US 20210021041A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0021041 A1**

CHIU et al. (43) **Pub. Date: Jan. 21, 2021**

(54) **COMPACT WIDEBAND INTEGRATED THREE-BROADSIDE-MODE PATCH ANTENNA**

(71) Applicant: **The Hong Kong University of Science and Technology**, Hong Kong (CN)

(72) Inventors: **Chi Yuk CHIU**, Hong Kong (CN); **Ross David MURCH**, Hong Kong (CN)

(21) Appl. No.: **17/064,266**

(22) Filed: **Oct. 6, 2020**

Related U.S. Application Data

(63) Continuation-in-part of application No. 16/220,916, filed on Dec. 14, 2018, now Pat. No. 10,854,977.

(60) Provisional application No. 62/708,755, filed on Dec. 21, 2017, provisional application No. 62/973,720, filed on Oct. 22, 2019.

Publication Classification

(51) **Int. Cl.**

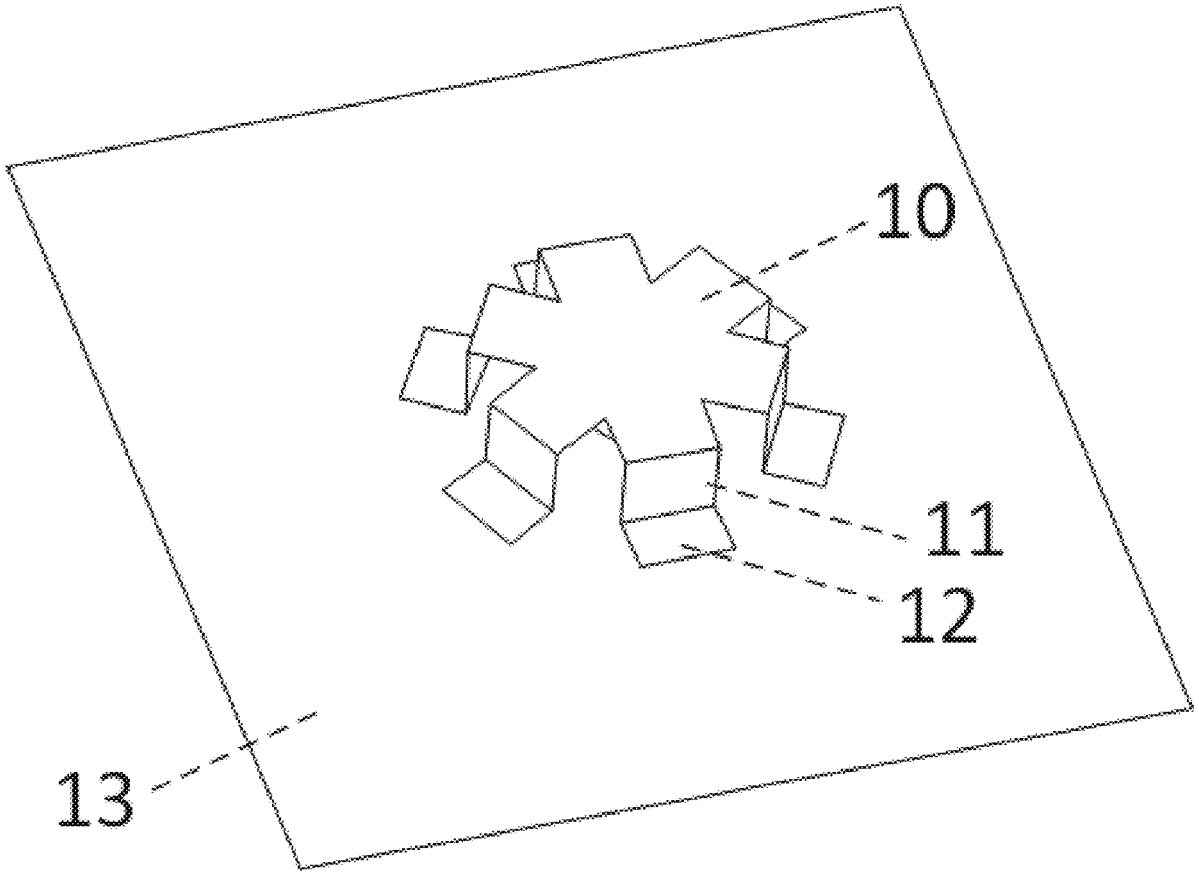
H01Q 9/04	(2006.01)
H01Q 5/15	(2006.01)
H01Q 5/50	(2006.01)
H01Q 21/06	(2006.01)

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

CPC ***H01Q 9/0407*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 5/50*** (2015.01); ***H01Q 5/15*** (2015.01)

(57) **ABSTRACT**

A three-broadside-mode patch antenna includes: a rotationally symmetric radiator; a patch, wherein the patch is separated from the rotationally symmetric radiator by a dielectric and configured to capacitively feed the rotationally symmetric radiator; and three antenna probes, connected to the patch, configured to provide three antenna ports corresponding to three respective broadside radiation polarizations.



US 20210021045A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0021045 A1**

Hamabe (43) **Pub. Date: Jan. 21, 2021**

(54) **ANTENNA DEVICE AND ONE SET OF ANTENNA DEVICES**

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

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

(21) Appl. No.: **16/927,272**

(22) Filed: **Jul. 13, 2020**

(30) **Foreign Application Priority Data**

Jul. 18, 2019 (JP) 2019-132921

Publication Classification

(51) **Int. Cl.**

H01Q 9/16 (2006.01)

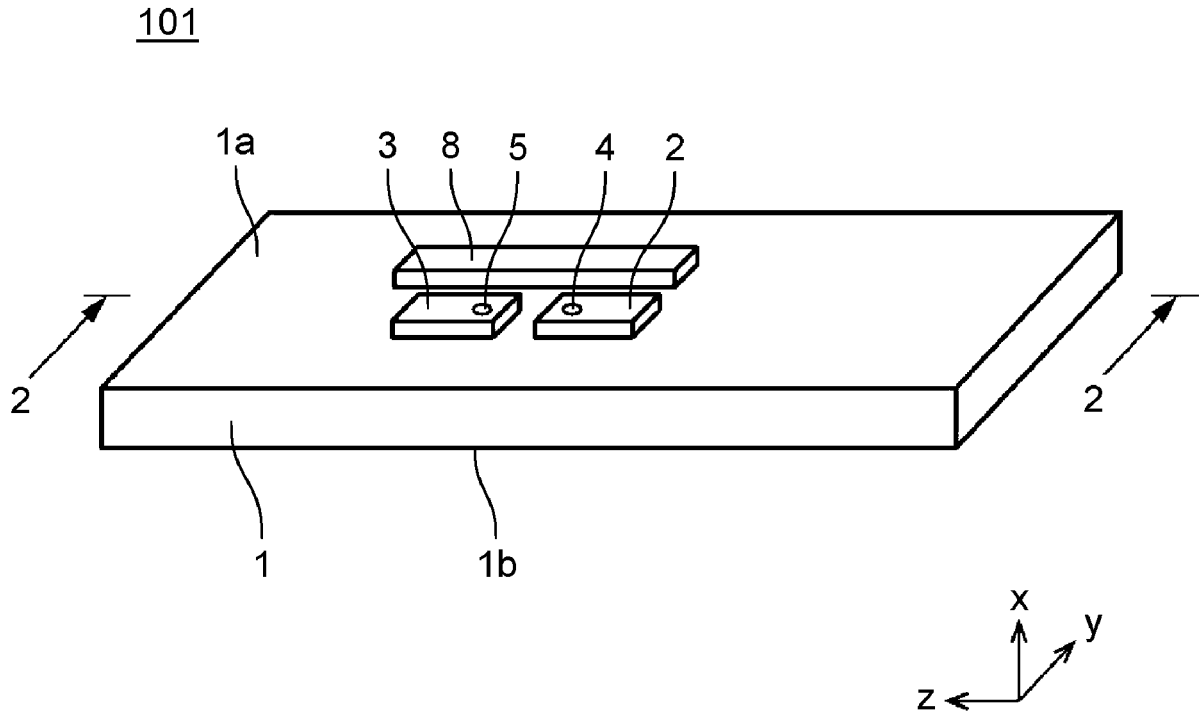
H01Q 1/48 (2006.01)

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

CPC ***H01Q 9/16*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna device including: a ground conductor having one end and another end in a longitudinal direction; a feeding antenna conductor disposed close to the other end; a non-feeding antenna conductor disposed close to the one end; an artificial magnetic conductor that is layered between the feeding and the non-feeding antenna conductors, and the ground conductor, and that is disposed away from each of the feeding and non-feeding antenna conductors, and the ground conductor; and at least one via conductor that is disposed between the one end of the ground conductor and the non-feeding antenna conductor in the longitudinal direction, and that electrically connects the ground conductor and the artificial magnetic conductor, wherein in the longitudinal direction, a length from the one end of the ground conductor to the non-feeding antenna conductor is shorter than a length from the other end of the ground conductor to the feeding antenna conductor.



US 20210021047A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0021047 A1**

Shen et al. (43) **Pub. Date: Jan. 21, 2021**

(54) **PCB ANTENNA**

(71) Applicant: **AAC Technologies Pte. Ltd.**, Singapore city (SG)

(72) Inventors: **Yachuan Shen**, Shenzhen (CN); **Lei Zheng**, Shenzhen (CN); **Yongsheng Peng**, Shenzhen (CN); **Hongjun Wang**, Shenzhen (CN)

(21) Appl. No.: **16/945,945**

(22) Filed: **Aug. 3, 2020**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2019/093502, filed on Jun. 28, 2019.

Publication Classification

(51) **Int. Cl.**

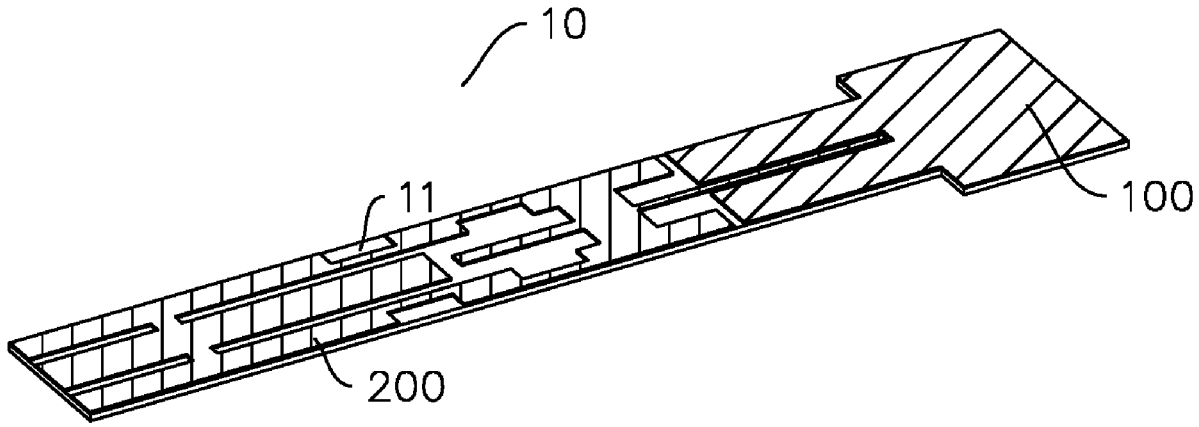
H01Q 13/10	(2006.01)
H01Q 1/38	(2006.01)
H01Q 21/30	(2006.01)

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

CPC ***H01Q 13/10*** (2013.01); *H01Q 1/241* (2013.01); ***H01Q 21/30*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

Provided is a PCB antenna, including PCB substrate, first and second radiating portions, the first radiating portion includes first radiator, second and third radiators extending therefrom to form feeding groove; the second radiating portion includes fourth radiator, fifth and sixth radiators extending therefrom, seventh radiator, eighth and ninth radiators extending therefrom, and tenth and eleventh radiators symmetrically arranged, the fifth radiator extends to the feeding groove; the sixth radiator extends in opposite direction of the fifth radiator; the seventh radiator extends in the direction of the sixth radiator and forms second slot therewith; the eighth radiator extends in opposite direction of the seventh radiator; third slot is formed between the tenth radiator and the second radiator, fourth slot is formed between the eleventh radiator and the third radiator. The PCB antenna provided can enhance medium and high frequency resonance and provide full-band omnidirectional antenna design under 4G demand.



US 20210021051A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0021051 A1**

CHEN et al. (43) **Pub. Date: Jan. 21, 2021**

(54) **SLOT ARRAY ANTENNA**

(71) Applicant: **AGC Inc.**, Tokyo (JP)

(72) Inventors: **Qiang CHEN**, Miyagi (JP); **Osamu KAGAYA**, Tokyo (JP); **Toshiki SAYAMA**, Tokyo (JP); **Takeshi MOTEGI**, Tokyo (JP)

(73) Assignee: **AGC Inc.**, Tokyo (JP)

(21) Appl. No.: **17/064,313**

(22) Filed: **Oct. 6, 2020**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2019/015478, filed on Apr. 9, 2019.

(30) **Foreign Application Priority Data**

Apr. 13, 2018 (JP) 2018-077333
Dec. 7, 2018 (JP) 2018-229768

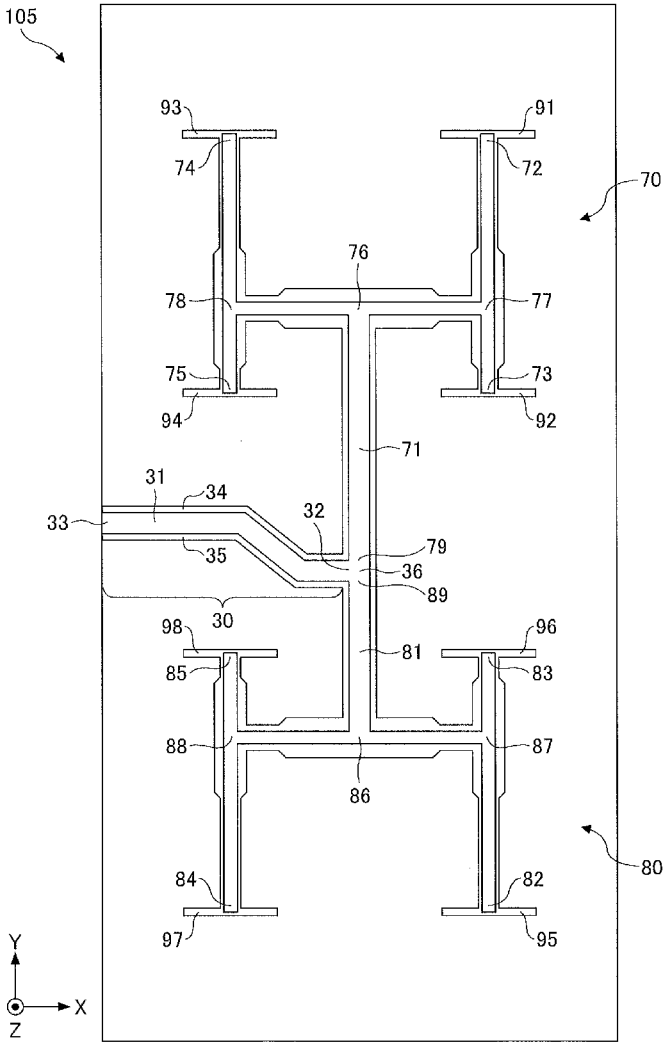
Publication Classification

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 21/00 (2006.01)
H01P 1/20 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 21/064*** (2013.01); ***H01P 1/20*** (2013.01); ***H01Q 21/0075*** (2013.01)

(57) **ABSTRACT**

A slot array antenna includes a dielectric layer, a power feeding unit, a first coplanar waveguide formed in a conductor layer provided on one surface of the dielectric layer, and a second coplanar waveguide formed in the conductor layer, wherein each of the first coplanar waveguide and the second coplanar waveguide includes a first end part connected to a point to which the power feeding unit is connected or situated in proximity and at least one second end part connected to at least one slot formed in the conductor layer.



US 20210021054A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0021054 A1**

HUANG (43) **Pub. Date: Jan. 21, 2021**

(54) **ANTENNA SYSTEM**

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

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

(21) Appl. No.: **16/700,041**

(22) Filed: **Dec. 2, 2019**

(30) **Foreign Application Priority Data**

Jul. 16, 2019 (TW) 108125019

Publication Classification

(51) **Int. Cl.**

H01Q 21/26 (2006.01)

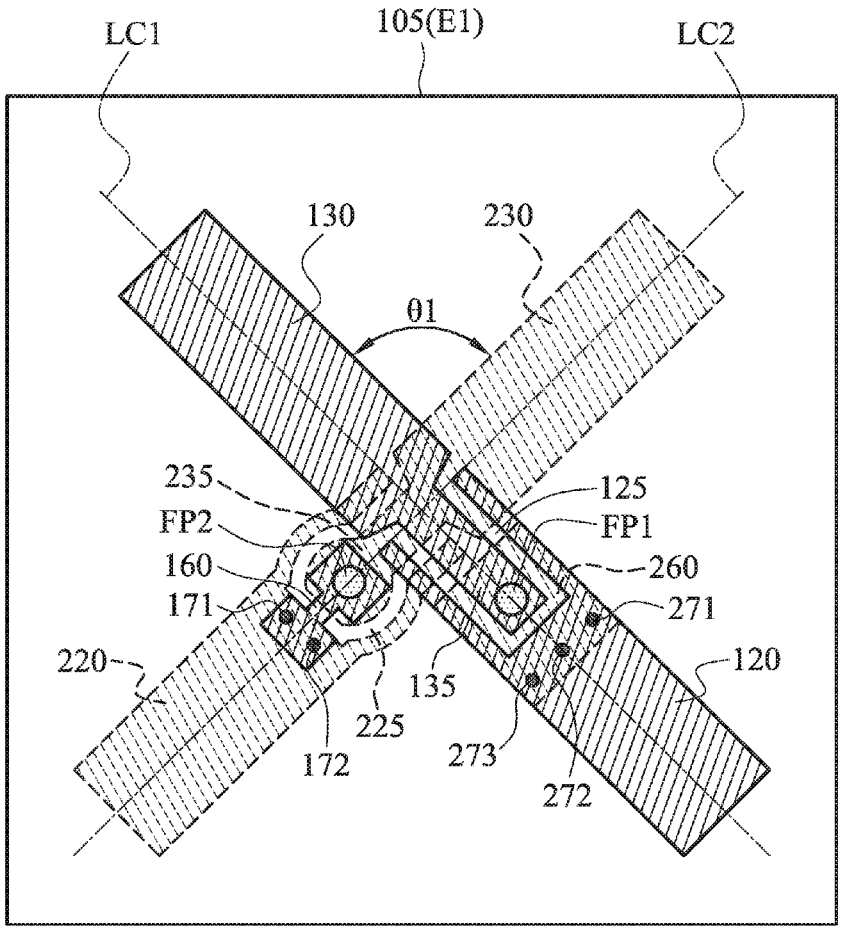
H01Q 9/16 (2006.01)

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

CPC ***H01Q 21/26*** (2013.01); ***H01Q 9/16*** (2013.01)

(57) **ABSTRACT**

An antenna system includes a dielectric substrate, a first dipole antenna element, a second dipole antenna element, a first additional metal element, a second additional metal element, first conductive via elements, and second conductive via elements. The first dipole antenna element and the first additional metal element are disposed on a first surface of the dielectric substrate. The first dipole antenna element includes a first radiation element and a second radiation element. The second dipole antenna element and the second additional metal element are disposed on a second surface of the dielectric substrate. The second dipole antenna element includes a third radiation element and a fourth radiation element. The first additional metal element is coupled through the first conductive via elements to the third radiation element. The second additional metal element is coupled through the second conductive via elements to the first radiation element.



US 20210021055A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0021055 A1**

KIM et al. (43) **Pub. Date: Jan. 21, 2021**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

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

(72) Inventors: **Taekyun KIM**, Suwon-si (KR); **Haekwon LEE**, Suwon-si (KR); **Taejoon BAE**, Suwon-si (KR)

(21) Appl. No.: **16/929,329**

(22) Filed: **Jul. 15, 2020**

(30) **Foreign Application Priority Data**

Jul. 18, 2019 (KR) 10-2019-0086805

Publication Classification

(51) **Int. Cl.**

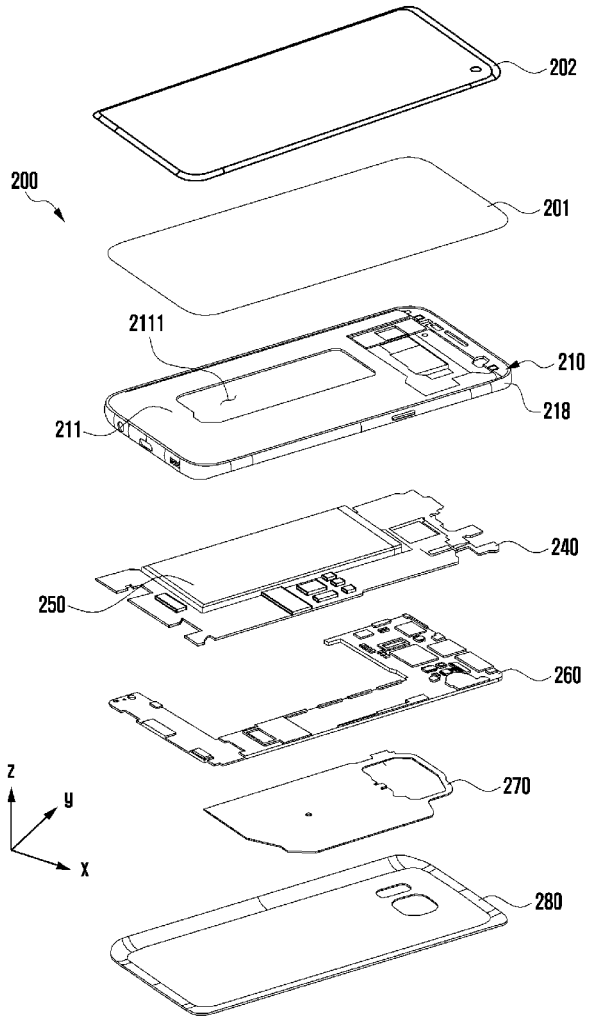
H01Q 21/28	(2006.01)
H01Q 7/00	(2006.01)
H01Q 1/24	(2006.01)
H01Q 5/307	(2006.01)

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

CPC ***H01Q 21/28*** (2013.01); ***H01Q 5/307*** (2015.01); ***H01Q 1/243*** (2013.01); ***H01Q 7/00*** (2013.01)

(57) **ABSTRACT**

In various embodiments, an electronic device may include: a housing including an inner space, and a first antenna structure disposed in the inner space of the housing, the first antenna structure including: a dielectric substrate, at least one first conductor disposed in a first area of the dielectric substrate, and at least one second conductor disposed in a second area of the dielectric substrate extending from the first area of the dielectric substrate. The electronic device may further include at least one third conductor capacitively coupled with the at least one second conductor, a first wireless communication circuit configured to transmit and/or receive a signal of a first frequency band through the at least one first conductor, and a second wireless communication circuit configured to transmit and/or receive a radio signal of a second frequency band through the at least one second conductor and the at least one third conductor.



US 20210028535A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0028535 A1

WU et al. (43) Pub. Date: Jan. 28, 2021

(54) DUAL-POLARIZED MILLIMETER WAVE ANTENNA UNIT, ANTENNA SYSTEM, AND MOBILE TERMINAL

(71) Applicant: **SHENZHEN SUNWAY COMMUNICATION CO., LTD.**, Shenzhen City, Guangdong (CN)

(72) Inventors: **Shengjie WU**, Shenzhen (CN); **Anping ZHAO**, Shenzhen (CN)

(73) Assignee: **SHENZHEN SUNWAY COMMUNICATION CO., LTD.**, Shenzhen City, Guangdong (CN)

(21) Appl. No.: **16/606,132**

(22) PCT Filed: **Sep. 11, 2019**

(86) PCT No.: **PCT/CN2019/105247**

§ 371 (c)(1),
(2) Date: **Oct. 17, 2019**

(30) **Foreign Application Priority Data**

Jul. 23, 2019 (CN) 201910664228.3

Publication Classification

(51) **Int. Cl.**

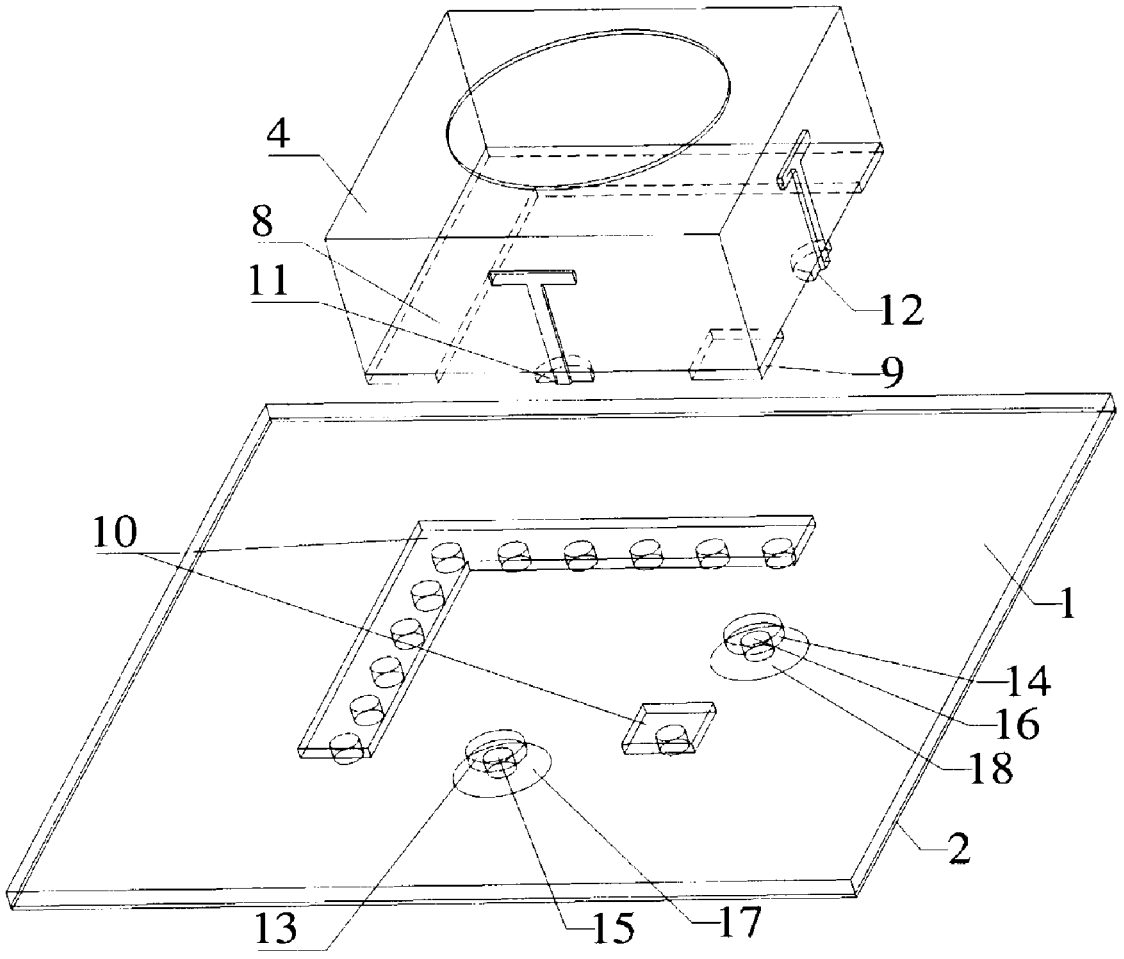
H01Q 1/24	(2006.01)
H01Q 21/00	(2006.01)
H01Q 15/24	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 15/24*** (2013.01); ***H01Q 21/0006*** (2013.01)

(57) **ABSTRACT**

A dual-polarized millimeter wave antenna unit, an antenna system, and a mobile terminal are disclosed. The dual-polarized millimeter wave antenna unit comprises a main part, a first feed branch, a second feed branch, and a radiator, wherein the radiator is arranged on the top face of the main part, the first feed branch is arranged on a first side face of the main part, the second feed branch is arranged on a second side face of the main body, the first feed branch and the second feed branch are communicated with the bottom face of the main part, the first side face is perpendicular to the second side face, and a weld region is arranged on the bottom face of the main part. The dual-polarized millimeter wave antenna unit provided by the invention has the advantages of wideband, dual polarization, and low sidelobe, thus being especially suitable for 5G communication.



US 20210028536A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0028536 A1**

Han et al. (43) **Pub. Date: Jan. 28, 2021**

(54) **THREE-SLOTTED ANTENNA APPARATUS AND METHOD**

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

(72) Inventors: **Chulmin Han**, Redmond, WA (US); **Wee Kian Toh**, San Diego, CA (US); **Wei Huang**, San Diego, CA (US); **Hongwei Liu**, San Diego, CA (US)

(21) Appl. No.: **17/066,292**

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

Related U.S. Application Data

(63) Continuation of application No. 16/604,962, filed on Oct. 11, 2019, now Pat. No. 10,847,871, filed as application No. PCT/CN2018/082450 on Apr. 10, 2018, which is a continuation of application No. 15/488,308, filed on Apr. 14, 2017, now Pat. No. 10,236,559.

Publication Classification

(51) **Int. Cl.**

H01Q 1/24	(2006.01)
H01Q 5/371	(2006.01)
H01Q 5/35	(2006.01)
H01Q 13/10	(2006.01)
H01Q 5/50	(2006.01)
H01Q 1/48	(2006.01)
H01Q 13/18	(2006.01)
H04B 7/0404	(2006.01)
H04B 7/0413	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 5/371*** (2015.01); ***H01Q 5/35*** (2015.01); ***H01Q 13/10*** (2013.01); *H01Q 21/28* (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 13/18*** (2013.01); ***H04B 7/0404*** (2013.01); ***H04B 7/0413*** (2013.01); ***H01Q 5/50*** (2015.01)

(57) **ABSTRACT**

An apparatus and associated method are provided involving a housing having a periphery configured to operate as a second antenna, a third antenna, and a fourth antenna. The periphery includes a top wall having a first slot formed therein, a first side wall having a second slot formed therein, and a second side wall having a third slot formed therein. The top wall is arranged between the first side wall and the second side wall, and a top portion of the periphery is defined between the second slot and the third slot. The top portion is divided into a first top side portion and a second top side portion via the first slot. Further, the first top side portion operates as the second antenna, and the second top side portion operates as both the third antenna and the fourth antenna.

US 20210028548A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0028548 A1**

TSUTSUMI et al. (43) **Pub. Date: Jan. 28, 2021**

(54) **ANTENNA APPARATUS, AND MANUFACTURING METHOD**

(71) Applicant: **Kabushiki Kaisha Toshiba**, Minato-ku (JP)

(72) Inventors: **Yukako TSUTSUMI**, Kawasaki (JP); **Makoto Higaki**, Setagaya (JP)

(73) Assignee: **Kabushiki Kaisha Toshiba**, Minato-ku (JP)

(21) Appl. No.: **16/816,449**

(22) Filed: **Mar. 12, 2020**

(30) **Foreign Application Priority Data**

Jul. 25, 2019 (JP) 2019-136852

Publication Classification

(51) **Int. Cl.**

H01Q 13/10 (2006.01)

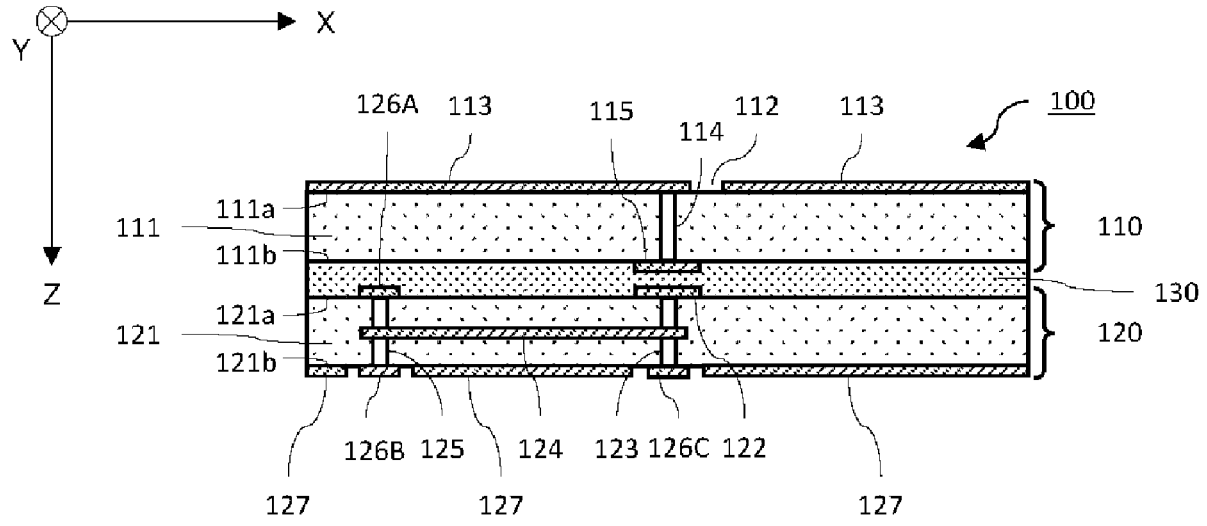
H01Q 1/22 (2006.01)

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

CPC ***H01Q 13/10*** (2013.01); *H01Q 1/48* (2013.01); ***H01Q 1/2283*** (2013.01)

(57) **ABSTRACT**

An antenna apparatus includes a first dielectric substrate including a first surface and a second surface opposite to the first surface, a radiating element located on the first surface or in the first dielectric substrate, a first electrode on the second surface, a first conductor provided through the first dielectric substrate from the first surface to the second surface, to connect electrically the radiating element and the first electrode, a second dielectric substrate including a third surface and a fourth surface opposite to the third surface, an adhesive layer between the second surface and the third surface, a second electrode on the third surface, a first signal line located on the fourth surface or in the second dielectric substrate, and a second conductor provided through the second dielectric substrate from the third surface to the fourth surface, to connect electrically the second electrode and the first signal line.



US 20210028556A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0028556 A1**

BRAR et al. (43) **Pub. Date: Jan. 28, 2021**

(54) **MULTI-PORT MULTI-BEAM ANTENNA SYSTEM ON PRINTED CIRCUIT BOARD WITH LOW CORRELATION FOR MIMO APPLICATIONS AND METHOD THEREFOR**

(71) Applicant: **BENCHMARK ELECTRONICS, INC.**, TEMPE, AZ (US)

(72) Inventors: **RAJVEER SINGH BRAR**, TEMPE, AZ (US); **MARK FELIPE**, TEMPE, AZ (US)

(73) Assignee: **BENCHMARK ELECTRONICS, INC.**, TEMPE, AZ (US)

(21) Appl. No.: **17/015,559**

(22) Filed: **Sep. 9, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/877,096, filed on Jul. 22, 2019.

Publication Classification

(51) **Int. Cl.**

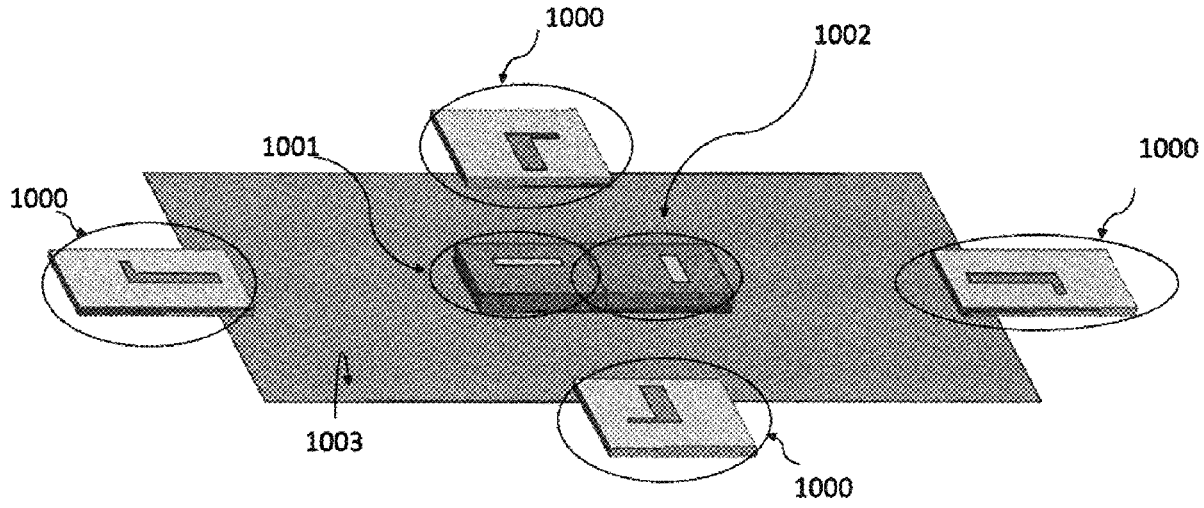
H01Q 21/06	(2006.01)
H01Q 19/30	(2006.01)
H01Q 9/04	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 21/067*** (2013.01); ***H01Q 19/30*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/045*** (2013.01); ***H01Q 21/062*** (2013.01)

(57) **ABSTRACT**

An antenna assembly has a dielectric substrate. A plurality of end fire antennas in a Yagi-Uda configuration is positioned around edges of the dielectric substrate.



US 20210036431A1

(19) **United States**

(12) **Patent Application Publication**

Wu et al.

(10) **Pub. No.: US 2021/0036431 A1**

(43) **Pub. Date: Feb. 4, 2021**

(54) **ANTENNA AND MOBILE TERMINAL**

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

(72) Inventors: **Pengfei Wu**, Shanghai (CN); **Hanyang Wang**, Reading (GB); **Chien-Ming Lee**, Shenzhen (CN); **Dong Yu**, Shanghai (CN); **Jiaqing You**, Shanghai (CN)

(21) Appl. No.: **17/044,174**

(22) PCT Filed: **Apr. 25, 2018**

(86) PCT No.: **PCT/CN2018/084490**

§ 371 (c)(1),
(2) Date: **Sep. 30, 2020**

Publication Classification

(51) **Int. Cl.**

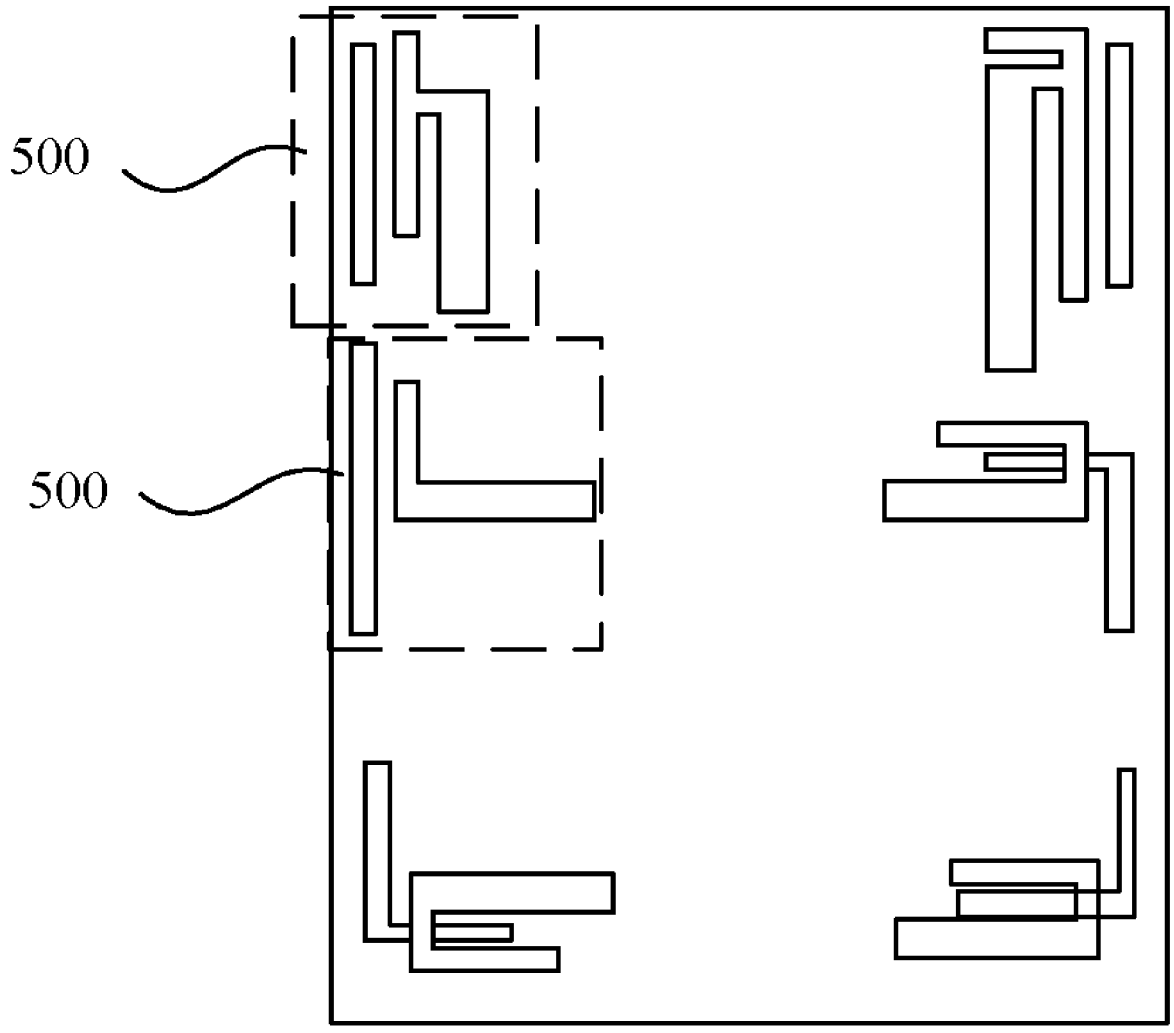
H01Q 21/06	(2006.01)
H01Q 1/52	(2006.01)
H01Q 13/16	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 21/064*** (2013.01); ***H01Q 1/24*** (2013.01); ***H01Q 13/16*** (2013.01); ***H01Q 1/523*** (2013.01)

(57) **ABSTRACT**

An antenna and a mobile terminal are provided. The antenna includes a plurality of antenna units arranged in an array, and each antenna unit includes a first radiating element and a second radiating element, where the first radiating element includes a first slot disposed on a metal layer, the second radiating element includes at least one radiating stub, and the first radiating element is coupled to the at least one radiating stub. In any two adjacent antenna units, a feeder of one antenna unit is connected to a first radiating element of the antenna unit, and a feeder of the other antenna unit is connected to a second radiating element of the antenna unit. In the technical solution, feeders of adjacent antenna units are directly connected to different first radiating elements and second radiating elements.



US 20210036433A1

(19) **United States**

(12) **Patent Application Publication**

KIM

(10) **Pub. No.: US 2021/0036433 A1**

(43) **Pub. Date: Feb. 4, 2021**

(54) **ANTENNA APPARATUS**

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

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

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

(21) Appl. No.: **16/737,129**

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

(30) **Foreign Application Priority Data**

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

Publication Classification

(51) **Int. Cl.**

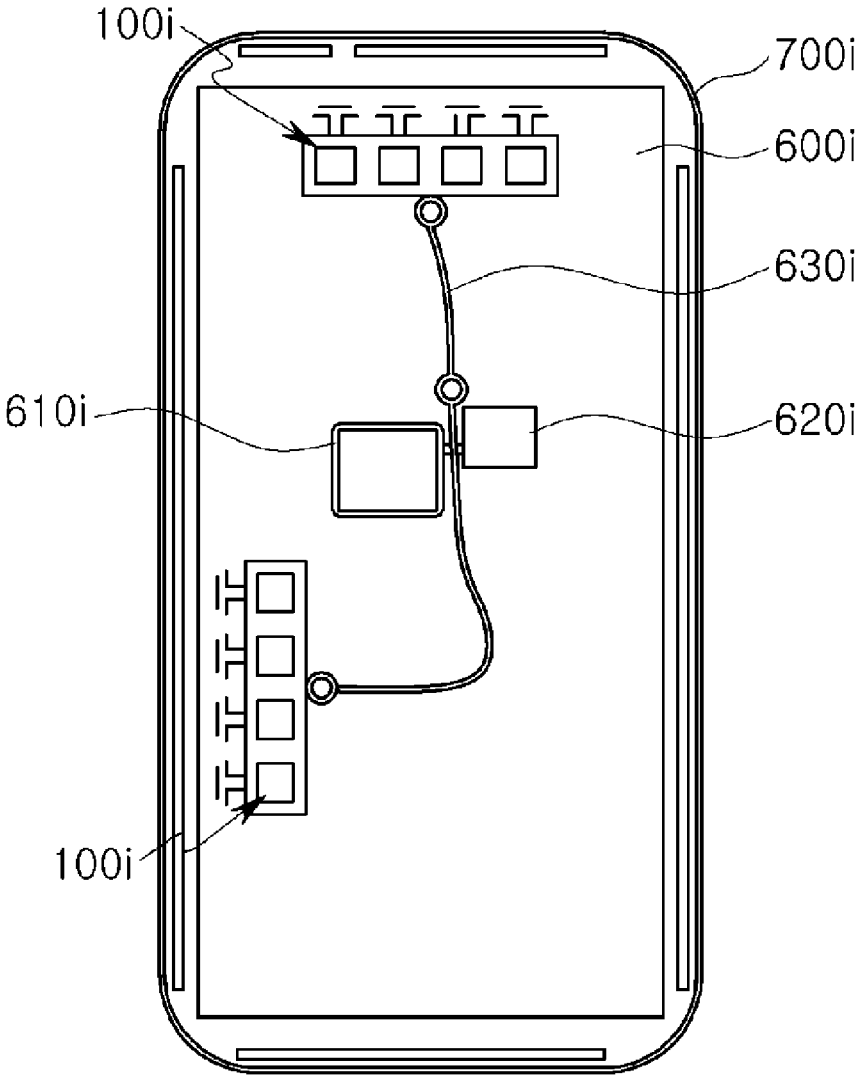
H01Q 21/06 (2006.01)
H01Q 21/00 (2006.01)
H01Q 1/48 (2006.01)
H01Q 5/35 (2006.01)

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

CPC ***H01Q 21/065*** (2013.01); ***H01Q 21/0025*** (2013.01); *H01Q 1/241* (2013.01); ***H01Q 5/35*** (2015.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

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.



US 20210037123A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0037123 A1**

Kim et al. (43) **Pub. Date: Feb. 4, 2021**

(54) **ELECTRONIC DEVICE WITH METAL FRAME ANTENNA**

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

(72) Inventors: **Jaehyung Kim**, Gyeonggi-do (KR); **Jinkyu Bang**, Gyeonggi-do (KR); **Jinu Kim**, Seoul (KR); **Donghwan Kim**, Gyeonggi-do (KR); **Taegyu Kim**, Gyeonggi-do (KR); **Kiyoung Chang**, Seoul (KR)

(21) Appl. No.: **17/073,766**

(22) Filed: **Oct. 19, 2020**

Related U.S. Application Data

(63) Continuation of application No. 16/126,534, filed on Sep. 10, 2018, now Pat. No. 10,812,636, which is a continuation of application No. 15/351,161, filed on Nov. 14, 2016, now Pat. No. 10,075,569.

(30) **Foreign Application Priority Data**

Nov. 13, 2015 (KR) 10-2015-0159787

Publication Classification

(51) **Int. Cl.**

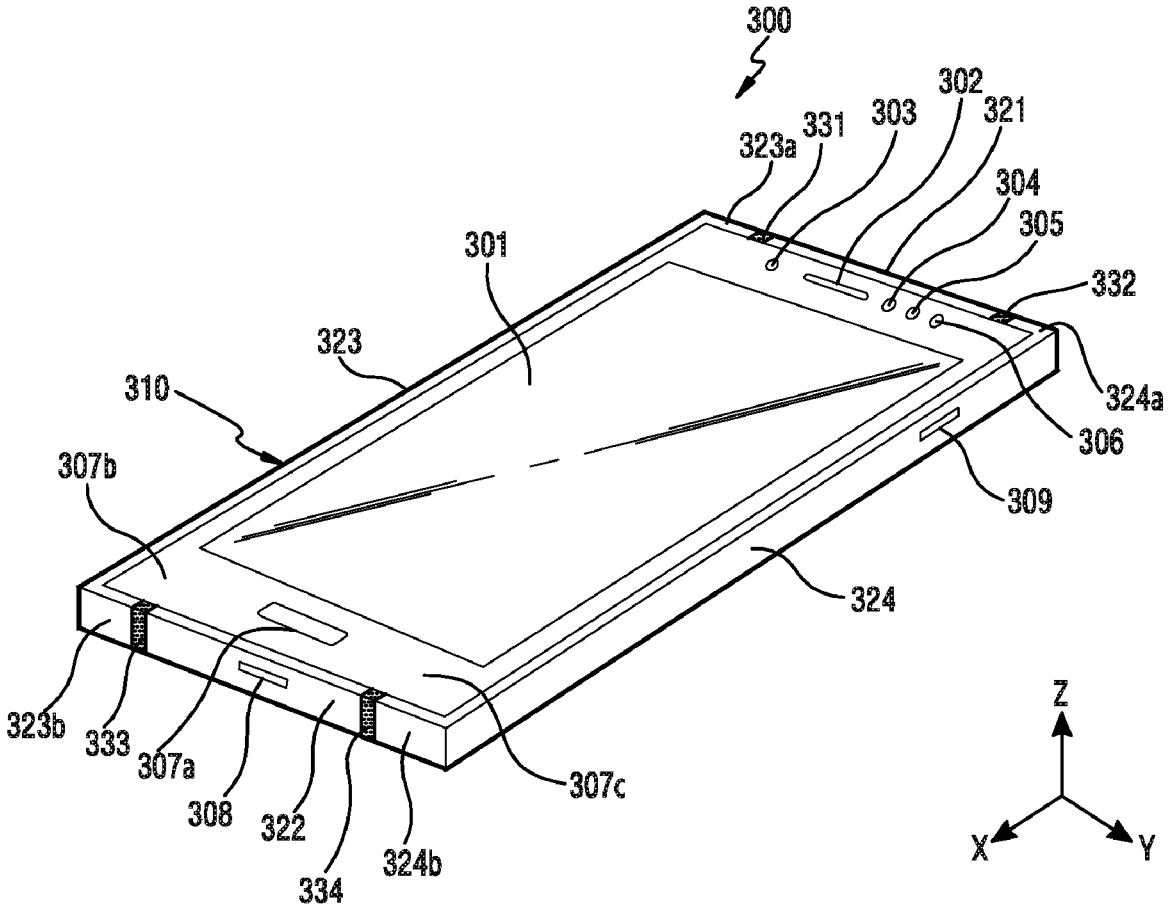
H04M 1/02	(2006.01)
H01Q 9/30	(2006.01)
H01Q 5/385	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H04M 1/0218*** (2013.01); ***H04M 1/026*** (2013.01); ***H01Q 9/30*** (2013.01); *H04M 1/0268* (2013.01); ***H01Q 1/243*** (2013.01); *H04M 1/0214* (2013.01); *H04M 1/0235* (2013.01); ***H01Q 5/385*** (2015.01)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a housing and a connection part. The housing includes a first housing portion that includes a first side face, and a second housing portion that includes a second side face. The connection part connects the first housing portion and the second housing portion. A first conductive member extends along at least a portion of the first side face, a first non-conductive member is disposed on the first side face, a second conductive member extends along at least a portion of the second side face, a second non-conductive member is disposed on the second side face, and when the second housing portion faces the first housing portion, the first non-conductive member and the second non-conductive member are substantially aligned.



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(19) **United States**

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CHANG et al. (43) **Pub. Date: Feb. 11, 2021**

(54) **MOBILE DEVICE**

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(72) Inventors: **Kun-Sheng CHANG**, New Taipei City (TW); **Ching-Chi LIN**, New Taipei City (TW)

(21) Appl. No.: **16/577,061**

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H01Q 5/30	(2006.01)

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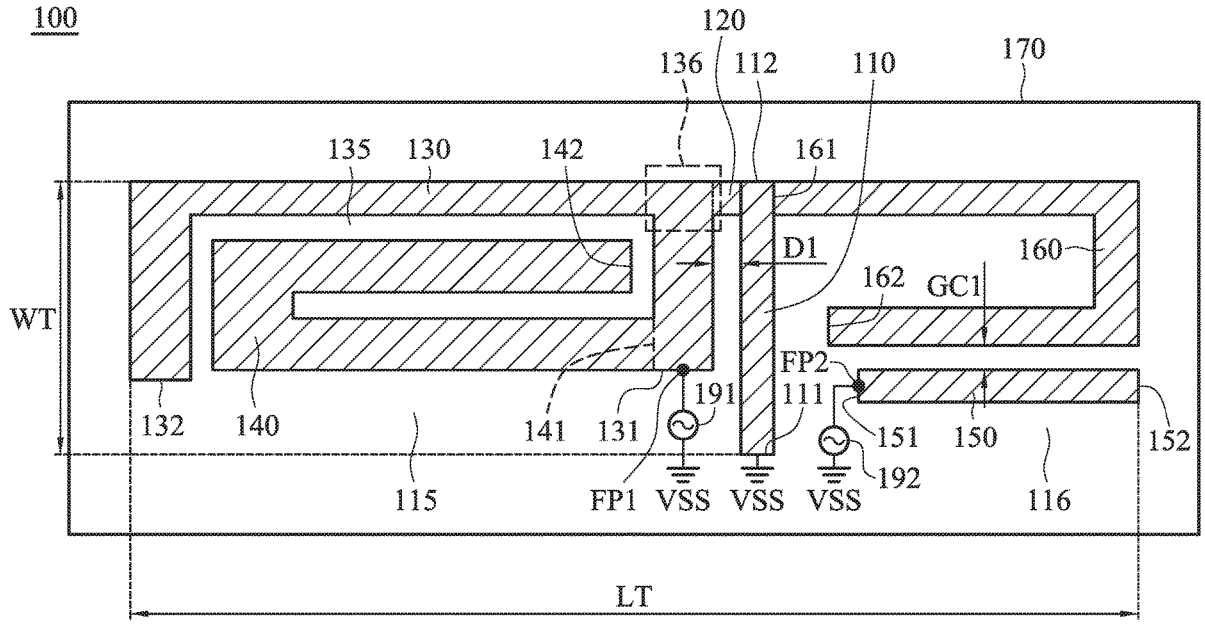
CPC ***H01Q 1/24*** (2013.01); ***H01Q 5/30*** (2015.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

A mobile device includes a common ground element, a connection element, a first radiation element, a second radiation element, a third radiation element, a fourth radiation element, and a dielectric substrate. The first radiation element has a first feeding point. The first radiation element is coupled through the connection element to the common ground element. The second radiation element is coupled to the first feeding point. The second radiation element is at least partially surrounded by the first radiation element. The third radiation element has a second feeding point. The fourth radiation element is adjacent to the third radiation element. The fourth radiation element is coupled to the common ground element. An antenna structure disposed on the dielectric substrate is formed by the common ground element, the connection element, the first radiation element, the second radiation element, the third radiation element, and the fourth radiation element.



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(19) United States

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Ma et al. (43) Pub. Date: Feb. 11, 2021

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

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

(72) Inventors: **Guozhong Ma**, Shenzhen (CN); **Fengwen Chen**, Dongguann (CN); **Dongxing Tu**, Shenzhen (CN)

(21) Appl. No.: **17/081,444**

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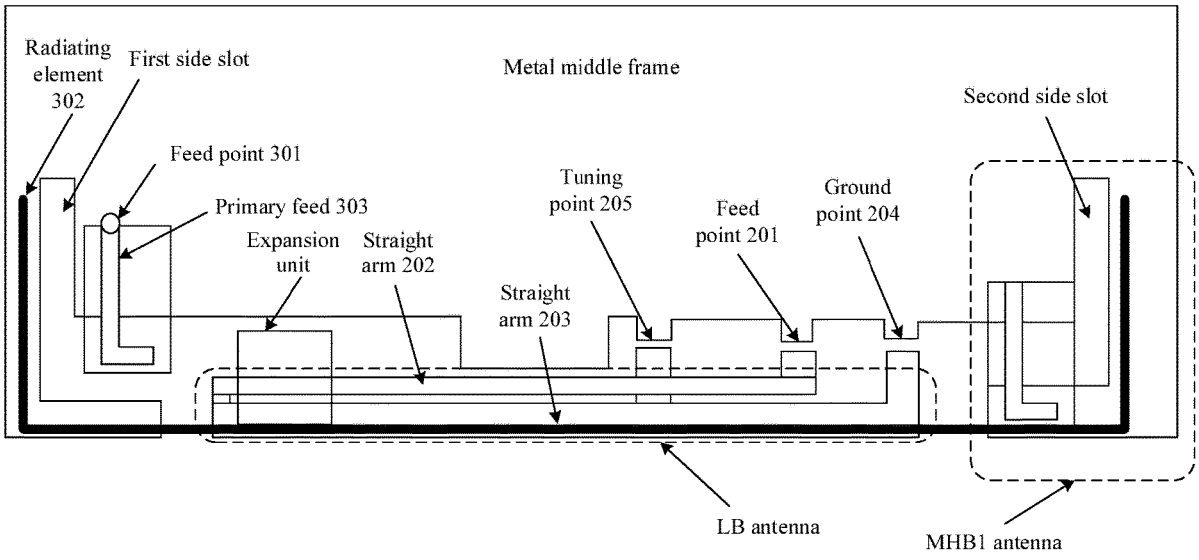
H01Q 5/307	(2006.01)
H01Q 1/52	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/521*** (2013.01); ***H01Q 5/307*** (2015.01); ***H01Q 13/10*** (2013.01)

(57) **ABSTRACT**

An antenna apparatus includes a first medium- and high-band (MBHB) antenna, and a terminal device includes a metal middle frame and a metal frame, a slot is opened on a side of the metal middle frame, and the MBHB antenna includes a first feed point, a first primary feed, and a radiating slot constituted by the metal middle frame and the metal frame, a first end of the radiating slot is connected to the side slot of the metal middle frame and is grounded using the metal middle frame, and an opening of a second end of the radiating slot is disposed at a bottom edge of the metal frame, where the first primary feed is connected to the first feed point and is spaced from the radiating slot, and the first primary feed is orthogonal to the radiating slot.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0036402 A1**

MA et al. (43) **Pub. Date: Feb. 4, 2021**

(54) **ANTENNAS AND CONNECTORS LOCATED IN SLOTS**

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(21) Appl. No.: **16/761,006**

(22) PCT Filed: **Dec. 15, 2017**

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§ 371 (c)(1),
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H01Q 1/36	(2006.01)

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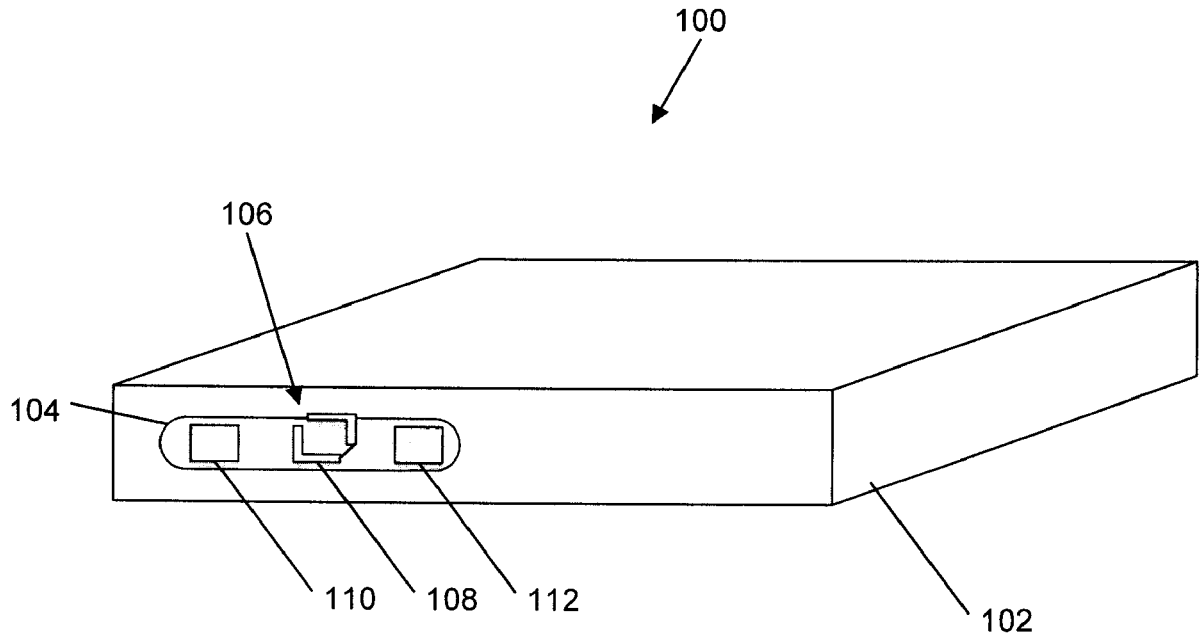
(57) **ABSTRACT**

An example device includes a conductive housing. The conductive housing has a slot containing a dielectric material. An antenna includes a resonating element disposed within the slot. A first connector is disposed within the slot. A second connector is disposed within the slot. The resonating element of the antenna is located between the first connector and the second connector.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0036407 A1**

KIM et al. (43) **Pub. Date: Feb. 4, 2021**

(54) **CHIP ANTENNA**

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

(21) Appl. No.: **16/828,788**

(22) Filed: **Mar. 24, 2020**

(30) **Foreign Application Priority Data**

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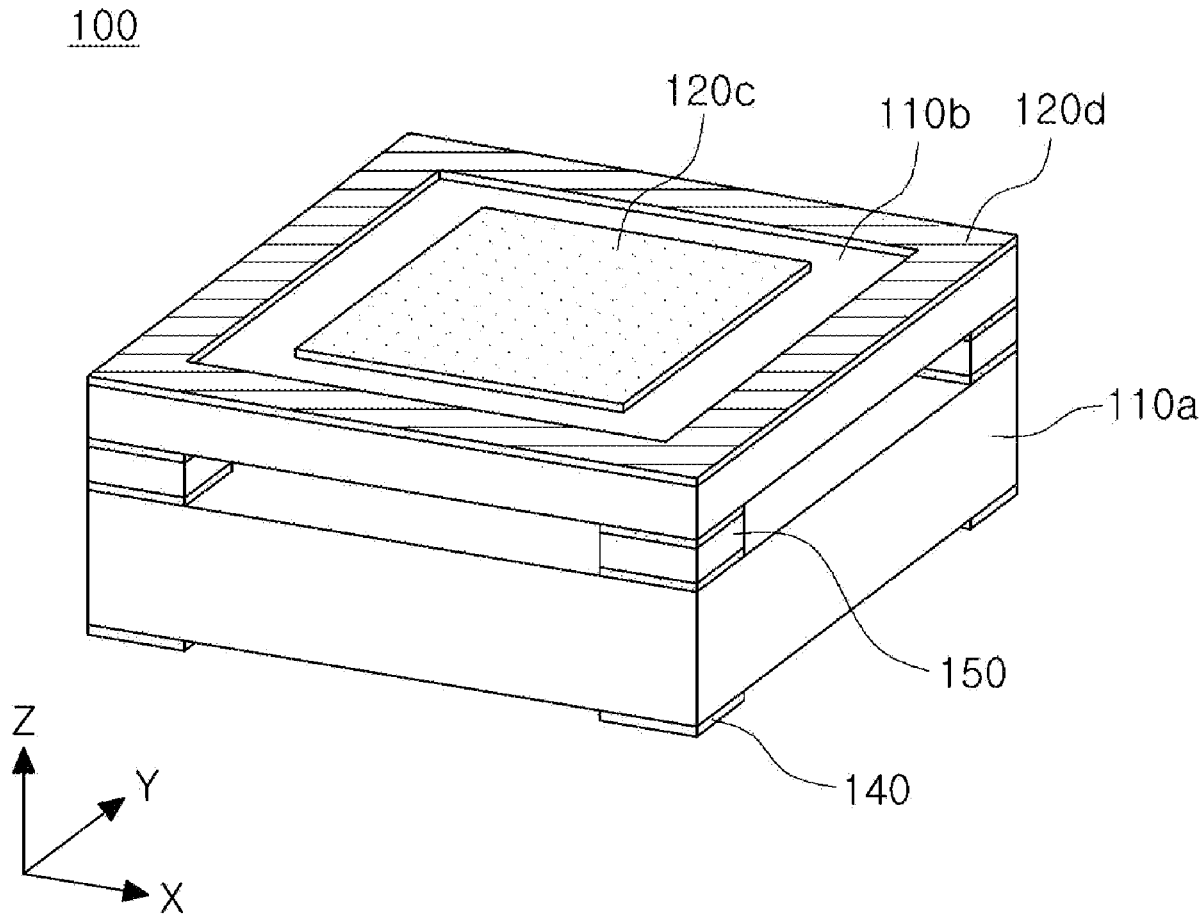
H01Q 21/08	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 21/08*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

A chip antenna comprises a first substrate, a second substrate overlapping the first substrate, a first patch, provided on a first surface of the first substrate a second patch, provided on the second substrate, at least one feed via penetrating through the first substrate in a thickness direction and configured to provide a feed signal to the first patch, and a bonding pad provided on a second surface of the first substrate. The first substrate comprises a dielectric substance and a magnetic substance.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0036408 A1**

Hang et al. (43) **Pub. Date: Feb. 4, 2021**

(54) **ANTENNA MODULE AND MOBILE TERMINAL**

(71) Applicant: **AAC Technologies Pte. Ltd.**, Singapore city (SG)

(72) Inventors: **Mingjun Hang**, Shenzhen (CN); **Kai Dong**, Shenzhen (CN)

(21) Appl. No.: **16/996,934**

(22) Filed: **Aug. 19, 2020**

Related U.S. Application Data

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H01Q 21/06	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 9/0421*** (2013.01); ***H01Q 21/0025*** (2013.01)

(57) **ABSTRACT**

The present disclosure provides an antenna module and a mobile terminal. The antenna module includes a dielectric block and a radiation patch. The dielectric block is a polyhedron, the radiation patch is attached to a plurality of surfaces of the dielectric block, and the radiation patch is provided with a feed point and a ground point. The mobile terminal is provided with several antenna modules described above. The antenna module provided in the present disclosure attaches the radiation patch to the plurality of surfaces of the dielectric block with a polyhedral structure, thereby reducing an overall volume of the antenna module while increasing an effective radiation area of the radiation patch and enhancing radiation performance of the antenna module.