US 20210151858A1

(19) **United States**

(12) **Patent Application Publication**

Wu et al.

(10) **Pub. No.: US 2021/0151858 A1**

(43) **Pub. Date: May 20, 2021**

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

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

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

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

(21) Appl. No.: **17/077,958**

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

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

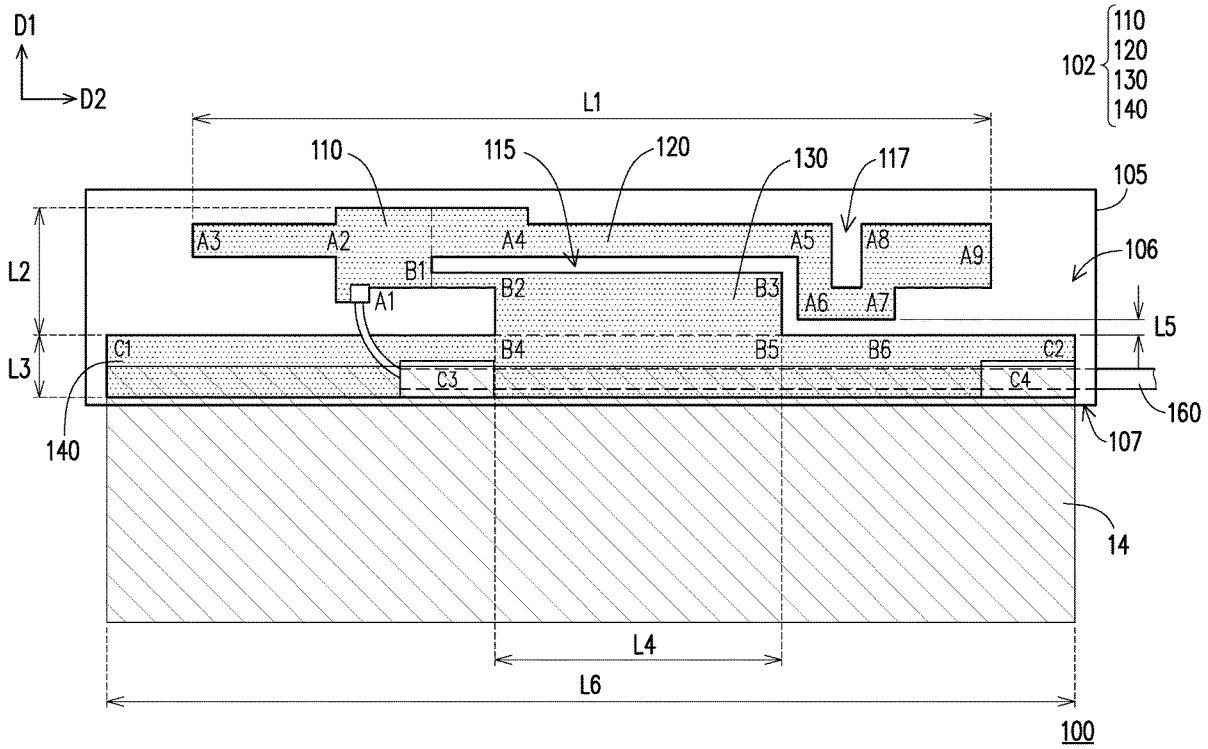
H01Q 1/24	(2006.01)
H01Q 9/04	(2006.01)
H01Q 13/10	(2006.01)
H01Q 5/371	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 5/371*** (2015.01); ***H01Q 13/10*** (2013.01); ***H01Q 9/0457*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a first radiator, a second radiator, an antenna ground, and a conductor. The first radiator for resonating at a high frequency band includes a feeding end. The second radiator is connected to the first radiator and resonates at a low frequency band with a part of the first radiator. The antenna ground is located on one side of the first radiator and the second radiator. The conductor is located between the second radiator and the antenna ground in a first direction and connected to the first radiator and the antenna ground. A slit having at least one bending portion is formed among the second radiator, and the conductor and the antenna ground. An electronic device is further provided.



US 20210151861A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0151861 A1**

CHEN et al. (43) **Pub. Date: May 20, 2021**

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

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

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

(21) Appl. No.: **17/100,015**

(22) Filed: **Nov. 20, 2020**

(30) **Foreign Application Priority Data**

Nov. 20, 2019 (CN) 201911143629.0

Publication Classification

(51) **Int. Cl.**

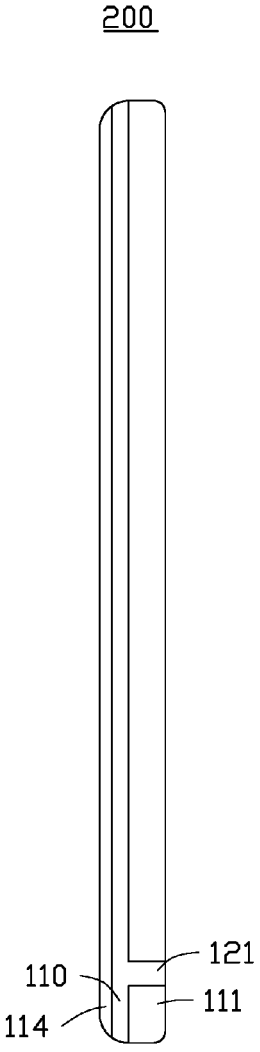
H01Q 1/24	(2006.01)
H04B 1/00	(2006.01)
H01Q 1/48	(2006.01)
H01Q 5/335	(2006.01)
H01Q 13/10	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H04B 1/006*** (2013.01); ***H01Q 13/10*** (2013.01); ***H01Q 5/335*** (2015.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna structure with wide radiation bandwidth in a reduced physical space includes a housing, a connection capacitor, and a feed portion. The housing defines at least one gap and a slot dividing the housing into a first radiation portion, a second radiation portion, and a third radiation. The connection capacitor bridges the first gap, connecting the first radiation portion and the second radiation portion. The feed portion is electrically connected to the first radiation portion. The current flows through the first radiation portion and towards the second radiation portion through the connection capacitor. The current is further coupled to the third radiation portion to generate radiation signals in different frequency bands.



US 20210151871A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0151871 A1**

LYU (43) **Pub. Date: May 20, 2021**

(54) **ANTENNA MODULE**

(71) Applicants: **Inventec (Pudong) Technology Corporation**, Shanghai (CN); **INVENTEC CORPORATION**, TAIPEI CITY (TW)

(72) Inventor: **Chao-An LYU**, TAIPEI CITY (TW)

(21) Appl. No.: **16/712,965**

(22) Filed: **Dec. 12, 2019**

(30) **Foreign Application Priority Data**

Nov. 15, 2019 (CN) 201911120549.3

Publication Classification

(51) **Int. Cl.**

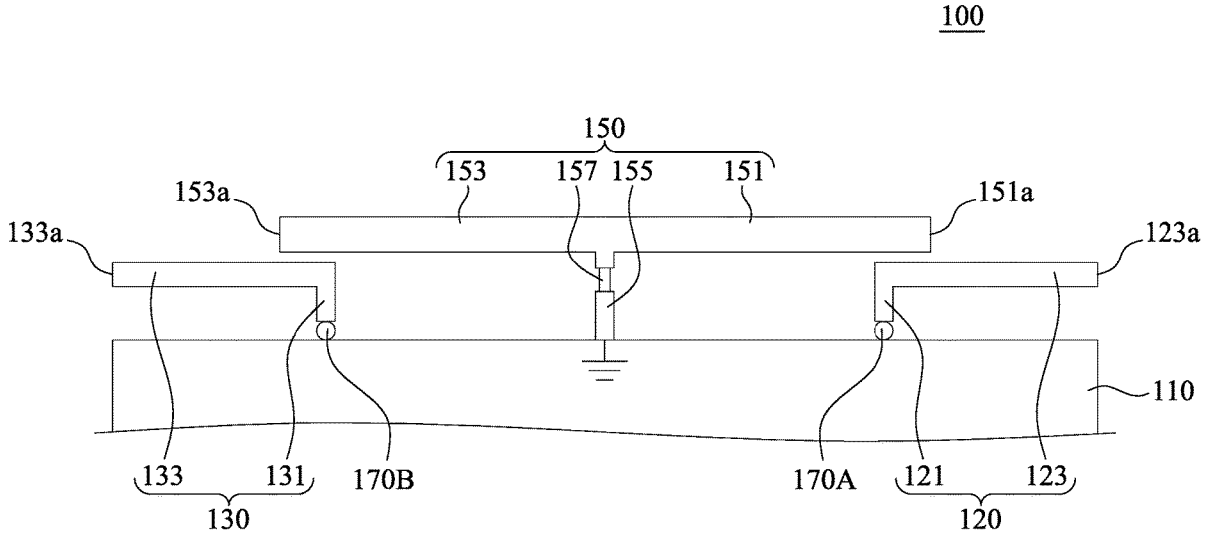
H01Q 1/48	(2006.01)
H01Q 9/16	(2006.01)
H01Q 9/42	(2006.01)

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

CPC ***H01Q 1/48*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 9/16*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a grounding conductor, a first radiator, a second radiator, and a grounding component. The grounding conductor has a grounding function. The first radiator includes a first feeding portion and a first radiating portion. The second radiator includes a second feeding portion and a second radiating portion. The grounding component is located between the first radiator and the second radiator, and includes a first coupling portion, a second coupling portion, a capacitor, and a first grounding portion. The first radiating portion is spaced apart from the first coupling portion and the second radiating portion is spaced apart from the second coupling portion. The capacitor is located among the first coupling portion, the second coupling portion, and the first grounding portion. The first grounding portion is connected to the grounding conductor.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0151885 A1**

LYU (43) **Pub. Date: May 20, 2021**

(54) **MULTI-BAND ANTENNA**

(71) Applicants: **Inventec (Pudong) Technology Corporation**, Shanghai (CN); **INVENTEC CORPORATION**, Taipei City (TW)

(72) Inventor: **Chao-An LYU**, TAIPEI CITY (TW)

(21) Appl. No.: **16/711,454**

(22) Filed: **Dec. 12, 2019**

(30) **Foreign Application Priority Data**

Nov. 15, 2019 (CN) 201911120474.9

Publication Classification

(51) **Int. Cl.**

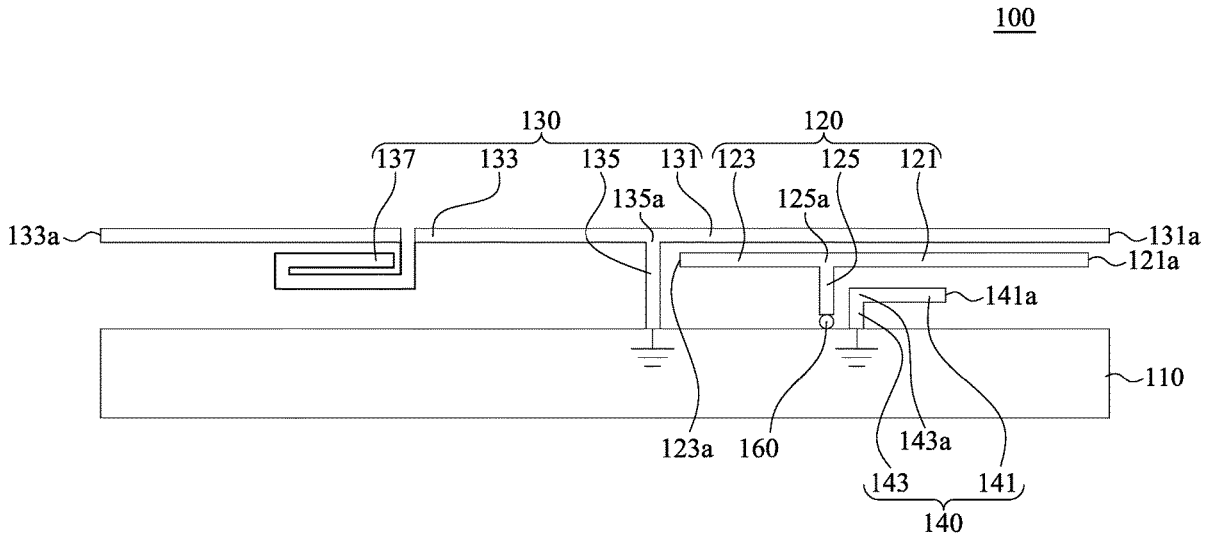
H01Q 5/307 (2006.01)
H01Q 5/10 (2006.01)
H01Q 9/42 (2006.01)
H01Q 1/48 (2006.01)

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

CPC ***H01Q 5/307*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 5/10*** (2015.01)

(57) **ABSTRACT**

A multi-band antenna includes a grounding conductor, a first radiator, and a second radiator. The grounding conductor has a grounding function. The first radiator has a first radiating portion, a second radiating portion, and a feeding portion configured to connect to a signal source. The second radiator includes a third radiating portion, a fourth radiating portion, and a first grounding portion. A length of the third radiating portion or a length of the fourth radiating portion is longer than lengths of first radiating portion and the second radiating portion combined, and the third radiating portion or the fourth radiating portion is radiationally coupled with the first radiating portion and the second radiating portion.



US 20210151886A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0151886 A1

Wang et al. (43) Pub. Date: May 20, 2021

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

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

(72) Inventors: **Hanyang Wang**, Reading (GB); **Lei Wang**, Shanghai (CN); **Yan Wang**, Shenzhen (CN); **Jiaqing You**, Shanghai (CN); **Dong Yu**, Shanghai (CN); **Liang Xue**, Shanghai (CN); **Chien-ming Lee**, Shenzhen (CN)

(21) Appl. No.: **17/055,396**

(22) PCT Filed: **May 15, 2018**

(86) PCT No.: **PCT/CN2018/086932**

§ 371 (c)(1),
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Publication Classification

(51) **Int. Cl.**

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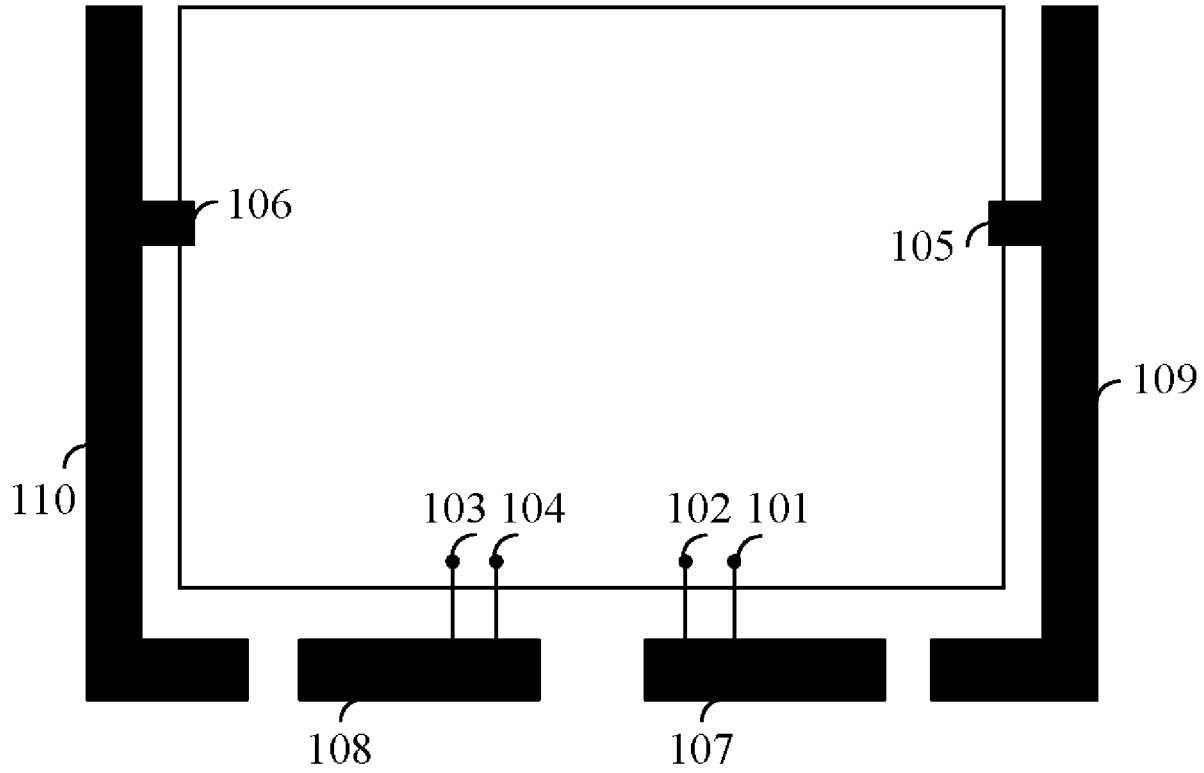
H01Q 1/38	(2006.01)
H01Q 1/48	(2006.01)
H01Q 21/28	(2006.01)

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

CPC ***H01Q 5/35*** (2015.01); ***H01Q 21/28*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

An antenna system and a terminal device. The, where the antenna system includes a first feed point, a first ground point, a second feed point, a second ground point, a third ground point, a fourth ground point, a first radiator, a second radiator, a first resonance structure, and a second resonance structure, where the first feed point is coupled to the first radiator, the second feed point is coupled to the second radiator, the first radiator is coupled to the first ground point, and the second radiator is coupled to the second ground point, the first resonance structure is electromagnetically coupled to the first radiator at a first distance from the first radiator, and the second resonance structure is electromagnetically coupled to the second radiator at a second distance from the second radiator.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0151887 A1**

WANG (43) **Pub. Date: May 20, 2021**

(54) **ANTENNA, TERMINAL MIDDLE-FRAME, AND TERMINAL**

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

(72) Inventor: **Yali WANG**, Beijing (CN)

(73) Assignee: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(21) Appl. No.: **16/814,872**

(22) Filed: **Mar. 10, 2020**

(30) **Foreign Application Priority Data**

Nov. 20, 2019 (CN) 201911143009.7

Publication Classification

(51) **Int. Cl.**

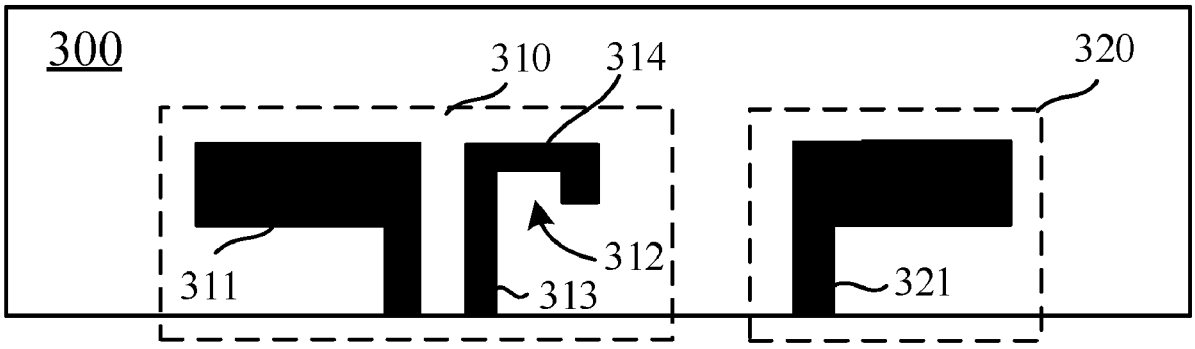
H01Q 5/385	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/52	(2006.01)
H01Q 5/371	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 5/385*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/371*** (2015.01); ***H01Q 1/523*** (2013.01)

(57) **ABSTRACT**

An antenna includes: a first antenna portion and a second antenna portion arranged adjacently. The first antenna portion includes a first antenna branch and a first parasitic branch, and the second antenna portion includes a second antenna branch. The first parasitic branch is positioned between the first antenna branch and the second antenna branch. The first parasitic branch is L-shaped, and includes a first branch segment and a second branch segment. A first end of the first branch segment is in contact to a ground region, a second end of the first branch segment is joined to a first end of the second branch segment, and a second end of the second branch segment points towards the second antenna branch.



US 20210151890A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0151890 A1

ZHANG et al. (43) Pub. Date: May 20, 2021

(54) **A LOW-PROFILE DUAL-POLARIZATION FILTERING MAGNETO-ELECTRIC DIPOLE ANTENNA**

(71) Applicant: **SOUTH CHINA UNIVERSITY OF TECHNOLOGY**, Guangzhou, Guangdong (CN)

(72) Inventors: **Xiuyin ZHANG**, Guangzhou (CN); **Shengjie YANG**, Guangzhou (CN); **Zhijie ZHANG**, Guangzhou (CN); **Yongmei PAN**, Guangzhou (CN); **Yunfei CAO**, Guangzhou (CN); **Yao ZHANG**, Guangzhou (CN)

(73) Assignee: **SOUTH CHINA UNIVERSITY OF TECHNOLOGY**, Guangzhou, Guangdong (CN)

(21) Appl. No.: **17/046,315**

(22) PCT Filed: **Oct. 25, 2019**

(86) PCT No.: **PCT/CN2019/113146**

§ 371 (c)(1),
(2) Date: **Oct. 9, 2020**

(30) **Foreign Application Priority Data**

Mar. 1, 2019 (CN) 201910153863.5

Publication Classification

(51) **Int. Cl.**

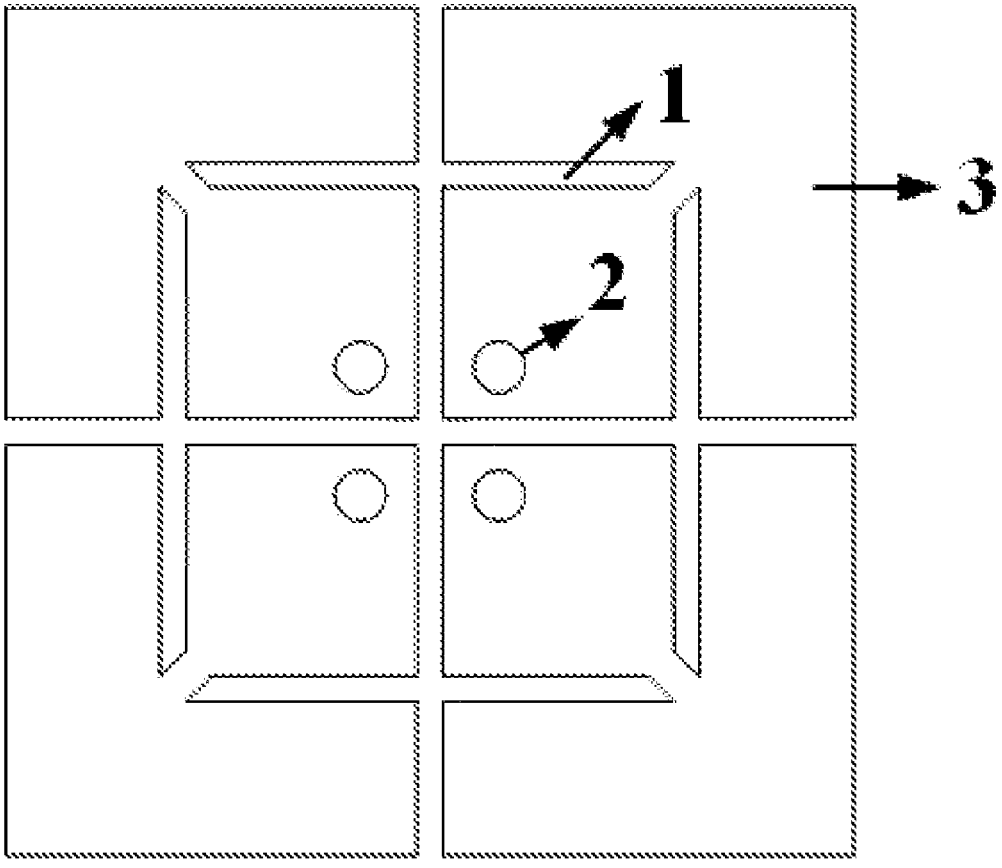
H01Q 9/16	(2006.01)
H01Q 1/38	(2006.01)
H01Q 1/50	(2006.01)

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

CPC ***H01Q 9/16*** (2013.01); ***H01Q 1/50*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

The invention discloses a dual-polarized filtering magneto-electric dipole antenna, which comprises an upper dielectric substrate and a lower dielectric substrate. The upper surface of the upper dielectric substrate is printed with a radiator structure, and the lower dielectric substrate is printed with a slot coupling feed network; the radiator structure comprises four parasitic patches loaded with symmetrical slots. The parasitic patches are loaded with short-circuit probes, and the slot coupling feed network comprises two orthogonal sets of Y-shaped feeders and cross-shaped slots, and the cross-shaped slots are printed on a metal floor. The new parasitic slot structures on the radiator structure increases the bandwidth while introducing a high roll-off band edge filtering effect, and combined with the slot coupling feed network with filtering function to achieve good band-pass filtering characteristics and hardly introduce additional insertion loss.



US 20210151896A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0151896 A1**

KUSUKAME et al. (43) **Pub. Date: May 20, 2021**

(54) **ANTENNA DEVICE**

(71) Applicant: **TOYOTA JIDOSHA KABUSHIKI KAISHA**, Toyota-shi, Aichi-ken (JP)

(72) Inventors: **Taiki KUSUKAME**, Tomioka-shi (JP); **Takeshi SAMPO**, Tomioka-shi (JP); **Takayuki SONE**, Tomioka-shi (JP); **Masaki TSUKAMOTO**, Toyota-shi (JP)

(73) Assignee: **TOYOTA JIDOSHA KABUSHIKI KAISHA**, Toyota-shi, Aichi-ken (JP)

(21) Appl. No.: **16/622,552**

(22) PCT Filed: **Mar. 22, 2018**

(86) PCT No.: **PCT/JP2018/011381**

§ 371 (c)(1),
(2) Date: **Dec. 13, 2019**

(30) **Foreign Application Priority Data**

Jun. 14, 2017 (JP) 2017-117005

Publication Classification

(51) **Int. Cl.**

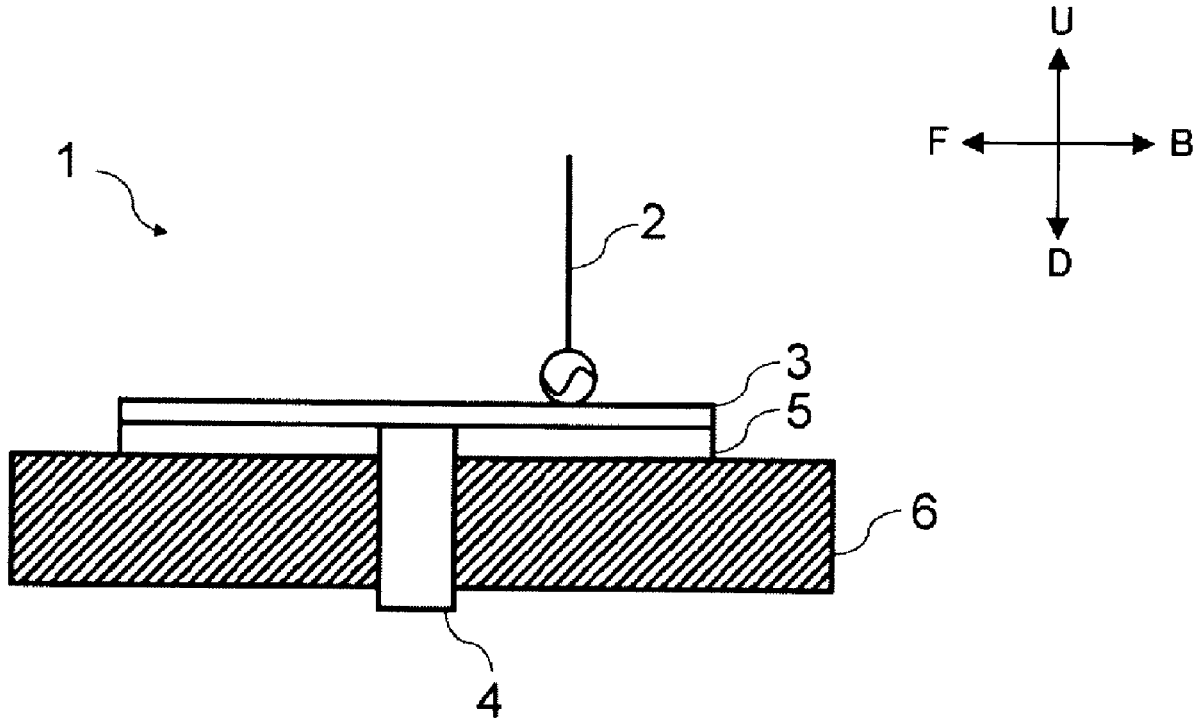
H01Q 17/00	(2006.01)
H01Q 9/30	(2006.01)
H01Q 1/52	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 17/007*** (2013.01); ***H01Q 9/30*** (2013.01); *H01Q 1/325* (2013.01); ***H01Q 1/528*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 17/001*** (2013.01)

(57) **ABSTRACT**

An antenna device is mounted on a base plate. The antenna device includes an antenna element, a base, and a magnetic body. The antenna element is mounted on the base. The magnetic body is disposed between the base and the base plate.



US 20210159583A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0159583 A1

LIAO et al. (43) Pub. Date: May 27, 2021

(54) **CHIP-TYPE ANTENNA IMPROVED STRUCTURE**

(71) Applicant: **Power Wave Electronic Co .,Ltd.**, Taipei City (TW)

(72) Inventors: **Wen-Jiao LIAO**, Taipei City (TW); **Yun-Chan TSAI**, Taipei City (TW); **Shih-Hsun HUNG**, Taipei City (TW); **Shi-Hong YANG**, Taipei City (TW)

(21) Appl. No.: **16/690,775**

(22) Filed: **Nov. 21, 2019**

Publication Classification

(51) **Int. Cl.**

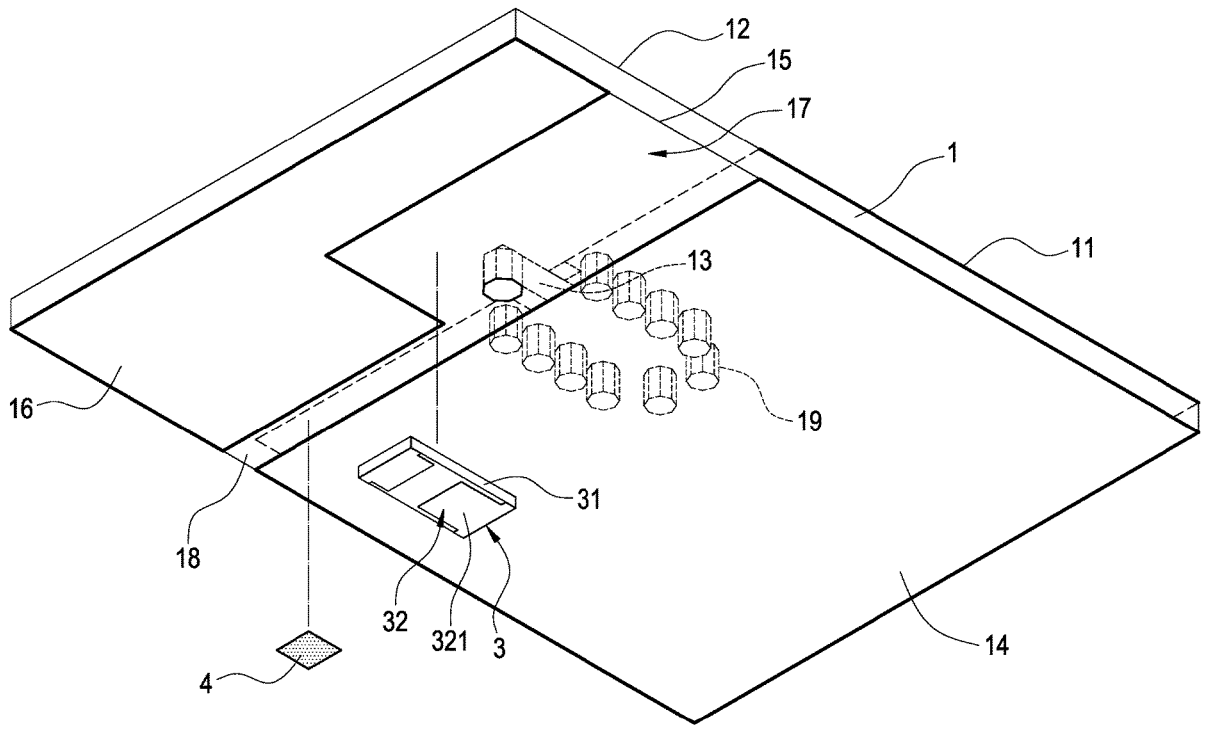
H01Q 1/22	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/50	(2006.01)
H03H 7/38	(2006.01)
H03H 7/01	(2006.01)

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

CPC ***H01Q 1/22*** (2013.01); ***H01Q 1/48*** (2013.01); ***H03H 7/01*** (2013.01); ***H03H 7/38*** (2013.01); ***H01Q 1/50*** (2013.01)

(57) **ABSTRACT**

A chip-type antenna structure includes a baseboard, a matching element, a radiation single body and a frequency-modulation element. The baseboard includes a first-ground surface, a first-clearance area and a signal-feed-in unit. A second-ground surface, a second-clearance area, a third-ground surface and a plurality of via holes through the baseboard and electrically connected to the first-ground surface and the second-ground surface are arranged on the other side of the baseboard. The matching element is electrically connected between the signal-feed-in unit and the first-ground surface. One side of the radiation single body is electrically connected to the signal-feed-in unit through the via holes. The other side of the radiation single body is electrically connected to the third-ground surface. The frequency-modulation element is electrically connected between the second-ground surface and the third-ground surface to adjust the frequency-modulation element to adjust a receiving-transmitting frequency of the chip-type antenna structure.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0159586 A1**

HUANG (43) **Pub. Date: May 27, 2021**

(54) **ANTENNA STRUCTURE**

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

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

(21) Appl. No.: **16/867,946**

(22) Filed: **May 6, 2020**

(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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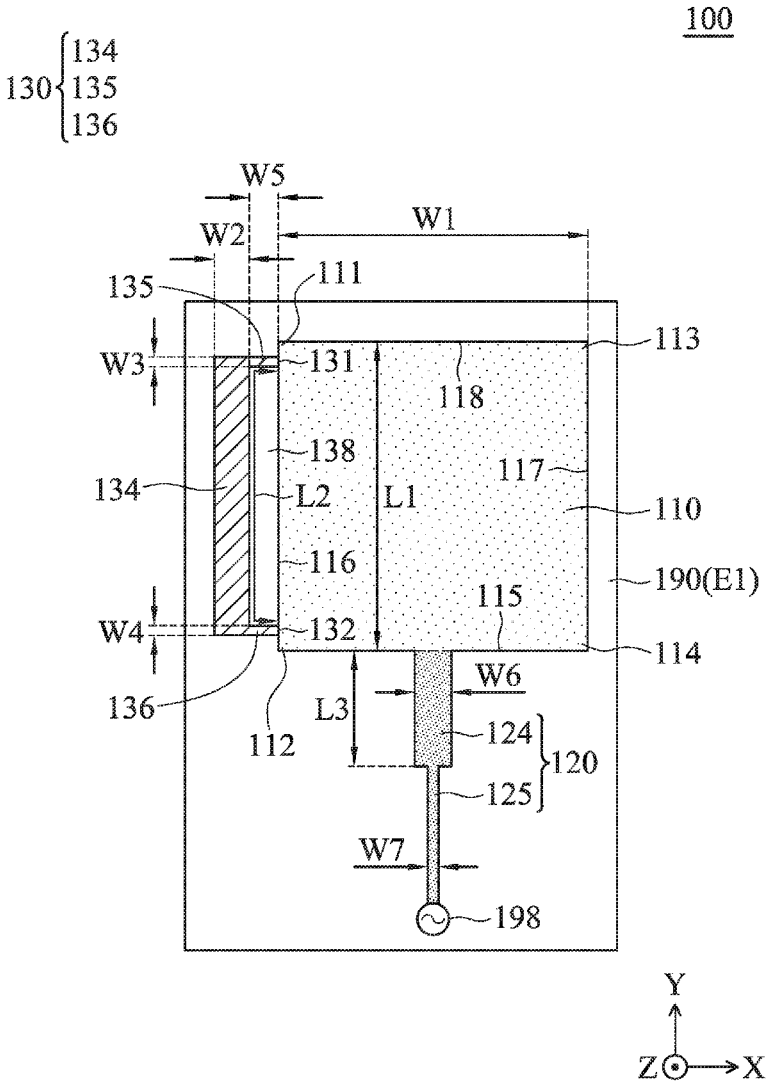
H01Q 13/10	(2006.01)
H01Q 9/06	(2006.01)
H01Q 9/42	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 13/10*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 9/06*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a main radiation element, a first feeding element, a first additional radiation element, a dielectric substrate, and a ground plane. A first signal source is coupled through the first feeding element to a first side of the main radiation element. The first additional radiation element is coupled to a second side of the main radiation element. A first slot is formed between the first additional radiation element and the main radiation element. The second side is different from the first side. The dielectric substrate has a first surface and a second surface which are opposite to each other. The main radiation element, the first feeding element, and the first additional radiation element are disposed on the first surface of the dielectric substrate. The ground plane is adjacent to the second surface of the dielectric substrate.



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(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2021/0159599 A1

(43) Pub. Date: May 27, 2021

PARK et al.

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA THAT RADIATES WAVES BY A NON-CONDUCTING PORTION**

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

(72) Inventors: **Seongjin PARK**, Gyeonggi-do (KR); **Minhong DO**, Gyeonggi-do (KR); **Kyungrok LEE**, Gyeonggi-do (KR); **Seokwoo LEE**, Gyeonggi-do (KR); **Sukchan HONG**, Gyeonggi-do (KR); **Jaebong CHUN**, Gyeonggi-do (KR); **Hyunsuk CHOI**, Gyeonggi-do (KR)

(73) Assignee: **Samsung Electronics Co., Ltd.**

(21) Appl. No.: **17/104,441**

(22) Filed: **Nov. 25, 2020**

(30) **Foreign Application Priority Data**

Nov. 25, 2019 (KR) 10-2019-0152269

Publication Classification

(51) **Int. Cl.**

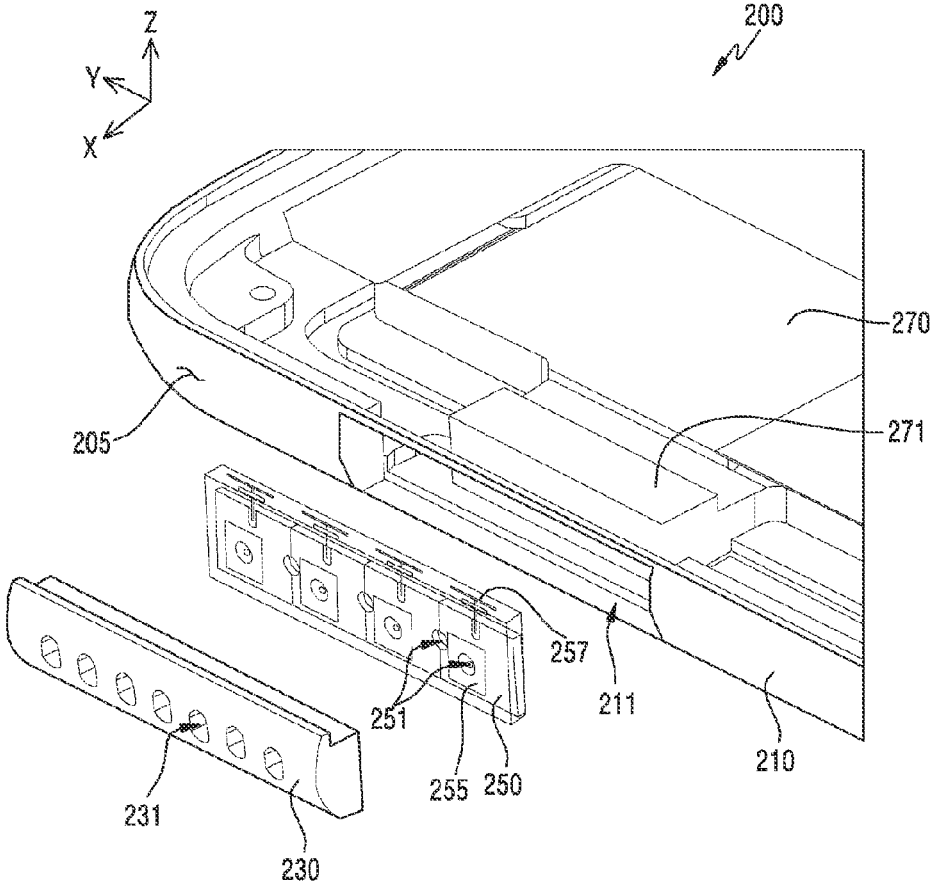
H01Q 9/04	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/42	(2006.01)
H01Q 21/10	(2006.01)

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

CPC ***H01Q 9/0407*** (2013.01); ***H01Q 1/48*** (2013.01); *H01Q 1/24* (2013.01); ***H01Q 21/10*** (2013.01); ***H01Q 1/421*** (2013.01)

(57) **ABSTRACT**

Disclosed is an electronic device including a housing having a front surface, a rear surface, and a side surface partially surrounding a space between the front surface and the rear surface, wherein at least one of the front surface, the rear surface, and the side surface comprises a non-conductive portion, and at least a partial region of the non-conductive portion comprises a first through hole, a component at least partially overlapping the first through hole when the non-conductive portion is viewed from outside the housing, wherein the component is disposed at a position spaced apart from the non-conductive portion by a first distance, and an antenna structure disposed at a position spaced apart from the non-conductive portion by a second distance shorter than the first distance, wherein the antenna structure is configured to radiate radio waves through the non-conductive portion, and comprises at least one second through hole.



US 20210159600A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0159600 A1**

Rodríguez (43) **Pub. Date: May 27, 2021**

(54) **FREQUENCY AND POLARIZATION RECONFIGURABLE ANTENNA SYSTEMS**

(71) Applicant: **Skyworks Solutions, Inc.**, Woburn, MA (US)

(72) Inventor: **René Rodríguez**, Rancho Santa Margarita, CA (US)

(21) Appl. No.: **17/112,616**

(22) Filed: **Dec. 4, 2020**

Related U.S. Application Data

(63) Continuation of application No. 16/556,830, filed on Aug. 30, 2019, now Pat. No. 10,892,555, which is a continuation of application No. 15/834,468, filed on Dec. 7, 2017, now Pat. No. 10,439,288.

(60) Provisional application No. 62/432,839, filed on Dec. 12, 2016, provisional application No. 62/512,958, filed on May 31, 2017.

Publication Classification

(51) **Int. Cl.**

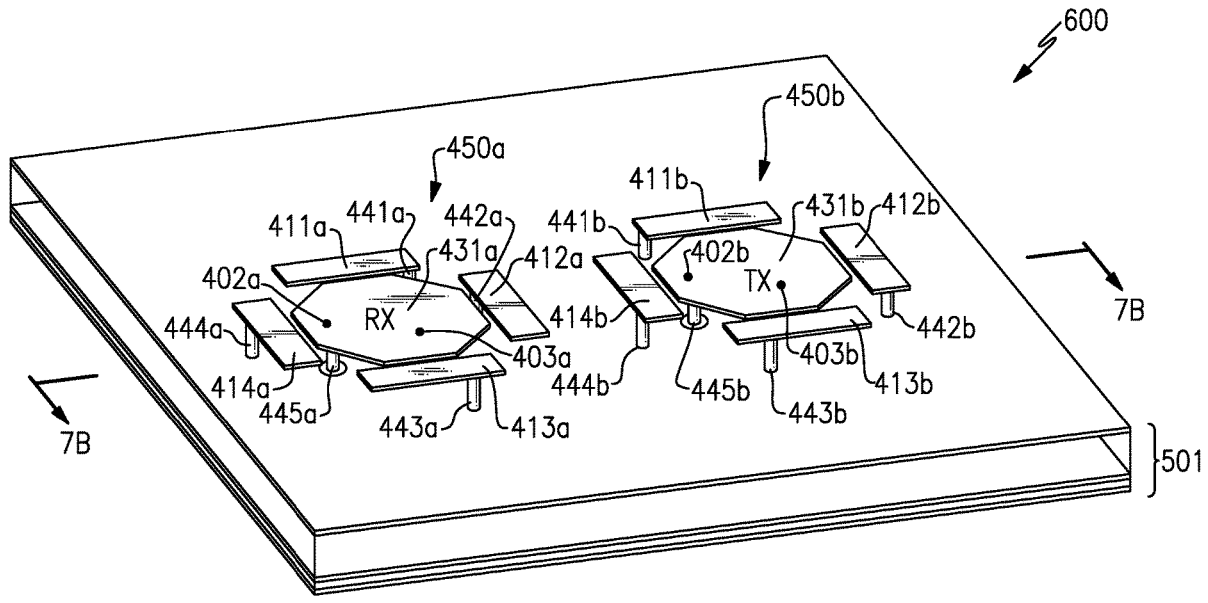
H01Q 9/04	(2006.01)
H01Q 9/16	(2006.01)
H01Q 1/50	(2006.01)
H01Q 19/00	(2006.01)

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

CPC ***H01Q 9/0442*** (2013.01); ***H01Q 9/16*** (2013.01); *H01Q 1/38* (2013.01); ***H01Q 19/005*** (2013.01); ***H01Q 1/50*** (2013.01)

(57) **ABSTRACT**

Apparatus and methods for reconfigurable antenna systems are provided herein. In certain configurations, an antenna system includes an antenna element, a tuning conductor adjacent to and spaced apart from the antenna element, and a switch electrically connected between the tuning conductor and a reference voltage, such as ground. The tuning conductor is operable to load the antenna element, and the switch selectively connects the tuning conductor to the reference voltage to provide tuning to the antenna element.



US 20210159602A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0159602 A1**

Wu et al. (43) **Pub. Date: May 27, 2021**

(54) **ANTENNA MODULE**

(71) Applicant: **PEGATRON CORPORATION**, TAIPEI CITY (TW)

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

(73) Assignee: **PEGATRON CORPORATION**, TAIPEI CITY (TW)

(21) Appl. No.: **17/035,435**

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

(30) **Foreign Application Priority Data**

Nov. 25, 2019 (TW) 108142812

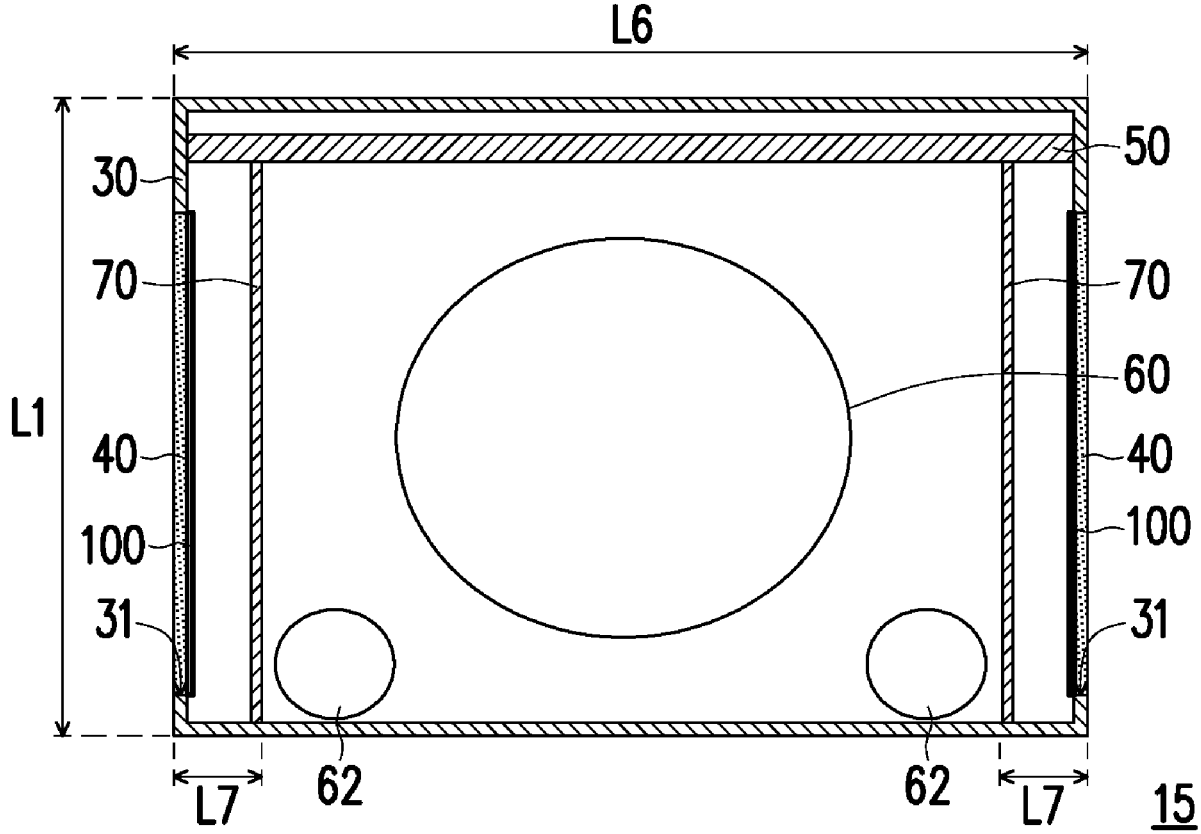
Publication Classification

(51) **Int. Cl.**
H01Q 13/16 (2006.01)
H01Q 13/10 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 13/16*** (2013.01); ***H01Q 13/103*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a metal frame and an antenna structure. The metal frame includes an opening and a first edge and a second edge located at two opposite sides of the opening. The antenna structure is disposed at the opening and includes a first radiator, a second radiator, a first conductor, and a second conductor. The first radiator includes first and second sections. The first section is near the first edge and includes a feeding end, and the second section extends from the first section to the second edge. The second radiator is located between the first section and the first edge and includes a ground end. A first slit is formed between the second radiator and the first section. The first conductor is connected between the second radiator and the metal frame. The second conductor is connected between the second radiator and the metal frame.



US 20210159610A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0159610 A1

Manesh et al. (43) Pub. Date: May 27, 2021

(54) **DUAL-POLARIZED MICROSTRIP PATCH ANTENNA AND ARRAY**

(71) Applicant: **The Board of Regents of the University of Oklahoma**, Norman, OK (US)

(72) Inventors: **Hadi Saeidi Manesh**, Norman, OK (US); **Guifu Zhang**, Norman, OK (US)

(21) Appl. No.: **17/094,421**

(22) Filed: **Nov. 10, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/938,741, filed on Nov. 21, 2019.

Publication Classification

(51) **Int. Cl.**

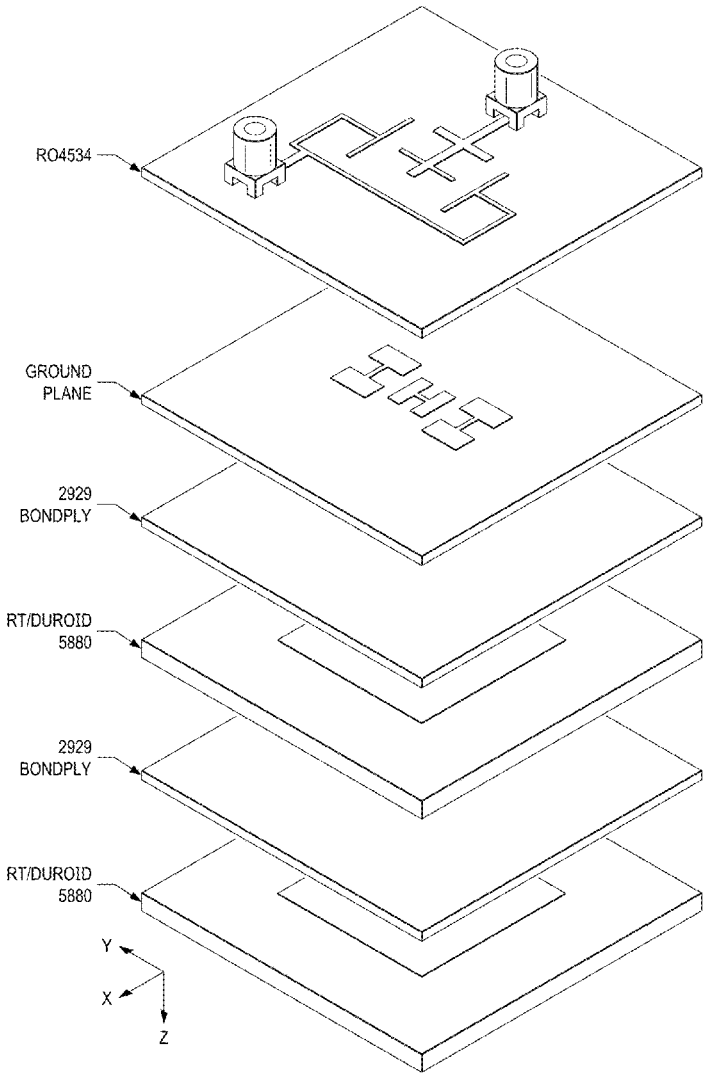
H01Q 21/24	(2006.01)
H01Q 19/00	(2006.01)
H01Q 1/48	(2006.01)
H01Q 21/00	(2006.01)
G01S 7/02	(2006.01)

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

CPC ***H01Q 21/24*** (2013.01); ***H01Q 19/005*** (2013.01); *G01S 13/95* (2013.01); ***H01Q 21/0025*** (2013.01); ***G01S 7/025*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

A microstrip patch antenna comprising: a unit cell comprising: a plurality of layers comprising: a first laminate comprising one or more horizontal polarization feed lines and one or more vertical polarization feed lines, a second laminate comprising a radiating square patch, and a third laminate comprising a parasitic patch; and a ground plane comprising one or more polarization slots. A differential feed antenna comprising: a balun; a plurality of feed lines; and one or more polarization ports configured to excite at a plurality of locations.



US 20210159611A1

(19) **United States**

(12) **Patent Application Publication**

Wu et al.

(10) **Pub. No.: US 2021/0159611 A1**

(43) **Pub. Date: May 27, 2021**

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

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

(72) Inventors: **Chien-Yi Wu**, Taipei City (TW); **Hau Yuen Tan**, Taipei City (TW); **I-Shu Lee**, Taipei City (TW); **Hung-Ming Yu**, Taipei City (TW)

(73) Assignee: **PEGATRON CORPORATION**, TAIPEI CITY (TW)

(21) Appl. No.: **17/096,624**

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

(30) **Foreign Application Priority Data**

Nov. 27, 2019 (TW) 108143208

Publication Classification

(51) **Int. Cl.**

H01Q 21/30 (2006.01)

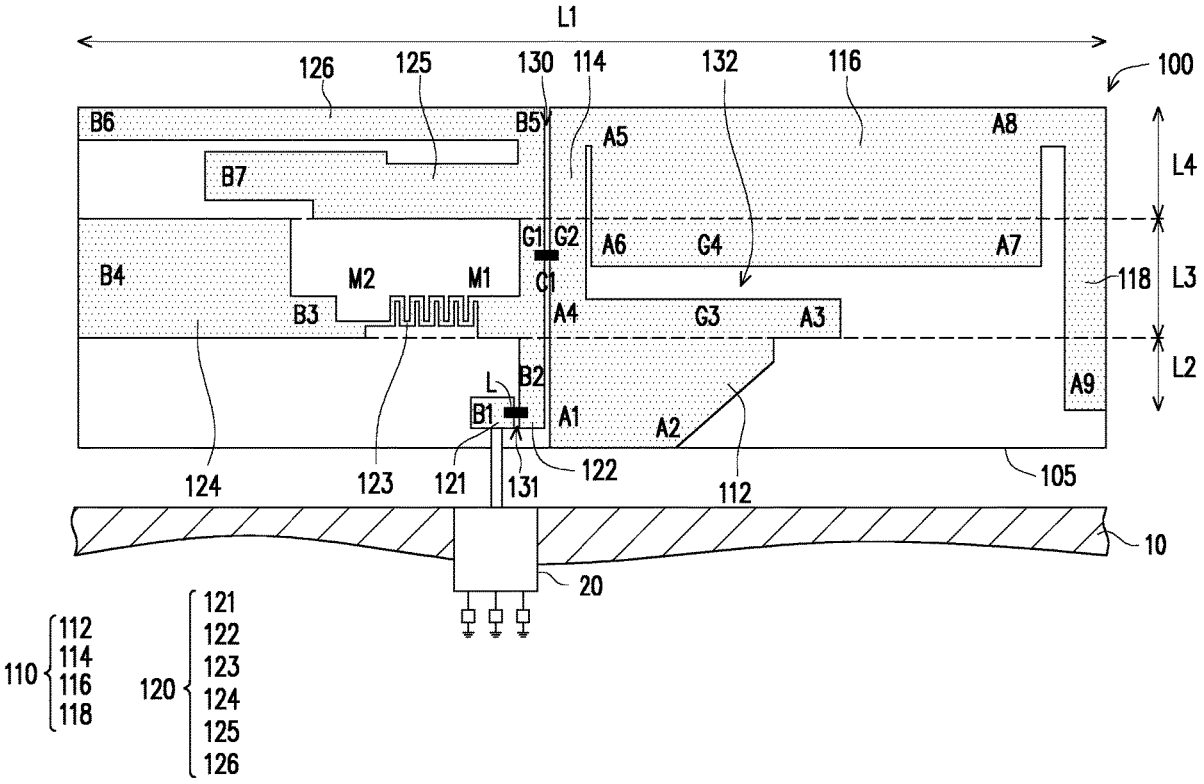
H01Q 9/42 (2006.01)

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

CPC ***H01Q 21/30*** (2013.01); ***H01Q 9/42*** (2013.01)

(57) **ABSTRACT**

An antenna structure including a first radiator and a second radiator is provided. The first radiator includes a first segment, a second segment, a third segment, and a fourth segment all bent to be connected in sequence, in which the first segment includes a feed-in terminal. The second radiator includes a fifth segment, and a sixth segment, a seventh segment, an eighth segment, and a ninth segment which are connected respectively to the fifth segment, in which the fifth segment is located beside the first radiator while a first slit is formed between the first radiator and the fifth segment of the second radiator, the sixth segment includes a ground terminal, and the first radiator and the second radiator are adapted to couple to form a first frequency band, a second frequency band, a third frequency band, and a fourth frequency band.



US 20210167485A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167485 A1**

So et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **ELECTRONIC DEVICES HAVING ANTENNA ASSEMBLIES**

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

(72) Inventors: **Yu Chen So**, Taipei City (TW); **Ju-Hung Chen**, Taipei City (TW); **Lien-Chia Chiu**, Taipei City (TW); **Hao Ming Chen**, Taipei City (TW)

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

(21) Appl. No.: **17/047,171**

(22) PCT Filed: **Jul. 19, 2018**

(86) PCT No.: **PCT/US2018/042781**

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

Publication Classification

(51) **Int. Cl.**

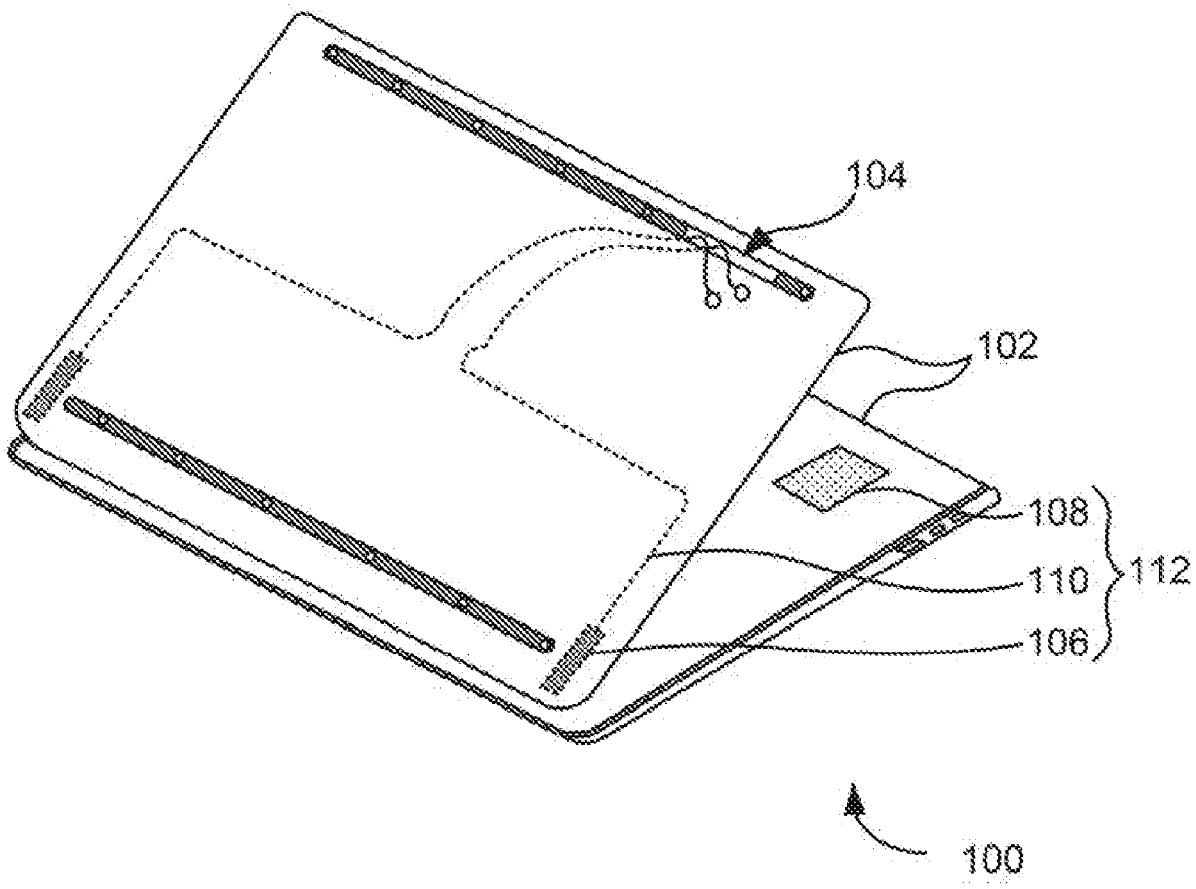
H01Q 1/22	(2006.01)
G06F 1/16	(2006.01)
H04B 1/034	(2006.01)
H01Q 1/42	(2006.01)

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

CPC ***H01Q 1/2266*** (2013.01); ***H01Q 1/42*** (2013.01); ***H04B 1/034*** (2013.01); ***G06F 1/1698*** (2013.01)

(57) **ABSTRACT**

In one example, an electronic device may include a housing having an opening and an antenna assembly disposed in the housing. The antenna assembly may include an antenna mounted to the housing, an antenna module disposed corresponding to the opening, and a cable to connect the antenna to the antenna module via routing the cable through the opening.



US 20210167491A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167491 A1**

CHANG et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **ELECTRONIC DEVICE**

(71) Applicant: **Acer Incorporated**, New Taipei City (TW)

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

(21) Appl. No.: **16/826,446**

(22) Filed: **Mar. 23, 2020**

(30) **Foreign Application Priority Data**

Dec. 2, 2019 (TW) 108143909

Publication Classification

(51) **Int. Cl.**

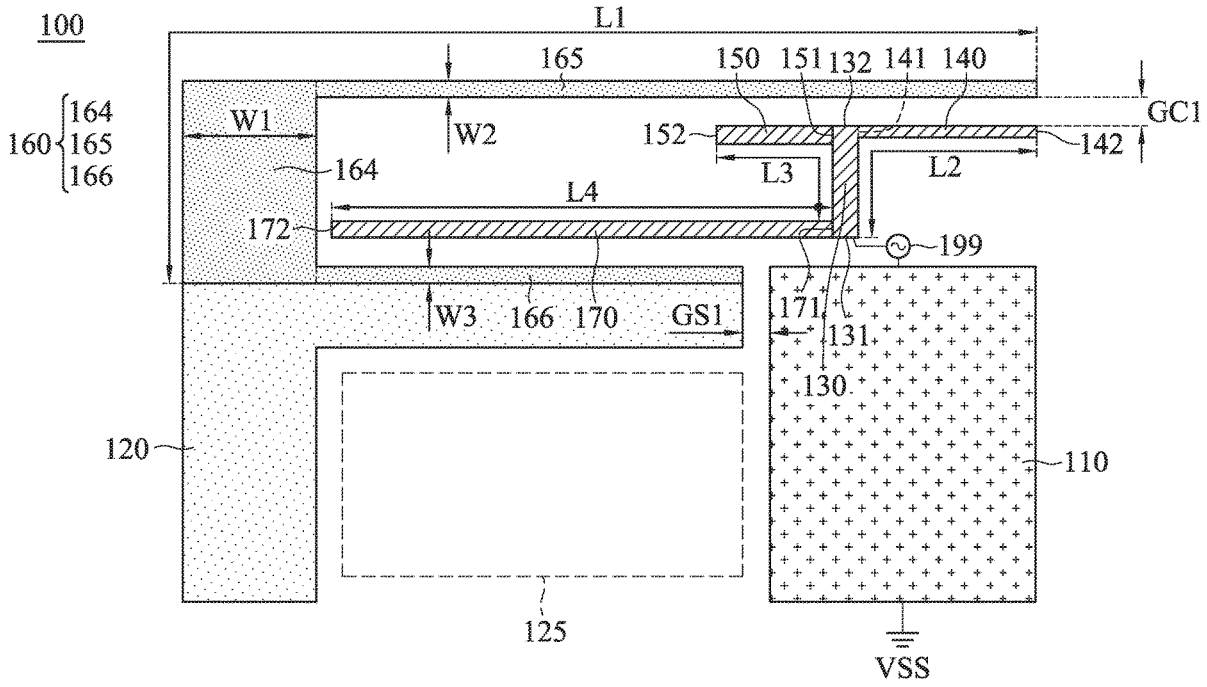
H01Q 1/52	(2006.01)
H01Q 1/24	(2006.01)
H01Q 5/335	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 1/52*** (2013.01); ***H01Q 9/0485*** (2013.01); ***H01Q 5/335*** (2015.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An electronic device includes a first metal element, a second metal element, a feeding radiation element, a first radiation element, a second radiation element, a third radiation element, and a matching radiation element. The first metal element is coupled to a ground voltage. The second metal element is separated from the first metal element. The first radiation element and the second radiation element are coupled to the feeding radiation element. The third radiation element is coupled to the second metal element, and is adjacent to the first radiation element and the second radiation element. An antenna structure is formed by the feeding radiation element, the first radiation element, the second radiation element, the third radiation element, and the matching radiation element. A sensing pad is formed by the second metal element and the third radiation element.



US 20210167499A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167499 A1**

TSENG et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Yi-Ling TSENG**, Taoyuan City (TW); **Chung-Hung LO**, Taoyuan City (TW); **Chin-Lung TSAI**, Taoyuan City (TW); **Kuan-Hsien LEE**, Taoyuan City (TW); **Ying-Cong DENG**, Taoyuan City (TW); **Chung-Ting HUNG**, Taoyuan City (TW)

(21) Appl. No.: **16/747,222**

(22) Filed: **Jan. 20, 2020**

(30) **Foreign Application Priority Data**

Nov. 28, 2019 (TW) 108143307

Publication Classification

(51) **Int. Cl.**

H01Q 5/307 (2015.01)

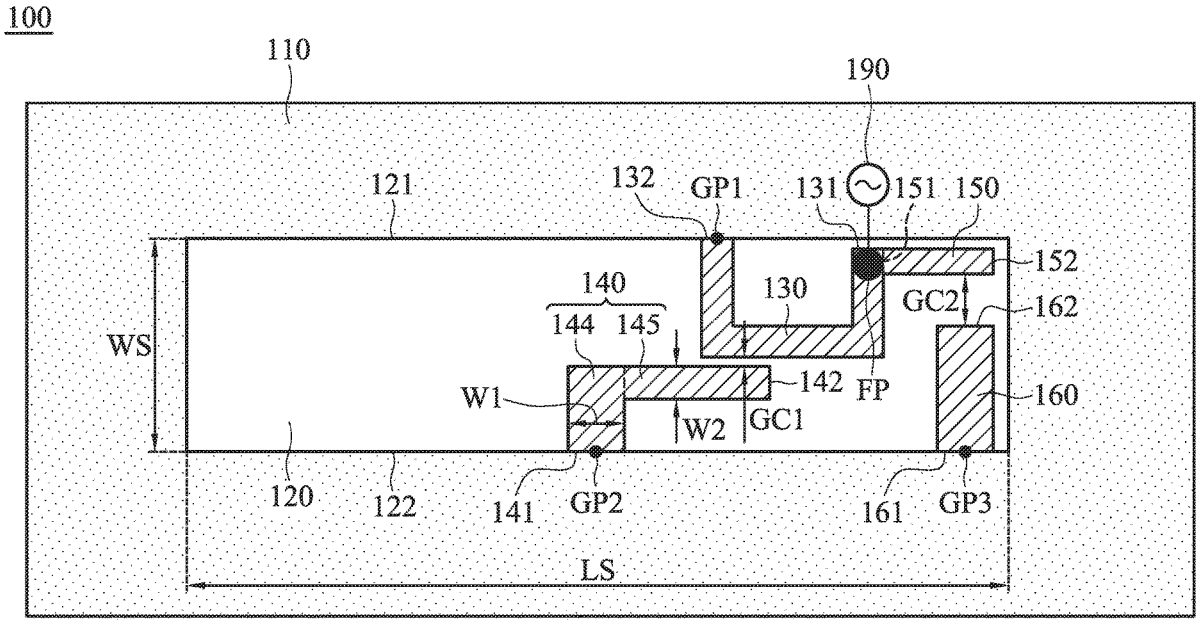
H01Q 1/48 (2006.01)

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

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

(57) **ABSTRACT**

An antenna structure includes a ground plane, a first radiation element, a second radiation element, a third radiation element, and a fourth radiation element. A closed slot is formed in the ground plane. The first radiation element has a feeding point. The first radiation element is coupled to a first shorting point on the ground plane. The second radiation element is coupled to a second shorting point on the ground plane. The second radiation element is adjacent to the first radiation element. The third radiation element is coupled to the feeding point. The fourth radiation element is coupled to a third shorting point on the ground plane. The fourth radiation element is adjacent to the third radiation element. The first radiation element, the second radiation element, the third radiation element, and the fourth radiation element are all disposed inside the closed slot.



US 20210167500A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167500 A1**

Declos et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **ANTENNA WITH MULTIPLE COUPLED REGIONS**

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

(72) Inventors: **Laurent Declos**, San Diego, CA (US); **Chew Chwee Heng**, Singapore (SG); **Sebastian Rowson**, San Diego, CA (US); **Jeffrey Shamblin**, San Diego, CA (US)

(21) Appl. No.: **17/170,212**

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

Related U.S. Application Data

(63) Continuation of application No. 15/948,203, filed on Apr. 9, 2018, now Pat. No. 10,916,846, which is a continuation of application No. 14/885,981, filed on Oct. 16, 2015, now Pat. No. 9,941,588, which is a continuation-in-part of application No. 13/767,854, filed on Feb. 14, 2013, now Pat. No. 9,190,733, which is a continuation of application No. 12/536,419, filed on Aug. 5, 2009, now abandoned, which is a continuation-in-part of application No. 13/289,901, filed on Nov. 4, 2011, now Pat. No. 8,717,241, which is a continuation of application No. 12/894,052, filed on Sep. 29, 2010, now Pat. No. 8,077,116, which is a continuation of application No. 11/841,207, filed on Aug. 20, 2007, now Pat. No. 7,830,320.

Publication Classification

(51) **Int. Cl.**

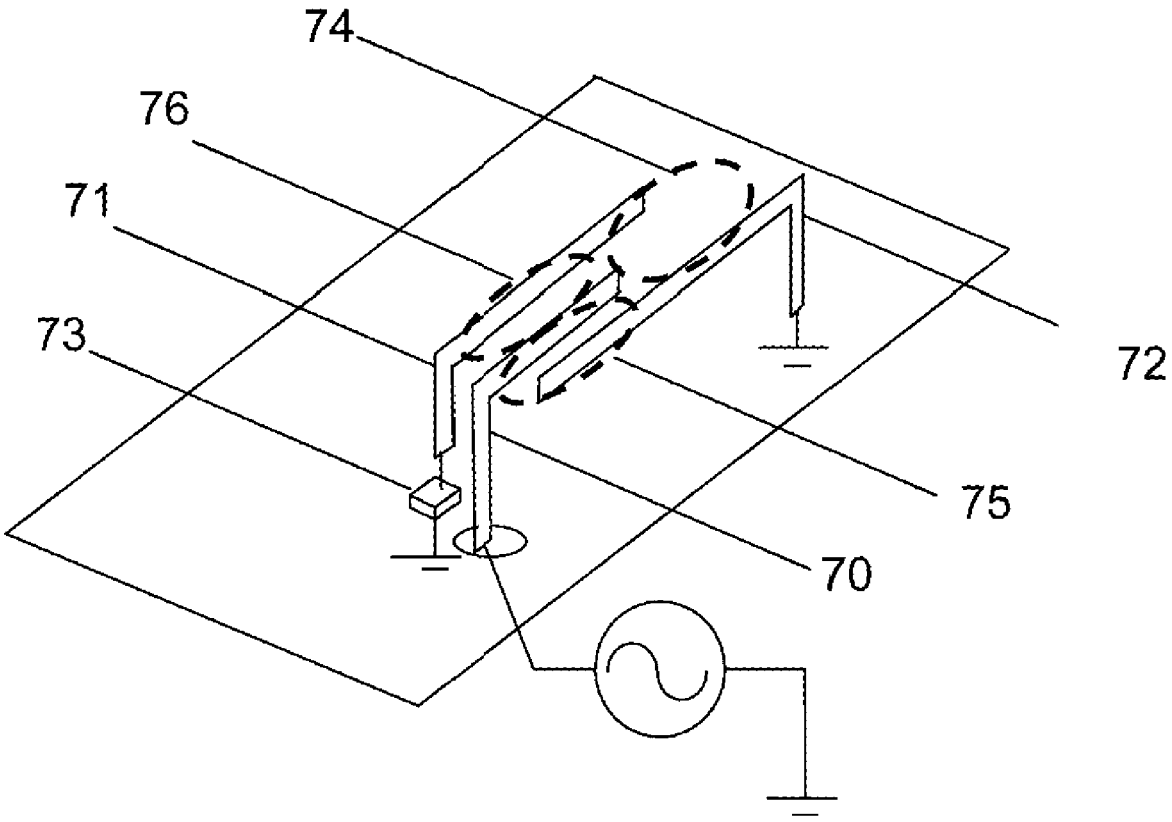
H01Q 5/328	(2015.01)
H01Q 5/385	(2015.01)
H01Q 7/00	(2006.01)
H01Q 19/00	(2006.01)
H01Q 9/06	(2006.01)
H01Q 5/378	(2015.01)
H01Q 9/42	(2006.01)
H01Q 5/321	(2015.01)

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

CPC ***H01Q 5/328*** (2015.01); ***H01Q 5/385*** (2015.01); ***H01Q 7/005*** (2013.01); ***H01Q 5/321*** (2015.01); ***H01Q 9/06*** (2013.01); ***H01Q 5/378*** (2015.01); ***H01Q 9/42*** (2013.01); ***H01Q 19/005*** (2013.01)

(57) **ABSTRACT**

A device includes a plurality of antennas, including one or more active antennas, the antennas being configured in one of a plurality of possible configurations to achieve operation in WAN, LTE, WiFi, or WiMax bands, or a combination thereof. In some embodiments, a passive antenna is utilized with lumped loading to fix the antenna tuning state. A primary and auxiliary radiator can be included in the device and configured for WAN/LTE bands, while additional antennas can be incorporated for WiFi and WiMax bands. Various antenna configurations incorporate the antenna having multiple coupled regions.



US 20210167501A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167501 A1**

LO et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Chung-Hung LO**, Taoyuan City (TW); **Ying-Cong DENG**, Taoyuan City (TW); **Kuan-Hsien LEE**, Taoyuan City (TW); **Yi-Ling TSENG**, Taoyuan City (TW); **Chung-Ting HUNG**, Taoyuan City (TW); **Chin-Lung TSAI**, Taoyuan City (TW)

(21) Appl. No.: **16/747,260**

(22) Filed: **Jan. 20, 2020**

(30) **Foreign Application Priority Data**

Nov. 28, 2019 (TW) 108143305

Publication Classification

(51) **Int. Cl.**

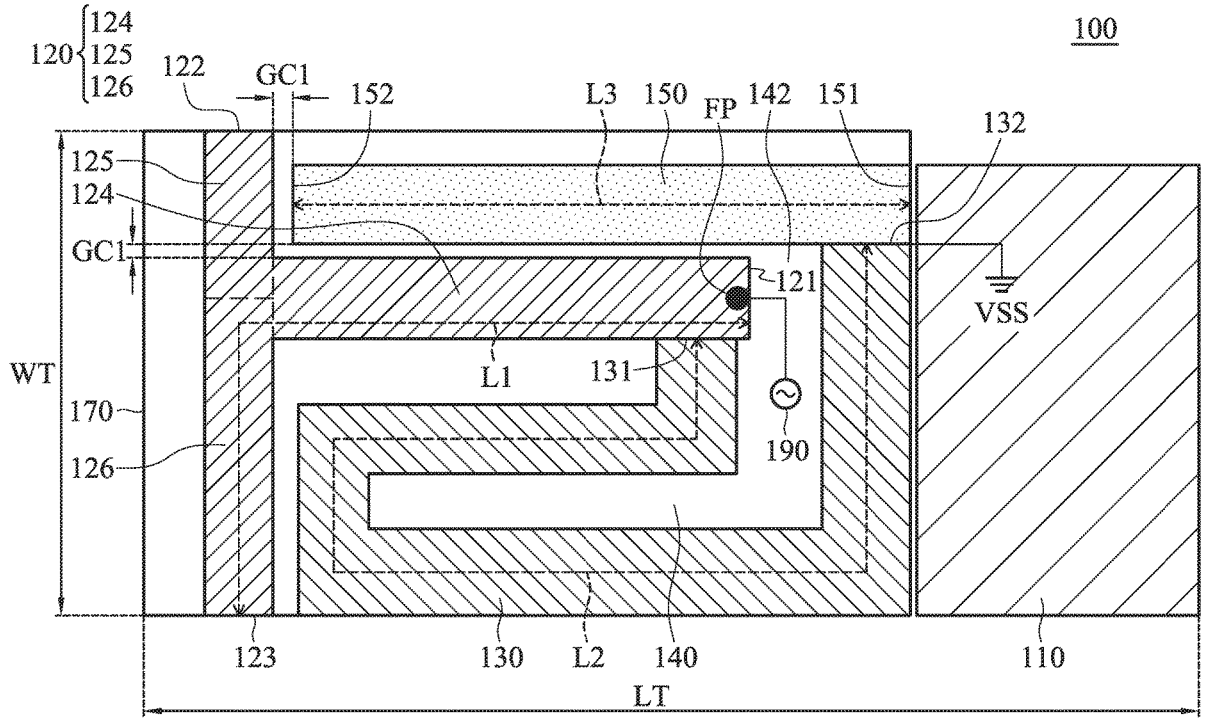
H01Q 5/371	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/38	(2006.01)
H01Q 9/30	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 5/371*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 9/30*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a ground plane, a first radiation element, a second radiation element, a third radiation element, and a dielectric substrate. The ground plane provides a ground voltage. The first radiation element includes a connection branch, a first branch, and a second branch. The connection branch has a feeding point. The first branch and the second branch substantially extend in opposite directions. The second radiation element is coupled to the feeding point. The second radiation element substantially surrounds a non-metal region, and is further coupled to the ground voltage. The third radiation element is coupled to the ground voltage. The third radiation element is adjacent to the first radiation element. The first radiation element, the second radiation element, and the third radiation element are all disposed on the dielectric substrate.



US 20210167504A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167504 A1**

YU (43) **Pub. Date: Jun. 3, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventor: **Chung Ta YU**, New Taipei City (TW)

(21) Appl. No.: **16/751,264**

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

(30) **Foreign Application Priority Data**

Nov. 29, 2019 (TW) 108143540

Publication Classification

(51) **Int. Cl.**

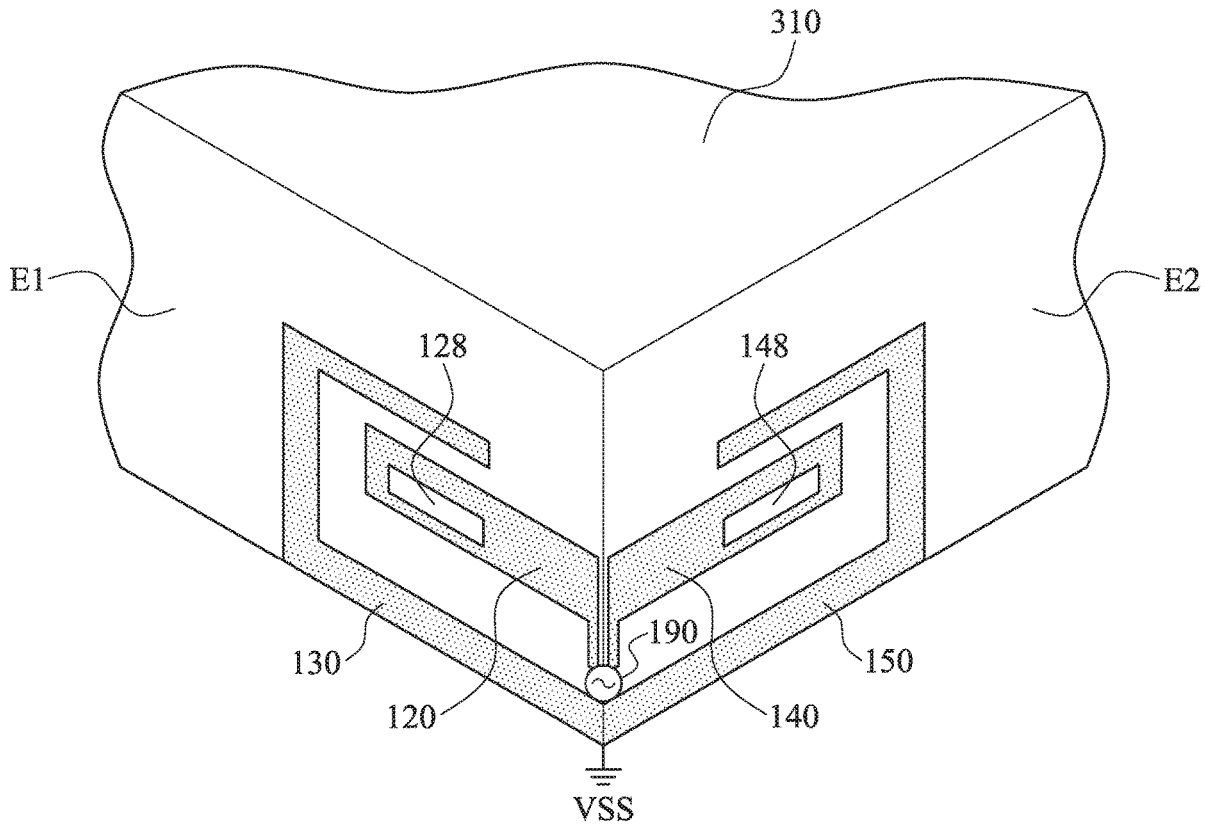
H01Q 9/04	(2006.01)
H01Q 1/38	(2006.01)
H01Q 13/16	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 9/045*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 13/16*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a nonconductive supporting element, a first feeding radiation element, a first grounding radiation element, a second feeding radiation element, and a second grounding radiation element. The first feeding radiation element and the second feeding radiation element are coupled to a signal source. The first feeding radiation element has a first slot. The second feeding radiation element has a second slot. The first grounding radiation element and the second grounding radiation element are coupled to a ground voltage. The first grounding radiation element is adjacent to the first feeding radiation element. The second grounding radiation element is adjacent to the second feeding radiation element. The first feeding radiation element, the first grounding radiation element, the second feeding radiation element, and the second grounding radiation element are disposed on the nonconductive supporting element.



US 20210167507A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0167507 A1

YAMADA et al. (43) Pub. Date: Jun. 3, 2021

(54) **ANTENNA DEVICE AND INVERTED F ANTENNA**

(71) Applicant: **YOKOWO CO., LTD.**, Kita-ku, Tokyo (JP)

(72) Inventors: **Kenichi YAMADA**, Tomioka-Shi, Gunma (JP); **Takeshi SAMPO**, Tomioka-Shi, Gunma (JP)

(73) Assignee: **YOKOWO CO., LTD.**, Kita-ku, Tokyo (JP)

(21) Appl. No.: **16/641,647**

(22) PCT Filed: **Jun. 28, 2018**

(86) PCT No.: **PCT/JP2018/024683**

§ 371 (c)(1),
(2) Date: **Feb. 25, 2020**

(30) **Foreign Application Priority Data**

Aug. 31, 2017 (JP) 2017-167153

Publication Classification

(51) **Int. Cl.**

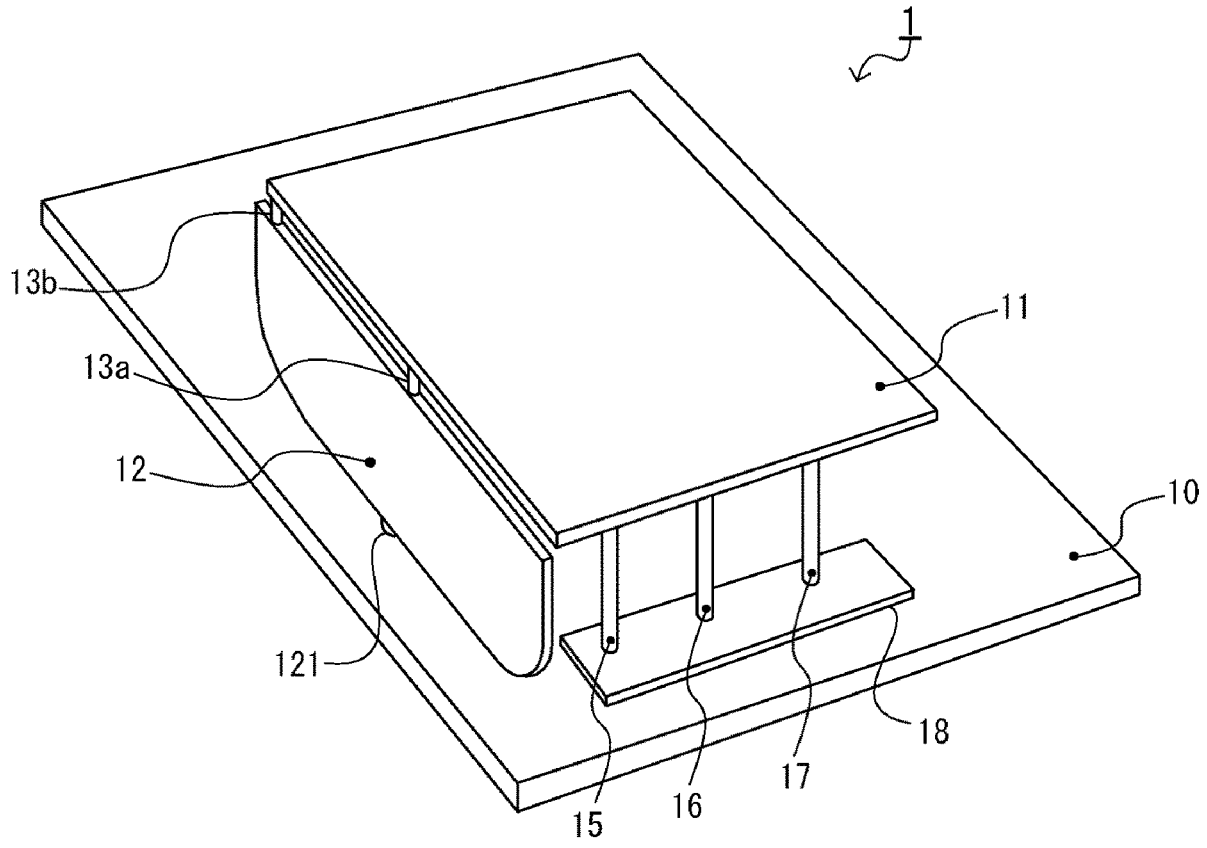
H01Q 9/04	(2006.01)
H01Q 1/38	(2006.01)
H01Q 9/42	(2006.01)
H01Q 5/364	(2006.01)

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

CPC ***H01Q 9/0421*** (2013.01); ***H01Q 5/364*** (2015.01); ***H01Q 9/42*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

An antenna device according to the present invention includes: an inverted F antenna which includes a planar part having a face opposing a grounding surface with a predetermined interval therebetween, a feeding part disposed in a plane forming a predetermined angle with respect to the grounding surface, and a short-circuit part for grounding a portion of the planar part, wherein each of the planar part and the feeding part has a plate shape, and is physically separated from each other; and wherein the planar part and the feeding part are electrically connected each other at a frequency less than or equal to a predetermined frequency.



US 20210167521A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167521 A1**

TSAI et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Chin-Lung TSAI**, Taoyuan City (TW); **Ying-Cong DENG**, Taoyuan City (TW); **Chung-Hung LO**, Taoyuan City (TW); **Kuan-Hsien LEE**, Taoyuan City (TW); **Yi-Ling TSENG**, Taoyuan City (TW); **Chung-Ting HUNG**, Taoyuan City (TW)

(21) Appl. No.: **16/747,213**

(22) Filed: **Jan. 20, 2020**

(30) **Foreign Application Priority Data**

Nov. 28, 2019 (TW) 108143306

Publication Classification

(51) **Int. Cl.**

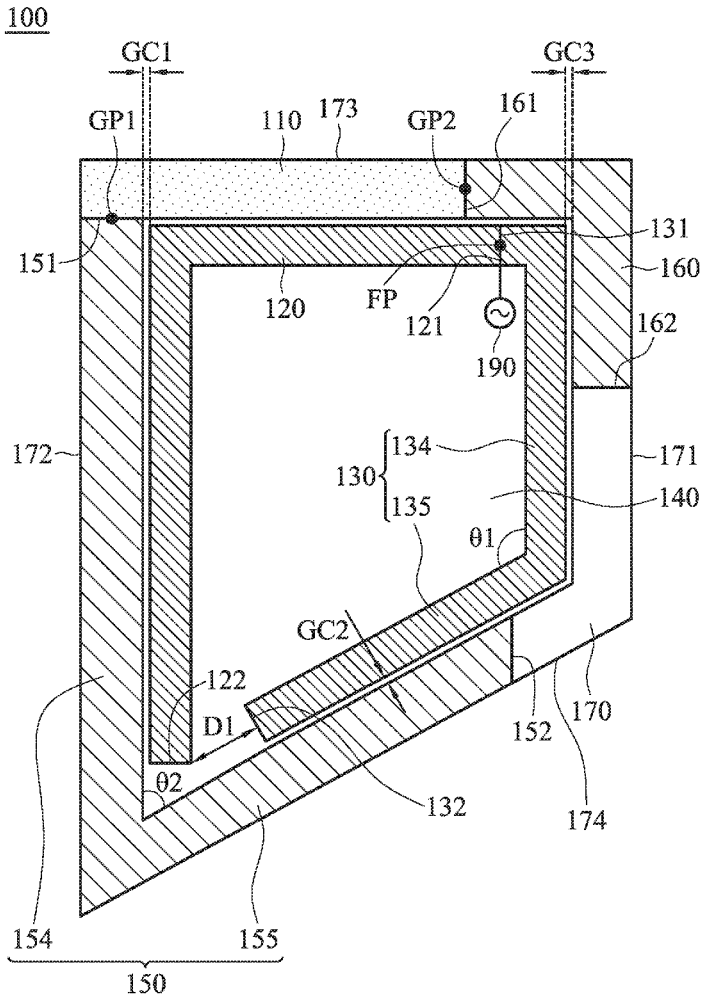
H01Q 21/30	(2006.01)
H01Q 1/48	(2006.01)
H01Q 1/38	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 21/30*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a ground plane, 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 feeding point. The second radiation element is coupled to the feeding point. The non-metal region is substantially surrounded by the first radiation element and the second radiation element. The third radiation element is coupled to a first shorting point on the ground plane. The third radiation element is adjacent to the first radiation element and the second radiation element. The fourth radiation element is coupled to a second shorting point on the ground plane. The fourth radiation element is adjacent to the second radiation element. The ground plane, the first radiation element, the second radiation element, the third radiation element, and the fourth radiation element are all disposed on the dielectric substrate.



US 20210167809A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0167809 A1

XU et al. (43) Pub. Date: Jun. 3, 2021

(54) MOBILE TERMINAL HAVING SHARED RADIO FREQUENCY ANTENNA

(71) Applicant: **JRD Communication (Shenzhen) LTD.**, Shenzhen City (CN)

(72) Inventors: **Jianhua XU**, Shenzhen City (CN); **Fan HUANG**, Shenzhen City (CN)

(73) Assignee: **JRD Communication (Shenzhen) LTD.**, Shenzhen City (CN)

(21) Appl. No.: **16/641,656**

(22) PCT Filed: **Aug. 24, 2018**

(86) PCT No.: **PCT/CN2018/102348**

§ 371 (c)(1),
(2) Date: **Feb. 25, 2020**

(30) **Foreign Application Priority Data**

Aug. 25, 2017 (CN) 201710741183.6

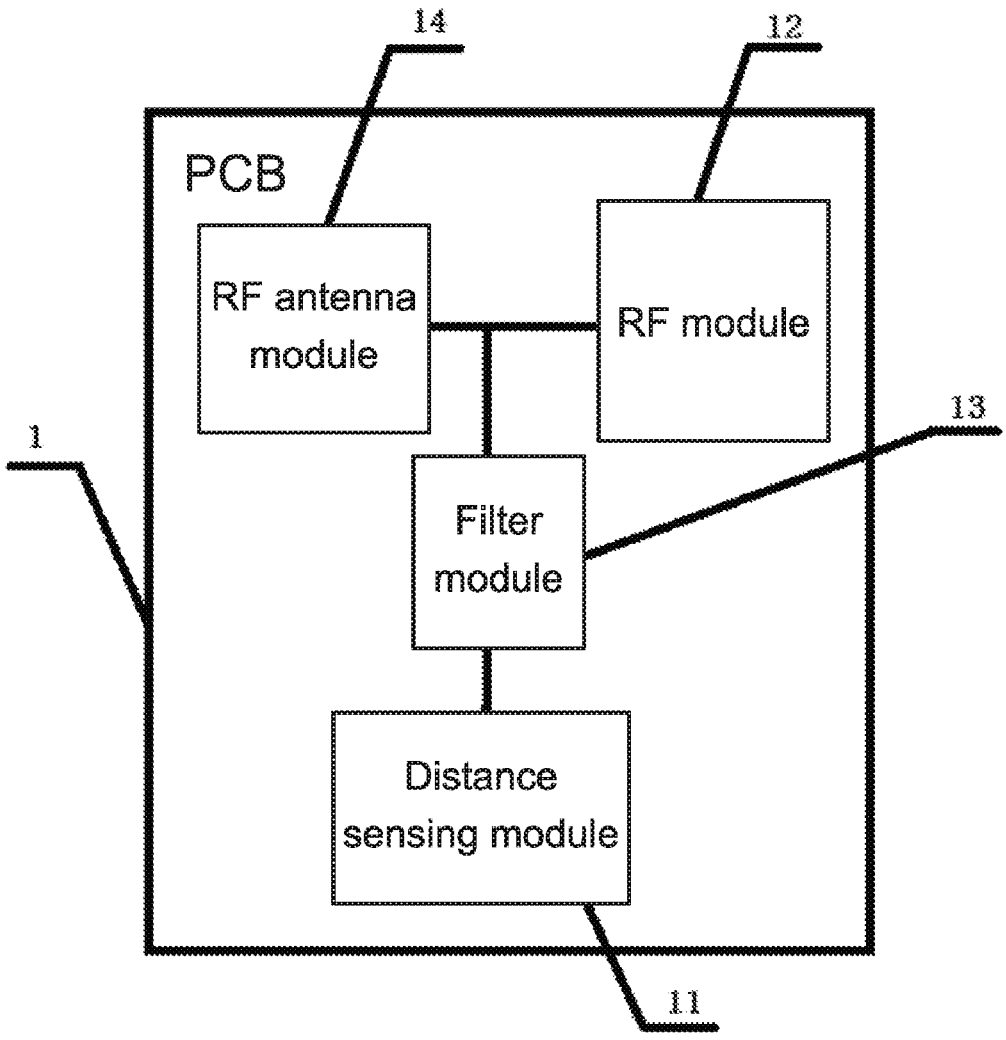
Publication Classification

(51) **Int. Cl.**
H04B 1/40 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
CPC ***H04B 1/40*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

The present application discloses a mobile terminal having a shared radio frequency antenna, comprising a PCB; the PCB is provided thereon with a distance sensing module, a radio frequency module, a filtering module for preventing a signal, that is not needed by the operation of the distance sensing module, from passing, and a radio frequency antenna module for generating a resonance frequency that is needed by the operation of the distance sensing module and a resonance frequency that is needed by the operation of the radio frequency module; the distance sensing module is connected to the radio frequency antenna module by means of the filtering module; and the radio frequency antenna module is further connected to the radio frequency module.



US 20210167927A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0167927 A1**

Pajona et al. (43) **Pub. Date: Jun. 3, 2021**

(54) **STATE PREDICTION PROCESS AND METHODOLOGY**

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

(72) Inventors: **Olivier Pajona**, Antibes (FR); **Sebastian Rowson**, San Diego, CA (US); **Laurent Desclos**, San Diego, CA (US)

(21) Appl. No.: **17/175,834**

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

Related U.S. Application Data

(63) Continuation of application No. 16/530,376, filed on Aug. 2, 2019, now Pat. No. 10,924,247, which is a continuation of application No. 16/180,175, filed on Nov. 5, 2018, now Pat. No. 10,374,779, which is a continuation of application No. 15/209,644, filed on Jul. 13, 2016, now Pat. No. 10,122,516, which is a continuation of application No. 14/077,128, filed on Nov. 11, 2013, now Pat. No. 9,425,497, which is a continuation-in-part of application No. 13/749,627, filed on Jan. 24, 2013, now Pat. No. 9,231,669.

(60) Provisional application No. 61/725,019, filed on Nov. 11, 2012.

Publication Classification

(51) **Int. Cl.**

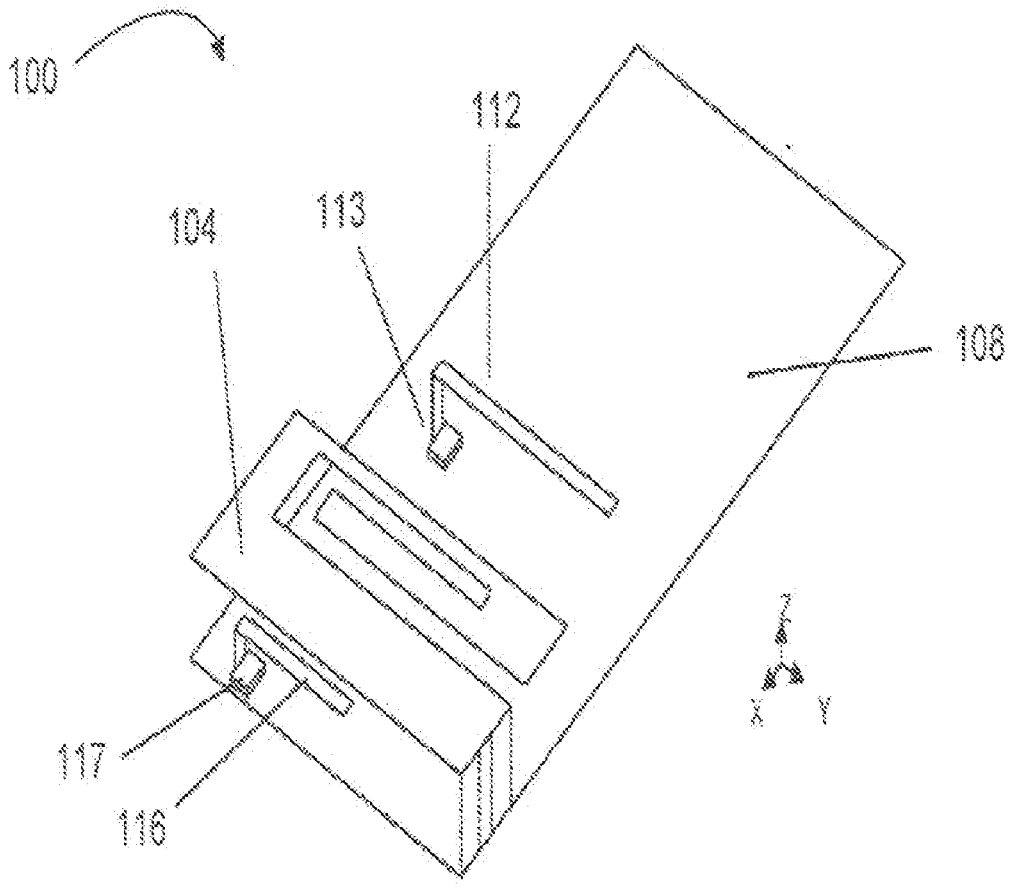
H04L 5/00	(2006.01)
H04B 17/318	(2015.01)
H01Q 19/28	(2006.01)
H01Q 1/24	(2006.01)
H04B 7/06	(2006.01)
H04B 7/0413	(2017.01)
H01Q 3/44	(2006.01)
H04B 7/10	(2017.01)

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

CPC ***H04L 5/0057*** (2013.01); ***H04B 17/318*** (2015.01); ***H01Q 19/28*** (2013.01); *H04B 7/10* (2013.01); ***H04B 7/0689*** (2013.01); ***H04B 7/0413*** (2013.01); ***H01Q 3/44*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

A system and method for optimizing the performance for MIMO are provided, the system including multiple antennas, including at least one modal antenna, wherein each of the at least one modal antenna has multiple modes corresponding to multiple radiation patterns, and a processor coupled to the multiple antennas and configured to select a mode among the multiple modes to optimize signal quality for each time interval based on a CQI by considering envelop correlation effects.



US 20210168932A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0168932 A1**

(43) **Pub. Date: Jun. 3, 2021**

WOO

(54) **ELECTRONIC DEVICE**

(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)

(72) Inventor: **Seungmin WOO**, Seoul (KR)

(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)

(21) Appl. No.: **17/154,209**

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

Related U.S. Application Data

(63) Continuation of application No. 16/852,004, filed on Apr. 17, 2020, now Pat. No. 10,966,314, which is a continuation of application No. 16/141,841, filed on Sep. 25, 2018, now Pat. No. 10,660,198.

(60) Provisional application No. 62/564,222, filed on Sep. 27, 2017.

(30) **Foreign Application Priority Data**

Feb. 21, 2018 (KR) 10-2018-0020712

Publication Classification

(51) **Int. Cl.**

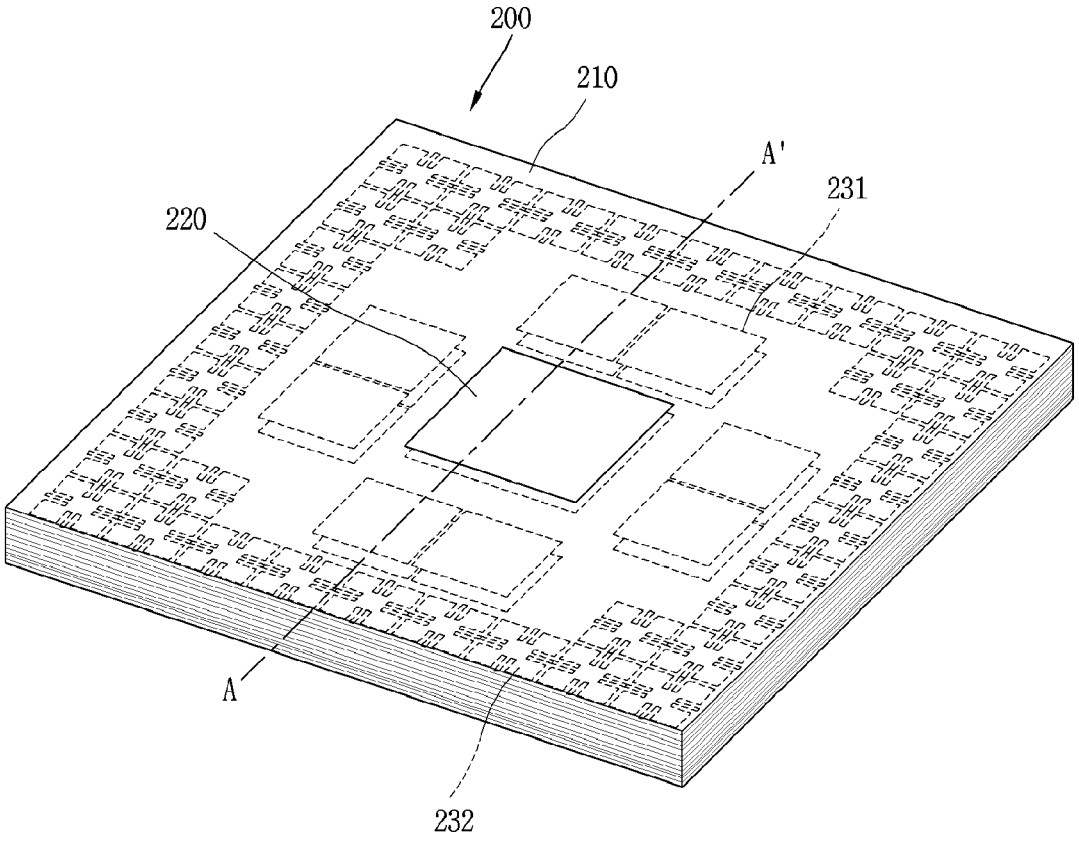
H05K 1/02	(2006.01)
H01Q 9/04	(2006.01)
H01Q 21/06	(2006.01)
H01Q 1/48	(2006.01)
H05K 1/18	(2006.01)
H05K 1/11	(2006.01)
H01Q 1/52	(2006.01)

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

CPC ***H05K 1/0271*** (2013.01); ***H01Q 9/045*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 1/48*** (2013.01); *H05K 1/0298* (2013.01); ***H05K 1/181*** (2013.01); ***H05K 1/115*** (2013.01); ***H01Q 1/521*** (2013.01); *H05K 2201/10098* (2013.01); ***H05K 1/0236*** (2013.01)

(57) **ABSTRACT**

The present disclosure relates to an electronic device, and the electronic device may include a circuit board provided within a main body of the electronic device, on which a conductive layer made of a conductive material and a dielectric layer made of an insulating material are alternately laminated; at least one or more patch antennas disposed on the circuit board; a core layer located at a central portion inside the circuit board, and configured with any one of the dielectric layers; a ground layer disposed below the core layer; and an EBG structure located inside the circuit board in a symmetrical shape at the top and bottom with respect to the core layer, and the EBG structure restricts operating frequency signals radiated from the respective patch antennas from being interfered with each other.



US 20210175607A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0175607 A1

Ramasamy et al. (43) Pub. Date: Jun. 10, 2021

(54) **SYSTEM AND METHOD FOR ANTENNA PATTERN POSITIONING OF INTEGRATED ANTENNA VENT**

(71) Applicant: **Dell Products, LP**, Round Rock, TX (US)

(72) Inventors: **Suresh K. Ramasamy**, Cedar Park, TX (US); **Sumana Pallampati**, Austin, TX (US); **Changsoo Kim**, Cedar Park, TX (US)

(73) Assignee: **Dell Products, LP**, Round Rock, TX (US)

(21) Appl. No.: **16/704,998**

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

Publication Classification

(51) **Int. Cl.**

H01Q 1/22 (2006.01)

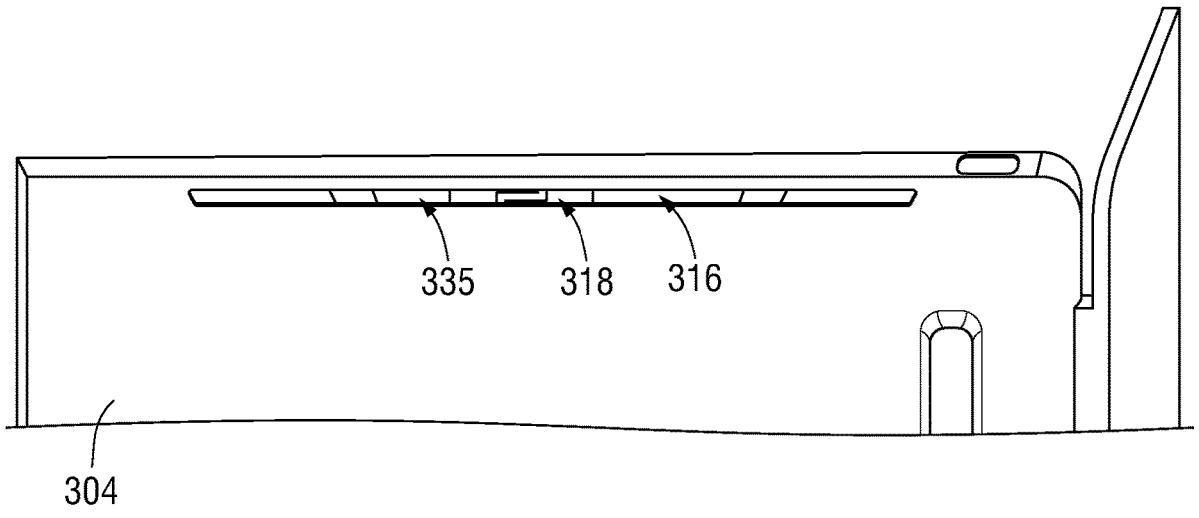
H01Q 1/48 (2006.01)

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

CPC ***H01Q 1/2266*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An information handling system to wirelessly transmit and receive data at an antenna may include a base housing metal chassis containing components of the information handling system, the base housing metal chassis including a C-cover and D-cover housing the components; and an antenna cavity formed within the C-Cover and D-cover including: a first aperture formed through a portion of the D-cover; a second aperture formed through a portion of the C-cover; and a grounding wall formed within the antenna cavity to operatively couple currents associated with the antenna such that the currents travel from the first aperture to the send aperture causing emitted electromagnetic radiation to be emitted towards the second aperture.



US 20210175608A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175608 A1**

Ramasamy et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **SYSTEM AND METHOD FOR OPERATION OF A HINGE CAVITY ANTENNA**

(71) Applicant: **Dell Products, LP**, Round Rock, TX (US)

(72) Inventors: **Suresh K. Ramasamy**, Cedar Park, TX (US); **Sumana Pallampati**, Austin, TX (US); **Changsoo Kim**, Cedar Park, TX (US)

(73) Assignee: **Dell Products, LP**, Round Rock, TX (US)

(21) Appl. No.: **16/706,025**

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

Publication Classification

(51) **Int. Cl.**

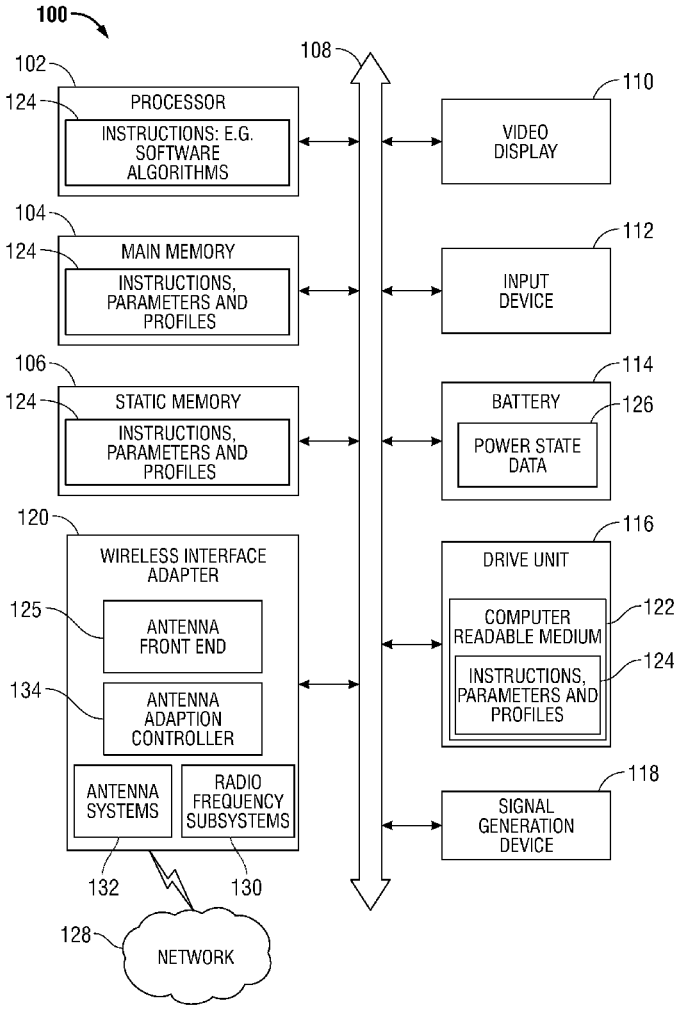
H01Q 1/22	(2006.01)
G06F 1/16	(2006.01)
H05K 5/02	(2006.01)

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

CPC ***H01Q 1/2266*** (2013.01); ***H05K 5/0226*** (2013.01); ***H01Q 1/2283*** (2013.01); ***G06F 1/1681*** (2013.01)

(57) **ABSTRACT**

An information handling system to wirelessly transmit and receive data at an antenna may include a base housing chassis containing components of the information handling system including a processor and memory and including a C-cover and a metal D-cover; a display chassis assembly having a display screen and including an A-cover; a hinge mechanically coupling the display chassis assembly to the base housing chassis; a hinge gap integrated along a hinge between an edge of the A-cover and an edge of the metal D-cover; an antenna to emit a radio frequency signal to a contained hinge gap resonant cavity formed within the hinge gap; and a flexible printed circuit (FPC) having a ground line operatively coupling the base housing chassis to the display chassis assembly to form a ground path across the hinge gap to shunt excitation currents along the hinge gap and to determine a size of the contained hinge gap resonant cavity between the A-cover and D-cover to accommodate an operating frequency of the radio frequency signal or harmonics of the operating frequency.



US 20210175610A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175610 A1**

Ramasamy et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **SYSTEM AND METHOD FOR OPERATING AN ANTENNA WITHIN AN ANTENNA VENT BEING CO-LOCATED WITH AN AUDIO OR THERMAL VENT**

(71) Applicant: **Dell Products, LP**, Round Rock, TX (US)

(72) Inventors: **Suresh K. Ramasamy**, Cedar Park, TX (US); **Sumana Pallampati**, Austin, TX (US); **Changsoo Kim**, Cedar Park, TX (US)

(73) Assignee: **Dell Products, LP**, Round Rock, TX (US)

(21) Appl. No.: **16/705,129**

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

Publication Classification

(51) **Int. Cl.**

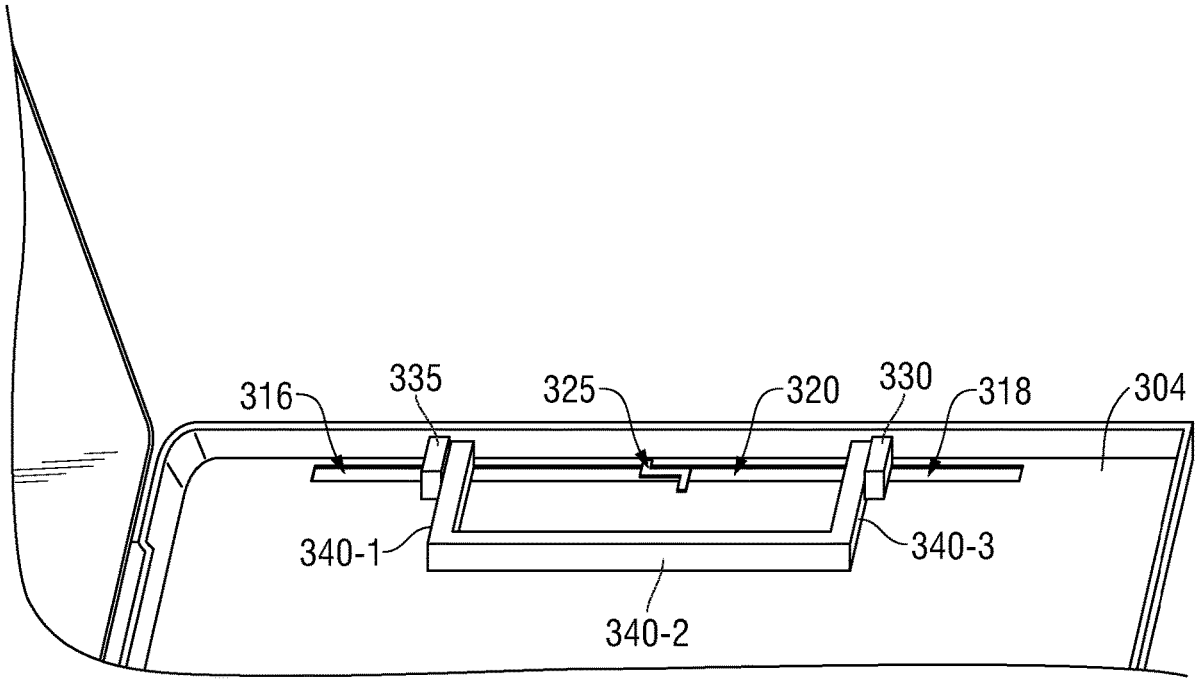
H01Q 1/24	(2006.01)
H01Q 9/30	(2006.01)
H01Q 1/22	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/2266*** (2013.01); ***H01Q 9/30*** (2013.01)

(57) **ABSTRACT**

An information handling system to wirelessly transmit and receive data at an antenna may include a base housing metal chassis containing components of the information handling system including a thermal vent, an audio vent, and an antenna vent, the antenna vent being co-located with the thermal vent and audio vent; and the co-located antenna vent including: partitions defining a width of an aperture formed at the co-located antenna vent to accommodate a target frequency range; a monopole antenna system formed within the co-located antenna vent including a parasitic coupling element; and a grounding wall defined along an edge of the co-located antenna vent.



US 20210175611A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175611 A1**

CHANG et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **MOBILE DEVICE AND DETACHABLE ANTENNA STRUCTURE**

(71) Applicant: **Acer Incorporated**, New Taipei City (TW)

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

(21) Appl. No.: **16/930,442**

(22) Filed: **Jul. 16, 2020**

(30) **Foreign Application Priority Data**

Dec. 10, 2019 (TW) 108145077

Publication Classification

(51) **Int. Cl.**

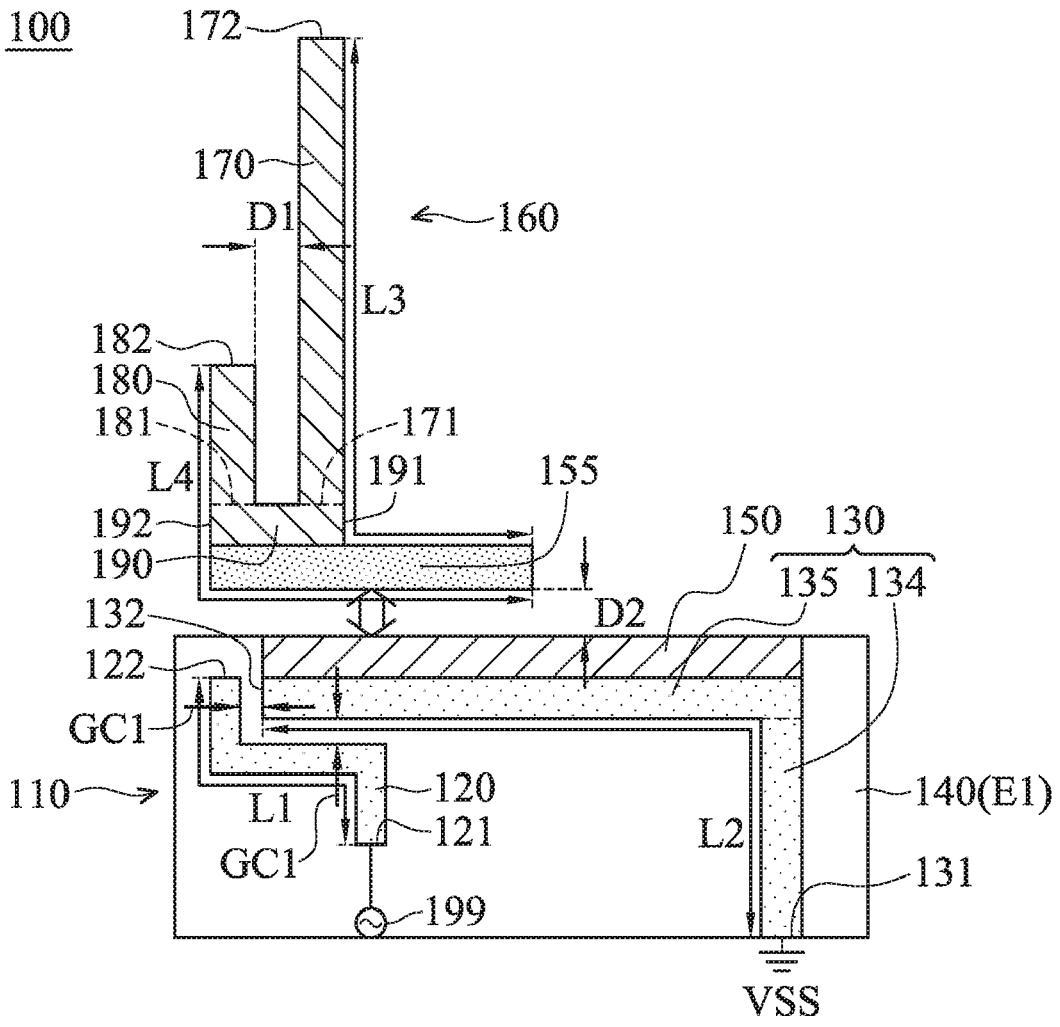
H01Q 1/24	(2006.01)
H01Q 1/36	(2006.01)
G06F 1/16	(2006.01)
H01Q 1/44	(2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 1/44*** (2013.01); ***G06F 1/1626*** (2013.01); ***H01Q 1/36*** (2013.01)

(57) **ABSTRACT**

A mobile device includes a main antenna structure and a detachable antenna structure. The main antenna structure includes a feeding radiation element, a grounding radiation element, a dielectric substrate, and an iron element. The grounding radiation element is adjacent to the feeding radiation element. The feeding radiation element and the grounding radiation element are disposed on the surface of the dielectric substrate. The iron element is coupled to the grounding radiation element. The detachable antenna structure includes a first radiation element, a second radiation element, a third radiation element, and a magnetic element. The third radiation element is coupled between the first radiation element and the second radiation element. The magnetic element is coupled to the third radiation element. When the magnetic element is attracted to the iron element, the detachable antenna structure can enhance the radiation gain of the main antenna structure.



US 20210175624A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175624 A1**

Ding et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **ULTRA-WIDEBAND WALL-MOUNTED ANTENNA**

(71) Applicant: **Kunshan Hamilton Communication Technology Co., Ltd**, Jiangsu (CN)

(72) Inventors: **Juntao Ding**, Jiangsu (CN); **Zhaoying Song**, Jiangsu (CN); **Jiexiang Wang**, Jiangsu (CN); **Wenkai Luo**, Jiangsu (CN); **Lu Zhang**, Jiangsu (CN)

(21) Appl. No.: **16/072,090**

(22) PCT Filed: **May 18, 2017**

(86) PCT No.: **PCT/CN2017/084824**

§ 371 (c)(1),
(2) Date: **Jul. 23, 2018**

(30) **Foreign Application Priority Data**

Mar. 14, 2017 (CN) 201710155066.1

Publication Classification

(51) **Int. Cl.**

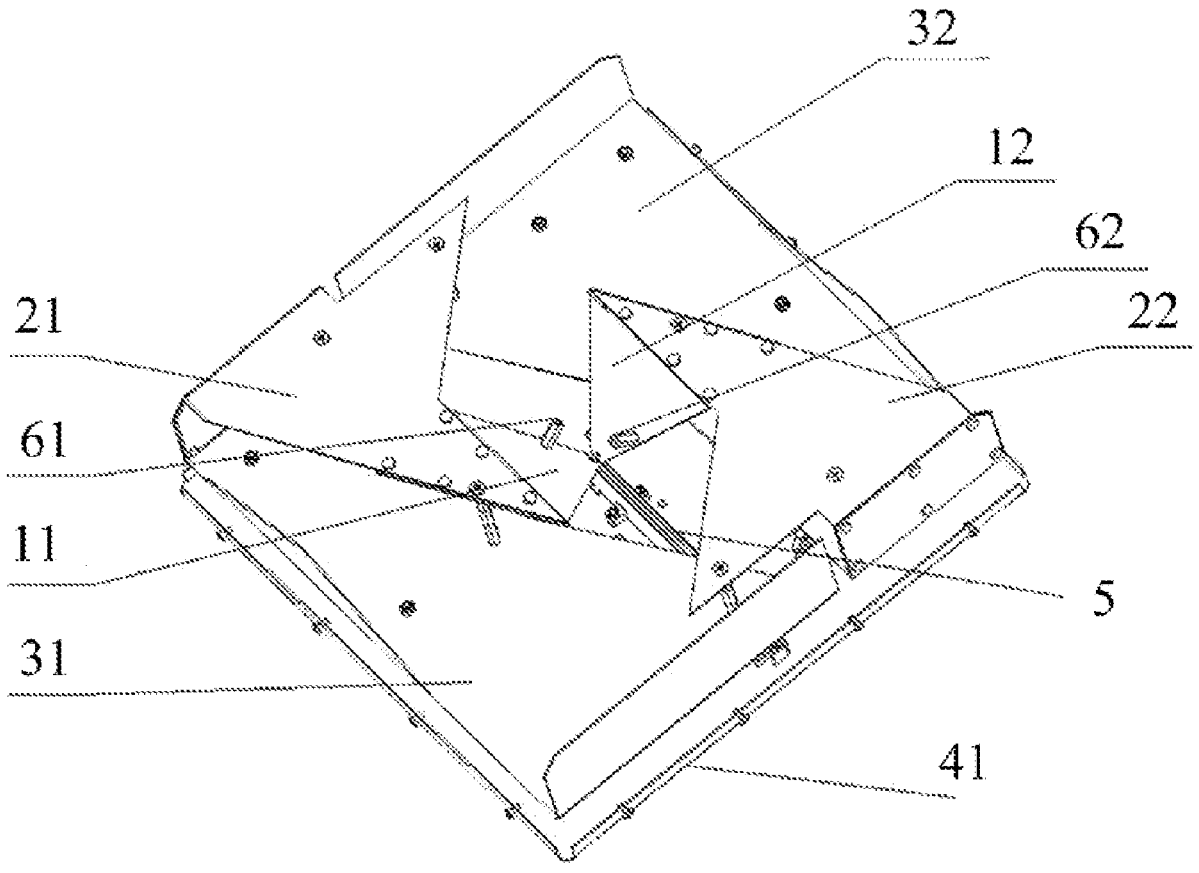
H01Q 5/25	(2006.01)
H01Q 19/10	(2006.01)
H01Q 1/12	(2006.01)

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

CPC ***H01Q 5/25*** (2015.01); ***H01Q 1/1221*** (2013.01); ***H01Q 19/10*** (2013.01)

(57) **ABSTRACT**

The present invention relates to an anchor point for e.g. lifting and/or lashing down an object. The anchor point comprises a base, which is configured for fixing to the object such that it is rotatable about an axis of rotation. The anchor point also comprises a retainer bracket held on two bearing points on the base such that it is tiltable about a tilt axis relative to the base. In order to prevent the retainer bracket from getting stuck when a force is applied thereto, which may lead to a sudden and jerky turnover of the retainer bracket or even to fracturing of the anchor point and crashing of the load, the tilt axis is movable relative to the base according to the present invention. Preferably, a motion link, for example, is provided on at least one bearing point.



US 20210175625A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0175625 A1

GUO (43) Pub. Date: Jun. 10, 2021

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

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

(72) Inventor: **Fang GUO**, Beijing (CN)

(73) Assignee: **BEIJING XIAOMI MOBILE SOFTWARE CO., LTD.**, Beijing (CN)

(21) Appl. No.: **16/900,662**

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

(30) **Foreign Application Priority Data**

Dec. 6, 2019 (CN) 201911242946.8

Publication Classification

(51) **Int. Cl.**

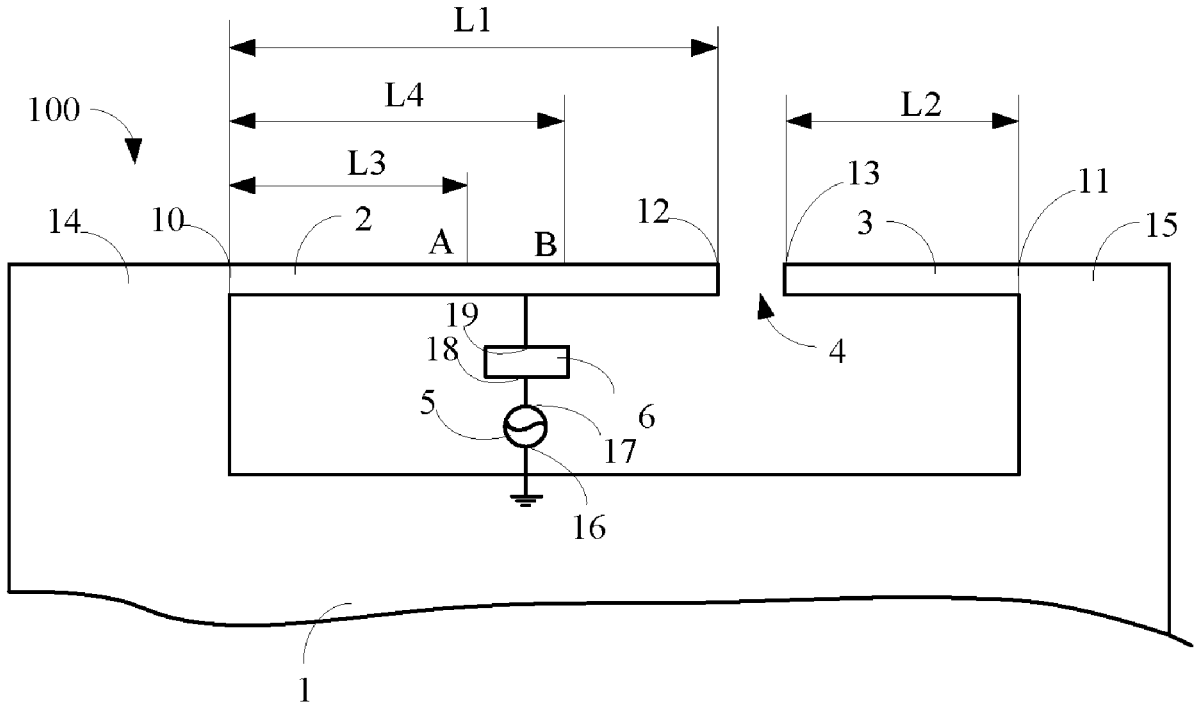
H01Q 5/371	(2006.01)
H01Q 1/48	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 5/371*** (2015.01); ***H01Q 9/0457*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

The present disclosure relates to an antenna structure and an electronic device. The antenna structure includes: a metal frame body; a first antenna branch coupled to one side edge of the metal frame body; a second antenna branch coupled to the other side edge of the metal frame body; an antenna gap defined by the first antenna branch and the second antenna branch after the first antenna branch and the second antenna branch both extend towards a middle portion of the metal frame body, an extension length of the first antenna branch being greater than an extension length of the second antenna branch; and a feed point with one end coupled to a ground point and the other end coupled to the first antenna branch.



US 20210175627A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0175627 A1

YI et al. (43) Pub. Date: Jun. 10, 2021

(54) **ANTENNA SUBSTRATE AND ANTENNA MODULE COMPRISING THE SAME**

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

(72) Inventors: **Moon Hee YI**, Suwon-si (KR); **Tae Seong KIM**, Suwon-si (KR)

(21) Appl. No.: **16/789,039**

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

(30) **Foreign Application Priority Data**

Dec. 10, 2019 (KR) 10-2019-0163278

Publication Classification

(51) **Int. Cl.**

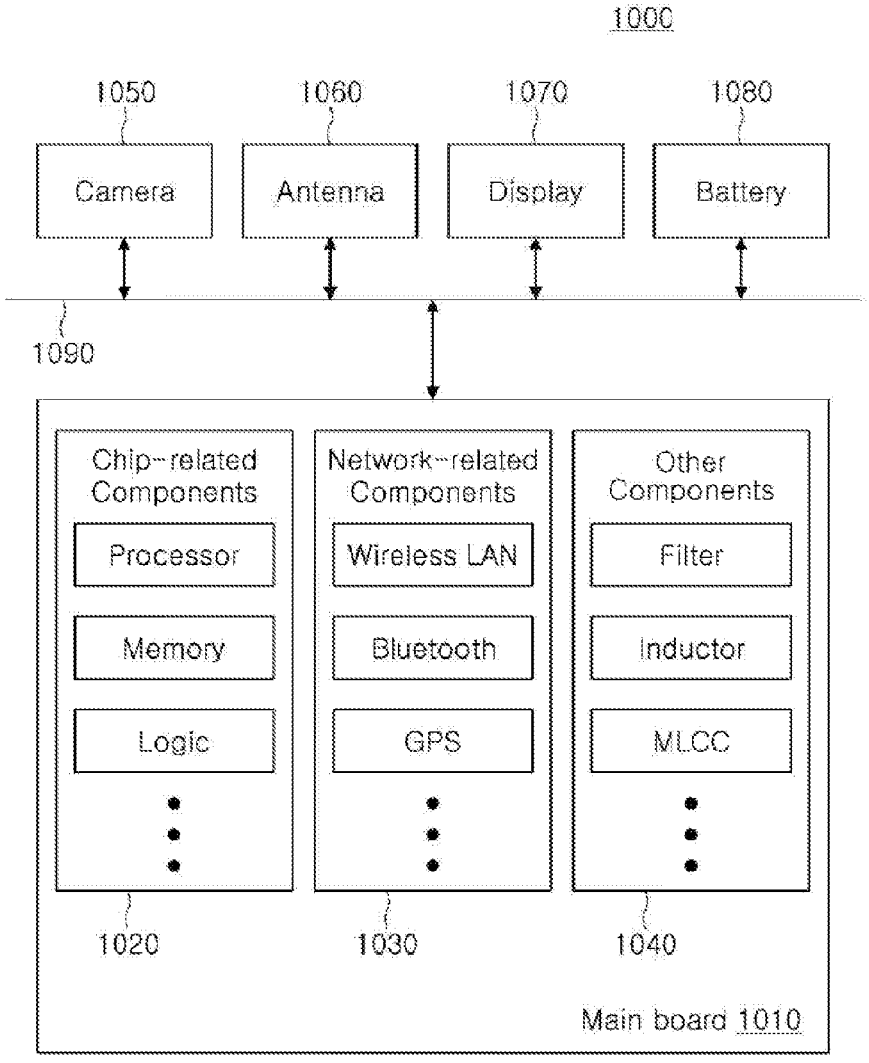
H01Q 9/04	(2006.01)
H01Q 1/42	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 9/045*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 1/422*** (2013.01)

(57) **ABSTRACT**

An antenna substrate and an antenna module including the same are provided. The antenna substrate includes an antenna unit including first and second pattern layers adjacent to each other and disposed on different levels and a first insulating layer providing a first insulating region between the first and second pattern layers, and a feed unit including third and fourth pattern layers adjacent to each other and disposed on different levels and a second insulating layer providing a second insulating region between the third and fourth pattern layers. Each of the first and second pattern layers includes an antenna pattern, and each of the third and fourth pattern layers includes a feed pattern. The antenna unit is disposed on the feed unit. The first insulating region is thicker than the second insulating region.



US 20210175629A1

(19) **United States**

(12) **Patent Application Publication**

KANG et al.

(10) **Pub. No.: US 2021/0175629 A1**

(43) **Pub. Date: Jun. 10, 2021**

(54) **ANTENNA MODULE**

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

(72) Inventors: **Kyung In KANG**, Suwon-si (KR); **Jeong Ki RYOO**, Suwon-si (KR); **Kyu Bum HAN**, Suwon-si (KR)

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

(21) Appl. No.: **17/179,476**

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

Related U.S. Application Data

(63) Continuation of application No. 16/296,900, filed on Mar. 8, 2019, now Pat. No. 10,957,982.

(30) **Foreign Application Priority Data**

Apr. 23, 2018 (KR) 10-2018-0046816
Aug. 3, 2018 (KR) 10-2018-0090870

Publication Classification

(51) **Int. Cl.**

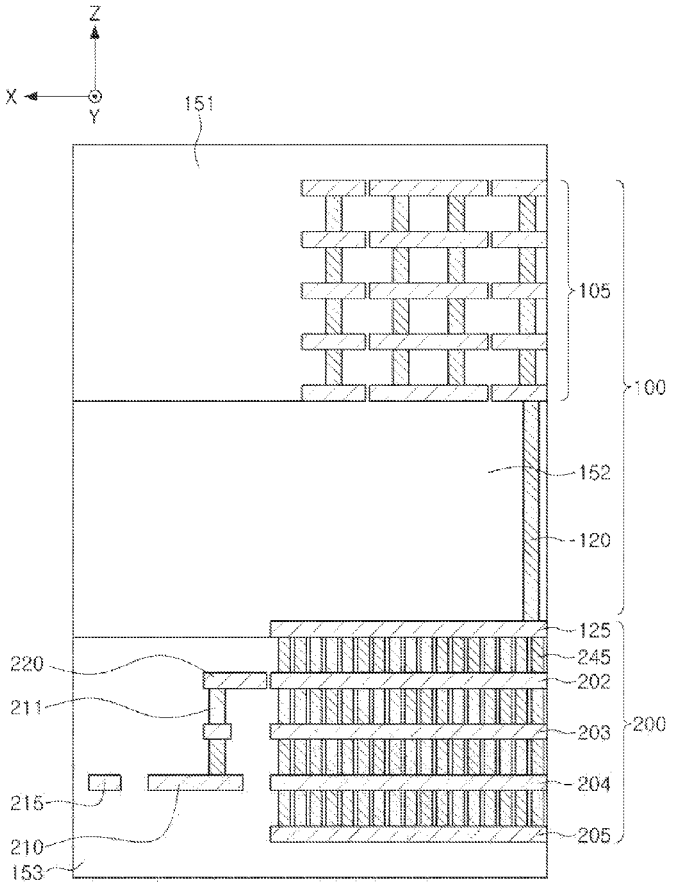
H01Q 9/04	(2006.01)
H01L 23/498	(2006.01)
H01Q 21/06	(2006.01)
H01Q 1/22	(2006.01)
H01L 23/00	(2006.01)
H01L 23/66	(2006.01)

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

CPC ***H01Q 9/0457*** (2013.01); ***H01L 23/49827*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 1/2283*** (2013.01); ***H01L 24/73*** (2013.01); *H01L 2224/73253* (2013.01); ***H01L 23/66*** (2013.01); ***H01Q 1/2291*** (2013.01); *H01L 2924/1421* (2013.01); *H01L 2223/6677* (2013.01); ***H01L 24/13*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a ground layer including a through-hole; a feed via disposed to pass through the through-hole; a patch antenna pattern spaced apart from the ground layer and electrically connected to one end of the feed via; a coupling patch pattern spaced apart from the patch antenna pattern; a first dielectric layer to accommodate the patch antenna pattern and the coupling patch pattern; a second dielectric layer to accommodate at least a portion of the feed via and the ground layer; and electrical connection structures disposed between the first dielectric layer and the second dielectric layer to separate the first dielectric layer from the second dielectric layer.



US 20210175631A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175631 A1**

Wu et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **ANTENNA STRUCTURE**

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

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

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

(21) Appl. No.: **17/039,065**

(22) Filed: **Sep. 30, 2020**

(30) **Foreign Application Priority Data**

Dec. 5, 2019 (TW) 108144556

Publication Classification

(51) **Int. Cl.**

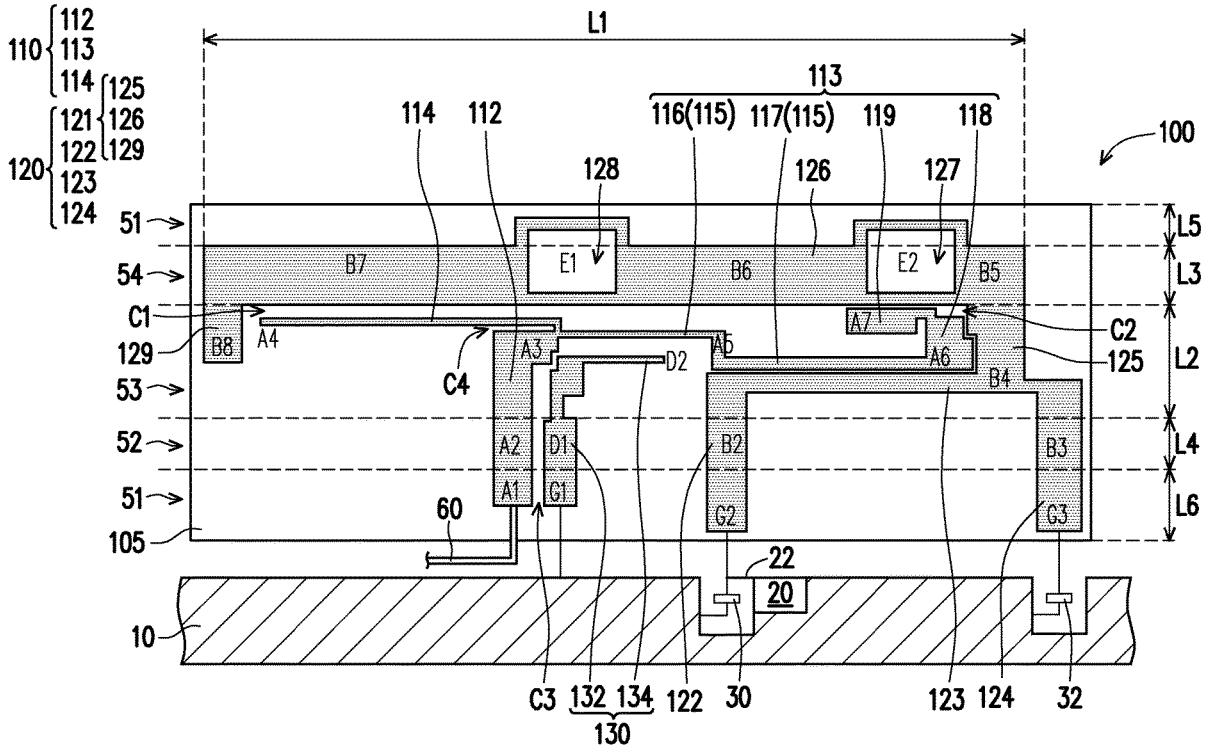
H01Q 13/16	(2006.01)
H01Q 21/06	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H01Q 13/16*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 21/06*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes first, second, and third radiators. The first radiator includes first, second, and third segments. One end of the first segment includes a signal feeding end. The second and third segments respectively extend in opposite directions from another end of the first segment. The second radiator includes a fourth segment, a fifth segment, and a sixth segment extending from an intersection of the fourth and fifth segments. The fourth segment includes a first ground end. The fifth segment includes a second ground end. A first slit is between the second and sixth segments; a second slit is between the third, fourth, and sixth segments. The third radiator includes seventh and eighth segments connected to each other in a bending manner. The seventh segment includes a third ground end. A third slit is between the first and seventh segments and between the third and eighth segments.



US 20210175636A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175636 A1**

LASITER et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **BROADBAND ANTENNA SYSTEM**

(71) Applicant: **QUALCOMM Incorporated**, San Diego, CA (US)

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Publication Classification

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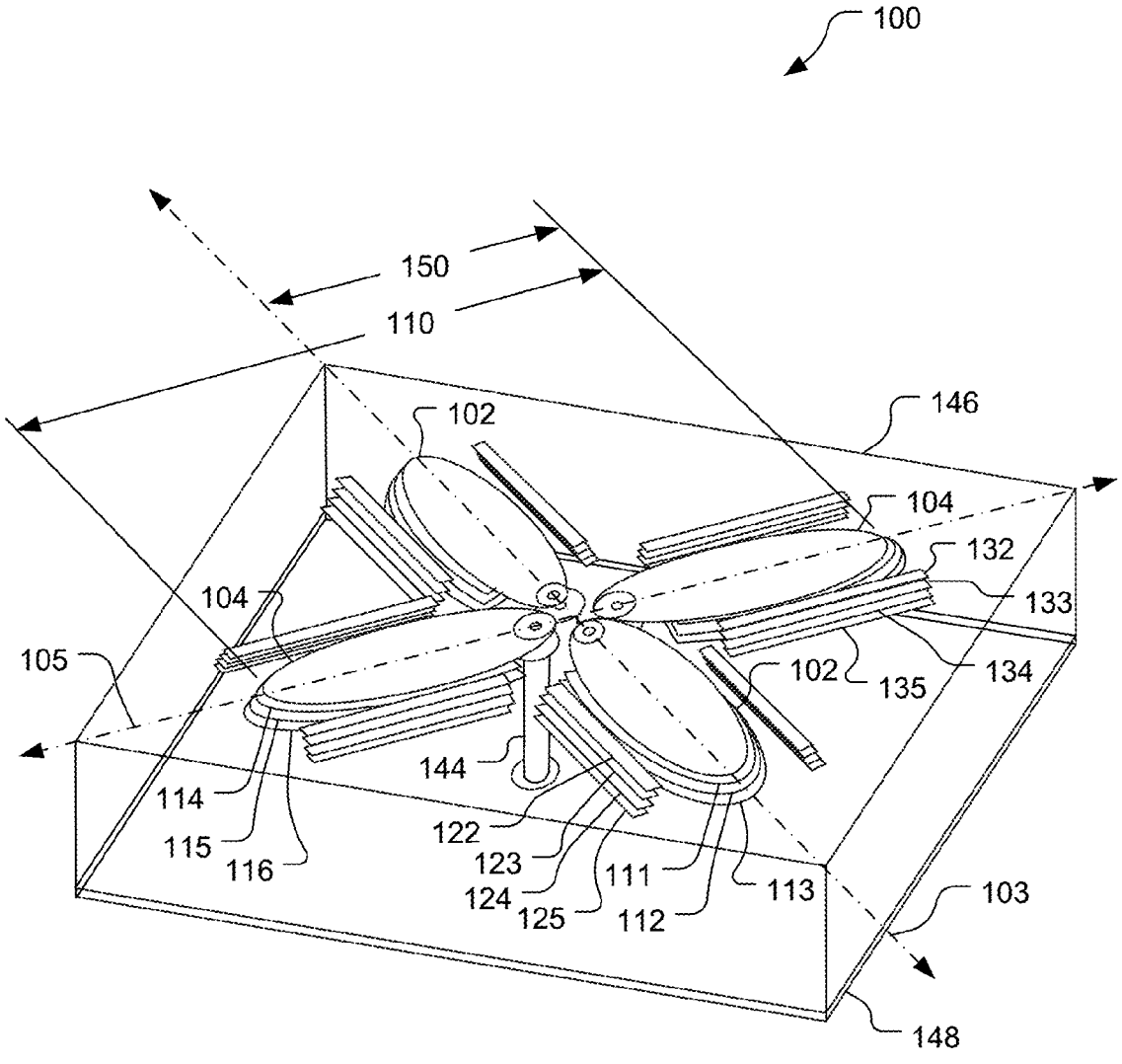
H01Q 21/26	(2006.01)
H01Q 9/28	(2006.01)

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

CPC ***H01Q 21/062*** (2013.01); *H01Q 1/48* (2013.01); ***H01Q 9/285*** (2013.01); ***H01Q 21/26*** (2013.01)

(57) **ABSTRACT**

An antenna system includes: a ground conductor; a substrate; a pair of planar dipole conductors disposed such that at least a portion of the substrate is disposed between the ground conductor and the pair of dipole conductors; a pair of energy couplers each electrically connected to a respective one of the pair of dipole conductors; and a pair of isolated lobes including electrically-conductive material. The pair of isolated lobes are electrically separate from the pair of dipole conductors and the pair of energy couplers, and disposed between the pair of dipole conductors and the ground conductor.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0175638 A1**

Povalac et al. (43) **Pub. Date: Jun. 10, 2021**

(54) **MULTI-POLARIZED ANTENNA ARRAY**

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(72) Inventors: **Karel Povalac**, Valasska Polanka (CZ); **Pavel Sadek**, Roznov (CZ); **Pavel Krenek**, Prostredni Becva (CZ)

(21) Appl. No.: **17/104,206**

(22) Filed: **Nov. 25, 2020**

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Publication Classification

(51) **Int. Cl.**

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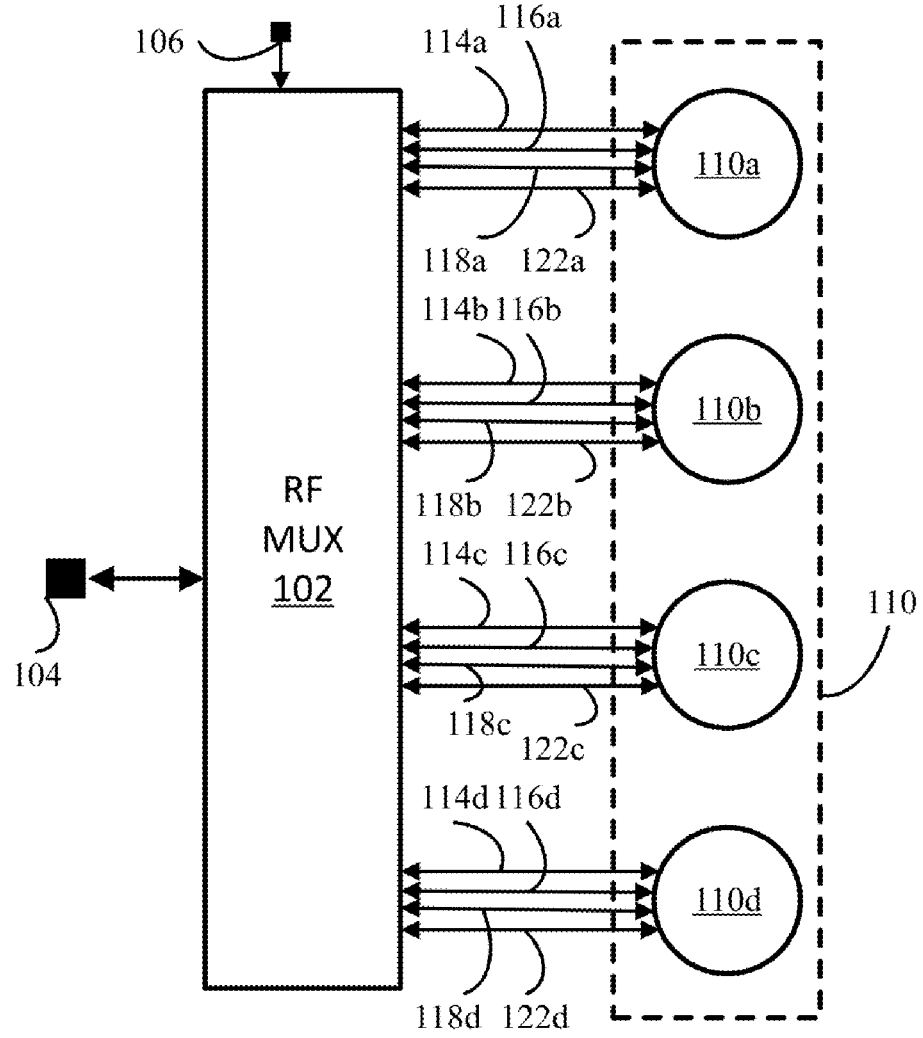
H01Q 5/35	(2006.01)
H01Q 3/34	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 21/24*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 3/34*** (2013.01); ***H01Q 5/35*** (2015.01)

(57) **ABSTRACT**

An apparatus and method for determining location information using a multi-polarized antenna array is disclosed. The multi-polarized antenna array includes a plurality of metal patches and a multiplexer. Each metal patch has at least two feed-points. The multiplexer is coupled to an RF terminal and to each of the at least two feed-points of each of the plurality of metal patches. The antenna array is configurable to couple each feed-point one at a time to the RF terminal. Location information may be determined by a controller coupled to the RF terminal from RF signals received via each feed-point.



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(43) **Pub. Date: Jun. 10, 2021**

Wang et al.

(54) **MULTIBAND MIMO ANTENNA IN A NESTED ARRANGEMENT**

(71) Applicant: **NetComm Wireless Pty Ltd**, Lane Cove (AU)

(72) Inventors: **Daniel Wang**, Lane Cove (AU); **Michael Cornelius**, Lane Cove (AU); **Steven Collins**, Lane Cove (AU)

(21) Appl. No.: **17/159,027**

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

Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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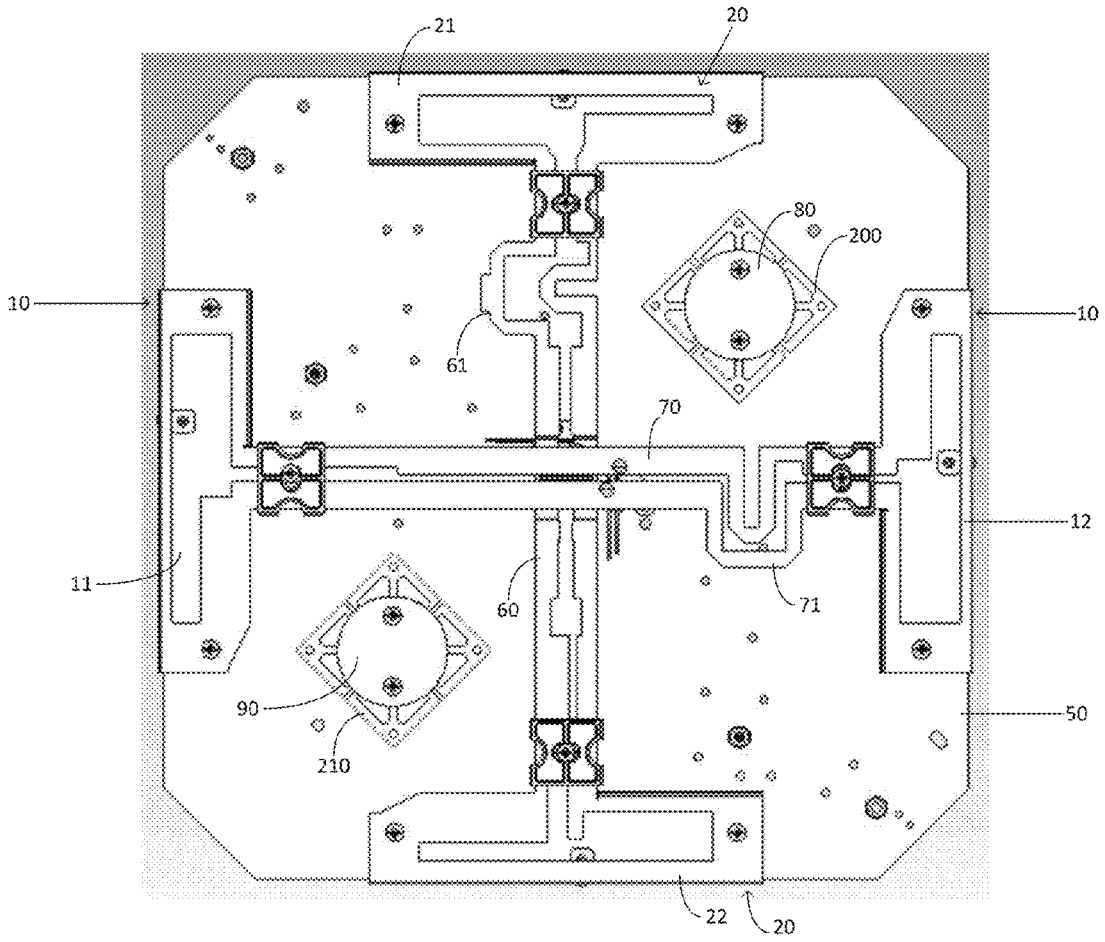
H01Q 1/38	(2006.01)
H01Q 21/00	(2006.01)

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

CPC ***H01Q 21/26*** (2013.01); *H04B 7/0413* (2013.01); ***H01Q 21/0075*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

Multiband multiple input multiple output (MIMO) dual polarised antenna assembly (**100**) comprising: dual polarised lower band antenna elements (**10**,**20**) mounted to ground plane (**50**) and located proximal to ground plane peripheral sides (**50**), the location of the lower band antenna elements (**10**, **20**) defining lower band peripheral boundary; dual polarised upper band antenna elements (**200**, **210**) mounted to ground plane (**50**) and nested within the lower band peripheral boundary; upper feeding network (**130**) connecting opposing pairs of lower band radiating elements (**11**, **12**, **21**, **22**) of the dual polarised lower band antenna elements (**10**,**20**) and feeds the lower band antenna elements (**11**, **12**, **21**, **22**), the upper feeding network (**130**) located within the lower band peripheral boundary; and lower feeding network (**140**) positioned below upper feeding network (**130**) and feeds the dual polarised upper band antenna elements (**10**, **20**) via upper feeding network using pair of ultra-wideband duplexers (**20**A, **20**B).



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(19) **United States**

(12) **Patent Application Publication**

Jung et al.

(10) **Pub. No.: US 2021/0175922 A1**

(43) **Pub. Date: Jun. 10, 2021**

(54) **MOBILE TERMINAL**

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(72) Inventors: **Kangjae Jung**, Seoul (KR); **Dongjin Kim**, Seoul (KR); **Yunmo Kang**, Seoul (KR); **Sungjoon Hong**, Seoul (KR); **Kyoungsun Hwang**, Seoul (KR); **Sungjung Rho**, Seoul (KR)

(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)

(21) Appl. No.: **17/172,324**

(22) Filed: **Feb. 10, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/480,978, filed on Jul. 25, 2019, now Pat. No. 10,951,260, filed as application No. PCT/KR2017/000952 on Jan. 26, 2017.

Publication Classification

(51) **Int. Cl.**

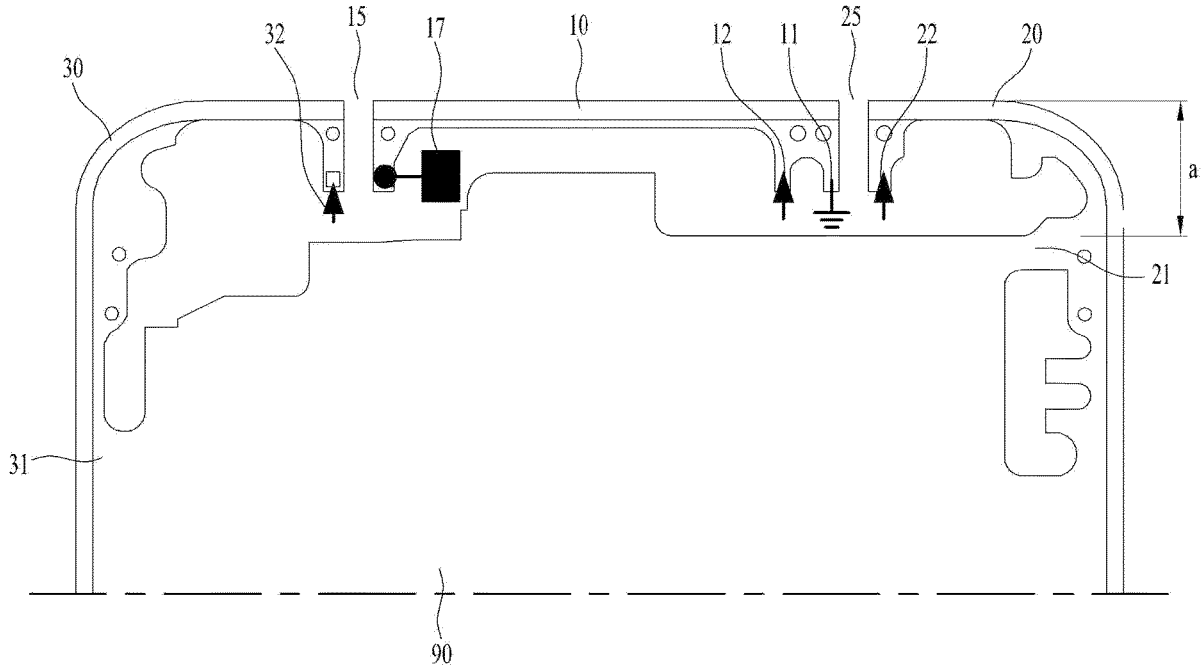
H04B 1/525	(2015.01)
H04M 1/02	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H04B 1/525*** (2013.01); ***H01Q 1/243*** (2013.01); ***H04M 1/0202*** (2013.01)

(57) **ABSTRACT**

A mobile terminal including a body for receiving an electronic component therein; a middle frame mounted on the body a main board mounted on the body; a side case surrounding an edge of the body, wherein the side case includes a plurality of antenna radiators having a first end and a second end, and a plurality of slits defined between the plurality of antenna radiators; a ground line connected to each of the antenna radiators; and a feeding line for supplying power to each of the antenna radiators. Further, each of the antenna radiators includes the second end grounded by the ground line and the first end spaced apart from the second end of a neighbor antenna radiator.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0184345 A1**

CHUANG et al. (43) **Pub. Date: Jun. 17, 2021**

(54) **ANTENNA SYSTEM**

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(21) Appl. No.: **16/751,274**

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

(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

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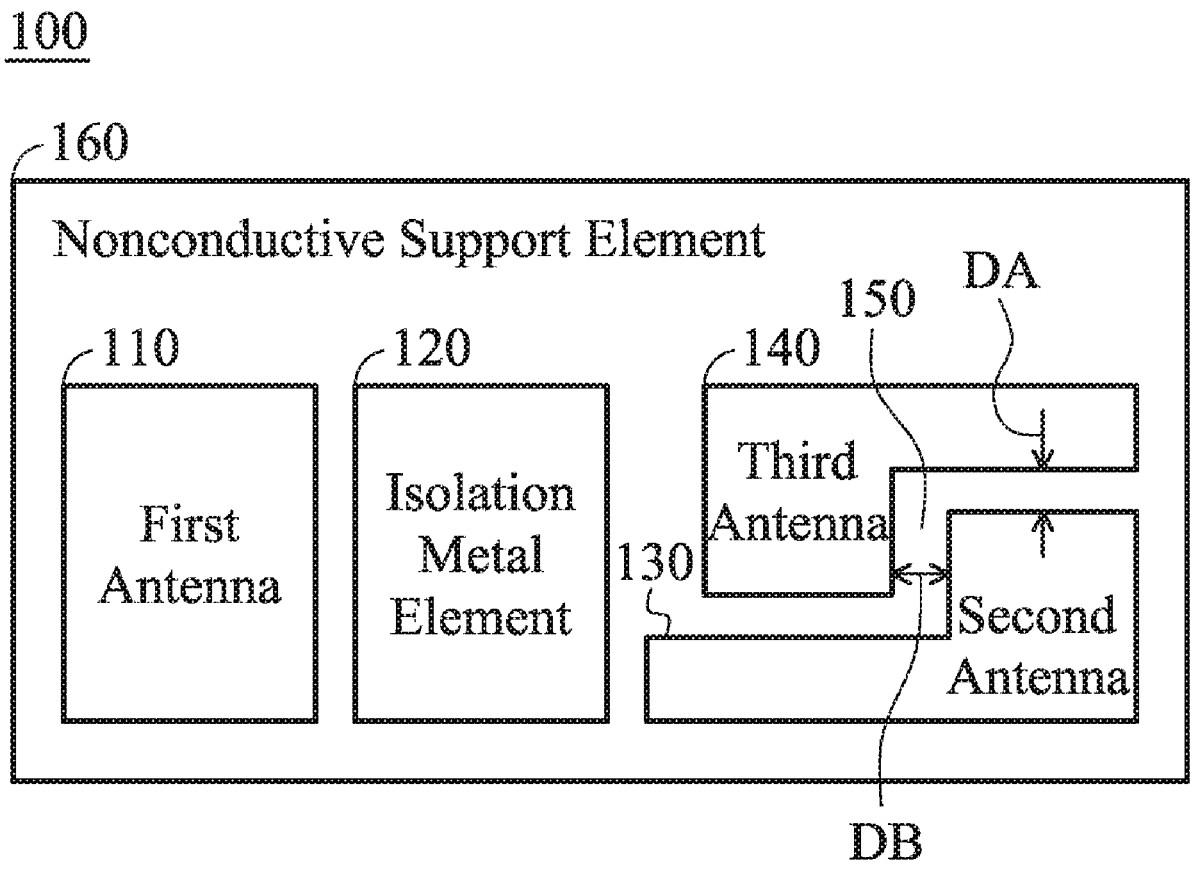
H01Q 9/04	(2006.01)
H01Q 13/10	(2006.01)
H01Q 21/28	(2006.01)

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

CPC ***H01Q 1/521*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 21/28*** (2013.01); ***H01Q 9/0421*** (2013.01); ***H01Q 13/106*** (2013.01); ***H01Q 21/30*** (2013.01)

(57) **ABSTRACT**

An antenna system includes a first antenna, a second antenna, a third antenna, an isolation metal element, and a nonconductive support element. The isolation metal element is disposed between the first antenna and the second antenna. The third antenna defines a notch region. The second antenna at least partially extends into the notch region. The distance between the third antenna and the second antenna is from 1 mm to 10 mm. The first antenna, the second antenna, the third antenna, and the isolation metal element are all disposed on the nonconductive support element.



US 20210184356A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0184356 A1

IKEDA et al. (43) Pub. Date: Jun. 17, 2021

(54) ANTENNA DEVICE

(71) Applicants: **DENSO CORPORATION**, Kariya-city, Aichi-pref (JP); **SOKEN, INC.**, Nisshin-city, Aichi-pref. (JP); **NATIONAL UNIVERSITY CORPORATION KYOTO INSTITUTE OF TECHNOLOGY**, Kyoto-shi, Kyoto (JP)

(72) Inventors: **Masakazu IKEDA**, Nisshin-city (JP); **Yuji SUGIMOTO**, Nisshin-city (JP); **Hiroaki KURAOKA**, Kariya-city (JP); **Shiro KOIDE**, Kariya-city (JP); **Tetsuya UEDA**, Kyoto-shi (JP); **Kohei ENOMOTO**, Kyoto-shi (JP)

(21) Appl. No.: **16/079,948**

(22) PCT Filed: **Feb. 13, 2017**

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Publication Classification

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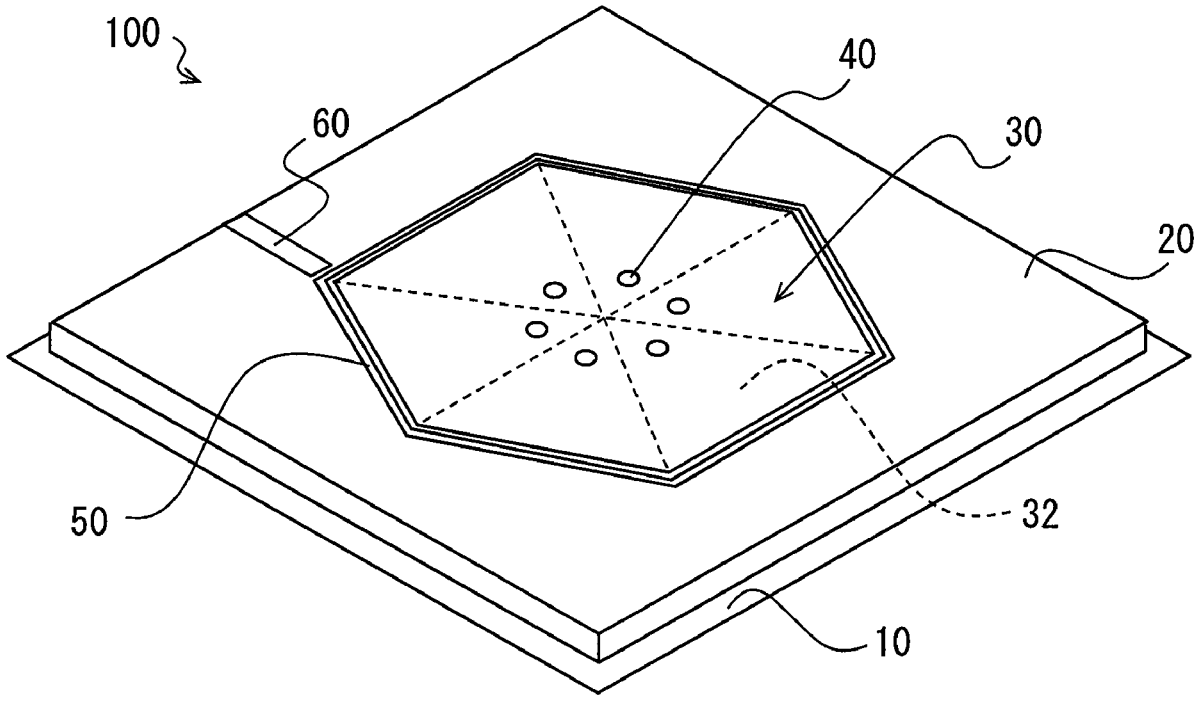
H01Q 1/48 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0421*** (2013.01); ***H01Q 9/0457*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna device includes a ground plate, a patch portion disposed parallel to the ground plate with a particular spacing, a plurality of short circuit portions that electrically connect the patch portion to the ground plate, and a loop portion which is a loop shaped conductor member at a particular spacing from an outer edge portion of the patch portion. The patch portion has an area which forms an electrostatic capacitance that causes parallel resonance with an inductance provided by the short circuit portions at a particular target frequency. The loop portion is formed with a perimeter length which is an integral multiple of the wavelength of radio waves at the target frequency. A feed point is disposed on the loop portion, and current is supplied to the patch portion through the loop portion.



US 20210185164A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0185164 A1

JUNG et al. (43) Pub. Date: Jun. 17, 2021

(54) ELECTRONIC DEVICE AND METHOD FOR SWITCHING OF ANTENNA THEREOF

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

(72) Inventors: **Hojin JUNG**, Suwon-si (KR); **Yongyoun KIM**, Suwon-si (KR); **Myeongsu OH**, Suwon-si (KR); **Duho CHU**, Suwon-si (KR)

(21) Appl. No.: **17/116,301**

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

(30) **Foreign Application Priority Data**

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Aug. 4, 2020 (KR) 10-2020-0097130

Publication Classification

(51) **Int. Cl.**
H04M 1/72454 (2006.01)
H04M 1/02 (2006.01)

(52) **U.S. Cl.**
CPC *H04M 1/72454* (2021.01); *H04M 1/0216* (2013.01)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a foldable housing, a communication circuit, a first transmission/reception circuit configured to transmit/receive a signal in a first frequency band, a first antenna electrically connected to the first transmission/reception circuit, and disposed on a portion of the first side member, a second transmission/reception circuit configured to transmit/receive a signal in a second frequency band different from the first frequency band, a second antenna electrically connected to the second transmission/reception circuit, and disposed on a portion of the first side member, a sensor configured to detect a contact of a user's body portion, and a processor. The processor may be configured to cause the first transmission/reception circuit to be electrically connected to the second antenna such that the signal in the first frequency band is transmitted/received through the second antenna when the contact of the user's body portion is detected by the sensor.