US 20210288393A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0288393 A1**

PARK et al. (43) **Pub. Date: Sep. 16, 2021**

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

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

(72) Inventors: **Seongjin PARK**, Suwon-si (KR); **Dongyeon KIM**, Suwon-si (KR); **Hosaeng KIM**, Suwon-si (KR); **Sumin YUN**, Suwon-si (KR); **Myunghun JEONG**, Suwon-si (KR); **Jehun JONG**, Suwon-si (KR); **Jaehoon JO**, Suwon-si (KR)

(21) Appl. No.: **17/335,527**

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

Related U.S. Application Data

(63) Continuation of application No. 16/884,513, filed on May 27, 2020, now Pat. No. 11,024,943.

(30) **Foreign Application Priority Data**

May 27, 2019 (KR) 10-2019-0061851

Publication Classification

(51) **Int. Cl.**

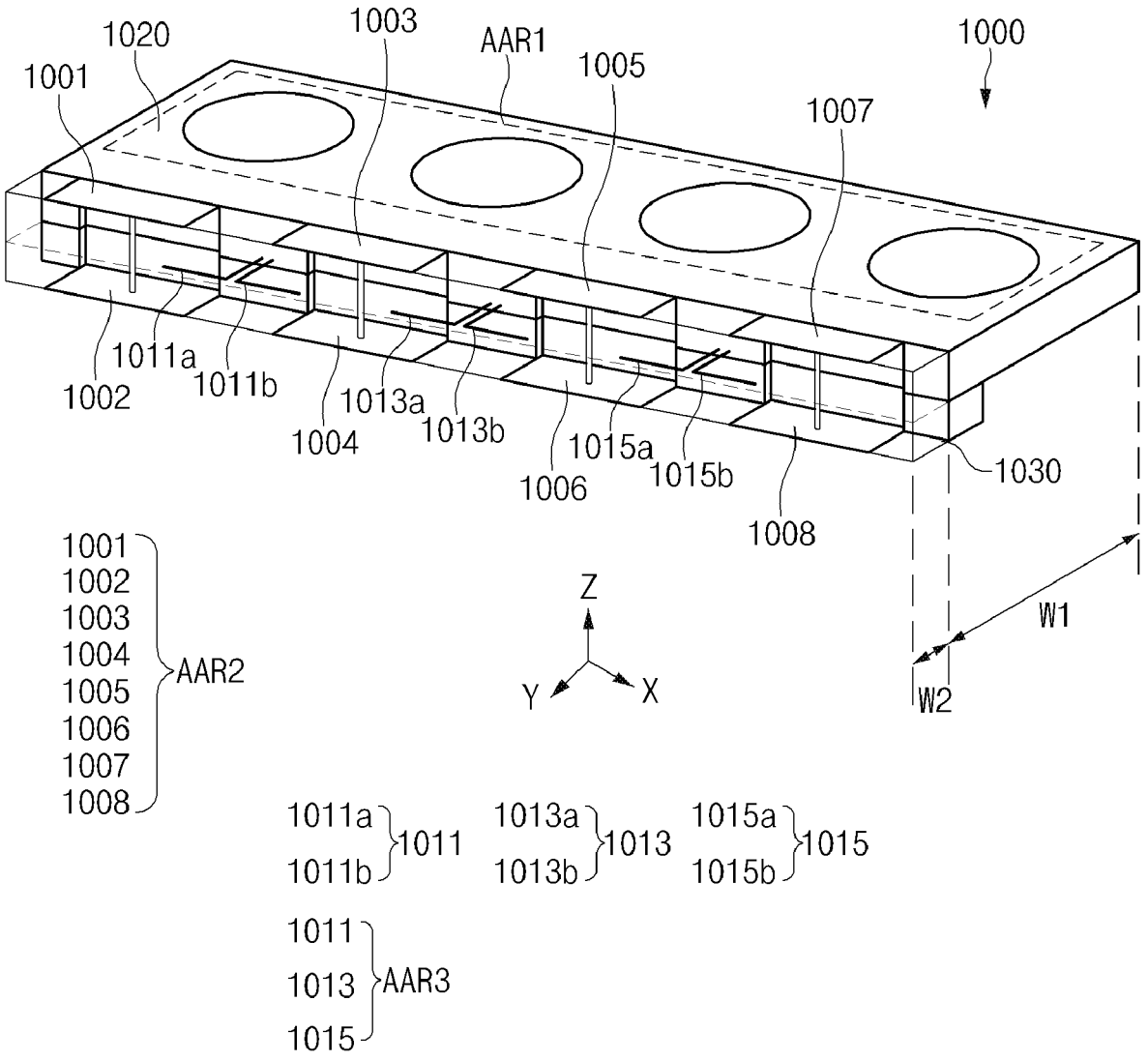
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
H01Q 9/16 (2006.01)

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

CPC ***H01Q 1/24*** (2013.01); ***H01Q 9/16*** (2013.01); ***H01Q 9/0421*** (2013.01)

(57) **ABSTRACT**

An electronic device including a housing, a display, an antenna structure positioned inside the housing, and a wireless communication circuit connected to the antenna structure, is provided. The antenna structure includes a dipole antenna element interposed between s-patch elements not to overlap with s-patch elements.



US 20210288396A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0288396 A1**

HASHIGUCHI (43) **Pub. Date: Sep. 16, 2021**

(54) **ANTENNA ASSEMBLY AND ELECTRONIC EQUIPMENT**

(71) Applicant: **Japan Aviation Electronics Industry, Limited**, Tokyo (JP)

(72) Inventor: **Osamu HASHIGUCHI**, Tokyo (JP)

(73) Assignee: **Japan Aviation Electronics Industry, Limited**, Tokyo (JP)

(21) Appl. No.: **17/141,447**

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

(30) **Foreign Application Priority Data**

Mar. 11, 2020 (JP) 2020-041791

Publication Classification

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

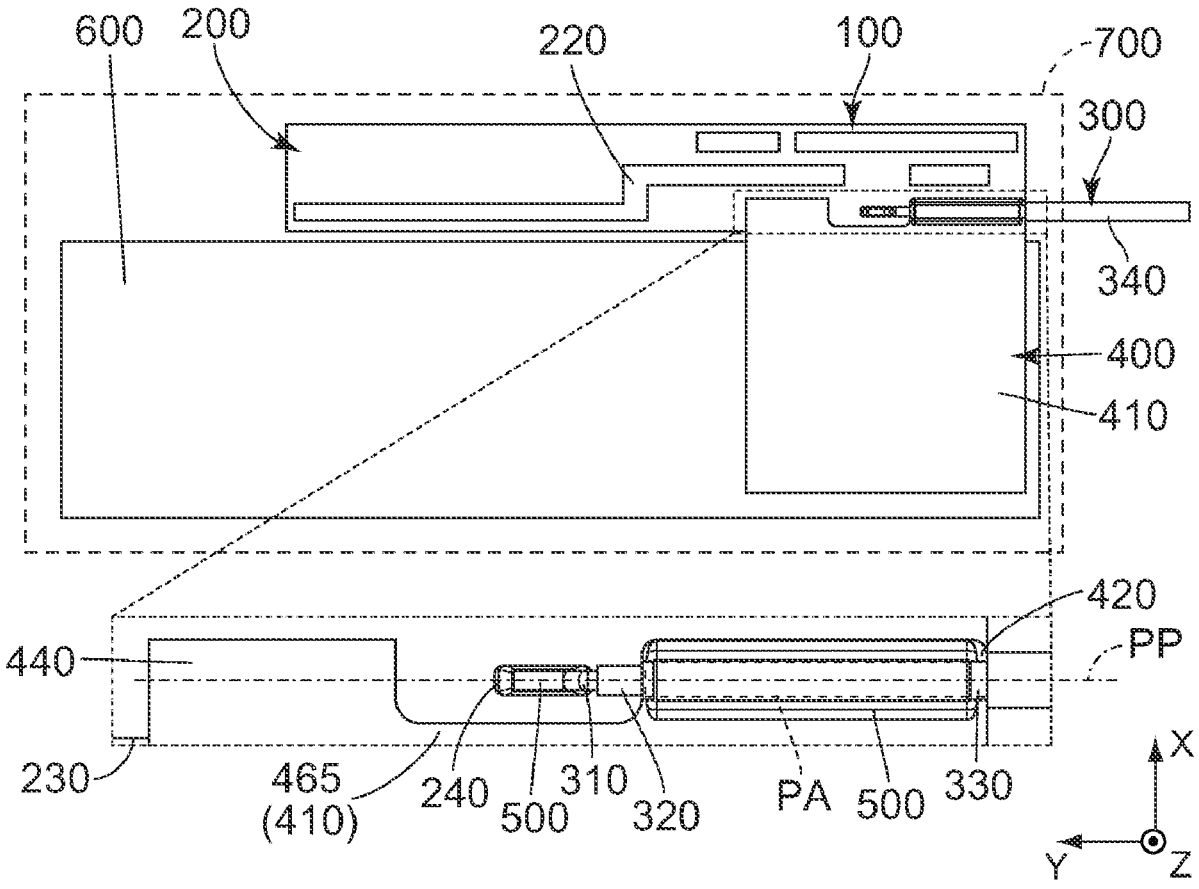
H01Q 1/48 (2006.01)

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

CPC ***H01Q 1/38*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

An antenna assembly comprises a circuit board formed with an antenna, a coaxial cable and a conductive film. The circuit board has an edge, a first pad and a second pad. An outer conductor of the coaxial cable has an exposed portion which is exposed from an outer cover of the coaxial cable over a predetermined area. The exposed portion is connected with the second pad. In a second direction perpendicular to a first direction, a center of the coaxial cable is positioned at a predetermined position. The conductive film is fixed on the circuit board. The conductive film has a main portion and at least one extending portion. In the predetermined area, the at least one extending portion and the second pad are aligned in the first direction. The at least one extending portion extends from the main portion over the predetermined position in the second direction.



US 20210288398A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0288398 A1**

SATO et al. (43) **Pub. Date: Sep. 16, 2021**

(54) **ANTENNA-INTEGRATED MODULE AND RADAR DEVICE**

(71) Applicant: **Panasonic Corporation**, Osaka (JP)

(72) Inventors: **JUNJI SATO**, Tokyo (JP); **RYOSUKE SHIOZAKI**, Tokyo (JP)

(21) Appl. No.: **17/334,322**

(22) Filed: **May 28, 2021**

Related U.S. Application Data

(63) Continuation of application No. 15/046,933, filed on Feb. 18, 2016, now Pat. No. 11,024,953.

(30) **Foreign Application Priority Data**

Mar. 3, 2015 (JP) 2015-041233

Publication Classification

(51) **Int. Cl.**

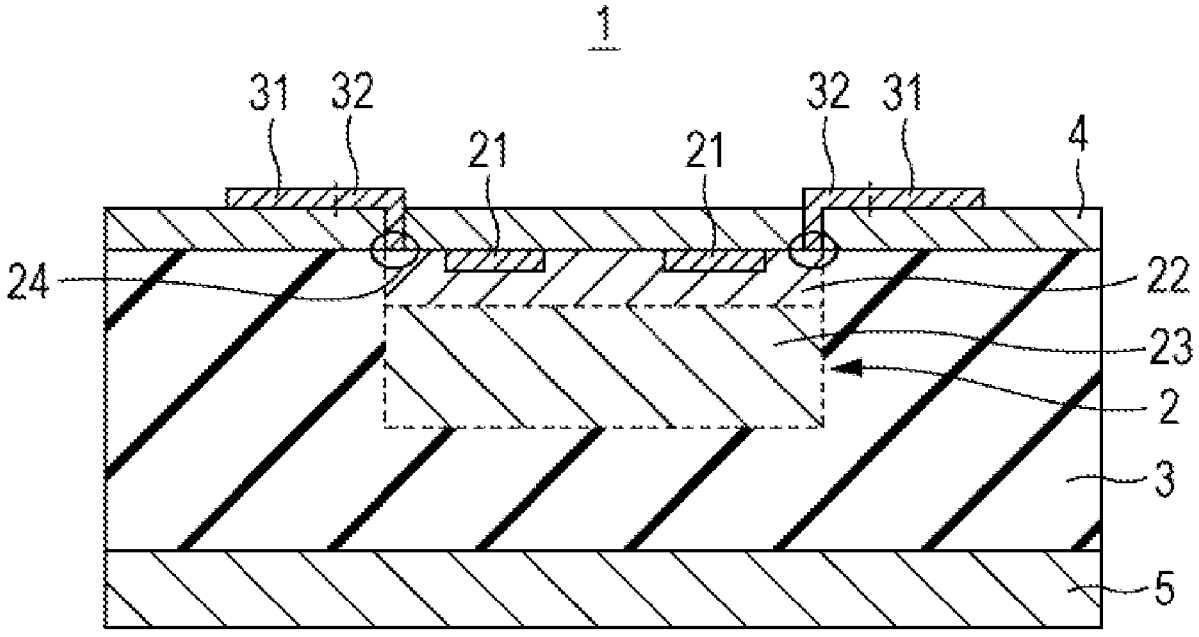
H01Q 1/38	(2006.01)
H01Q 21/08	(2006.01)
H01Q 23/00	(2006.01)
G01S 7/03	(2006.01)
H01L 23/66	(2006.01)
G01S 7/40	(2006.01)
G01S 7/02	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H01Q 1/38*** (2013.01); ***H01Q 21/08*** (2013.01); ***H01Q 23/00*** (2013.01); ***G01S 7/032*** (2013.01); ***H01L 23/66*** (2013.01); ***G01S 7/4026*** (2013.01); *H01Q 1/2283* (2013.01); ***H01Q 9/04*** (2013.01); *H01L 2224/04105* (2013.01); *H01L 2924/1421* (2013.01); *H01L 2223/6677* (2013.01); *H01L 2924/10253* (2013.01); *H01L 2224/12105* (2013.01); ***G01S 7/02*** (2013.01)

(57) **ABSTRACT**

An antenna-integrated module includes: a substrate; one or more semiconductor chips each arranged on the substrate; and one or more antenna elements that are connected to the one or more semiconductor chips. At least one antenna element among the one or more antenna elements is arranged in the same region on the substrate on which the one or more semiconductor chips are arranged.



US 20210288399A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0288399 A1**

Zhao et al. (43) **Pub. Date: Sep. 16, 2021**

(54) **MULTIPLE FEED SLOT ANTENNA**

(71) Applicant: **Motorola Mobility LLC**, Chicago, IL (US)

(72) Inventors: **Junsheng Zhao**, Vernon Hills, IL (US); **Eric Le Roy Krenz**, Crystal Lake, IL (US); **Hugh Smith**, Palatine, IL (US)

(73) Assignee: **Motorola Mobility LLC**, Chicago, IL (US)

(21) Appl. No.: **17/335,585**

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

Related U.S. Application Data

(62) Division of application No. 16/353,218, filed on Mar. 14, 2019.

Publication Classification

(51) **Int. Cl.**

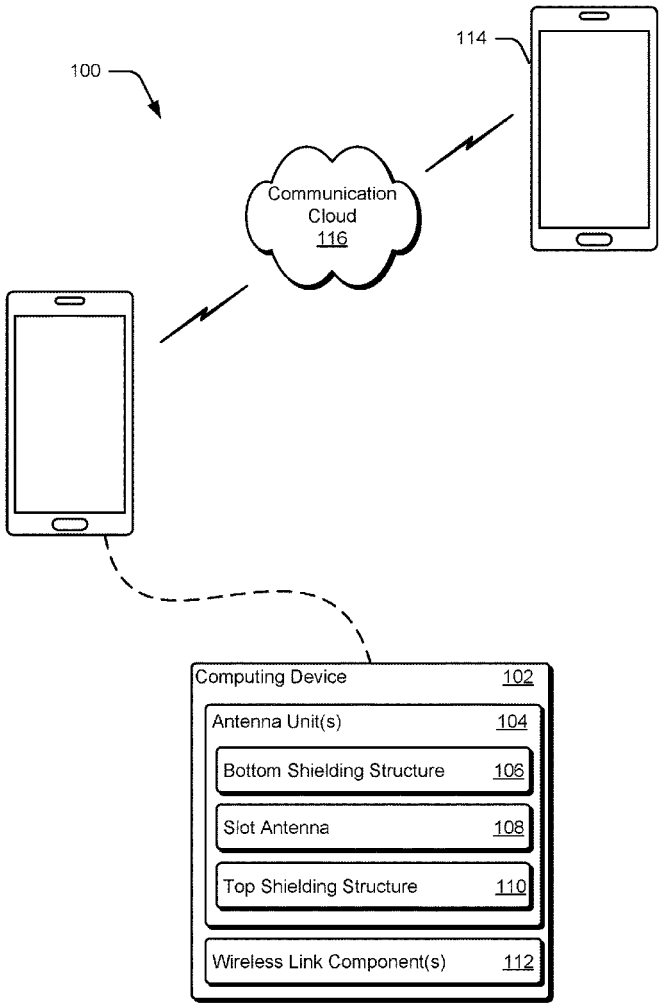
H01Q 1/38	(2006.01)
G06F 1/16	(2006.01)
H01Q 1/24	(2006.01)
H01Q 21/00	(2006.01)

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

CPC ***H01Q 1/38*** (2013.01); ***H01Q 21/0043*** (2013.01); ***H01Q 1/243*** (2013.01); ***G06F 1/1698*** (2013.01)

(57) **ABSTRACT**

Multiple feed, front-shielded, coplanar waveguide, direct-fed, cavity-backed slot antennas are described. Various implementations form an antenna unit capable of millimeter waveform and/or microwave waveform transmissions. An antenna comprises a conductive plate that includes an aperture. The aperture has a shape that extends along an axis that bisects the aperture into first and second bisected portions, the first bisected portion having a first geometry type, and the second portion having a second geometry type that is a bilateral symmetry shape type of the first geometry type. In implementations, the aperture is configured to radiate waveforms within a frequency range from about between 600 Megahertz (MHz) to 72 Gigahertz (GHz) by applying multiple signal feeds to the conductive plate.



US 20210288401A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0288401 A1**

LEE et al. (43) **Pub. Date: Sep. 16, 2021**

(54) **ELECTRONIC APPARATUS FOR TRANSMITTING SIGNALS THROUGH PLURALITY OF ANTENNAS, AND STRUCTURE THEREFOR**

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

(72) Inventors: **Dongju LEE**, Suwon-si, Gyeonggi-do (KR); **Bongsup SON**, Suwon-si, Gyeonggi-do (KR); **Kyoungsun LEE**, Suwon-si, Gyeonggi-do (KR); **Wonjin CHOI**, Suwon-si, Gyeonggi-do (KR); **Jiwoo LEE**, Suwon-si, Gyeonggi-do (KR)

(21) Appl. No.: **17/260,119**

(22) PCT Filed: **May 15, 2019**

(86) PCT No.: **PCT/KR2019/005819**

§ 371 (c)(1),
(2) Date: **Jan. 13, 2021**

(30) **Foreign Application Priority Data**

Aug. 3, 2018 (KR) 10-2018-0090637

Publication Classification

(51) **Int. Cl.**

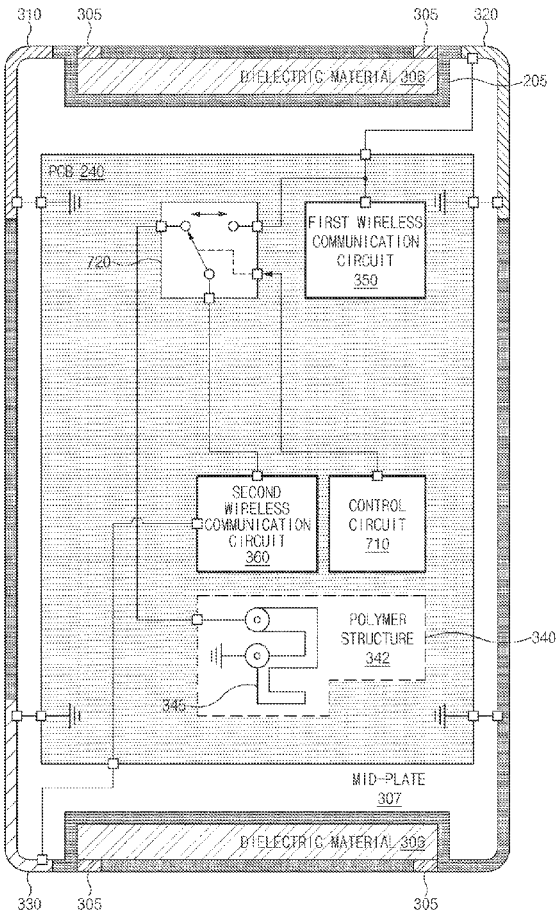
H01Q 1/52	(2006.01)
H04W 88/06	(2006.01)
H04B 7/0413	(2006.01)
H01Q 1/24	(2006.01)

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

CPC ***H01Q 1/523*** (2013.01); ***H01Q 1/243*** (2013.01); ***H04B 7/0413*** (2013.01); ***H04W 88/06*** (2013.01)

(57) **ABSTRACT**

An electronic device may include a housing including a first conductive portion, a second conductive portion electrically isolated from the first conductive portion, and a third conductive portion electrically isolated from the first conductive portion and the second conductive portion, a first wireless communication circuit disposed in the space and to transmit or receive a first signal and a second signal, which have a frequency in a first frequency range, through Multiple Input Multiple Output (MIMO) using the first conductive portion and the second conductive portion, respectively, and a second wireless communication circuit disposed in the space and transmit or receive a third signal and a fourth signal having a frequency in a second frequency range through Carrier Aggregation (CA) using the third conductive portion and the conductive pattern, respectively.



US 20210288411A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0288411 A1**

Zhao et al. (43) **Pub. Date: Sep. 16, 2021**

(54) **FRONT-SHIELDED, COPLANAR WAVEGUIDE, DIRECT-FED, CAVITY-BACKED SLOT ANTENNA**

(71) Applicant: **Motorola Mobility LLC**, Chicago, IL (US)

(72) Inventors: **Junsheng Zhao**, Vernon Hills, IL (US); **Eric Le Roy Krenz**, Crystal Lake, IL (US); **Hugh Smith**, Palatine, IL (US)

(73) Assignee: **Motorola Mobility LLC**, Chicago, IL (US)

(21) Appl. No.: **17/335,528**

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

Related U.S. Application Data

(62) Division of application No. 16/353,117, filed on Mar. 14, 2019.

Publication Classification

(51) **Int. Cl.**

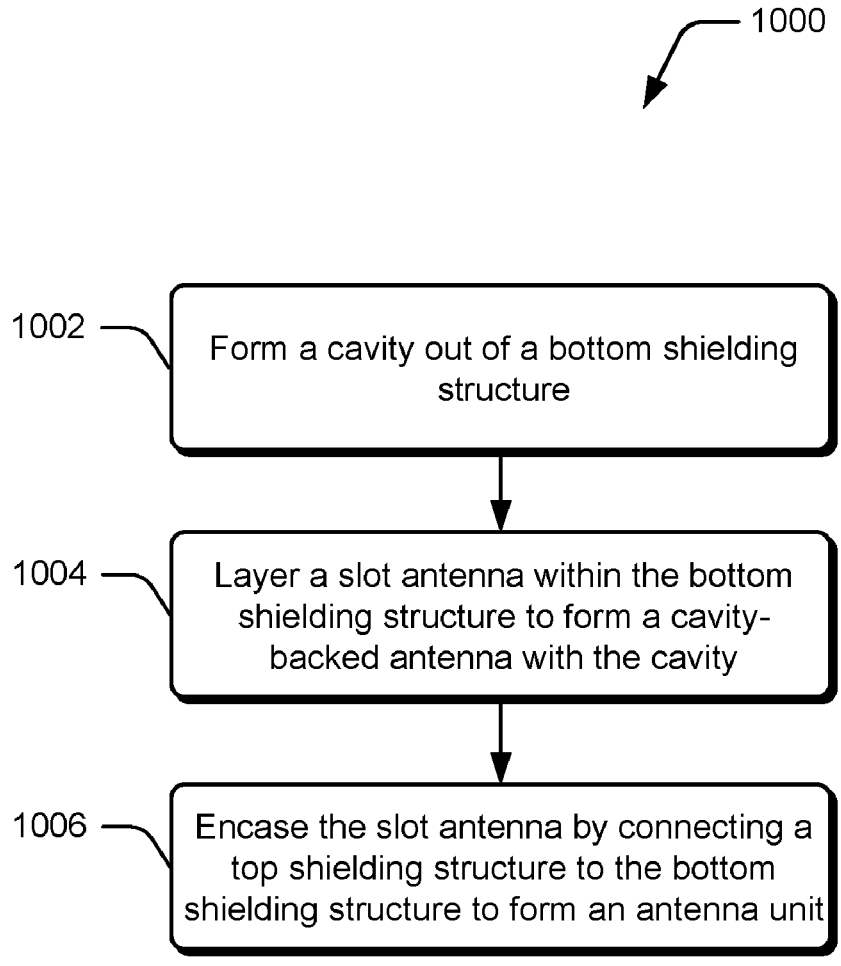
H01Q 13/18	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/40	(2006.01)
H01Q 21/00	(2006.01)

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

CPC ***H01Q 13/18*** (2013.01); ***H01Q 1/243*** (2013.01); *H01Q 1/2266* (2013.01); ***H01Q 21/0037*** (2013.01); ***H01Q 1/40*** (2013.01)

(57) **ABSTRACT**

Front-shielded, coplanar waveguide, direct-fed, cavity-backed slot antennas are described. Various implementations form an antenna unit capable of millimeter waveform and/or microwave waveform transmissions. A bottom shielding structure of the antenna unit defines a cavity, where various implementations include one or more dampening structures within the cavity. Some implementations includes a slot antenna within the cavity defined by the bottom shielding structure, such as a coplanar waveguide (CPW) direct-fed slot antenna, to form a cavity-backed slot antenna. Some implementations connect a top shielding structure to the bottom shielding structure to encase the slot antenna. In one or more implementations, the top shielding structure includes aperture windows to allow waveforms within a frequency range from about between 600 Megahertz (MHz) to 72 Gigahertz (GHz). and radiated by the slot antenna to radiate outward from the antenna unit.



US 20210288414A1

(19) **United States**

(12) **Patent Application Publication**

Plet et al.

(10) **Pub. No.: US 2021/0288414 A1**

(43) **Pub. Date: Sep. 16, 2021**

(54) **MULTIBAND ANTENNA STRUCTURE**

(71) Applicant: **NOKIA SHANGHAI BELL CO., LTD.**, Shanghai (CN)

(72) Inventors: **Jerome Plet**, Louannec (FR); **Zied Charaabi**, Lannion (FR); **Thomas Julien**, Lannion (FR); **Jean-Pierre Harel**, Lannion (FR); **Aurelien Hilary**, Paimpol (FR)

(73) Assignee: **NOKIA SHANGHAI BELL CO., LTD.**, Shanghai (CN)

(21) Appl. No.: **17/256,925**

(22) PCT Filed: **Jun. 29, 2018**

(86) PCT No.: **PCT/US18/40486**

§ 371 (c)(1),
(2) Date: **Dec. 29, 2020**

Publication Classification

(51) **Int. Cl.**

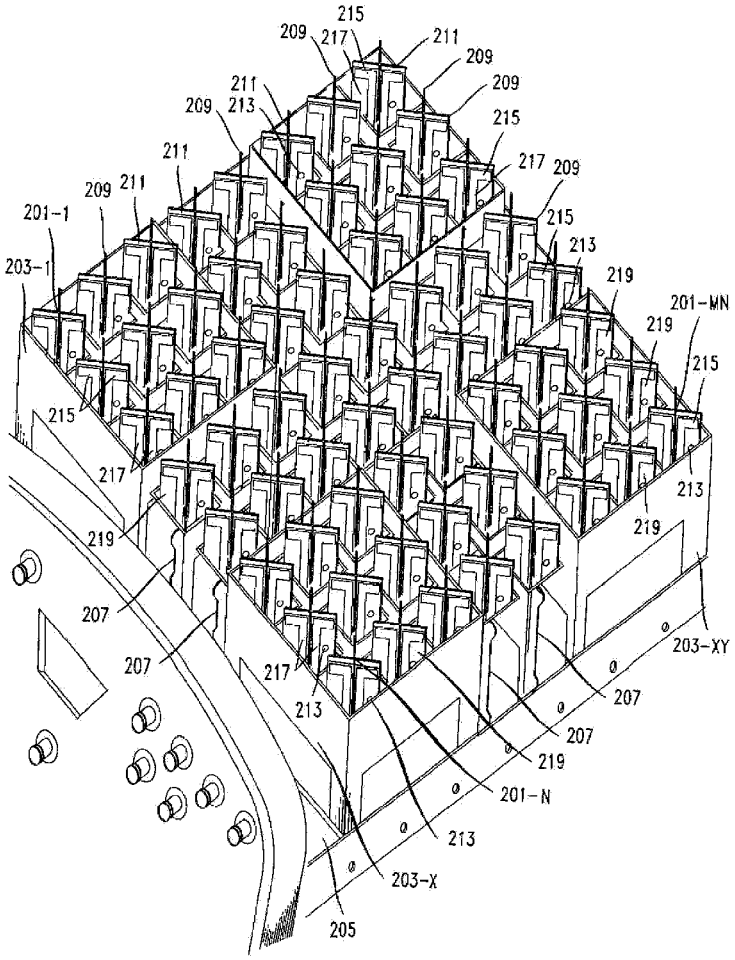
H01Q 21/00	(2006.01)
H01Q 21/28	(2006.01)
H01Q 1/42	(2006.01)
H01Q 21/26	(2006.01)
H01Q 19/13	(2006.01)
H01Q 25/00	(2006.01)

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

CPC ***H01Q 21/0025*** (2013.01); ***H01Q 21/28*** (2013.01); ***H01Q 25/001*** (2013.01); ***H01Q 21/26*** (2013.01); ***H01Q 19/136*** (2013.01); ***H01Q 1/42*** (2013.01)

(57) **ABSTRACT**

An active passive antenna arrangement as made up of an array of 5G antennas interleaved with multiband antenna structures that may be low band (LB) passive antennas. The 5G antenna array may be a mMIMO active array. The LB antennas are formed using conductive elements on thin supporting sheets that fit within the space between the 5G antennas. The substrates, and hence the radiating elements of the LB antennas, may be arranged so as to generally appear to form four sides of a rectangular box with the top and bottom surfaces removed. Thus, the LB antennas may be thought of as having been "slipped in" amongst a preexisting array of 5G antennas. Each LB antenna may surround one or more of the 5G antennas and 5G antennas of the array may also be external to an LB antenna.



US 20210288686A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0288686 A1**

(43) **Pub. Date: Sep. 16, 2021**

PARK et al.

(54) **SMALL ANTENNA APPARATUS AND METHOD FOR CONTROLLING THE SAME**

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

(72) Inventors: **Jungsik PARK**, Bucheon-si (KR); **Sooung CHUN**, Suwon-si (KR)

(21) Appl. No.: **17/337,713**

(22) Filed: **Jun. 3, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/884,487, filed on May 27, 2020, now Pat. No. 11,031,965, which is a continuation of application No. 16/155,248, filed on Oct. 9, 2018, now Pat. No. 10,680,671, which is a continuation of application No. 15/082,280, filed on Mar. 28, 2016, now Pat. No. 10,128,883, which is a continuation of application No. 13/727,205, filed on Dec. 26, 2012, now Pat. No. 9,306,288.

(30) **Foreign Application Priority Data**

Jan. 13, 2012 (KR) 10-2012-0004448

Publication Classification

(51) **Int. Cl.**

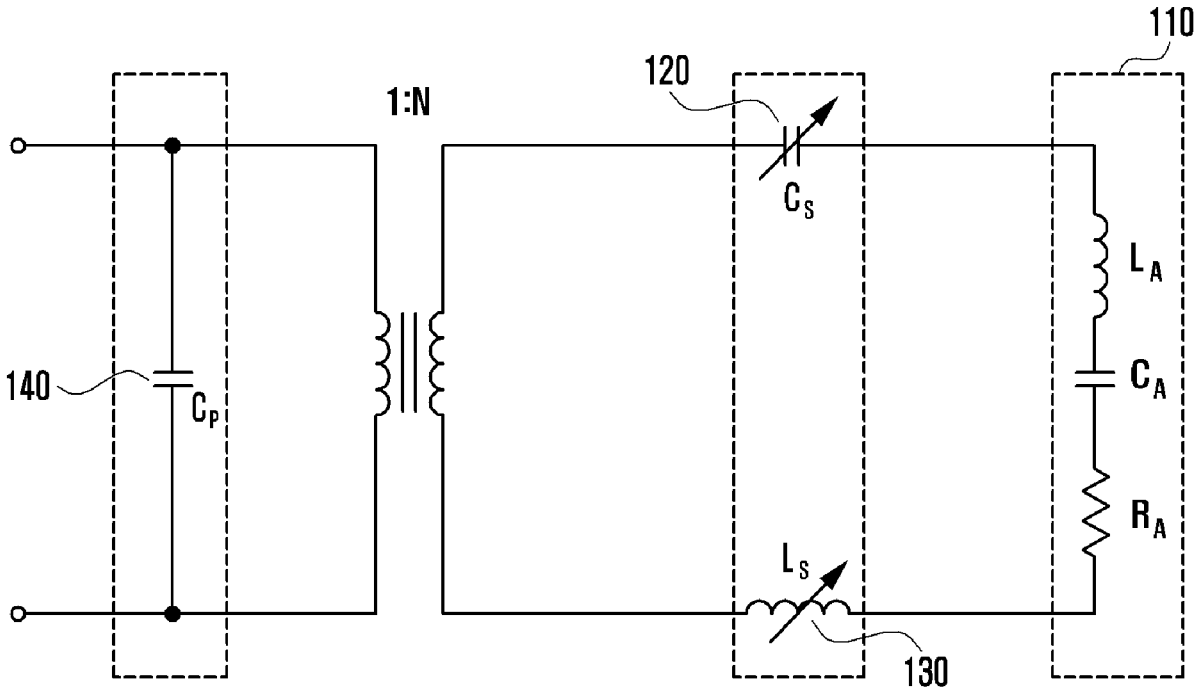
H04B 1/18	(2006.01)
H01Q 1/24	(2006.01)
H01Q 9/14	(2006.01)
H01Q 9/42	(2006.01)
H01Q 9/16	(2006.01)
H04W 88/02	(2006.01)
H01Q 1/48	(2006.01)

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

CPC ***H04B 1/18*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 9/145*** (2013.01); *H04B 1/0458* (2013.01); ***H01Q 9/16*** (2013.01); ***H04W 88/02*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 9/42*** (2013.01)

(57) **ABSTRACT**

An antenna apparatus for a mobile terminal is provided. The antenna apparatus includes an antenna pattern, a first electric circuit and a second electric circuit respectively connected between both ends of the antenna pattern and a system ground, and a third electric circuit disposed between the antenna pattern and a feeding line, wherein the first electric circuit and the second electric circuit extend electrical wavelengths of the antenna pattern and the third electric circuit increases input impedance matching.



US 20210296759A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0296759 A1**

KIM et al. (43) **Pub. Date: Sep. 23, 2021**

(54) **ELECTRONIC DEVICE INCLUDING 5G ANTENNA MODULE**

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

(72) Inventors: **Jaehyung KIM**, Suwon-si (KR); **Jinkyu BANG**, Suwon-si (KR); **Hanbin LEE**, Suwon-si (KR); **Sangmin HAN**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR)

(21) Appl. No.: **17/341,900**

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

Related U.S. Application Data

(63) Continuation of application No. 16/522,019, filed on Jul. 25, 2019, now Pat. No. 11,069,956.

(30) **Foreign Application Priority Data**

Jul. 26, 2018 (KR) 10-2018-0086954

Publication Classification

(51) **Int. Cl.**

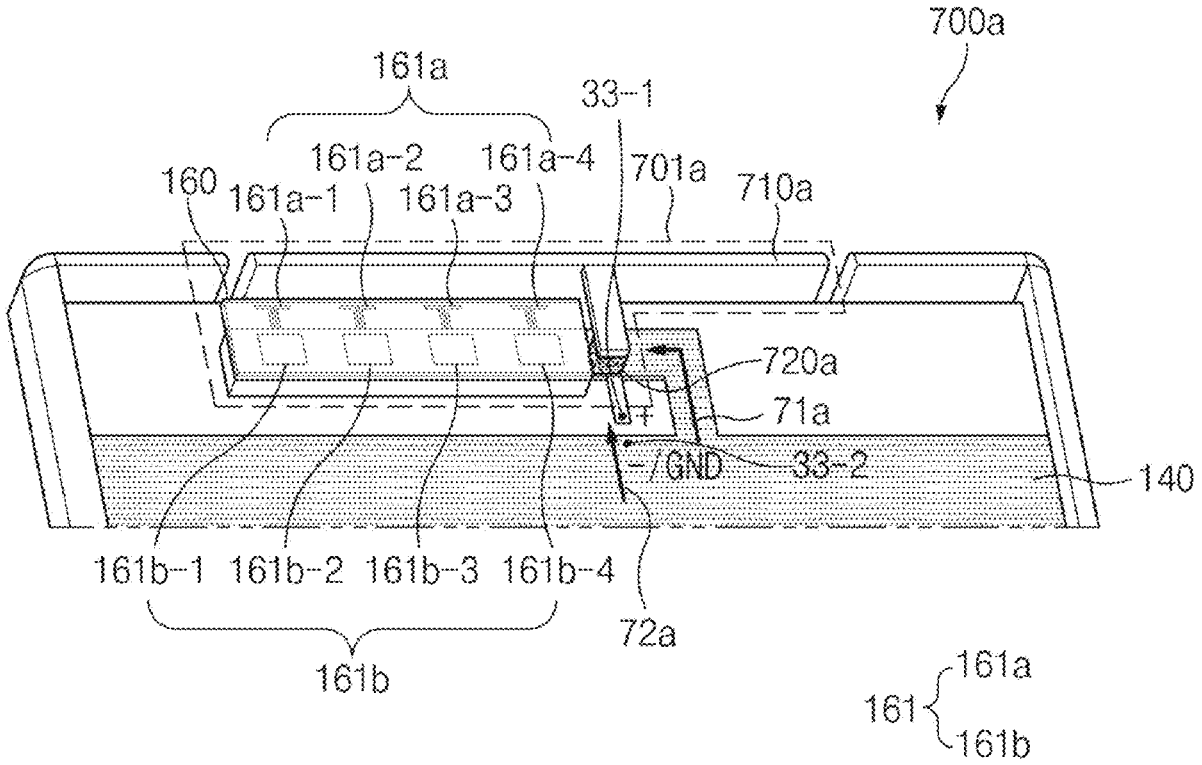
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 5/25 (2006.01)

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

CPC ***H01Q 1/243*** (2013.01); ***H01Q 5/25*** (2015.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

An electronic device including an antenna module is provided. The electronic device includes a 5th generation (5G) antenna module that includes an antenna array, at least one conductive region operating as a ground with respect to the antenna array, and a first communication circuit feeding a power to the antenna array to communicate through a millimeter wave signal, and a printed circuit board (PCB) that includes a second communication circuit and a ground region. The second communication circuit feeds the power to an electrical path at least including the at least one conductive region and transmits or receives a signal in a frequency band different from a frequency band of the millimeter wave signal based on the electrical path supplied with the power and the ground region.



US 20210296760A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0296760 A1**

Chen et al. (43) **Pub. Date: Sep. 23, 2021**

(54) **BASE STATION ANTENNA**

(71) Applicant: **CommScope Technologies LLC**, Hickory, NC (US)

(72) Inventors: **Changfu Chen**, Suzhou (CN); **Jian Zhang**, Suzhou (CN)

(21) Appl. No.: **17/199,582**

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

(30) **Foreign Application Priority Data**

Mar. 20, 2020 (CN) 202010198924.2

Publication Classification

(51) **Int. Cl.**

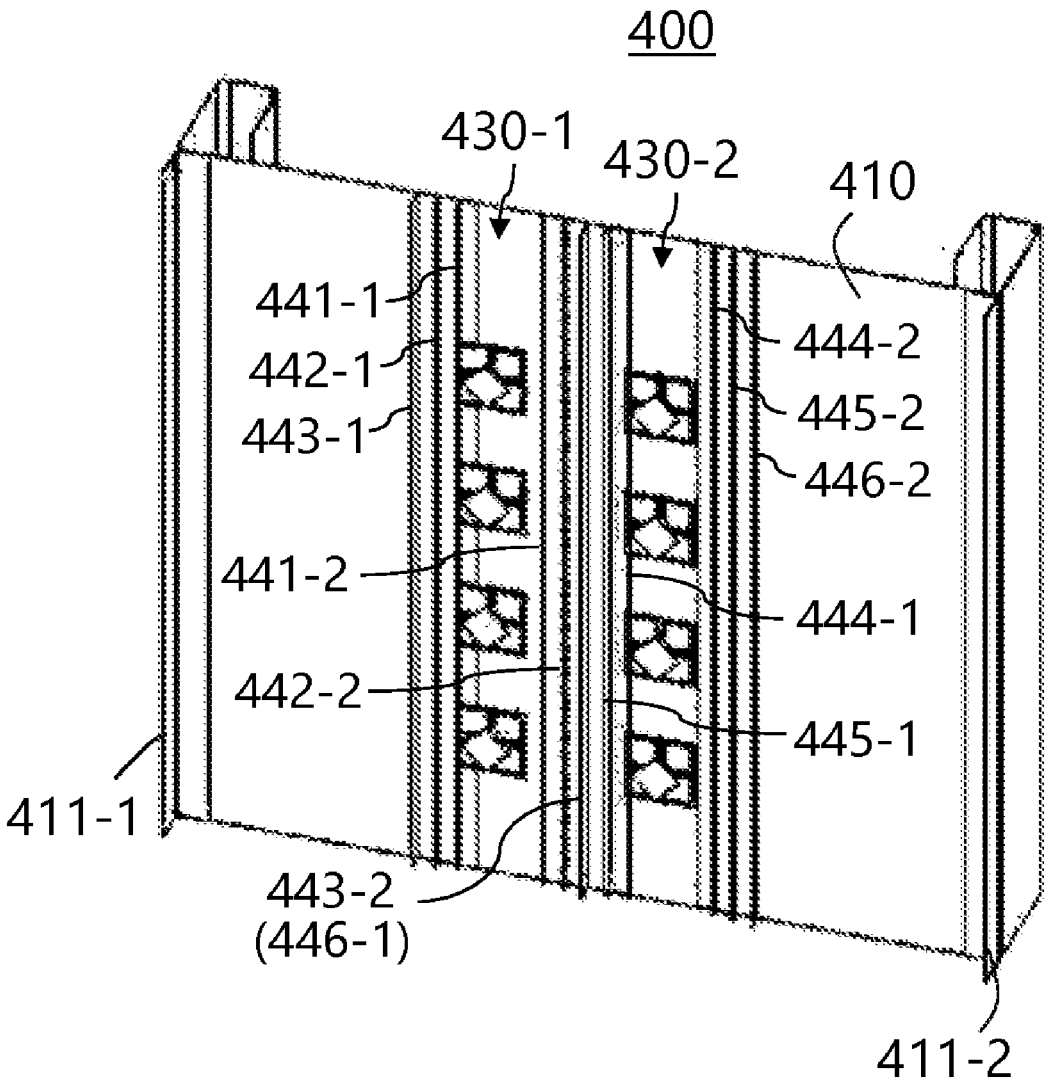
H01Q 1/24	(2006.01)
H01Q 21/26	(2006.01)
H01Q 19/10	(2006.01)

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

CPC ***H01Q 1/246*** (2013.01); ***H01Q 19/10*** (2013.01); ***H01Q 21/26*** (2013.01)

(57) **ABSTRACT**

The present invention relates to a base station antenna. The base station antenna comprises: a reflector that is configured to provide a ground plane; a first radiating element array including at least one first cross-polarized radiating element that is arranged on the reflector; and a first parasitic element array including first through third parasitic element pairs, wherein each of the first through third parasitic element pairs includes a pair of parasitic elements that are arranged substantially symmetrically on both sides of the first longitudinal axis, and distances from the first through third parasitic element pairs respectively to the first longitudinal axis increase sequentially, wherein projections of any two of the first parasitic element pair, the second parasitic element pair, the third parasitic element pair, and the at least one first cross-polarized radiating element on the first longitudinal axis at least partly overlap.



US 20210296765A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0296765 A1

Eslami et al. (43) Pub. Date: Sep. 23, 2021

(54) METHOD AND SYSTEM FOR CONTROLLING A MODAL ANTENNA

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

(72) Inventors: **Hamid Eslami**, San Diego, CA (US); **Michael Roe**, San Diego, CA (US); **Jatan Shah**, Irvine, CA (US); **Amin Shameli**, Irvine, CA (US); **Syed Khursheed Enam**, Lake Forest, CA (US); **Jesse Shih-Chieh Hsin**, San Diego, CA (US); **Rozi Rofougaran**, Santa Monica, CA (US)

(21) Appl. No.: **17/343,847**

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

Related U.S. Application Data

(63) Continuation of application No. 16/456,460, filed on Jun. 28, 2019, now abandoned.

(60) Provisional application No. 62/744,274, filed on Oct. 11, 2018, provisional application No. 62/718,430, filed on Aug. 14, 2018.

Publication Classification

(51) **Int. Cl.**

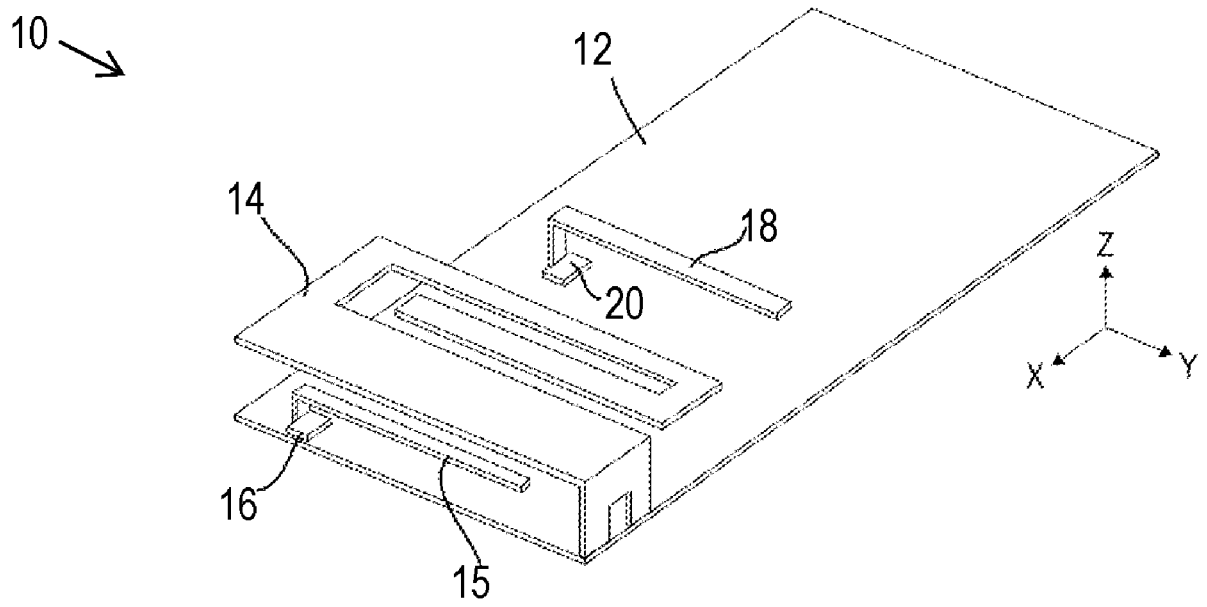
H01Q 1/36	(2006.01)
H01Q 3/28	(2006.01)
H01Q 5/378	(2006.01)

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

CPC ***H01Q 1/36*** (2013.01); ***H01Q 5/378*** (2015.01); ***H01Q 3/28*** (2013.01)

(57) **ABSTRACT**

A system for communicating data over a transmission line is disclosed. In one example implementation, the system may include a transmitter configured to modulate a control signal onto an RF signal using amplitude-shift keying modulation to generate a transmit signal. The system may include a receiver and a transmission line coupling the transmitter to the receiver. The transmitter may be configured to transmit the transmit signal over the transmission line to the receiver, and the receiver may be configured to de-modulate the control signal and extract clock information associated with the transmitter. In some embodiments, the system may include a tuning circuit and a modal antenna, and the tuning circuit may be or include the receiver. The receiver may be configured to adjust a mode of the modal antenna based on the control signal transmitted by the transmitter.



US 20210296775A1

(19) **United States**

(12) **Patent Application Publication**

GAO et al.

(10) **Pub. No.: US 2021/0296775 A1**

(43) **Pub. Date: Sep. 23, 2021**

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

(71) Applicant: **Nokia Solutions and Networks Oy**, Espoo (FI)

(72) Inventors: **Fei GAO**, Shanghai (CN); **Chaojun XU**, Shanghai (CN); **Gang SHEN**, Shanghai (CN)

(21) Appl. No.: **17/264,349**

(22) PCT Filed: **Aug. 2, 2018**

(86) PCT No.: **PCT/CN2018/098382**

§ 371 (c)(1),
(2) Date: **Jan. 29, 2021**

Publication Classification

(51) **Int. Cl.**

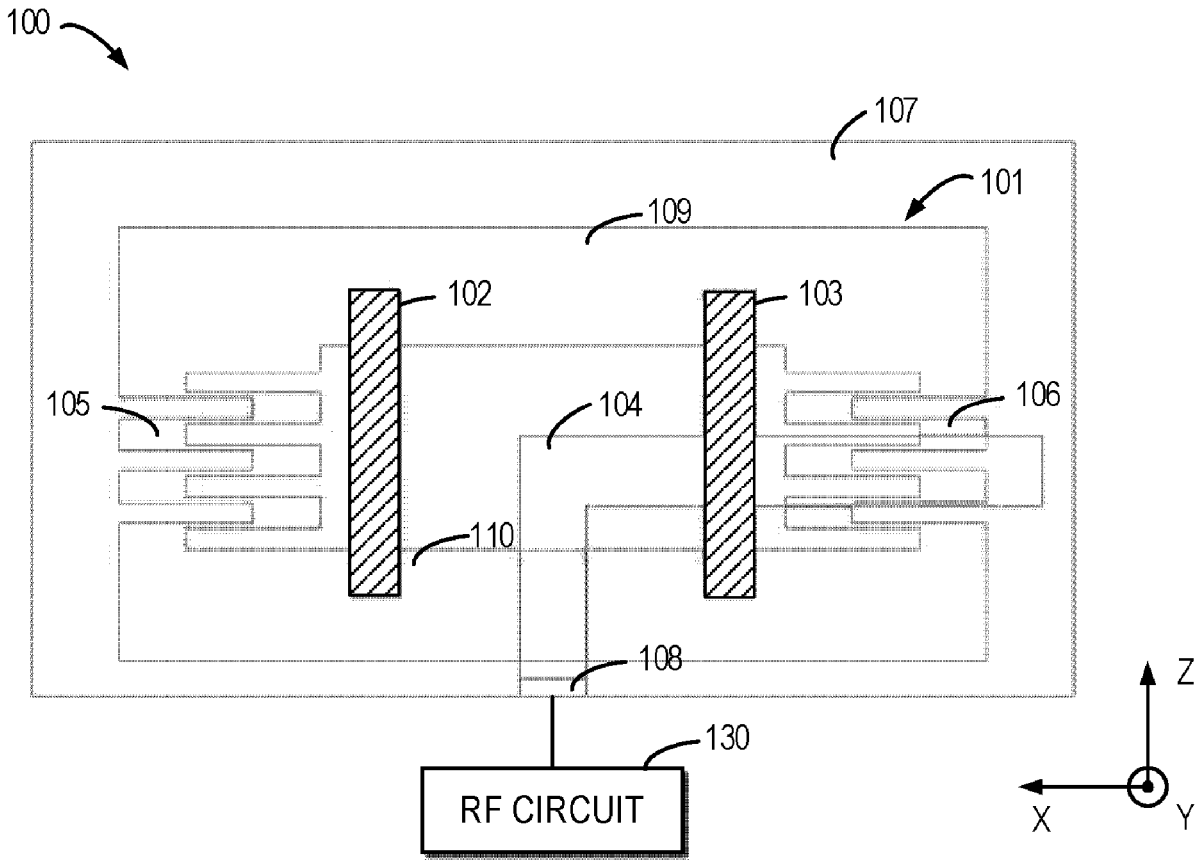
H01Q 7/00	(2006.01)
H01Q 1/38	(2006.01)
H01Q 5/385	(2006.01)

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

CPC ***H01Q 7/00*** (2013.01); ***H01Q 5/385*** (2015.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

In accordance with some embodiments, there is provided an apparatus. The apparatus includes a conductive loop; a first conductive member electromagnetically coupled to the conductive loop and galvanically coupled to a radio frequency circuit; a second conductive member arranged across and electromagnetically coupled to the conductive loop; and a third conductive member arranged across and electromagnetically coupled to the conductive loop, the third conductive member being spaced apart from the second conductive member and electromagnetically coupled to the first conductive member.



US 20210297514A1

(19) **United States**

(12) **Patent Application Publication**

JANG et al.

(10) **Pub. No.: US 2021/0297514 A1**

(43) **Pub. Date: Sep. 23, 2021**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

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

(72) Inventors: **Seyoung JANG**, Suwon-si (KR); **Chulwoo PARK**, Suwon-si (KR); **Dongil SON**, Suwon-si (KR); **Hyeongju LEE**, Suwon-si (KR)

(21) Appl. No.: **17/343,825**

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

Related U.S. Application Data

(63) Continuation of application No. 16/296,701, filed on Mar. 8, 2019.

(30) **Foreign Application Priority Data**

Mar. 9, 2018 (KR) 10-2018-0028195

Publication Classification

(51) **Int. Cl.**

H04M 1/02 (2006.01)

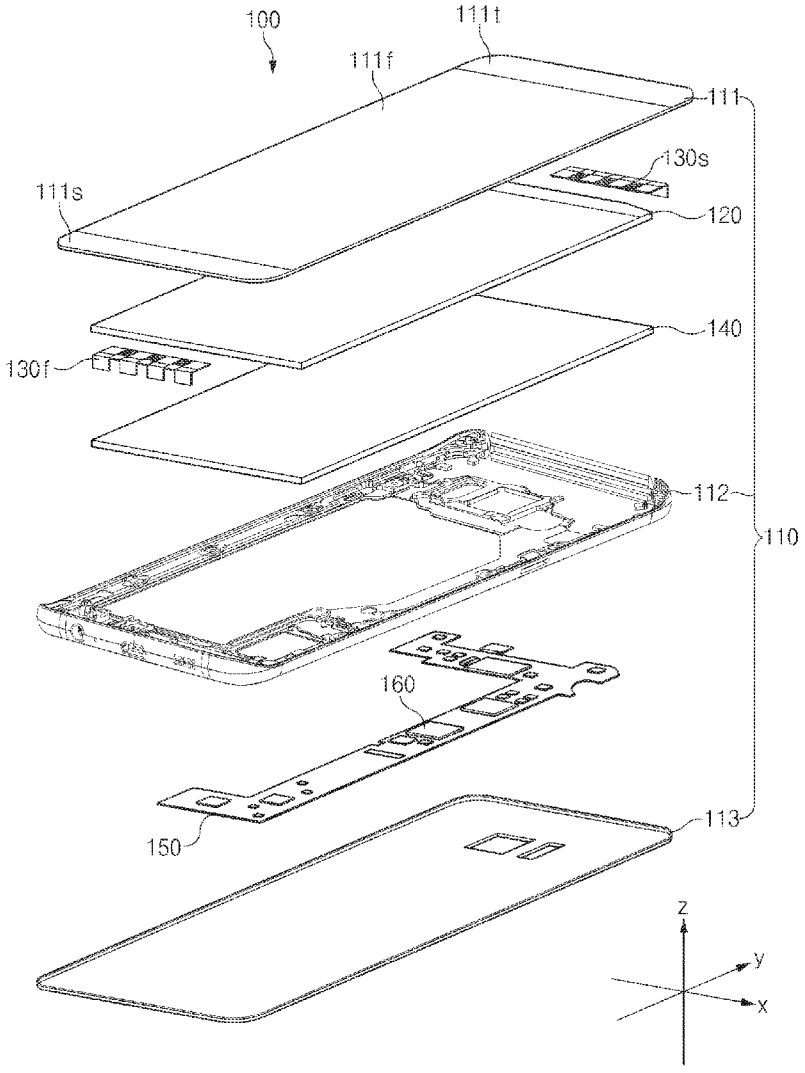
H01Q 1/24 (2006.01)

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

CPC ***H04M 1/026*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An electronic device includes a housing including a first plate including a glass plate, a second plate facing the first plate, and a side surface surrounding a space between the first plate and the second plate, a display positioned inside the space and exposed through a first area of the first plate, an antenna structure at least partially overlapping a second area of the first plate when viewed from above the first plate and which is connected to the second area, and a processor.



US 20210305690A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305690 A1**

SINHA et al. (43) **Pub. Date: Sep. 30, 2021**

(54) **CONSTRUCTION BLOCK ANTENNA ASSEMBLY**

(71) Applicants: **Guruditya SINHA**, New Delhi (IN); **Reena SINHA**, New Delhi (IN)

(72) Inventors: **Guruditya SINHA**, New Delhi (IN); **Reena SINHA**, New Delhi (IN)

(21) Appl. No.: **17/212,230**

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

(30) **Foreign Application Priority Data**

Mar. 25, 2020 (IN) 202041012962

Publication Classification

(51) **Int. Cl.**

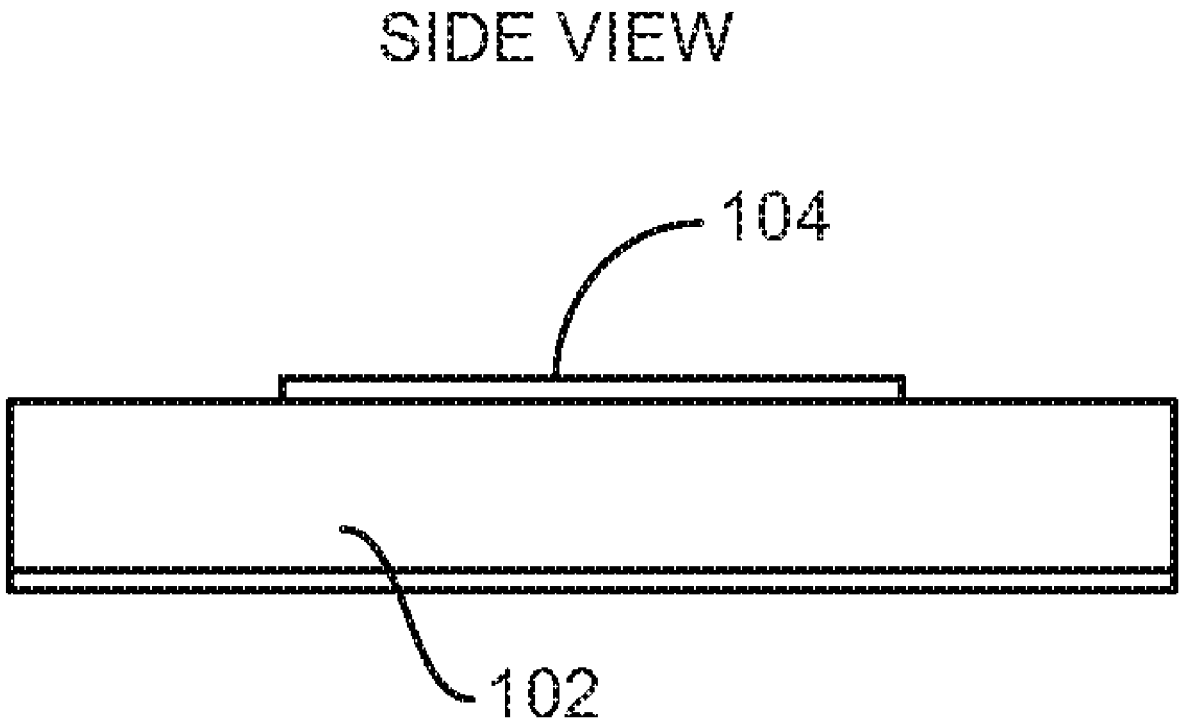
H01Q 1/44	(2006.01)
H01Q 1/48	(2006.01)
H01Q 9/04	(2006.01)
E04C 1/39	(2006.01)

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

CPC ***H01Q 1/44*** (2013.01); ***E04C 1/39*** (2013.01); ***H01Q 9/0421*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

Configurations of an electronic communication device, an electronic device or an antenna structure are described herein. The antenna structure includes a building construction block structure that provides a non-radiating portion of the antenna structure. A radiating element is formed on one side of the building construction block provides a radiating portion of the antenna structure. The radiating element may include a coating of a metallic element, such as copper. Further, the antenna structure includes a ground plane that is spaced apart from the radiating element on the building construction block structure. The ground plane may partially include a portion of the radiating element configured to adhere to the building construction block structure of the antenna structure. The antenna structure may passively transmit and/or receive signals and provisions flexibility of deployment in different configurations based on the applications.



US 20210305691A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305691 A1**

ITO (43) **Pub. Date: Sep. 30, 2021**

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

(71) Applicant: **Sony Corporation**, Tokyo (JP)

(72) Inventor: **Takayoshi ITO**, Tokyo (JP)

(73) Assignee: **Sony Corporation**, Tokyo (JP)

(21) Appl. No.: **17/262,226**

(22) PCT Filed: **Jul. 30, 2018**

(86) PCT No.: **PCT/JP2018/028498**

§ 371 (c)(1),
(2) Date: **Jan. 22, 2021**

Publication Classification

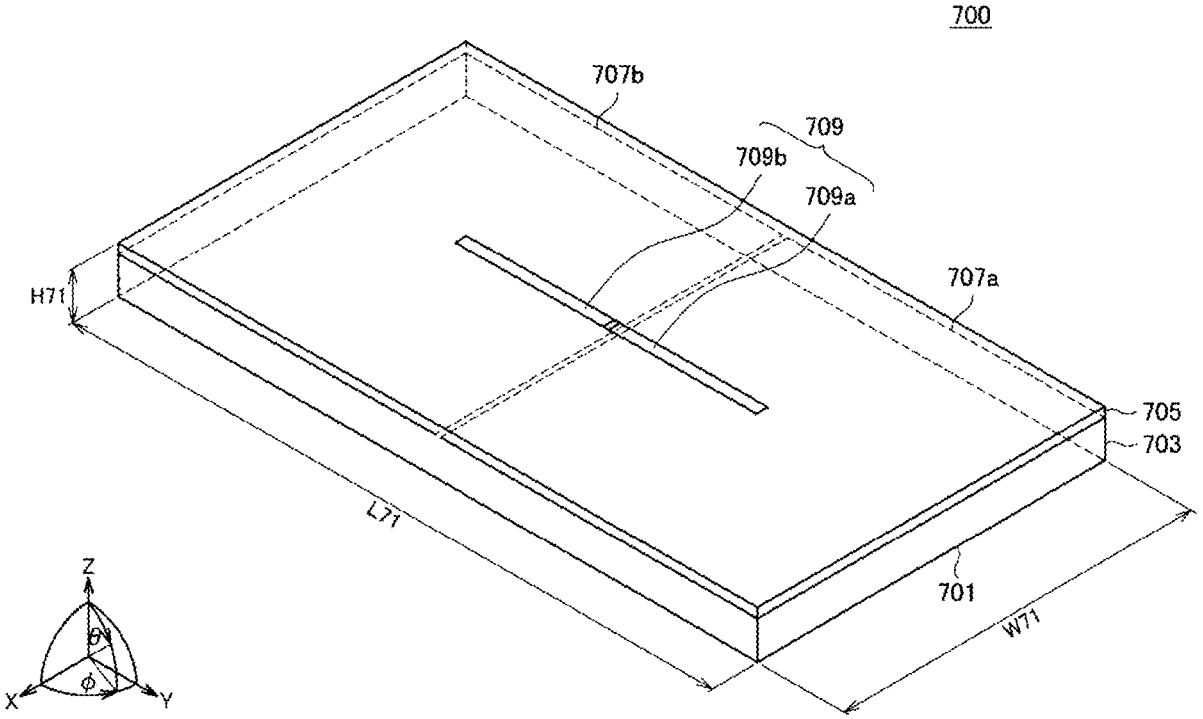
(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 9/04 (2006.01)

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

(57) **ABSTRACT**

To implement an antenna device capable of further reducing an influence of proximity to a metal and feeding power to an antenna element in a more suitable manner.

An antenna device includes: a substantially-flat-plate-shaped dielectric substrate; a metal base plate arranged on a first surface of the dielectric substrate; substantially-flat-plate-shaped first and second antenna elements arranged on a second surface of the dielectric substrate that is opposite to the first surface and on an opposite side of the dielectric substrate from the metal base plate so that a slit is formed; a first feeding pin that feeds power to the first antenna element; and a second feeding pin that feeds power to the second antenna element, in which a phase difference between feeding signals supplied to the first and second feeding pins, respectively, is approximately 180 degrees.



US 20210305695A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305695 A1**

LIANG et al. (43) **Pub. Date: Sep. 30, 2021**

(54) **ULTRA WIDE BAND ANTENNA AND COMMUNICATION TERMINAL**

(71) Applicant: **Beijing Xiaomi Mobile Software Co., Ltd.**, Beijing (CN)

(72) Inventors: **Xin LIANG**, Beijing (CN); **Shengxiang CHENG**, Beijing (CN)

(73) Assignee: **Beijing Xiaomi Mobile Software Co., Ltd.**

(21) Appl. No.: **16/985,682**

(22) Filed: **Aug. 5, 2020**

(30) **Foreign Application Priority Data**

Mar. 31, 2020 (CN) 202010246288.6

Publication Classification

(51) **Int. Cl.**

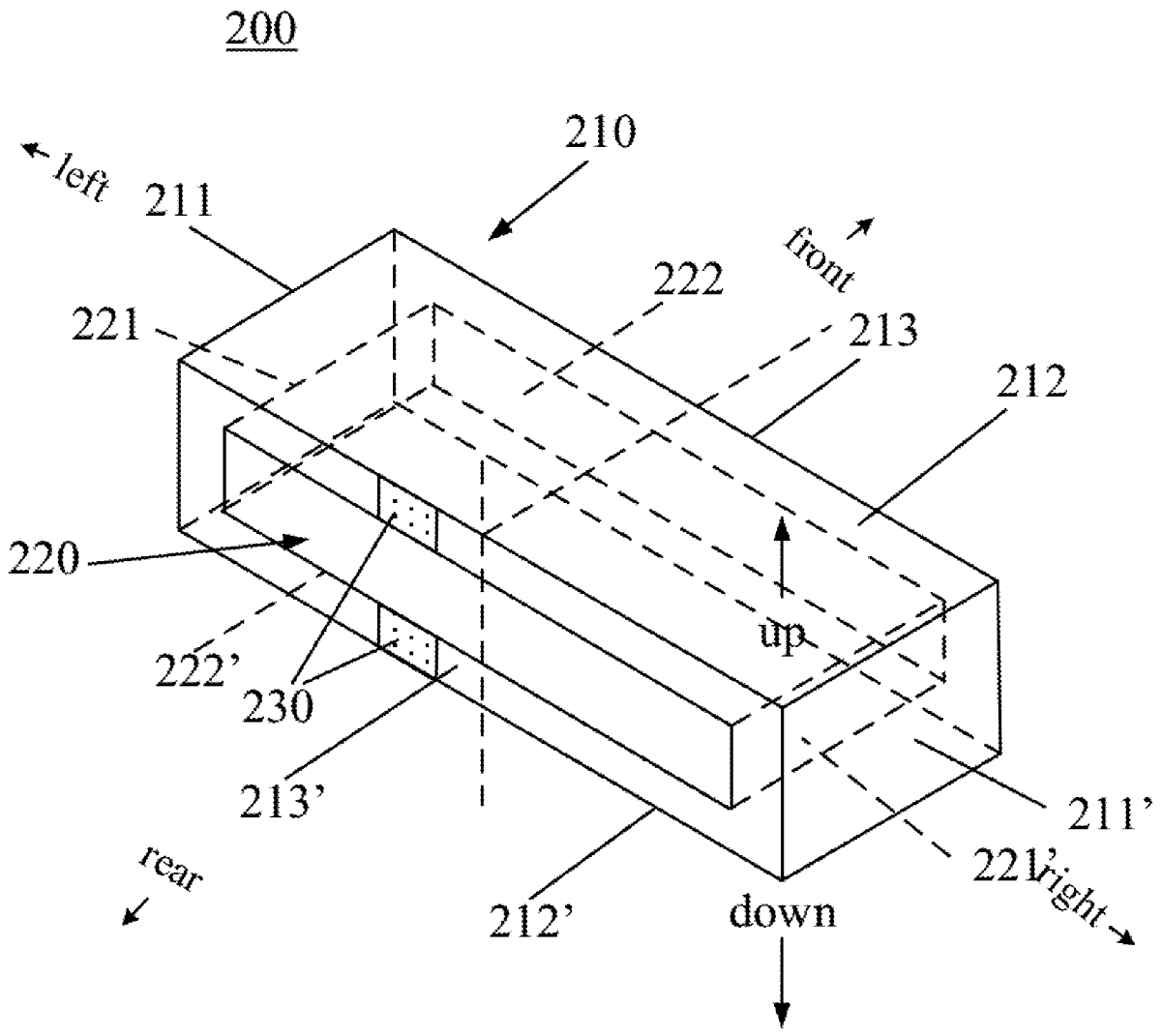
H01Q 5/25	(2006.01)
H01Q 9/30	(2006.01)
H01Q 13/18	(2006.01)
H01Q 21/06	(2006.01)

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

CPC ***H01Q 5/25*** (2015.01); ***H01Q 21/06*** (2013.01); ***H01Q 13/18*** (2013.01); ***H01Q 9/30*** (2013.01)

(57) **ABSTRACT**

An ultra wide band (UWB) antenna includes: a radiator, including a waveguide cavity which has opposite open-end faces; and a feeding end, disposed on one of the open-end faces. The UWB antenna according to the present disclosure overcomes the technical problems that a horn antenna in related technologies is difficult to be applied to an integrated communication terminal due to its large size, complicated structure, and difficulties in processing.



US 20210305700A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305700 A1**

ANGUERA et al. (43) **Pub. Date: Sep. 30, 2021**

(54) **COMPACT ANTENNA TECHNOLOGY FOR WIRELESS COMMUNICATIONS**

(71) Applicant: **Fractus Antennas, S.L.**, Barcelona (ES)

(72) Inventors: **Jaume ANGUERA**, Castello (ES); **Aurora ANDÚJAR**, Barcelona (ES); **Carles PUENTE**, Barcelona (ES)

(21) Appl. No.: **17/345,835**

(22) Filed: **Jun. 11, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/EP2019/084680, filed on Dec. 11, 2019.

(60) Provisional application No. 62/870,837, filed on Jul. 5, 2019, provisional application No. 62/777,835, filed on Dec. 11, 2018.

(30) **Foreign Application Priority Data**

Dec. 11, 2018 (EP) 18211745.7
Jul. 5, 2019 (EP) 19184772.2

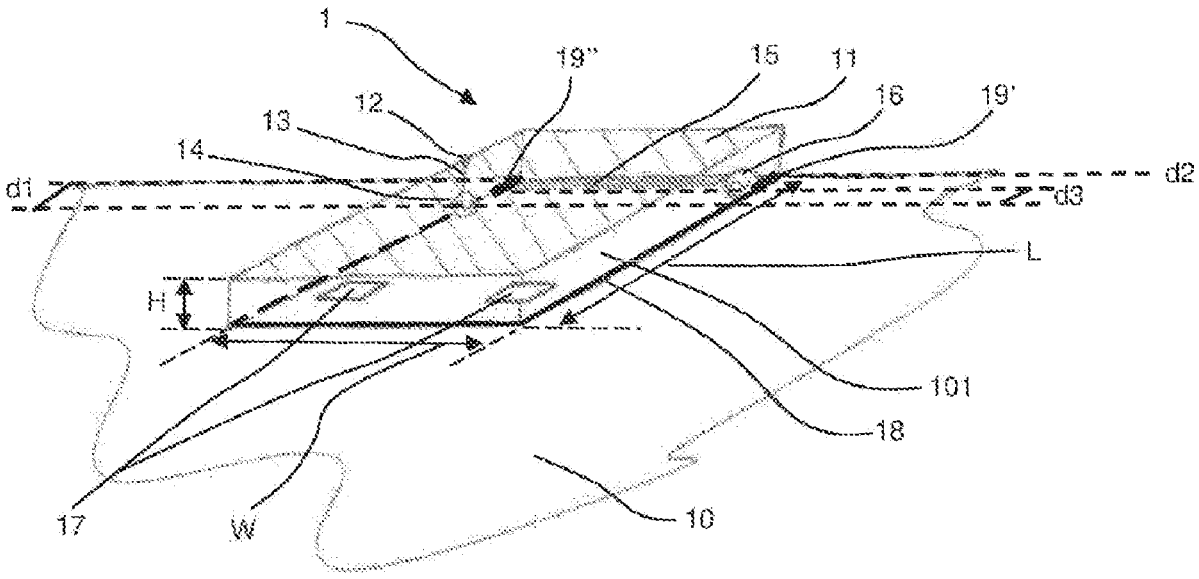
Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 15/12 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0407*** (2013.01); ***H01Q 1/242*** (2013.01); ***H01Q 15/12*** (2013.01)

(57) **ABSTRACT**

A wireless device using a radiating system able to operate in more than one communication system features compact dimensions and comprises a radiating structure that contains a compact booster arrangement that comprises first and second boosters, arranged in a configuration such that the boosters are not concatenated between them, i.e., not being placed one next to each other. One of the boosters comprises a slot or a gap in a ground plane layer and another of the boosters comprises at least a conductive part or element connected at a point to an additional conductive element that comprises a feeding point. The radiating structure also comprises the ground plane layer and a radiofrequency system. The radiating system also comprises one or two ports, each providing operation at least at one of the communication systems of operation.



US 20210305702A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305702 A1**

Li et al. (43) **Pub. Date: Sep. 30, 2021**

(54) **ANTENNA STRUCTURE AND COMMUNICATIONS TERMINAL**

(71) Applicant: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(72) Inventors: **Rihui Li**, Dongguan (CN); **Rui JIANG**, Dongguan (CN); **Zipeng HOU**, Dongguan (CN)

(73) Assignee: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(21) Appl. No.: **17/344,899**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2019/116599, filed on Nov. 8, 2019.

(30) **Foreign Application Priority Data**

Dec. 12, 2018 (CN) 201811521027.X

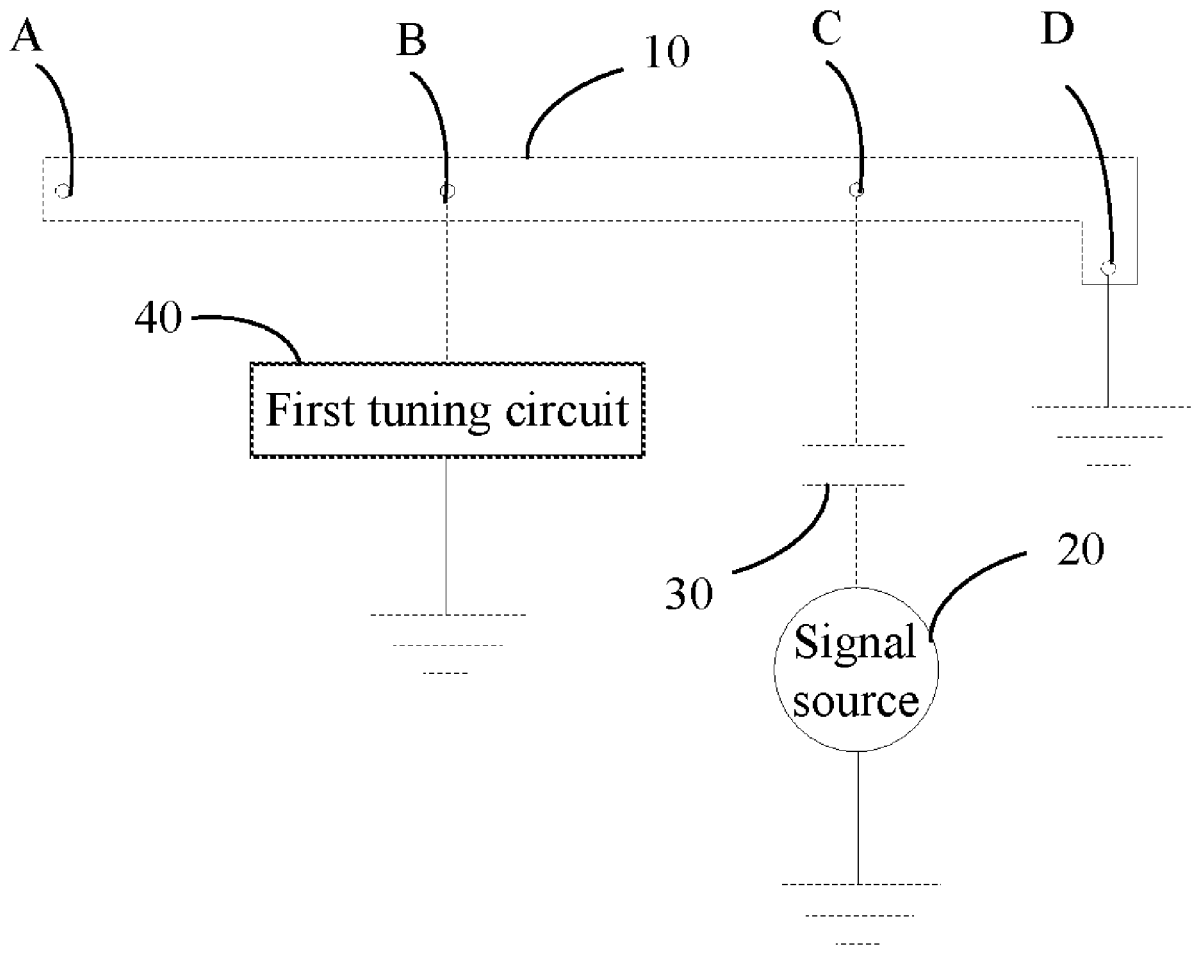
Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/328 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0442*** (2013.01); ***H01Q 9/0414*** (2013.01); ***H01Q 5/328*** (2015.01)

(57) **ABSTRACT**

This application provides an antenna structure and a communications terminal. The antenna structure includes an antenna radiator, a signal source, a first capacitor, and a first tuning circuit. A first terminal of the antenna radiator is grounded. A first terminal of the first capacitor and a first terminal of the first tuning circuit are electrically connected to a connection point of the antenna radiator. A second terminal of the first capacitor is electrically connected to the signal source. A second terminal of the first tuning circuit is grounded. Antenna impedance of the first terminal of the first capacitor at target frequencies is in the first quadrant of a Smith chart, and the target frequencies are at least some frequencies in frequency bands covered by the antenna radiator.



US 20210305703A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305703 A1**

LI (43) **Pub. Date: Sep. 30, 2021**

(54) **ANTENNA STRUCTURE AND COMMUNICATIONS TERMINAL**

(71) Applicant: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(72) Inventor: **Rihui LI**, Dongguan (CN)

(73) Assignee: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(21) Appl. No.: **17/345,193**

(22) Filed: **Jun. 11, 2021**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2019/117441, filed on Nov. 12, 2019.

(30) **Foreign Application Priority Data**

Dec. 12, 2018 (CN) 201811521132.3

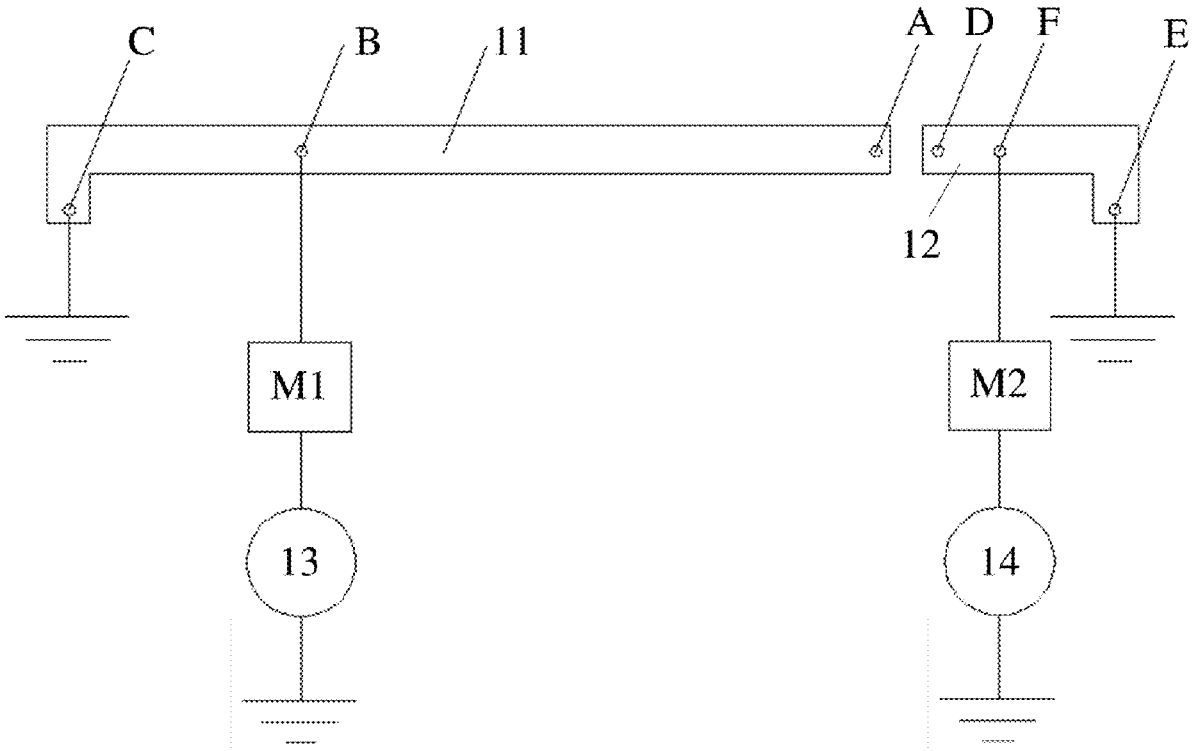
Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/328 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0442*** (2013.01); ***H01Q 9/0414*** (2013.01); ***H01Q 5/328*** (2015.01)

(57) **ABSTRACT**

An antenna structure includes a first antenna radiator, a second antenna radiator, and a first impedance matching circuit. The first antenna radiator and the second antenna radiator are disposed in a laminated or opposite manner, and a gap exists between the first antenna radiator and the second antenna radiator. The length of the first antenna radiator is greater than that of the second antenna radiator, and the resonant frequency band of the first antenna radiator is smaller than that of the second antenna radiator. The first end of the first antenna radiator is grounded, a first feeding point is provided on the first antenna radiator. The first end of the second antenna radiator is grounded, a second feeding point is provided on the second antenna radiator, and the second feeding point is connected to a second signal source.



US 20210305706A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305706 A1**

Chan et al. (43) **Pub. Date: Sep. 30, 2021**

(54) **ANTENNA DEVICE**

(71) Applicants: **Chun-Cheng Chan**, Taipei City (TW); **Shih-Chia Liu**, Taipei City (TW); **Yen-Hao Yu**, Taipei City (TW); **Li-Chun Lee**, Taipei City (TW); **Jui-Hung Lai**, Taipei City (TW)

(72) Inventors: **Chun-Cheng Chan**, Taipei City (TW); **Shih-Chia Liu**, Taipei City (TW); **Yen-Hao Yu**, Taipei City (TW); **Li-Chun Lee**, Taipei City (TW); **Jui-Hung Lai**, Taipei City (TW)

(73) Assignee: **COMPAL ELECTRONICS, INC.**, Taipei City (TW)

(21) Appl. No.: **17/211,825**

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

Related U.S. Application Data

(60) Provisional application No. 63/001,558, filed on Mar. 30, 2020.

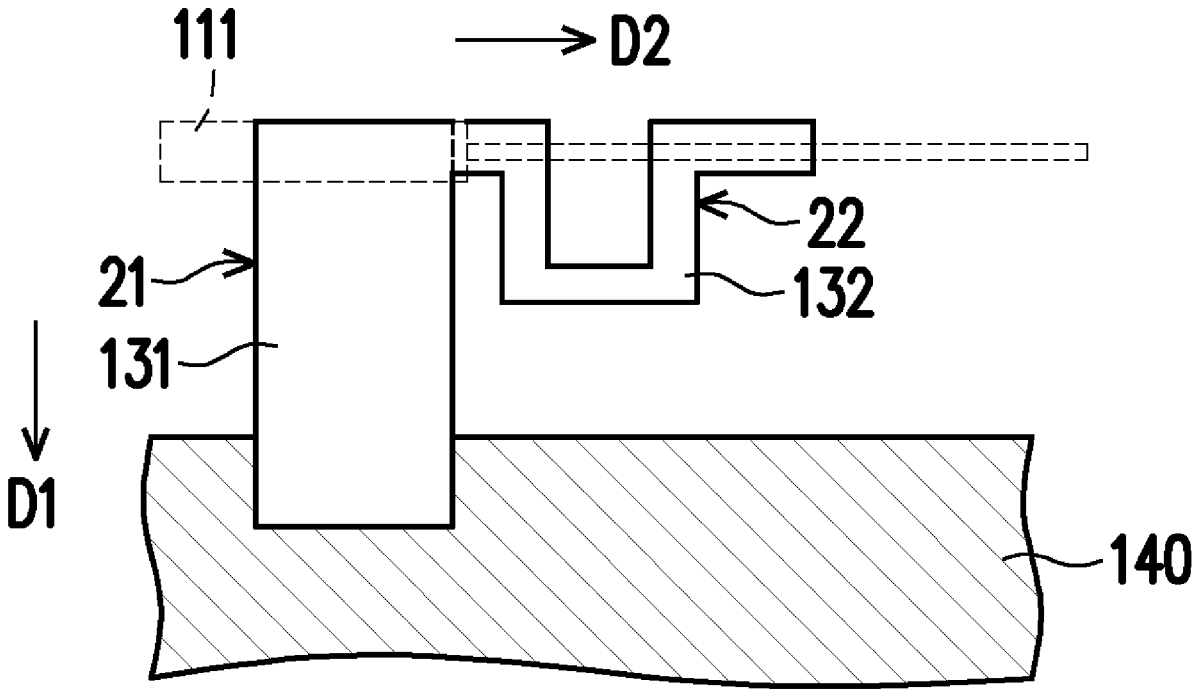
Publication Classification

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

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

(57) **ABSTRACT**

An antenna device is disposed. The antenna device includes a signal cable, a casing, a grounding component, and a metal member. The signal cable includes a signal portion and a grounding portion. The signal cable is fixed on the casing. The grounding portion is connected to the metal member through the grounding component.



US 20210305962A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0305962 A1**

LI (43) **Pub. Date: Sep. 30, 2021**

(54) **ANTENNA STRUCTURE AND COMMUNICATIONS TERMINAL**

(71) Applicant: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(72) Inventor: **Rihui LI**, Dongguan (CN)

(73) Assignee: **VIVO MOBILE COMMUNICATION CO., LTD.**, Dongguan (CN)

(21) Appl. No.: **17/343,985**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2019/117446, filed on Nov. 12, 2019.

(30) **Foreign Application Priority Data**

Dec. 12, 2018 (CN) 201811519716.7

Publication Classification

(51) **Int. Cl.**

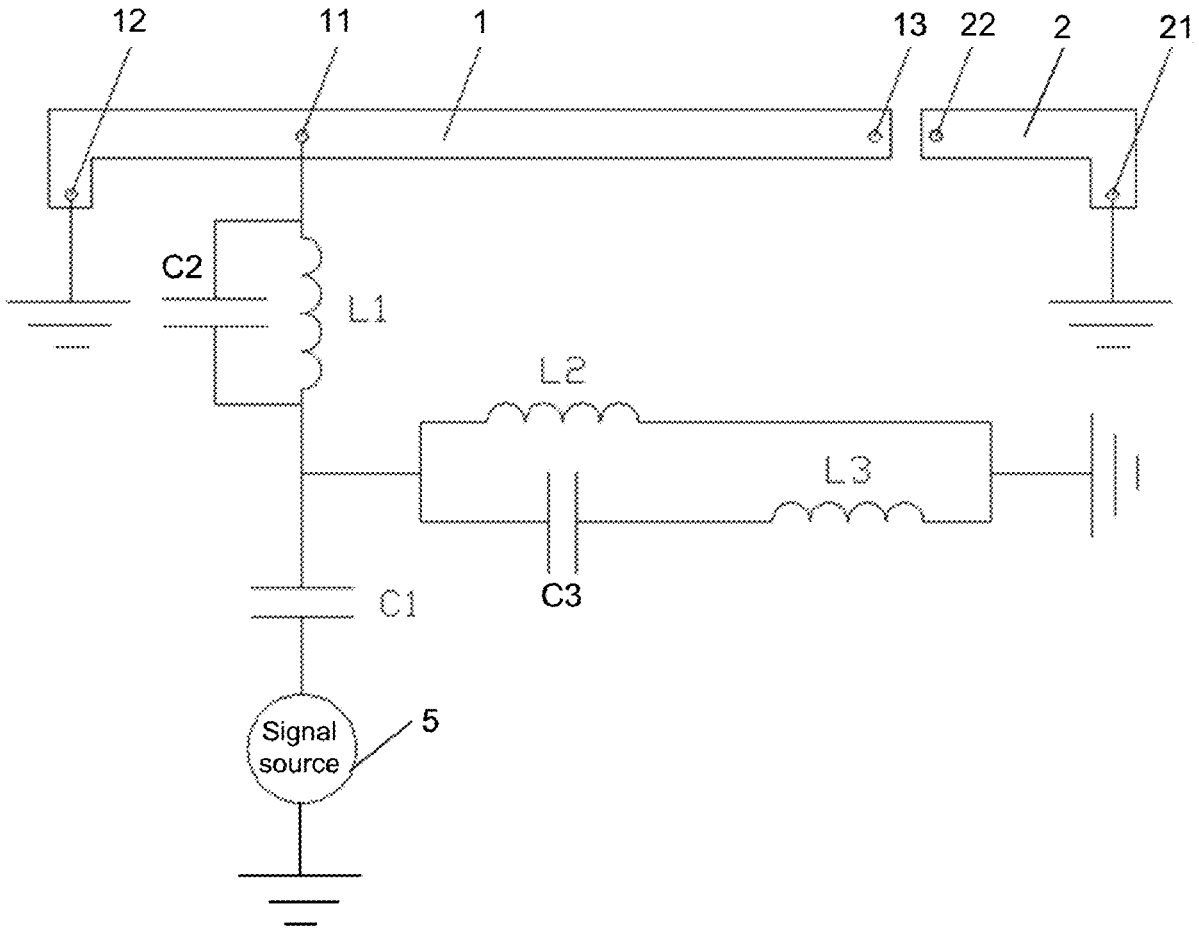
H03H 7/38	(2006.01)
H01Q 1/22	(2006.01)
H01Q 9/04	(2006.01)

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

CPC ***H03H 7/38*** (2013.01); ***H01Q 9/045*** (2013.01); ***H01Q 1/2291*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a first antenna radiator, a second antenna radiator, a first impedance matching circuit, a second impedance matching circuit, and a signal source, wherein the first antenna radiator is coupled to the second antenna radiator by means of a slot; the end of the first antenna radiator away from the slot is grounded, and the first antenna radiator is provided with a feed point, the end of the second antenna radiator away from the slot is grounded; a first end of the first impedance matching circuit is connected to the feed point, and a second end of the first impedance matching circuit is connected to a first end of the signal source; a first end of the second impedance matching circuit is connected to a third end of the first impedance matching circuit, and a second end of the second impedance matching circuit is grounded.



US 20210313677A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0313677 A1**

McCandless et al. (43) **Pub. Date: Oct. 7, 2021**

(54) **SWITCHABLE PATCH ANTENNA**

(71) Applicant: **Pivotal Commware, Inc.**, Kirkland, WA (US)

(72) Inventors: **Jay Howard McCandless**, Alpine, CA (US); **Eric James Black**, Bothell, WA (US); **Isaac Ron Bekker**, Los Angeles, CA (US)

(21) Appl. No.: **17/217,882**

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

Related U.S. Application Data

(63) Continuation of application No. 16/673,852, filed on Nov. 4, 2019, now Pat. No. 10,971,813, which is a continuation of application No. 16/280,939, filed on Feb. 20, 2019, now Pat. No. 10,468,767.

Publication Classification

(51) **Int. Cl.**

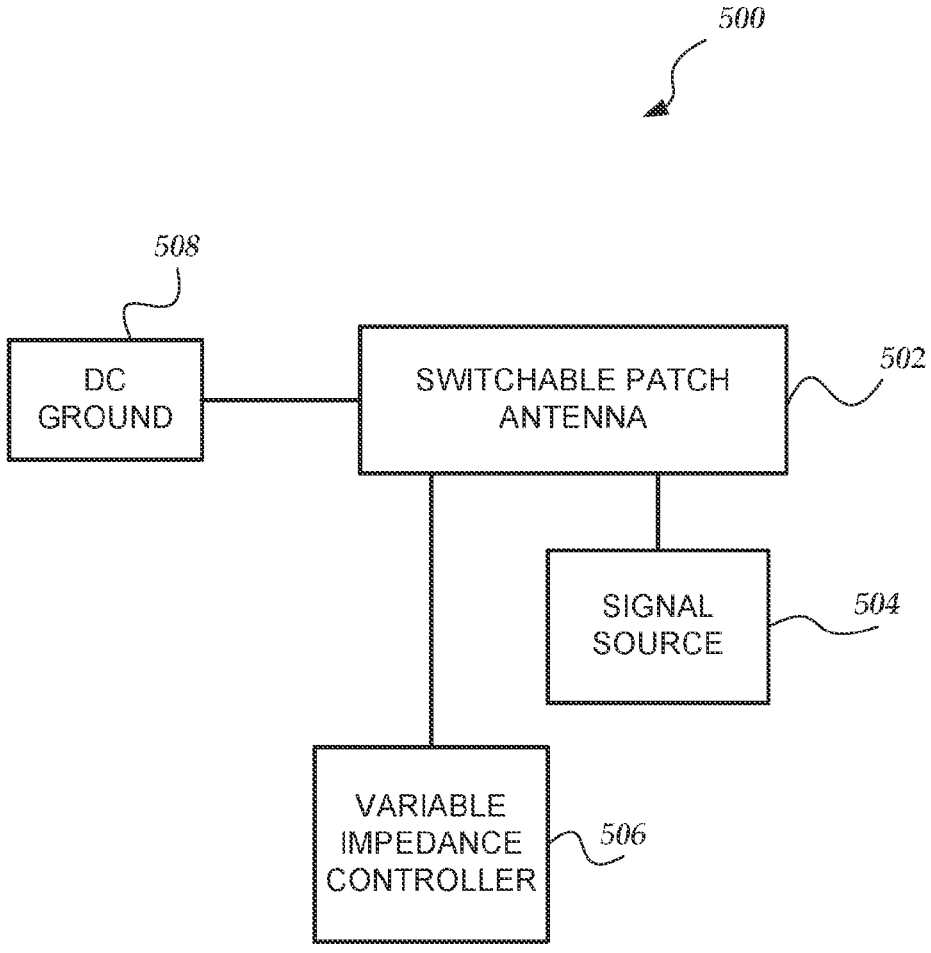
H01Q 1/52	(2006.01)
H01Q 1/36	(2006.01)
H01Q 9/04	(2006.01)
H01Q 3/24	(2006.01)

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

CPC ***H01Q 1/521*** (2013.01); ***H01Q 1/364*** (2013.01); ***H01Q 9/0407*** (2013.01); *H01Q 1/24* (2013.01); ***H01Q 1/52*** (2013.01); ***H01Q 3/247*** (2013.01); ***H01Q 1/36*** (2013.01); ***H01Q 9/04*** (2013.01)

(57) **ABSTRACT**

A switchable patch antenna comprises a planar conductor having an aperture (hole) formed in the middle of the planar conductor. Radiation of a sinusoidal signal is controlled by comparison of separate impedance values for two components that have separate impedance values. Each of the two components have one end coupled together at the terminal positioned at a center of the aperture and their other ends separately coupled to opposing edges of the aperture. A sinusoidal signal source is also coupled to the terminal positioned at the aperture's center. Further, when the impedance values of both components are substantially equivalent, radiation by the antenna of the provided signal and/or mutual coupling of other signals is disabled. Also, when an impedance value of one of the two components is substantially greater than the other impedance value of the other component, the provided signal is radiated and/or mutual coupling is enabled.



US 20210313692A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0313692 A1**

TAI et al. (43) **Pub. Date: Oct. 7, 2021**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **CHIH-FENG TAI**, HSINCHU (TW); **TZU-CHI LU**, HSINCHU (TW)

(21) Appl. No.: **17/020,999**

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

(30) **Foreign Application Priority Data**

Apr. 1, 2020 (TW) 109111381

Publication Classification

(51) **Int. Cl.**

H01Q 5/371 (2006.01)

H01Q 9/04 (2006.01)

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

CPC ***H01Q 5/371*** (2015.01); ***H01Q 9/0407*** (2013.01)

(57) **ABSTRACT**

An antenna structure is provided. The antenna structure includes a first radiation element, a second radiation element, and a feeding element. The first radiation element includes a first radiation portion, a second radiation portion, and a feeding portion. The second radiation element includes a third radiation portion, a fourth radiation portion, and a grounding portion. The third radiation portion and the first radiation portion are separate from each other and coupled to each other, the third radiation portion and the second radiation portion are separate from each other and coupled to each other, and the fourth radiation portion and the first radiation portion are separate from each other and coupled to each other. The feeding element is electrically connected with the feeding portion and the grounding portion. A junction between the feeding element and the feeding portion is defined as a feeding point.

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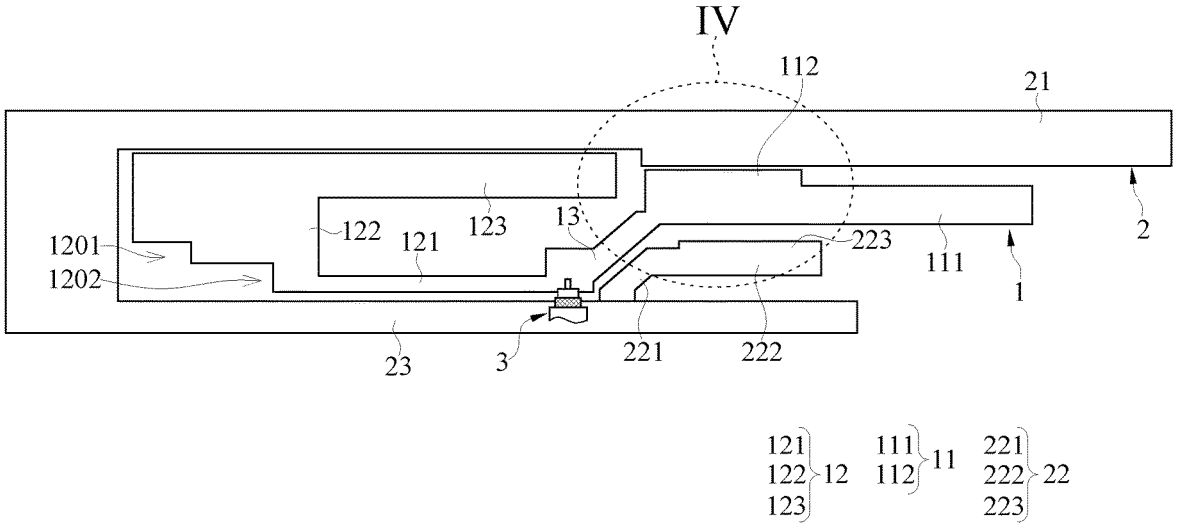


US 20210313697A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0313697 A1**

MAK (43) **Pub. Date: Oct. 7, 2021**

(54) **PATCH ANTENNA**

(71) Applicant: **STAR Systems International Limited**, Kwai Chung (HK)

(72) Inventor: **Chi Lun MAK**, Kwai Chung (HK)

(21) Appl. No.: **16/838,398**

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

Publication Classification

(51) **Int. Cl.**

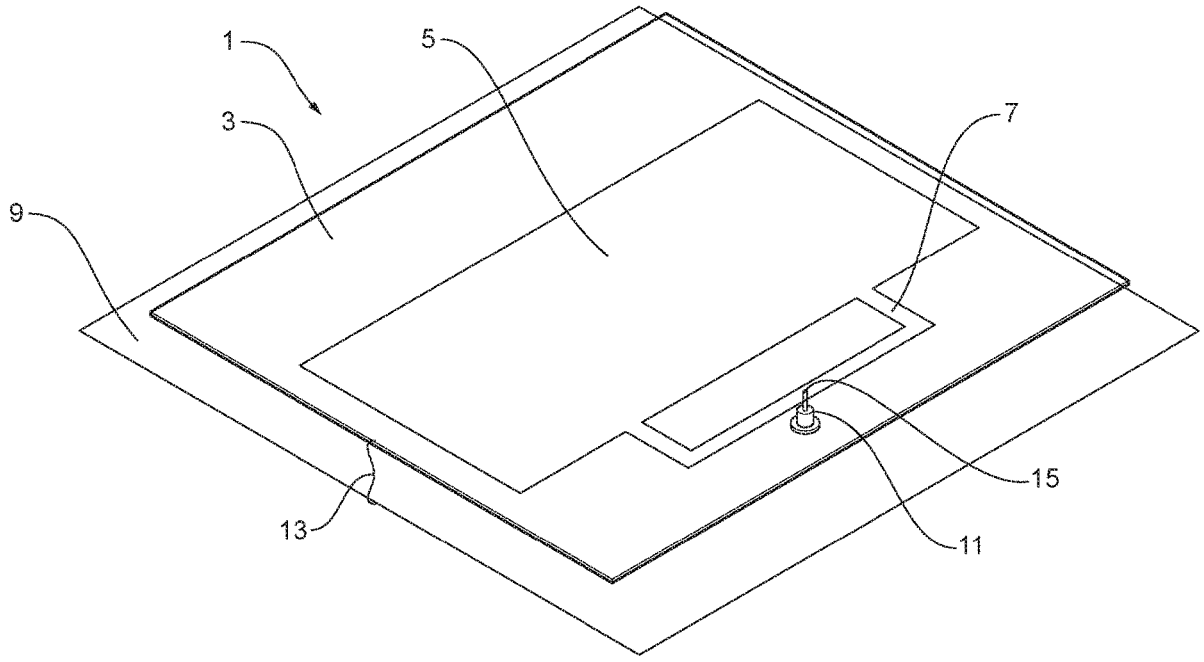
H01Q 9/04	(2006.01)
H01Q 5/371	(2006.01)
H01Q 21/06	(2006.01)

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

CPC ***H01Q 9/0457*** (2013.01); ***H01Q 5/371*** (2015.01); ***H01Q 9/0435*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 9/0478*** (2013.01)

(57) **ABSTRACT**

A patch antenna, comprising: a conductive element; and a first feed point; wherein the first feed point splits into at least two branches which are connected electrically to the conductive element. The two branches are configured such that a cross polarization in a H-plane is suppressed, and antenna gain is increased.



US 20210313698A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0313698 A1**

MORI (43) **Pub. Date: Oct. 7, 2021**

(54) **ANTENNA AND ELECTRONIC DEVICE**

(71) Applicant: **SONY CORPORATION**, TOKYO (JP)

(72) Inventor: **NOBUYUKI MORI**, TOKYO (JP)

(21) Appl. No.: **17/250,519**

(22) PCT Filed: **May 27, 2019**

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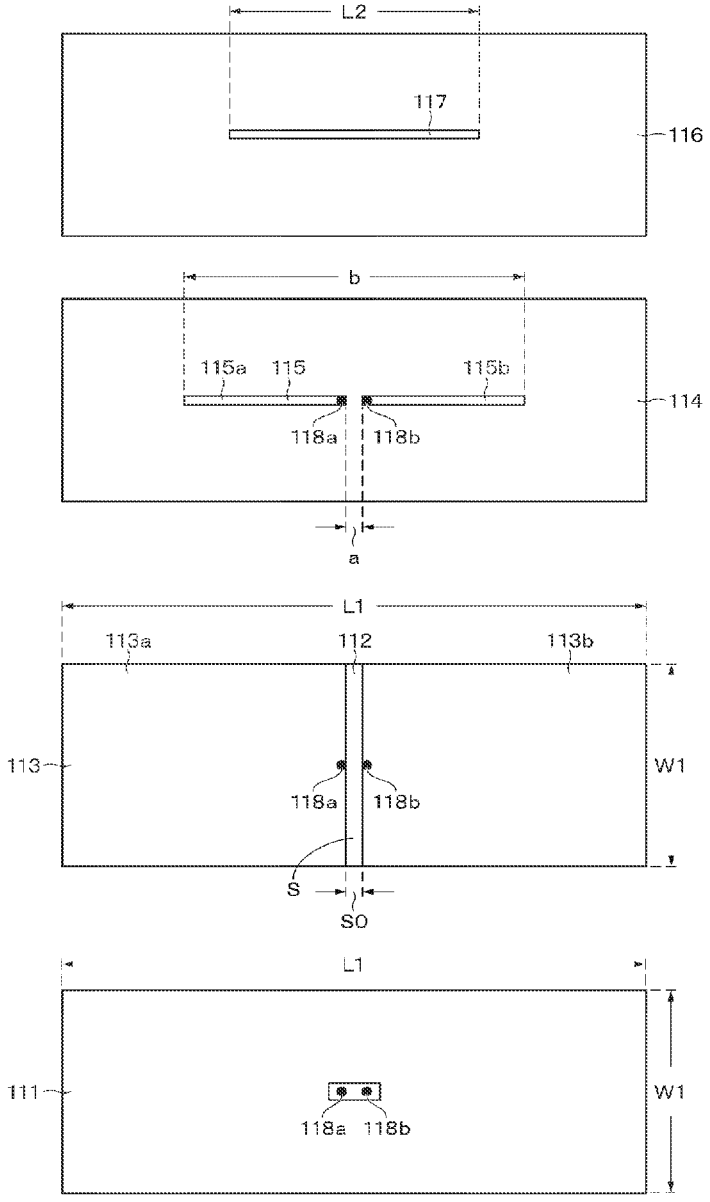
CPC ***H01Q 9/285*** (2013.01)

(57) **ABSTRACT**

An antenna is provided with a dielectric layer, a metal layer provided on one surface of the dielectric layer, a radiation element provided on the other surface of the dielectric layer, the radiation element including a slit portion in a central portion, a radiation system of which is magnetic field current radiation by electric field induction, a contactless feed element arranged above the slit portion, and a parasitic radiation element, a radiation system of which is electric field current radiation by magnetic field induction.



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Noah et al.

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(54) **MULTIPLE LAYER PRINTED CIRCUIT BOARD THAT INCLUDES MULTIPLE ANTENNAS AND SUPPORTS SATELLITE COMMUNICATIONS**

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(73) Assignee: **Skylo Technologies, Inc.**, Palo Alto, CA (US)

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Publication Classification

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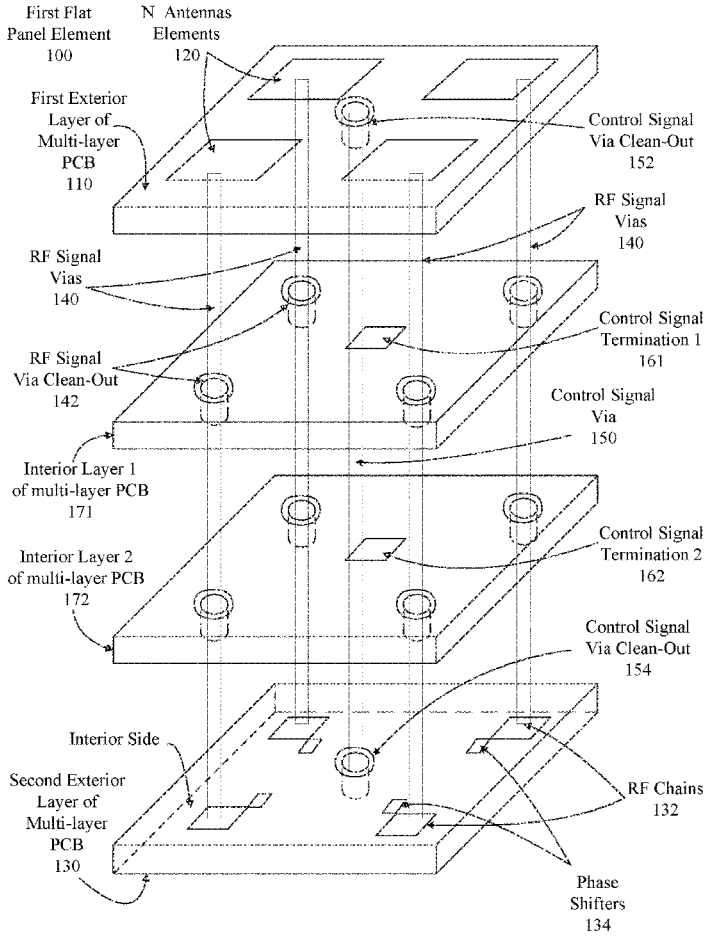
(57) **ABSTRACT**

Apparatuses, methods, and systems for a printed circuit board that includes multiple antennas, and operates to support satellite communications, are disclosed. One apparatus includes a first flat panel element. The first flat panel element includes a multilayer PCB (printed circuit board). The multilayer PCB includes a first exterior layer comprising N antenna elements, and a second exterior layer comprising N RF (radio frequency) chains operative to process the RF signals, each of the N RF chains electrically connected to a one of the N antenna elements, and N metal patches arranged in a square, wherein an air gap is located between the N metal patches and the N antenna elements, wherein dimensions, orientation, and spacing between the N metal patches and the N antenna elements are selected based on a carrier frequency, bandwidth, and directionality of the propagated RF signals.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0320392 A1**

HSU et al. (43) **Pub. Date: Oct. 14, 2021**

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

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H01Q 1/24	(2006.01)

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

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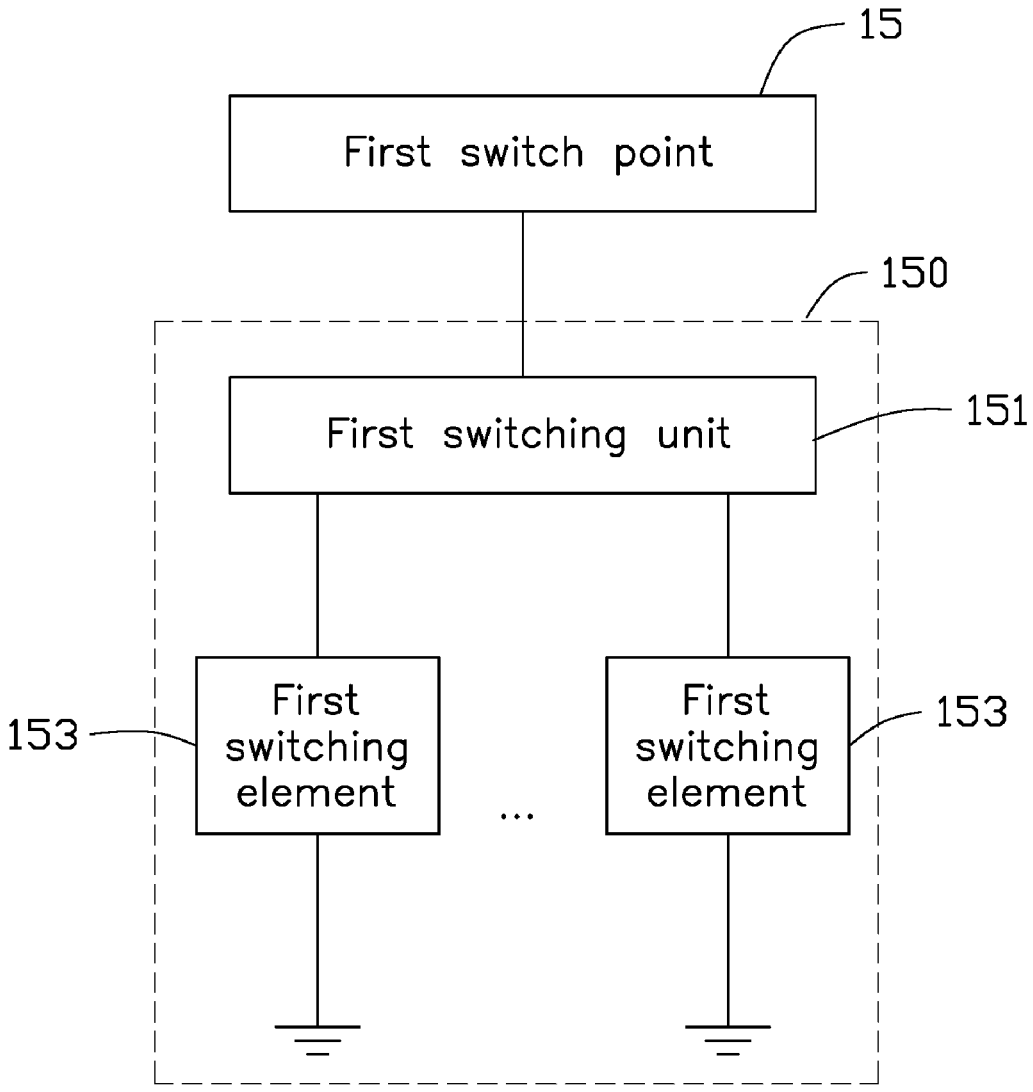
(57) **ABSTRACT**

An antenna structure with multiple frequency capabilities applied to an electronic device includes frame body, first feed point, a first switch point, and second switch point. The frame body has at least one portion made of metal material and defines two gaps. The frame body between gaps form a first radiation portion. The first feed point from a source feeds current and signal to the first radiation portion. The first switch point and the second switch point are located at two ends of the frame body adjacent to the first gap. The first switch point and the second switch point are grounded through a switch circuit.



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(43) **Pub. Date: Oct. 14, 2021**

PARK et al.

(54) **ANTENNA MODULE USING METAL BEZEL AND ELECTRONIC DEVICE INCLUDING THEREOF**

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(72) Inventors: **Sungchul PARK**, Gyeonggi-do (KR); **Wonjoon CHOI**, Gyeonggi-do (KR)

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

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(30) **Foreign Application Priority Data**

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CPC ***H01Q 13/18*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 21/064*** (2013.01); ***H01Q 5/35*** (2015.01)

(57) **ABSTRACT**

Disclosed is an electronic device including a metal bezel including a bezel patch separated through a bezel slit, a printed circuit board including a first conductive pattern and a second conductive pattern, which are separated through a substrate slit and a communication module transmitting or receiving an antenna signal, using an antenna element including the bezel patch, the first conductive pattern, and the second conductive pattern. The first conductive pattern is connected to a part of the metal bezel. The bezel patch and the second conductive pattern is arranged to be aligned vertically. A bezel cavity is formed between the bezel patch and the second conductive pattern.