Appl. No.: **17/158,135**

(22) Filed: **Jan. 26, 2021**

(30) **Foreign Application Priority Data**

Jan. 28, 2020 (EP) 20153977.2

Publication Classification

(51) **Int. Cl.**

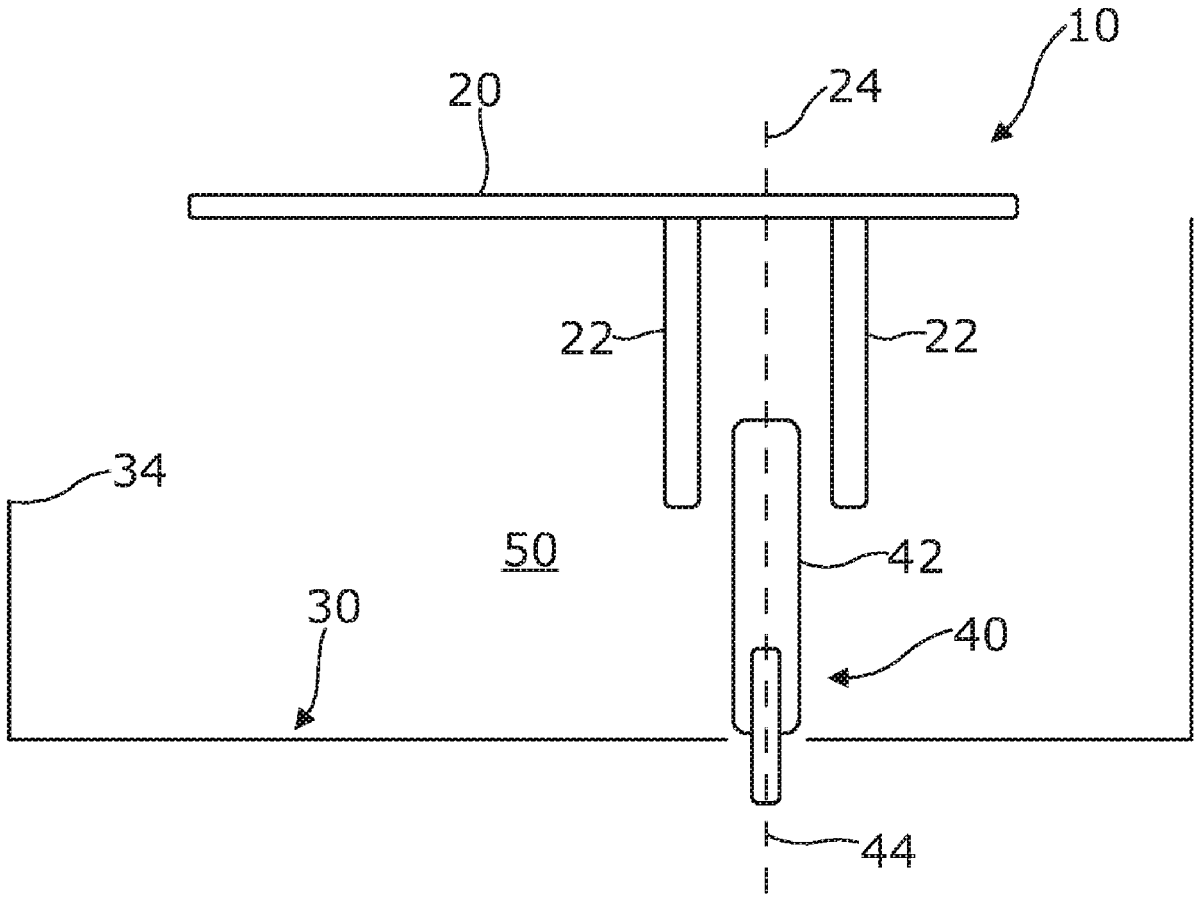
H01Q 5/15 (2006.01)
H01Q 5/47 (2006.01)
H01Q 13/18 (2006.01)

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

CPC ***H01Q 5/15*** (2015.01); ***H01Q 13/18*** (2013.01); ***H01Q 5/47*** (2015.01)

(57) **ABSTRACT**

An antenna system including a ground plane, an antenna radiator separated from and overlapping the ground plane and at least one first conductive element extending the antenna radiator towards the ground plane. The antenna system also includes at least one feed element configured to provide a radio-frequency feed for the antenna radiator. The feed element is spatially separated from the first conductive element and the antenna radiator.



US 20210234273A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0234273 A1**

Yuen et al. (43) **Pub. Date: Jul. 29, 2021**

(54) **PATCH ANTENNA USING BONDWIRES AS FREQUENCY TUNING ELEMENT**

(71) Applicant: **Innovation Sound Technology Co., Ltd**, Shenzhen, Guangdong (CN)

(72) Inventors: **Shun Ming Yuen**, Shenzhen, Guangdong (CN); **WaiYin Mung**, Shenzhen, Guangdong (CN); **Ka Ming Wu**, Shenzhen, Guangdong (CN)

(21) Appl. No.: **16/313,872**

(22) PCT Filed: **Aug. 13, 2018**

(86) PCT No.: **PCT/CN2018/100146**

§ 371 (c)(1),
(2) Date: **Dec. 27, 2018**

(30) **Foreign Application Priority Data**

Jul. 5, 2018 (CN) 201810731490.0

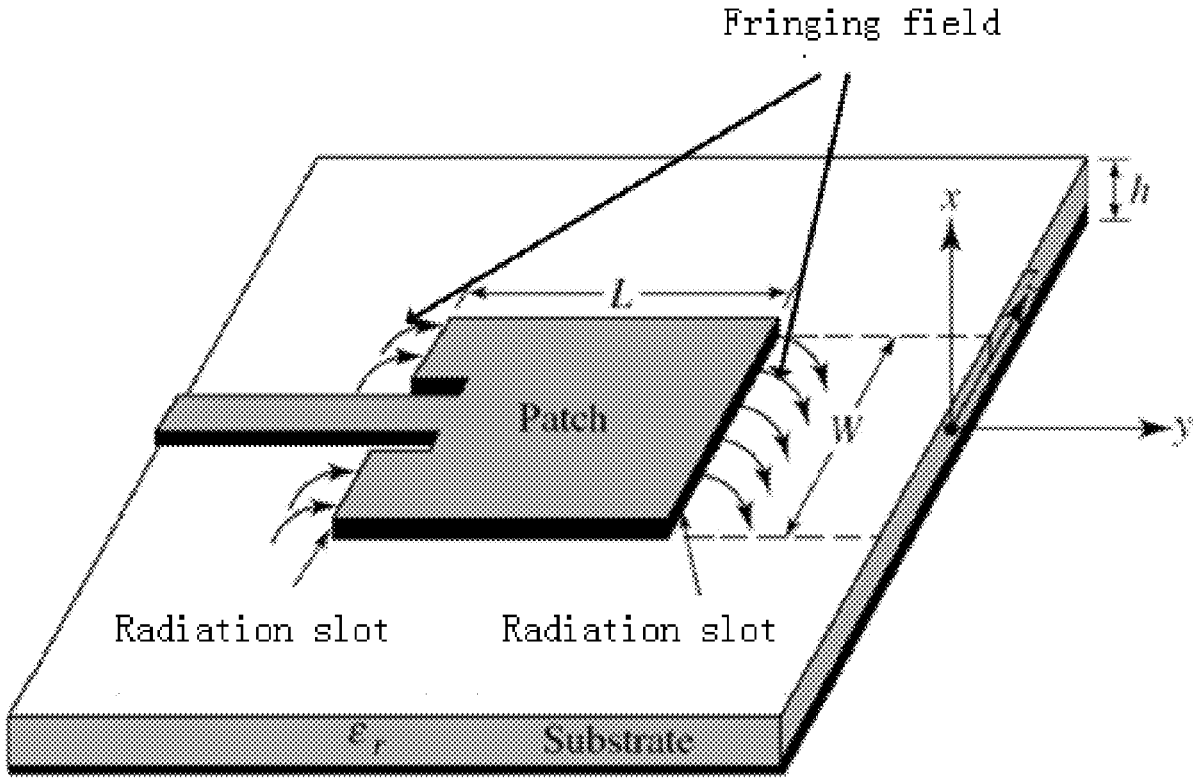
Publication Classification

(51) **Int. Cl.**
H01Q 5/314 (2006.01)
H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 5/314*** (2015.01); ***H01Q 9/0407*** (2013.01)

(57) **ABSTRACT**

Disclosed is a patch antenna using bondwires as a frequency tuning element. The patch antenna includes a patch and bondwires frequency tuning circuit, wherein the bondwires frequency tuning circuit is disposed within radiation slots on one side of the patch, the bondwires frequency tuning circuit is a combination of multiple bondwires, and a sum of a length of the bondwires frequency tuning circuit and a length of the patch is equal to a length of the patch antenna. Compared with traditional patch antennae, the patch antenna according to embodiments of the disclosure, which is a patch antenna using a combination of bondwires as a frequency tuning element, uses bondwires as part of the antenna. Fine tuning of antenna frequencies is implemented by designing different combinations of bondwires such that the antenna per se have a better flexibility.



US 20210234276A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0234276 A1

Wu et al. (43) Pub. Date: Jul. 29, 2021

(54) **MULTI-INPUT MULTI-OUTPUT ANTENNA STRUCTURE**

(71) Applicant: **PEGATRON CORPORATION**, Taipei City (TW)

(72) Inventors: **Chien-Yi Wu**, Taipei City (TW); **Chao-Hsu Wu**, Taipei City (TW); **Cheng-Hsiung Wu**, Taipei City (TW); **Shih-Keng Huang**, Taipei City (TW); **Ching-Hsiang Ko**, Taipei City (TW); **Sheng-Chin Hsu**, Taipei City (TW)

(73) Assignee: **PEGATRON CORPORATION**, Taipei City (TW)

(21) Appl. No.: **17/231,439**

(22) Filed: **Apr. 15, 2021**

Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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Publication Classification

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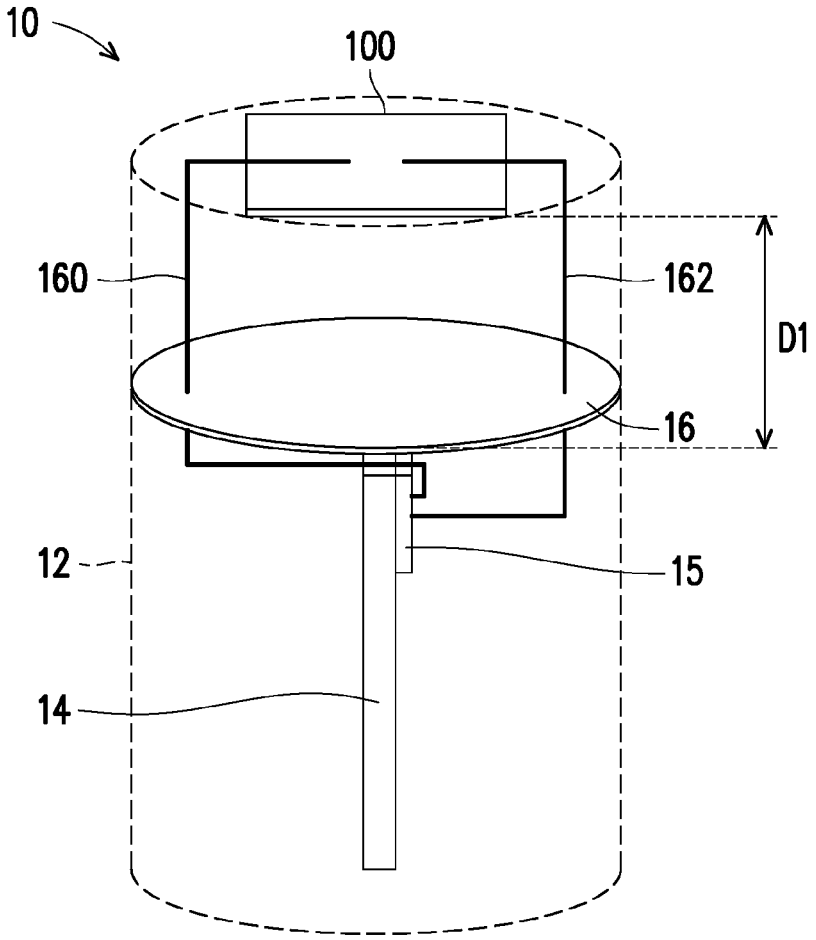
H01Q 9/04 (2006.01)
H01Q 9/06 (2006.01)
H01Q 9/16 (2006.01)

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

CPC ***H01Q 9/0407*** (2013.01); ***H01Q 9/16*** (2013.01); ***H01Q 9/06*** (2013.01)

(57) **ABSTRACT**

Provided is an electronic device including a multi-input multi-output antenna structure configured on a substrate, and the multi-input multi-output antenna structure includes two dipole antennas and two second grounded radiators. Each dipole antenna is used for resonating a first frequency band and a second frequency band. Each dipole antenna includes a feed-in radiator and a first grounded radiator. The feed-in radiator has a feed-in end. The first grounded radiator is disposed beside the feed-in radiator and has a first grounded end. The two second grounded radiators are positioned between the two dipole antennas, the two second grounded radiators are separated from the two first grounded radiators and are respectively corresponding to the two first grounded radiators, and a bent gap is formed between the two second grounded radiators.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0234277 A1**

Zekios et al. (43) **Pub. Date: Jul. 29, 2021**

(54) **ARRAYS WITH FOLDABLE AND DEPLOYABLE CHARACTERISTICS**

(71) Applicants: **Constantinos L. Zekios**, Miami, FL (US); **Stavros Georgakopoulos**, Miami, FL (US); **Muhammad Hamza**, Miami, FL (US)

(72) Inventors: **Constantinos L. Zekios**, Miami, FL (US); **Stavros Georgakopoulos**, Miami, FL (US); **Muhammad Hamza**, Miami, FL (US)

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

(21) Appl. No.: **17/213,645**

(22) Filed: **Mar. 26, 2021**

Related U.S. Application Data

(62) Division of application No. 16/680,673, filed on Nov. 12, 2019.

Publication Classification

(51) **Int. Cl.**

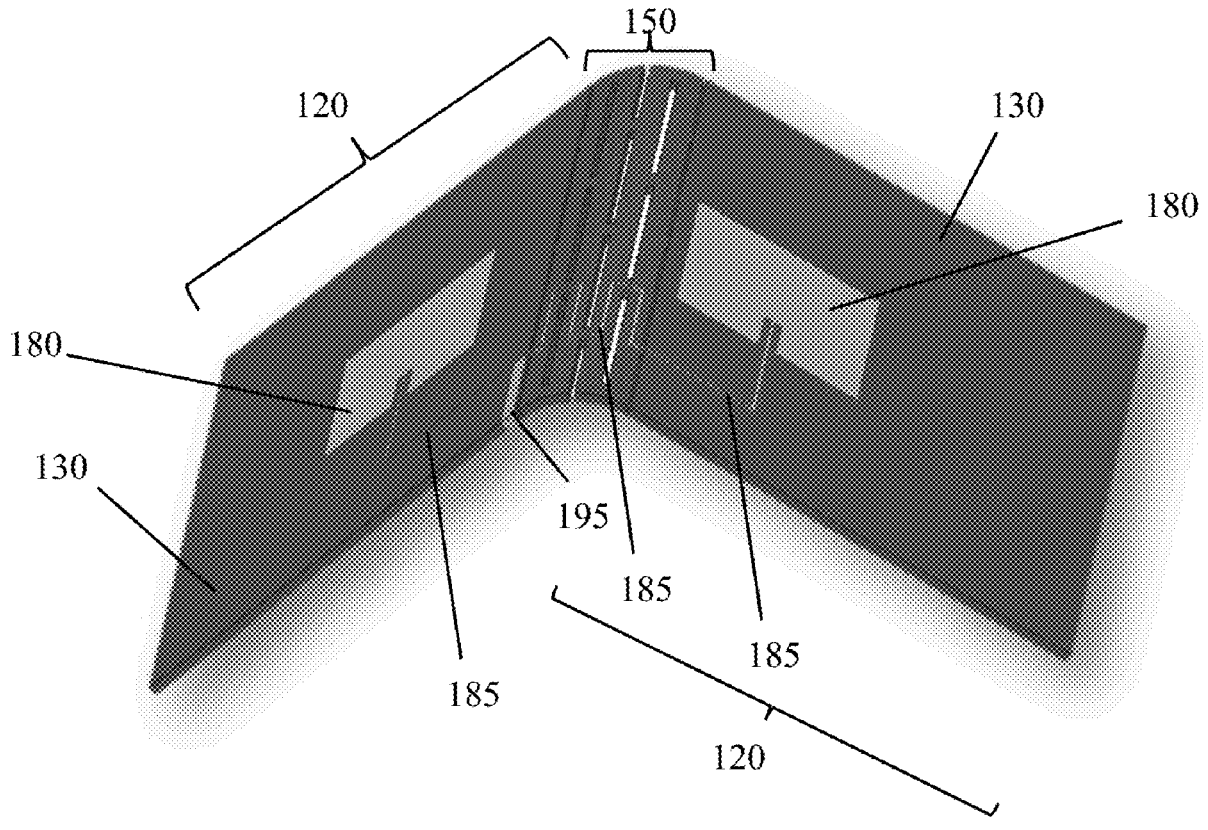
H01Q 9/04	(2006.01)
H01Q 1/08	(2006.01)
H01Q 9/28	(2006.01)
H01Q 1/38	(2006.01)

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

CPC ***H01Q 9/0414*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 9/285*** (2013.01); ***H01Q 1/08*** (2013.01)

(57) **ABSTRACT**

Antenna devices are provided, including tightly coupled arrays, transmitarrays, and reflectarrays. An antenna device can include a plurality of substrates each having an antenna element. The substrates can be provided in connected series or in an array. The substrates can be part of an origami array such that the entire array is foldable. The substrates can optionally be attached to a framework that can actuate the substrates to different configurations. By bending, folding, or otherwise repositioning the substrates/array, the electromagnetic characteristics of the antenna device can be easily reconfigured for the desired task.



US 20210242596A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0242596 A1**

KOMURA et al. (43) **Pub. Date: Aug. 5, 2021**

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

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

(72) Inventors: **Ryo KOMURA**, Kyoto (JP); **Yoshiki YAMADA**, Kyoto (JP)

(21) Appl. No.: **17/234,988**

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

Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

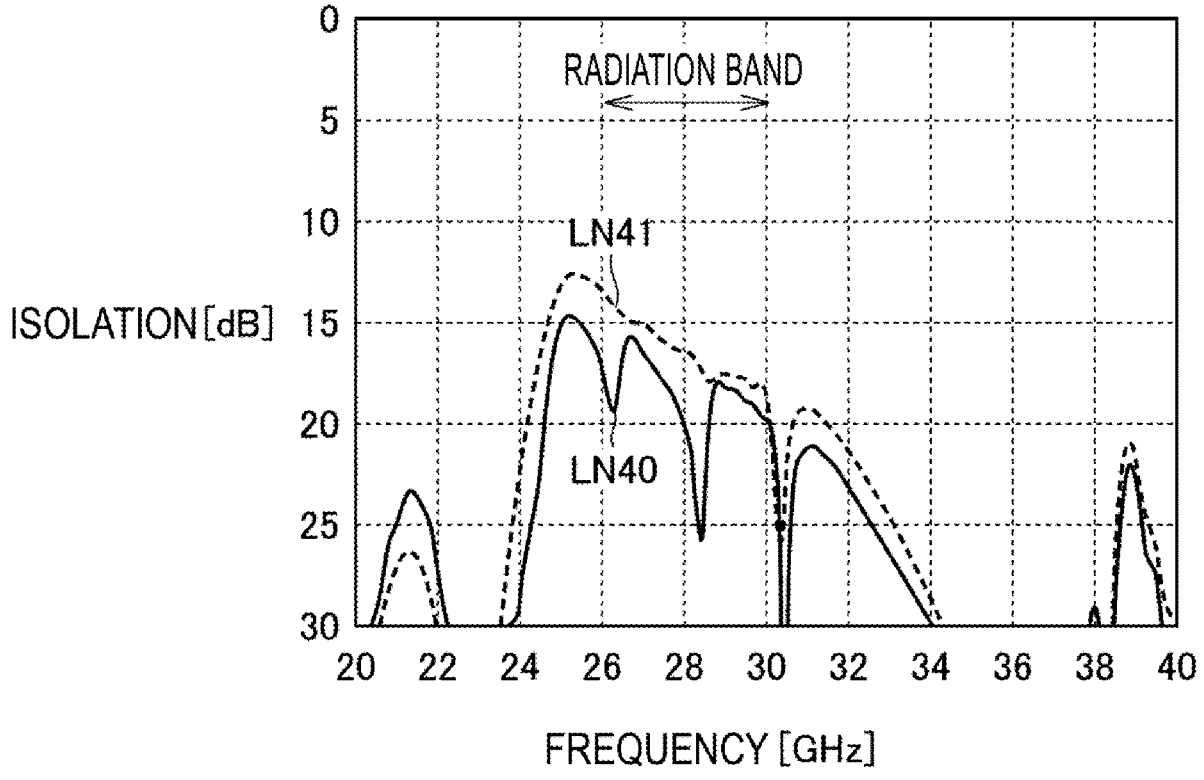
H01Q 9/04	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/52	(2006.01)

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

CPC ***H01Q 9/0421*** (2013.01); ***H01Q 1/52*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a dielectric substrate, a radiation electrode, a ground electrode, and a current-interrupting element. The radiation electrode is disposed in a layer of the dielectric substrate, and the ground electrode is disposed in another layer of the dielectric substrate. The current-interrupting element is electrically connected to the ground electrode. The current-interrupting element is configured to interrupt a current flowing through the ground electrode. The current-interrupting element has a first edge portion electrically connected to the ground electrode and a second edge portion left open and includes a planar electrode parallel to the ground electrode. The dimension of the current-interrupting element in the direction from the first edge portion to the second edge portion is about λ/4, where λ is the wavelength of a radio-frequency signal radiated from the radiation electrode.



US 20210242597A1

(19) **United States**

(12) **Patent Application Publication**

SOTOMA et al.

(10) **Pub. No.: US 2021/0242597 A1**

(43) **Pub. Date: Aug. 5, 2021**

(54) **COMMUNICATIONS DEVICE**

(71) Applicant: **SHARP KABUSHIKI KAISHA**, Sakai City (JP)

(72) Inventors: **NAOKI SOTOMA**, Sakai City (JP); **HIROKI KASHIWAGI**, Sakai City (JP)

(21) Appl. No.: **17/150,358**

(22) Filed: **Jan. 15, 2021**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

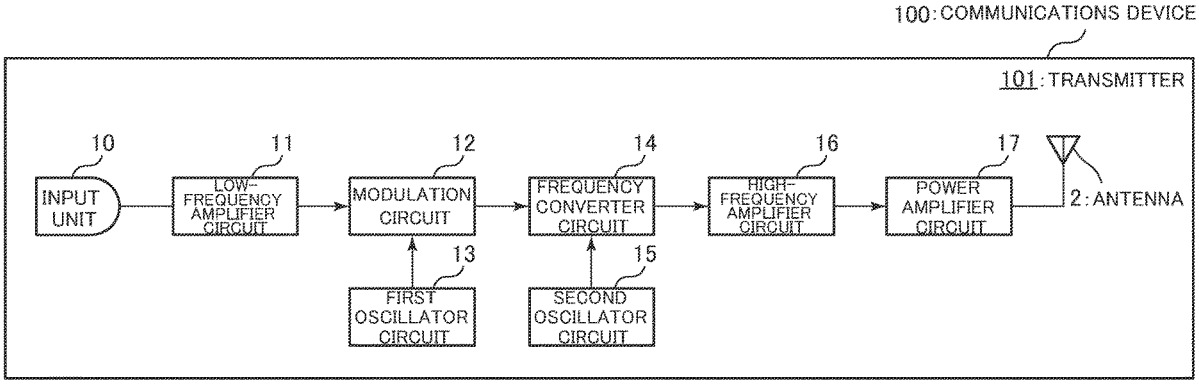
H01Q 9/04	(2006.01)
H01Q 1/52	(2006.01)
H01Q 15/24	(2006.01)

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

CPC ***H01Q 9/0478*** (2013.01); ***H01Q 15/24*** (2013.01); ***H01Q 1/52*** (2013.01)

(57) **ABSTRACT**

A communications device includes: an antenna radiating a first radio wave having a first polarization direction and a second radio wave having a second polarization direction, the first and second polarization directions being different; a casing provided with an opening through which the first radio wave and the second radio wave pass; and a cover provided to the opening and including a plurality of bars made of metal. The antenna is disposed so that neither the first polarization direction of the first radio wave nor the second polarization direction of the second wave orthogonally intersects with an extending direction of the bars.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0249766 A1**

WU et al. (43) **Pub. Date: Aug. 12, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Tzu-Min WU**, Hsinchu (TW); **Kuo-Jen LAI**, Hsinchu (TW); **Kuang-Yuan KU**, Hsinchu (TW)

(21) Appl. No.: **17/014,502**

(22) Filed: **Sep. 8, 2020**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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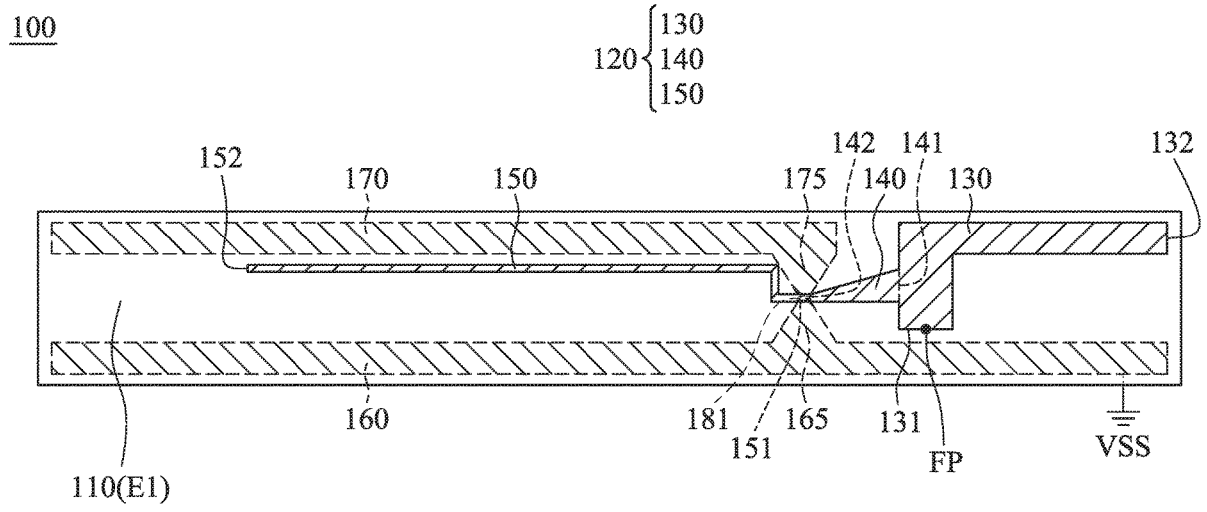
H01Q 9/06	(2006.01)
H01Q 5/48	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/38	(2006.01)

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

CPC ***H01Q 1/521*** (2013.01); ***H01Q 9/065*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/48*** (2015.01)

(57) **ABSTRACT**

An antenna structure includes a substrate, a feeding radiation element, a first grounding radiation element, a second grounding radiation element, and a first circuit element. The substrate has a first surface and a second surface which are opposite to each other. The feeding radiation element includes a body portion, a bridging portion, and an extension portion. The body portion has a feeding point. The bridging portion is coupled between the body portion and the extension portion. The first grounding radiation element is coupled to a ground voltage. The first circuit element is coupled between the first grounding radiation element and the second grounding radiation element. The bridging portion of the feeding radiation element is disposed on the first surface of the substrate. The first circuit element is disposed on the second surface of the substrate.



US 20210249775A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0249775 A1**

Thyagaranjan et al. (43) **Pub. Date: Aug. 12, 2021**

(54) **PATCH ANTENNA ASSEMBLY WITH GROUNDED POSTS**

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

(72) Inventors: **Mukund Ranga Thyagaranjan**, San Diego, CA (US); **Weichun Eric Lin**, San Diego, CA (US); **John Eric Shamblin**, San Diego, CA (US); **Mehak Garg**, San Diego, CA (US); **Manuel Rodriguez**, Temecula, CA (US); **Kenneth Mueller**, San Diego, CA (US)

(21) Appl. No.: **17/170,079**

(22) Filed: **Feb. 8, 2021**

Related U.S. Application Data

(60) Provisional application No. 62/972,151, filed on Feb. 10, 2020.

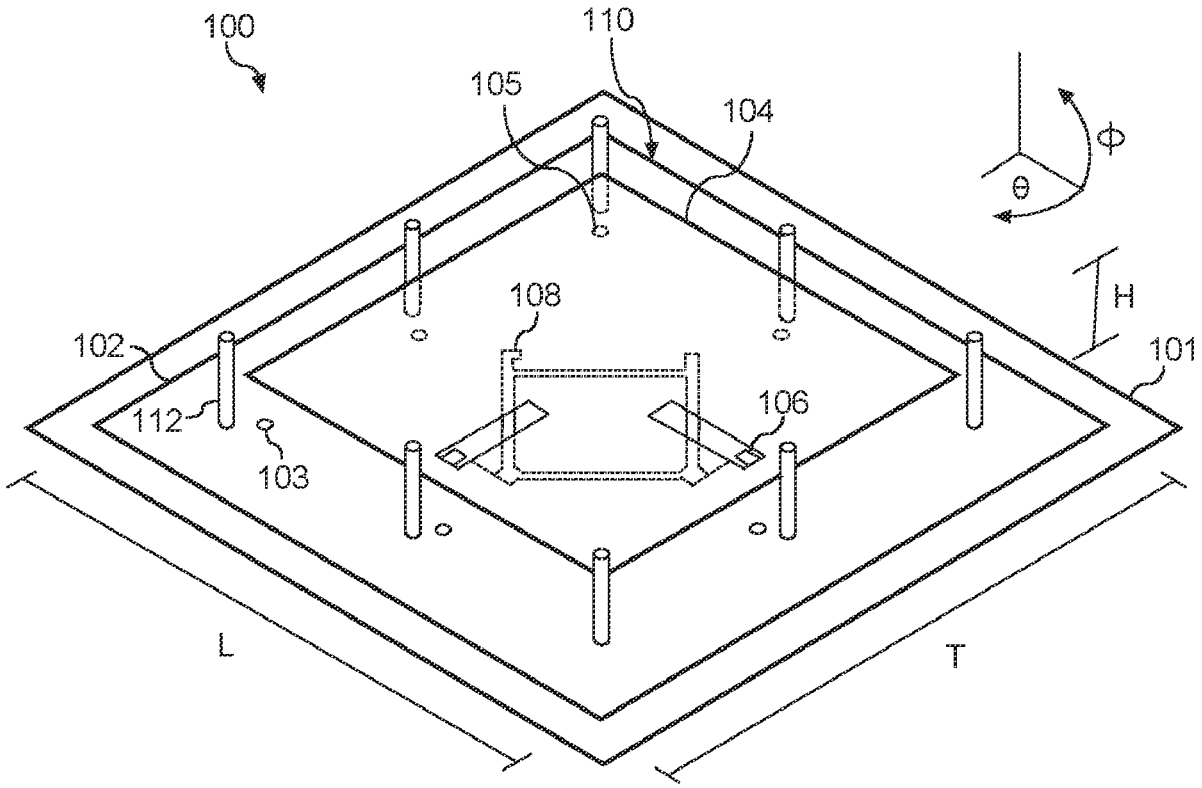
Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/15 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0414*** (2013.01); ***H01Q 5/15*** (2015.01)

(57) **ABSTRACT**

An antenna assembly can be configured for RF communications. The antenna assembly can include a ground plane disposed on a substrate. The antenna assembly can include a patch antenna structure spaced apart from the ground plane. The antenna assembly can include one or more grounded posts coupled to and extending from the substrate. The one or more grounded posts can be arranged along at least a portion of a periphery of the patch antenna structure. The patch antenna structure can emit a radiation pattern based at least in part on a transmit signal. The radiation pattern can induce a resultant field in the one or more grounded posts to adjust a characteristic of the radiation pattern.



US 20210249776A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0249776 A1**

WEI (43) **Pub. Date: Aug. 12, 2021**

(54) **ANTENNA STRUCTURE**

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

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

(21) Appl. No.: **17/010,219**

(22) Filed: **Sep. 2, 2020**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

H01Q 13/10 (2006.01)

H01Q 1/48 (2006.01)

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

CPC ***H01Q 13/106*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a metal mechanism element, a dielectric substrate, a feeding radiation element, a coupling radiation element, a ground plane, a first shorting element, a second shorting element, and a circuit element. The metal mechanism element has a slot. The dielectric substrate has a first surface and a second surface which are opposite to each other. The feeding radiation element extends across the slot. The coupling radiation element is adjacent to the feeding radiation element. The first shorting element is coupled to a first grounding point on the ground plane. The second shorting element is coupled to the metal mechanism element. The circuit element is coupled between the first shorting element and the second shorting element. The coupling radiation element is disposed on the first surface of the dielectric substrate. The feeding radiation element is disposed on the second surface of the dielectric substrate.