



US 20220052436A1

(19) **United States**(12) **Patent Application Publication**
Yang et al.(10) **Pub. No.: US 2022/0052436 A1**(43) **Pub. Date: Feb. 17, 2022**(54) **CHANNEL INFORMATION-BASED
FREQUENCY TUNING OF ANTENNAS****Publication Classification**(71) Applicant: **Hewlett-Packard Development
Company, L.P.**, Spring, TX (US)(72) Inventors: **Yao Cheng Yang**, Taipei City (TW);
Chun-Chih Liu, Taipei City (TW);
Yi-Ching Lin, Taipei City (TW);
Tzu-Chiang Cheng, Taipei City (TW);
Tsung-Teng Wang, Taipei City (TW);
Chia-Hung Kuo, Taipei City (TW);
Ming-Shien Tsai, Taipei City (TW);
Hung-Wen Cheng, Taipei City (TW);
Isaac Lagnado, Spring, TX (US)(73) Assignee: **HewlettPackard Development
Company, L.P.**, Spring, TX (US)(21) Appl. No.: **17/288,549**(22) PCT Filed: **Apr. 30, 2019**(86) PCT No.: **PCT/US2019/029823**

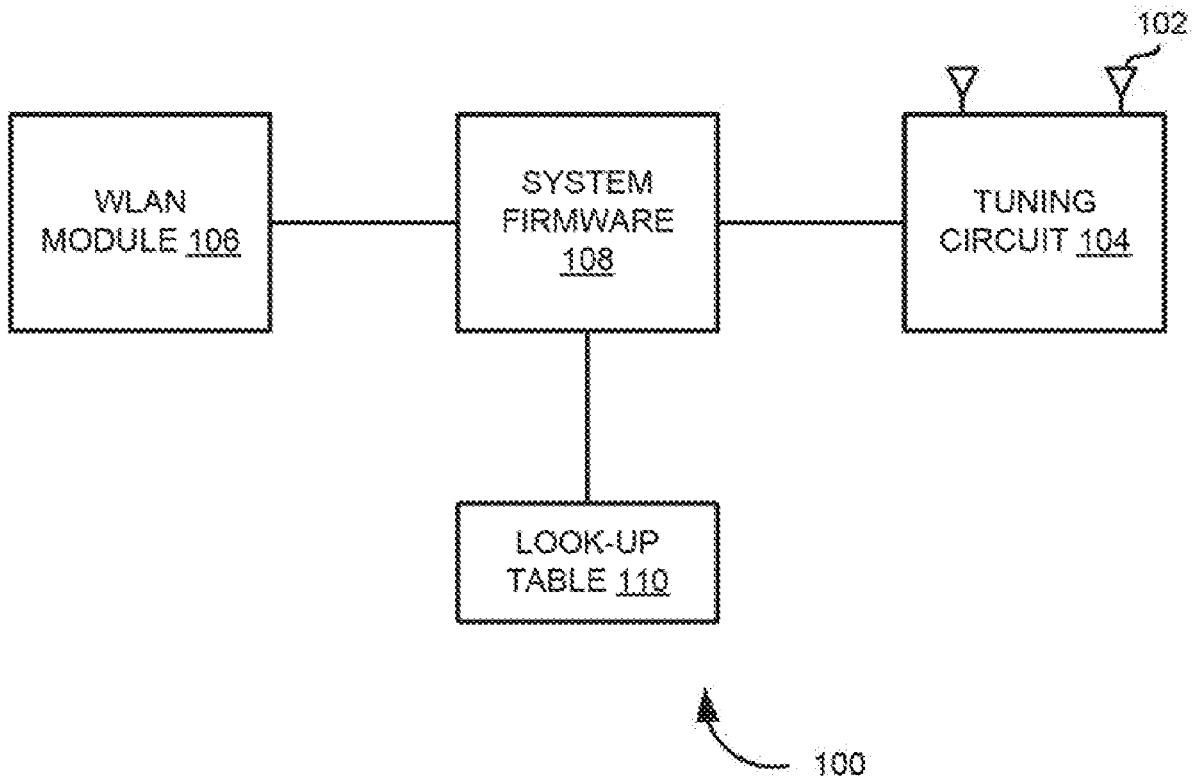
§ 371 (c)(1),

(2) Date: **Apr. 25, 2021**(51) **Int. Cl.****H01Q 1/22** (2006.01)**H01Q 21/28** (2006.01)**H01Q 5/30** (2006.01)**H01Q 5/50** (2006.01)**H04B 1/04** (2006.01)**H04B 1/401** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/2266** (2013.01); **H01Q 1/2291**
(2013.01); **H01Q 21/28** (2013.01); **H04B****1/401** (2013.01); **H01Q 5/50** (2015.01); **H04B****1/0458** (2013.01); **H01Q 5/30** (2015.01)

(57)

ABSTRACT

In one example, a computing device may include an antenna, a tuning circuit to tune the antenna, a wireless local area network (WLAN) module coupled to the antenna, a system firmware to boot up the computing device, and a look-up table residing in the system firmware. The system firmware may receive channel information from the WLAN module, determine a state of the antenna corresponding to the received channel information using the look-up table, and tune a frequency of the antenna corresponding to the determined state via the tuning circuit.





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(19) **United States**

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

(10) **Pub. No.: US 2022/0052437 A1**

(43) **Pub. Date: Feb. 17, 2022**

(54) **ELECTRONIC DEVICE COMPRISING
PLURALITY OF ANTENNAS**

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

(72) Inventors: **Jonghyuck LEE**, Gyeonggi-do (KR);
Haeyeon KIM, Gyeonggi-do (KR);
Sehyun PARK, Gyeonggi-do (KR)

(21) Appl. No.: **17/272,985**

(22) PCT Filed: **Sep. 27, 2019**

(86) PCT No.: **PCT/KR2019/012569**

§ 371 (c)(1),

(2) Date: **Mar. 3, 2021**

(30) **Foreign Application Priority Data**

Sep. 28, 2018 (KR) 10-2018-0116110

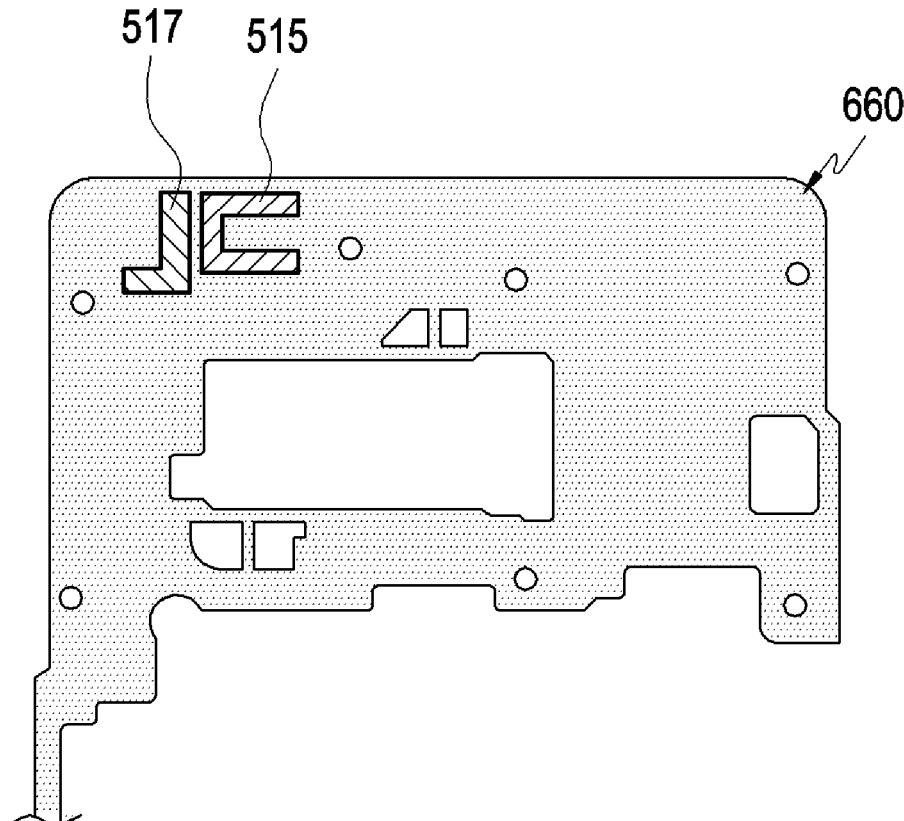
Publication Classification

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

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

(57) **ABSTRACT**

An electronic device according to various embodiments of the present invention can comprise: a housing comprising a front plate, a rear plate which faces the opposite direction from the front plate, and a lateral bezel structure which surrounds a space between the front plate and rear plate, and the side bezel structure comprises a first conductive part, a second conductive part and a first insulating part formed between the first conductive part and second conductive part; a printed circuit board which is disposed inside the housing and comprises at least one ground layer electrically connected in a first position of the first conductive part adjacent to the first insulating part; a first conductive pattern which is electrically connected in a second position of the first conductive part further away from the first insulating part than the first position, and is disposed between the first position and second position when seen from the outside of the lateral bezel structure; a first wireless communication circuit which is electrically connected in a second position and transmits and receives a first signal having a first frequency, and is electrically connected in a third position of the second conductive part and transmits and receives a second signal having a second frequency; a second conductive pattern which is disposed between the second position and third position when seen from the outside of a lateral member, and is electrically connected to the ground layer; and a second wireless communication circuit which is electrically connected in the second position and receives a third signal having a third frequency, and is electrically connected in the third position and receives a fourth signal having a fourth frequency. Various other embodiments may be possible.





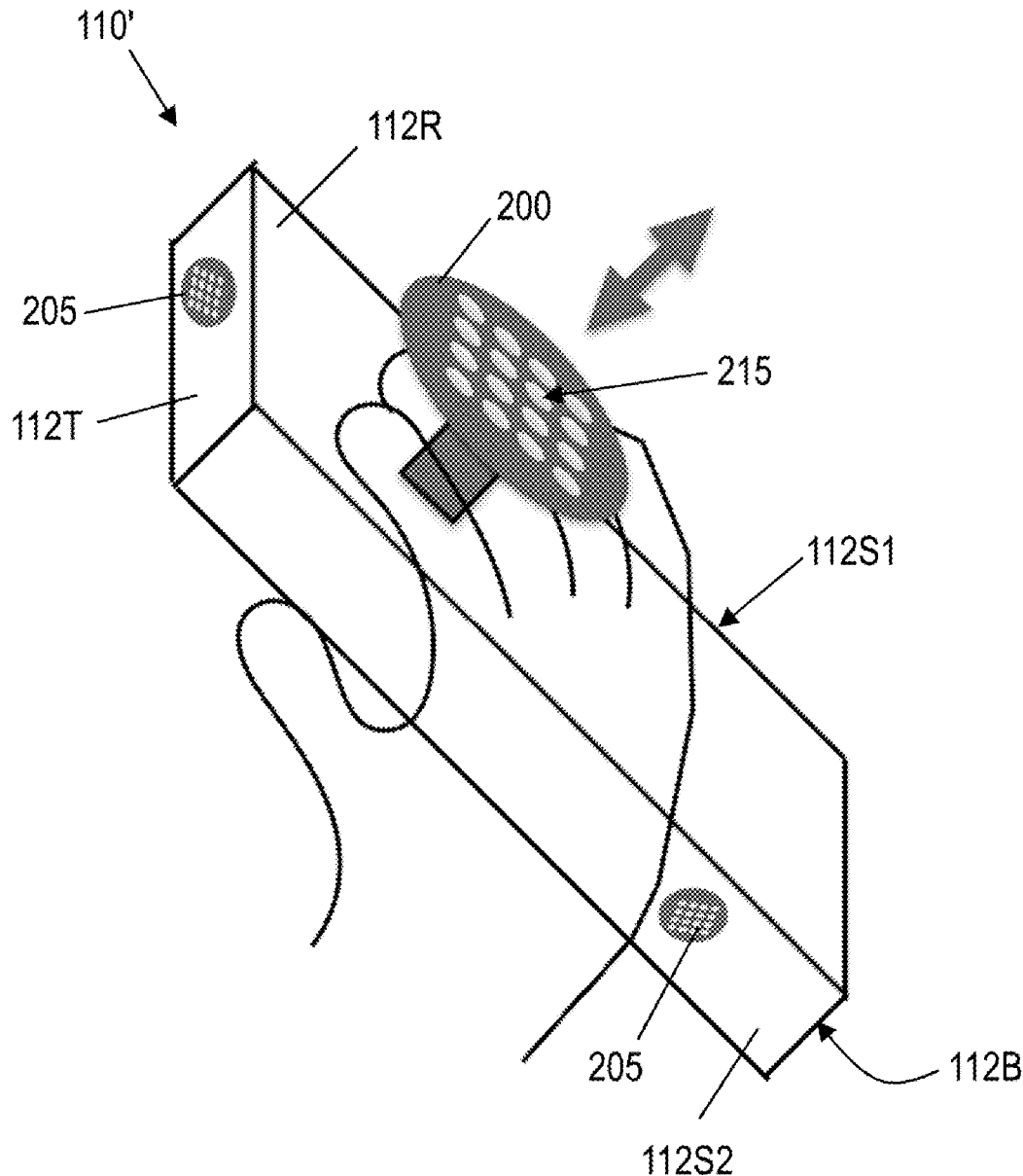
US 20220052441A1

(19) **United States**(12) **Patent Application Publication**
Woods, JR.(10) **Pub. No.: US 2022/0052441 A1**(43) **Pub. Date: Feb. 17, 2022**(54) **MOBILE DEVICE CASE WITH PHASED
ARRAY ANTENNA SYSTEM**(52) **U.S. Cl.**CPC *H01Q 1/244* (2013.01); *H01Q 3/36*
(2013.01); *H01Q 1/103* (2013.01)(71) Applicant: **GlaiveRF, Inc.**, Burlington, MA (US)(72) Inventor: **Wayne H. Woods, JR.**, Burlington,
MA (US)(21) Appl. No.: **16/993,634**(22) Filed: **Aug. 14, 2020****Publication Classification**(51) **Int. Cl.***H01Q 1/24* (2006.01)*H01Q 1/10* (2006.01)*H01Q 3/36* (2006.01)

(57)

ABSTRACT

A case for an electronic device includes: a body configured to receive the electronic device; a connector configured to connect to a port of the electronic device; and an extendable phased array antenna structure integrated with the body and moveable relative to the body between a retracted position and an extended position. The extendable phased array antenna structure comprises an array of antenna elements that are configured to form a beam in a determined direction, the antenna elements being operatively connected to the connector by circuitry in the case.





US 20220052442A1

(19) **United States**(12) **Patent Application Publication****Varnoosfaderani et al.**(10) **Pub. No.: US 2022/0052442 A1**(43) **Pub. Date: Feb. 17, 2022**

(54) **MULTI-BAND BASE STATION ANTENNAS
HAVING CROSSED-DIPOLE RADIATING
ELEMENTS WITH GENERALLY OVAL OR
RECTANGULARLY SHAPED DIPOLE ARMS
AND/OR COMMON MODE RESONANCE
REDUCTION FILTERS**

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

(72) Inventors: **Mohammad Vatankhah**
Varnoosfaderani, Sydney (AU);
Zhonghao Hu, Westmead (AU); **Ozgur**
Isik, Wentworth Point (AU)

(21) Appl. No.: **17/511,875**

(22) Filed: **Oct. 27, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/943,584, filed on Jul. 30, 2020, which is a continuation of application No. 15/897,388, filed on Feb. 15, 2018, now Pat. No. 10,770,803.

(60) Provisional application No. 62/500,607, filed on May 3, 2017.

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 21/26 (2006.01)

H01Q 21/06 (2006.01)

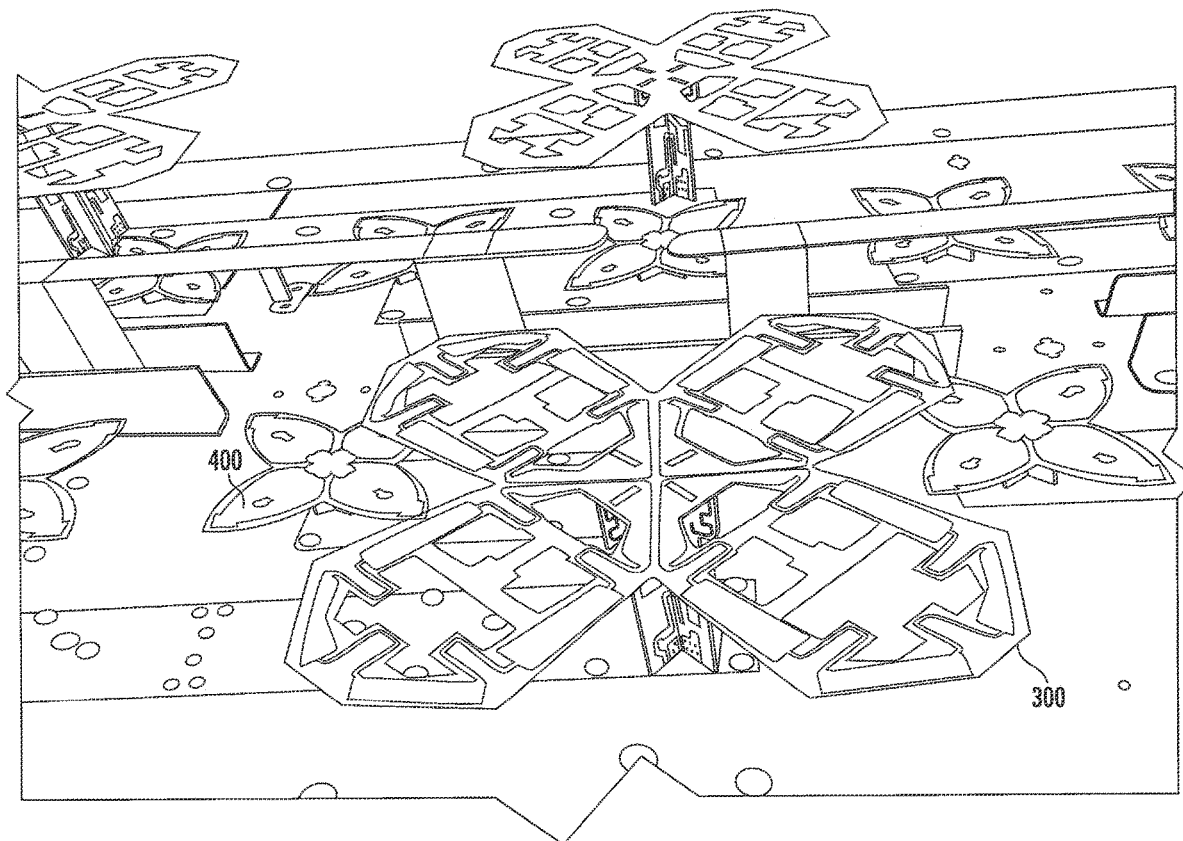
(52) **U.S. Cl.**

CPC **H01Q 1/246** (2013.01); **H01Q 21/26**
(2013.01); **H01Q 5/48** (2015.01); **H01Q**
21/065 (2013.01); **H01Q 21/062** (2013.01)

(57)

ABSTRACT

A dual-polarized radiating element for a base station antenna includes a first dipole that extends along a first axis, the first dipole including a first dipole arm and a second dipole arm and a second dipole that extends along a second axis, the second dipole including a third dipole arm and a fourth dipole arm and the second axis being generally perpendicular to the first axis, where each of the first through fourth dipole arms has first and second spaced-apart conductive segments that together form a generally oval shape.





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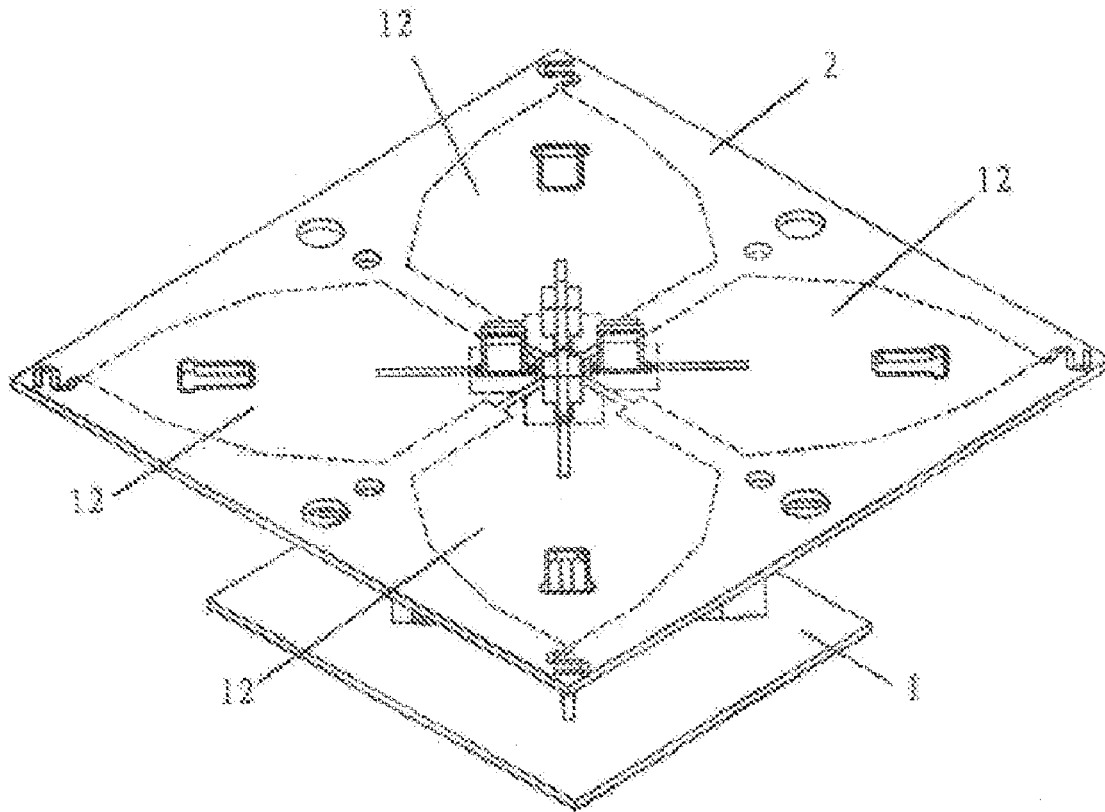
(19) **United States**(12) **Patent Application Publication****Wu et al.**(10) **Pub. No.: US 2022/0052443 A1**(43) **Pub. Date: Feb. 17, 2022**(54) **RADIATOR ASSEMBLY FOR BASE STATION ANTENNA****Publication Classification**(71) Applicant: **CommScope Technologies LLC**,
Hickory, NC (US)(72) Inventors: **Bo Wu**, Suzhou (CN); **PuLiang Tang**,
Suzhou (CN); **Ruixin Su**, Suzhou (CN);
YueMin Li, Suzhou (CN); **Hangsheng**
Wen, Suzhou (CN); **Ligang Wu**,
Suzhou (CN)(51) **Int. Cl.****H01Q 1/24** (2006.01)**H01Q 21/06** (2006.01)**H01Q 21/26** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/246** (2013.01); **H01Q 21/062**
(2013.01); **H01Q 9/28** (2013.01); **H01Q 1/24**
(2013.01); **H01Q 21/26** (2013.01)(21) Appl. No.: **17/512,836**(22) Filed: **Oct. 28, 2021****Related U.S. Application Data**(63) Continuation of application No. 16/860,249, filed on
Apr. 28, 2020, now Pat. No. 11,177,559.(30) **Foreign Application Priority Data**

May 8, 2019 (CN) 201910377664.2

(57)

ABSTRACT

A radiator assembly for a base station antenna has a central axis and two dipoles arranged in a crossed manner, where each of the dipoles includes two dipole arms, and each of the dipole arms have a radiating surface which has an outer contour. The radiator assembly comprises an electrically conductive annular element that mounted above the radiating surfaces. The annular element is configured to be closed circumferentially and has an inner contour which is compliant to an outer contour line of the combination of all four radiating surfaces.





US 20220052451A1

(19) **United States**(12) **Patent Application Publication**
YONG et al.(10) **Pub. No.: US 2022/0052451 A1**(43) **Pub. Date: Feb. 17, 2022**(54) **ULTRA-WIDEBAND ANTENNA FOR
REVERSIBLE ELECTRONIC DEVICE**(71) Applicant: **Shanghai Amphenol Airwave
Communication Electronics Co., Ltd,**
Shanghai (CN)(72) Inventors: **Checkchin YONG**, Shanghai (CN);
Hongliang GU, Shanghai (CN); **Jin
SHANG**, Shanghai (CN)(73) Assignee: **Shanghai Amphenol Airwave
Communication Electronics Co., Ltd,**
Shanghai (CN)(21) Appl. No.: **17/219,917**(22) Filed: **Apr. 1, 2021**(30) **Foreign Application Priority Data**

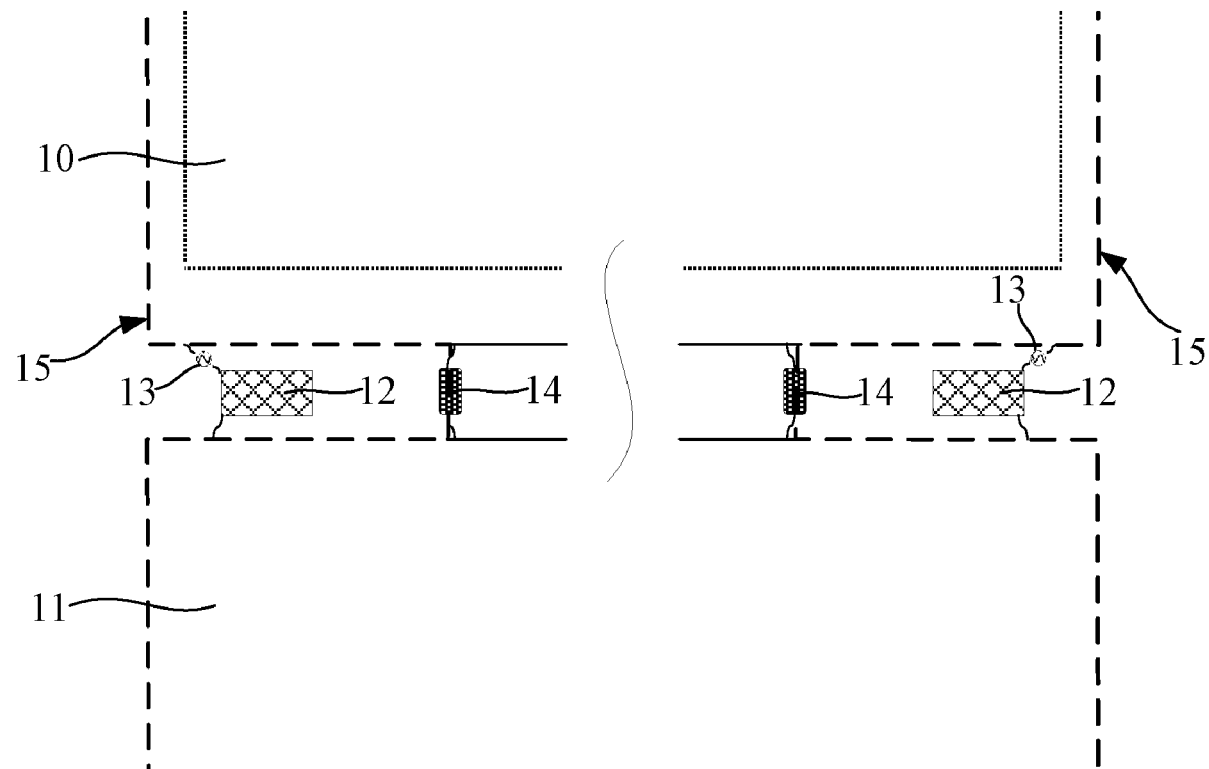
Aug. 14, 2020 (CN) 2020108203669

Publication Classification(51) **Int. Cl.****H01Q 5/25** (2006.01)**H01Q 1/22** (2006.01)**H01Q 13/10** (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/25** (2015.01); **H01Q 13/10**
(2013.01); **H01Q 1/2258** (2013.01)

(57)

ABSTRACT

The present disclosure provides an ultra-wideband antenna for a reversible electronic device in a narrow space including: an upper half and a lower half; a hinge connected with the upper half and the lower half; a first RF signal source, loaded on the hinge; an electrical connection structure, placed on one side of the first RF signal source and electrically connected with the upper half and the lower half; a gapped groove, extending inwardly to the electrical connection structure along the outer side of the upper half and the outer side of the lower half; the hinge is spanned on the gapped groove; the hinge excites the gapped groove to form a first ultra-wideband antenna. While realizing the ultra-wideband antennas, it can also integrate with other multiple antennas, and their isolations are better than -10 dB, which basically meets the antenna performance requirements.





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(19) **United States**(12) **Patent Application Publication**
SAMPO(10) **Pub. No.: US 2022/0052456 A1**(43) **Pub. Date: Feb. 17, 2022**(54) **SLOTTED PATCH ANTENNA****H01Q 1/28** (2006.01)**H01Q 13/10** (2006.01)(71) Applicant: **YOKOWO CO., LTD.**, Tokyo (JP)(52) **U.S. Cl.**(72) Inventor: **Takeshi SAMPO**, Tomioka-Shi (JP)CPC **H01Q 9/0435** (2013.01); **H01Q 13/10**
(2013.01); **H01Q 1/288** (2013.01); **H01Q 5/35**
(2015.01)(73) Assignee: **YOKOWO CO., LTD.**, Tokyo (JP)(21) Appl. No.: **17/511,585**

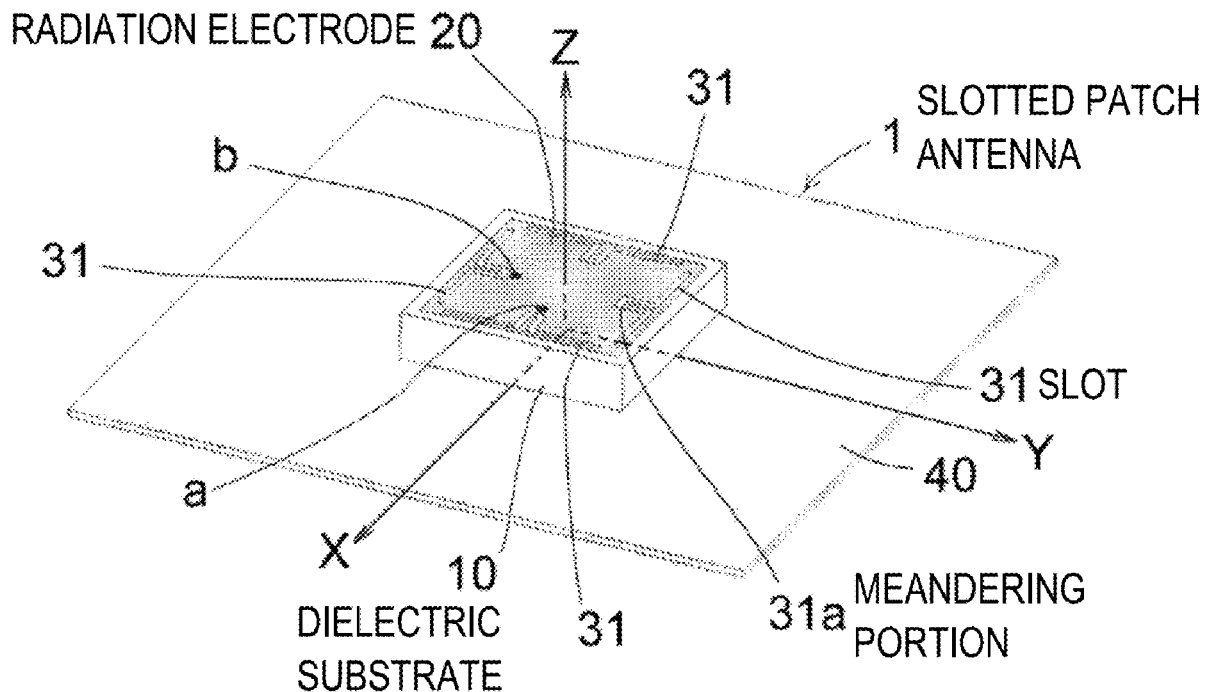
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ABSTRACT(22) Filed: **Oct. 27, 2021****Related U.S. Application Data**(63) Continuation of application No. 16/491,776, filed on
Sep. 6, 2019, filed as application No. PCT/JP2018/
008168 on Mar. 2, 2018.**Foreign Application Priority Data**

Mar. 8, 2017 (JP) 2017-043786

Publication Classification(51) **Int. Cl.****H01Q 9/04** (2006.01)**H01Q 5/35** (2006.01)

A slotted patch antenna includes a dielectric substrate, a radiation electrode which is provided on a major surface of the dielectric substrate, and a ground conductor which is disposed on a surface that is opposite to the major surface. The radiation electrode is formed with a slots having at least one of a meandering portion, a curve portion, or a folded portion. An external shape of the radiation electrode is a square, and totally two pairs of slots are formed inside the square, each of the slots being along respective sides of the square. Each of the slots is arranged so as to be line-symmetrical with respect to an axis of symmetry that is parallel with one of the sides of the square and passes through a center of the square, and to be point-symmetrical with respect to the center of the square.





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(19) **United States**

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

(10) **Pub. No.: US 2022/0052461 A1**

(43) **Pub. Date: Feb. 17, 2022**

(54) **DUAL BAND OMNIDIRECTIONAL
ANTENNA**

H01Q 5/307 (2006.01)

H01Q 21/08 (2006.01)

(71) Applicant: **UTC Fire & Security EMEA BVBA**,
Diegem (BE)

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

CPC *H01Q 21/20* (2013.01); *H01Q 21/08*
(2013.01); *H01Q 5/307* (2015.01); *H01Q 1/48*
(2013.01)

(72) Inventors: **Mateusz Mazur**, Sopot (PL); **Marat
Patotski**, Gdańsk (PL)

(21) Appl. No.: **17/117,470**

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

Related U.S. Application Data

(60) Provisional application No. 63/066,336, filed on Aug.
17, 2020.

Publication Classification

(51) **Int. Cl.**

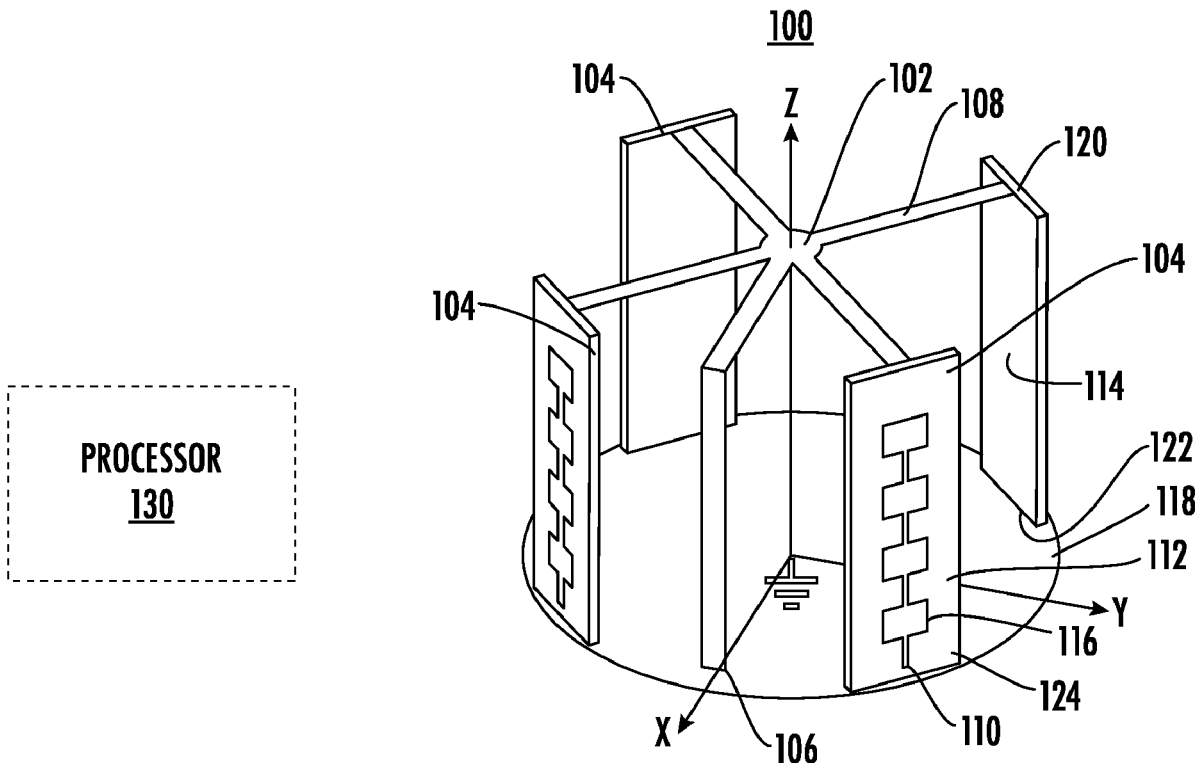
H01Q 21/20 (2006.01)

H01Q 1/48 (2006.01)

(57)

ABSTRACT

Provided are embodiments for a system and a method for operating an omnidirectional antenna. Embodiments include operating a first antenna that includes a first input configured to receive an input signal, a plurality of subarrays configured for transmitting and receiving signals, and a ground plane of the first antenna. Embodiments also include operating a second antenna coupled to the first antenna that includes a second input configured to receive an input signal, a plurality of arms configured for transmitting and receiving signals, a ground plane of the second antenna, and coupling the ground plane of the first antenna and the ground plane of a second antenna.



(19) **United States**

(12) **Patent Application Publication**
ANGUERA PROS et al.

(10) **Pub. No.: US 2022/0059927 A1**

(43) **Pub. Date: Feb. 24, 2022**

(54) **WIRELESS DEVICE INCLUDING A MULTIBAND ANTENNA SYSTEM**

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

(72) Inventors: **Jaume ANGUERA PROS**, Castellon (ES); **Ivan SANZ**, Barcelona (ES); **Carles PUENTE BALIARDA**, Barcelona (ES); **Josep MUMBRU**, Asnières-sur-Seine (FR)

(21) Appl. No.: **17/461,394**

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

Related U.S. Application Data

(63) Continuation of application No. 16/597,531, filed on Oct. 9, 2019, now Pat. No. 11,145,955, which is a continuation of application No. 15/331,390, filed on Oct. 21, 2016, now Pat. No. 10,476,134, which is a continuation of application No. 14/807,302, filed on Jul. 23, 2015, now abandoned, which is a continuation of application No. 12/593,290, filed on Sep. 26, 2009, now Pat. No. 9,130,267, filed as application No. PCT/EP2008/053526 on Mar. 26, 2008.

(60) Provisional application No. 60/910,113, filed on Apr. 4, 2007.

Foreign Application Priority Data

Mar. 30, 2007 (EP) 07105364.9

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)
H01Q 5/335 (2006.01)
H01Q 5/50 (2006.01)
H01Q 1/36 (2006.01)
H01Q 5/00 (2006.01)
H01Q 21/30 (2006.01)
H01Q 1/48 (2006.01)

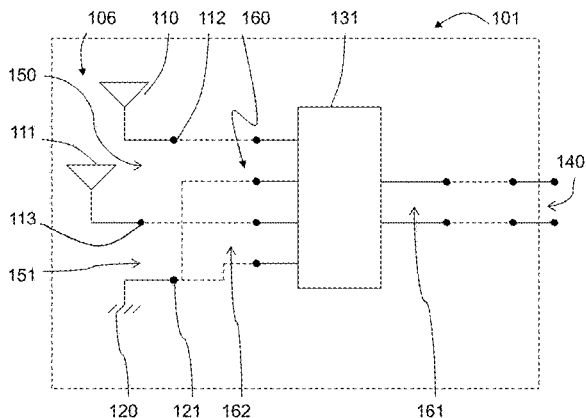
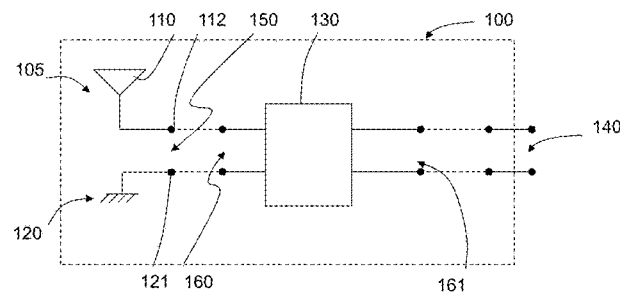
(52) **U.S. Cl.**

CPC **H01Q 1/243** (2013.01); **H01Q 5/335** (2015.01); **H01Q 5/50** (2015.01); **H01Q 1/48** (2013.01); **H01Q 5/00** (2013.01); **H01Q 21/30** (2013.01); **H01Q 1/36** (2013.01)

(57)

ABSTRACT

A wireless handheld or portable device includes an antenna system operable in a first frequency region and a higher, second frequency region. The antenna system comprises an antenna structure, a matching and tuning system, and an external input/output (I/O) port. The antenna structure comprises at least one radiating element including a connection point, a ground plane layer including at least one connection point, and at least one internal I/O port. At least one radiating element of the antenna structure protrudes beyond the ground plane layer. The antenna structure features at any of its internal I/O ports when disconnected from the matching and tuning system an input return loss curve having a minimum at a frequency outside the first frequency region of the antenna system. The matching and tuning system modifies the impedance of the antenna structure and provides impedance matching to the antenna system in the first and second regions.





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(19) **United States**(12) **Patent Application Publication**
Leutheuser et al.(10) **Pub. No.: US 2022/0059928 A1**(43) **Pub. Date: Feb. 24, 2022**(54) **HOUSING AND ANTENNA ARCHITECTURE
FOR MOBILE DEVICE****Publication Classification**(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Paul U. Leutheuser**, Saratoga, CA (US); **Martin J. Auclair**, Campbell, CA (US); **Kevin M. Froese**, San Francisco, CA (US); **Christopher J. Durning**, Cupertino, CA (US); **Jun Ham**, Cupertino, CA (US); **Lucy E. Browning**, San Francisco, CA (US); **Sawyer I. Cohen**, Menlo Park, CA (US); **Richard Hung Minh Dinh**, Cupertino, CA (US); **Donald J. Parr**, Mountain View, CA (US)(51) **Int. Cl.****H01Q 1/24** (2006.01)**H01Q 5/30** (2006.01)**H01Q 13/10** (2006.01)**H04M 1/02** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/243** (2013.01); **H01Q 5/30** (2015.01); **H04M 1/0283** (2013.01); **H04M 1/0249** (2013.01); **H01Q 13/10** (2013.01)

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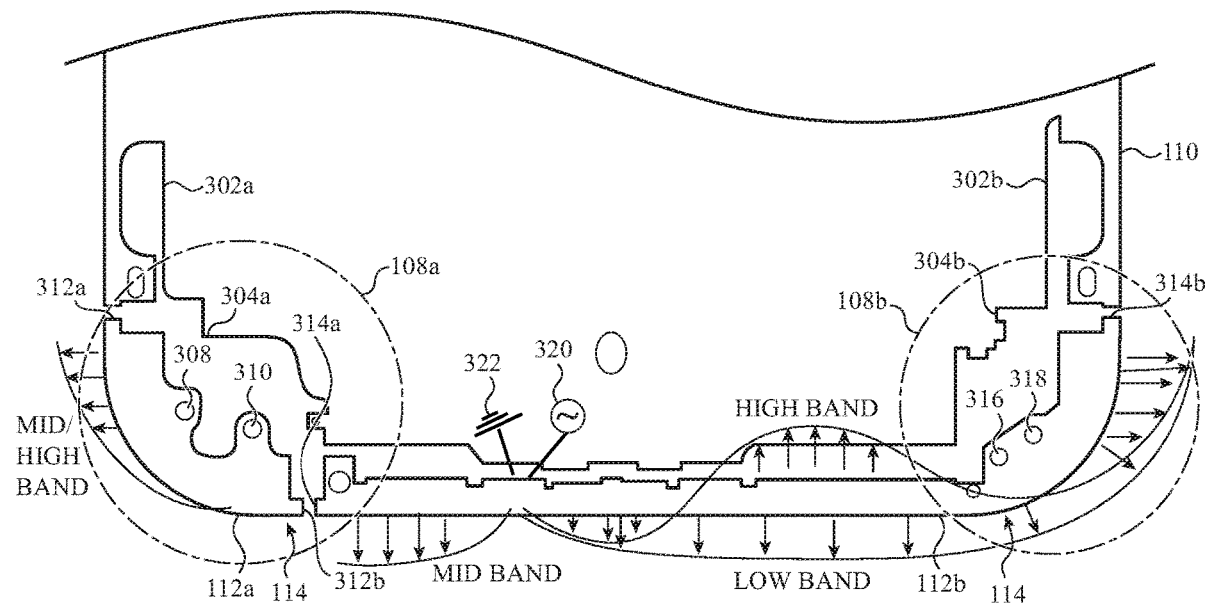
ABSTRACT

A device includes a display and a housing. The housing at least partially surrounds the display. The housing includes a first housing segment defining at least a first portion of an exterior surface of the device and a first interlock feature having an interlock surface that is offset with respect to an end surface of the first housing segment. The first interlock feature has a first opening formed in the interlock surface. The housing further includes a second housing segment defining at least a second portion of the exterior surface of the device and a second interlock feature having a second opening aligned with the first opening, and a non-conductive housing component defining a third portion of the exterior surface of the device and extending into the first opening and the second opening.

(21) Appl. No.: **17/480,287**(22) Filed: **Sep. 21, 2021****Related U.S. Application Data**

(63) Continuation of application No. 16/142,352, filed on Sep. 26, 2018, now Pat. No. 11,189,909.

(60) Provisional application No. 62/725,237, filed on Aug. 30, 2018.





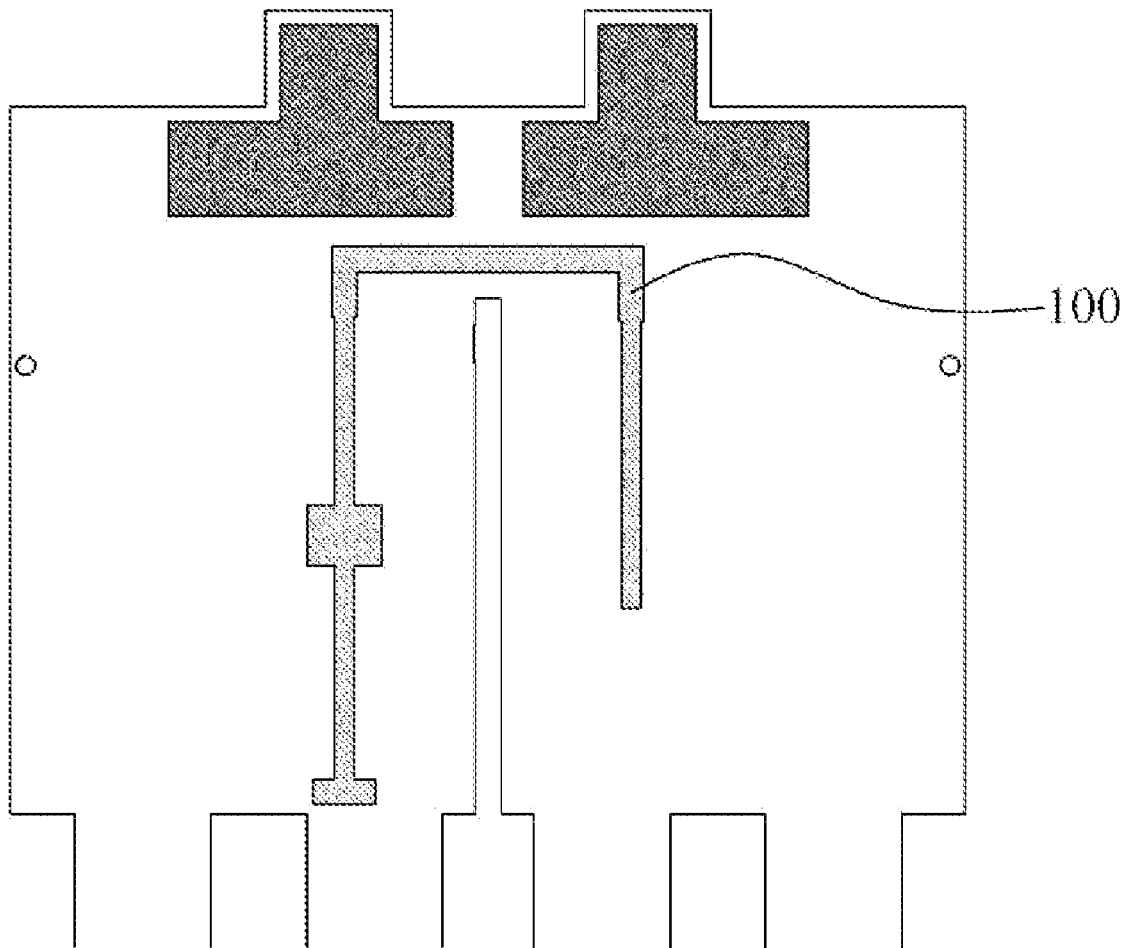
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(19) **United States**(12) **Patent Application Publication**
ENKHBAYAR et al.(10) **Pub. No.: US 2022/0059929 A1**(43) **Pub. Date: Feb. 24, 2022**(54) **BASE STATION ANTENNA RADIATOR
HAVING FUNCTION FOR SUPPRESSING
UNWANTED RESONANCES****Publication Classification**(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/246** (2013.01); **H01Q 9/0457**
(2013.01)(71) Applicant: **ACE TECHNOLOGIES
CORPORATION**, Incheon (KR)(72) Inventors: **Bayanmunkh ENKHBAYAR**, Incheon
(KR); **Ho-Yong KIM**, Incheon (KR);
Eun Hyuk KWAK, Incheon (KR); **Jae
Hoon TAE**, Incheon (KR)(73) Assignee: **ACE TECHNOLOGIES
CORPORATION**(21) Appl. No.: **17/521,365**(22) Filed: **Nov. 8, 2021****Related U.S. Application Data**(63) Continuation of application No. PCT/KR2020/
006013, filed on May 7, 2020.(30) **Foreign Application Priority Data**

May 10, 2019 (KR) 10-2019-0054729

(57) **ABSTRACT**

A base station antenna radiator comprises: a first balun substrate, on an upper surface of which a feed line, a first C-coupling member, and a first inductive filter line connected to the first C-coupling member, and on a lower surface of which a third C-coupling member opposite to the first C-coupling member and a third inductive filter line electrically connected to the first inductive filter line through a first via hole and connected to the third C-coupling member are formed, the first balun substrate being placed perpendicular to a reflector; a second balun substrate coupled orthogonally to the first balun substrate, and on which a metal pattern substantially identical to that of the first balun substrate is formed; and a radiating substrate disposed above the first and second balun substrates, placed parallel to the reflector, and on an upper surface of which at least one radiating patch is formed.





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(19) **United States**

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

(10) **Pub. No.: US 2022/0059931 A1**

(43) **Pub. Date: Feb. 24, 2022**

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

H01Q 9/42 (2006.01)

H01Q 5/371 (2006.01)

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

(52) **U.S. Cl.**
CPC **H01Q 1/36** (2013.01); **H01Q 5/371** (2015.01); **H01Q 9/42** (2013.01); **H01Q 13/24** (2013.01)

(72) Inventors: **JIA-YING XIE**, New Taipei (TW); **JIA-HUNG HSIAO**, New Taipei (TW); **CHIH-WEI LIAO**, New Taipei (TW)

(57) **ABSTRACT**

An antenna structure includes a frame portion and a feeding portion. The frame portion is provided with a first gap and a second gap. The first gap and the second gap penetrate and divide the frame portion into a first radiating portion, a second radiating portion, and a third radiating portion. The feeding portion is arranged on the first radiating portion adjacent to the second gap. One end of the feeding portion is electrically coupled to the first radiating portion, and the other end of the feeding portion is electrically coupled to a feeding point to feed current to the first radiating portion. The second radiating portion and/or the third radiating portion is provided with a side slot. A radiation frequency band of the second radiating portion and/or the third radiating portion where the side slot is located is adjusted by adjusting the length of the side slot.

(21) Appl. No.: **17/029,363**

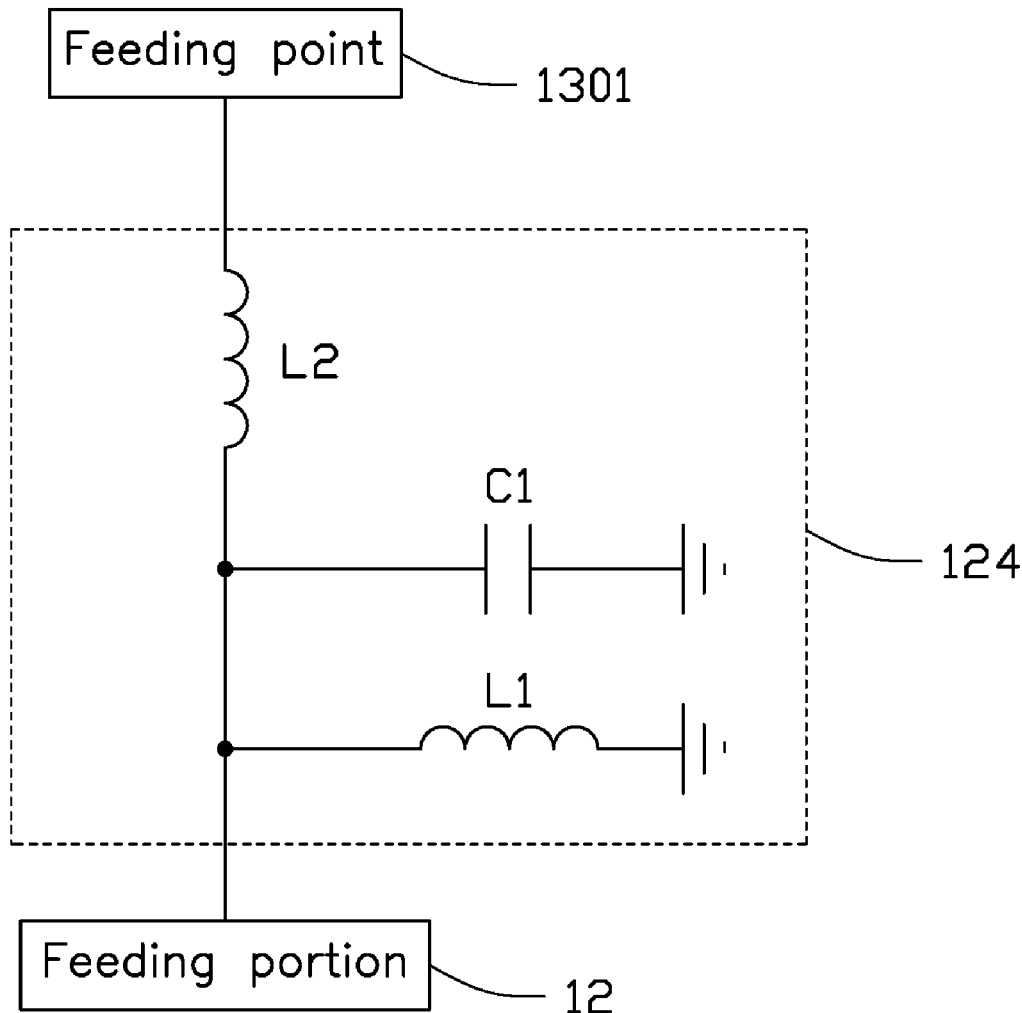
(22) Filed: **Sep. 23, 2020**

(30) **Foreign Application Priority Data**

Aug. 19, 2020 (CN) 202010839001.0

Publication Classification

(51) **Int. Cl.**
H01Q 1/36 (2006.01)
H01Q 13/24 (2006.01)





US 20220059940A1

(19) **United States**(12) **Patent Application Publication**
Pajona et al.(10) **Pub. No.: US 2022/0059940 A1**(43) **Pub. Date: Feb. 24, 2022**(54) **ANTENNA-LIKE MATCHING COMPONENT**(71) Applicant: **Ethertronics, Inc.**, San Diego, CA (US)(72) Inventors: **Olivier Pajona**, Nice (FR); **Sebastian Rowson**, San Diego, CA (US); **Laurent Desclos**, San Diego, CA (US)(21) Appl. No.: **17/521,271**(22) Filed: **Nov. 8, 2021**

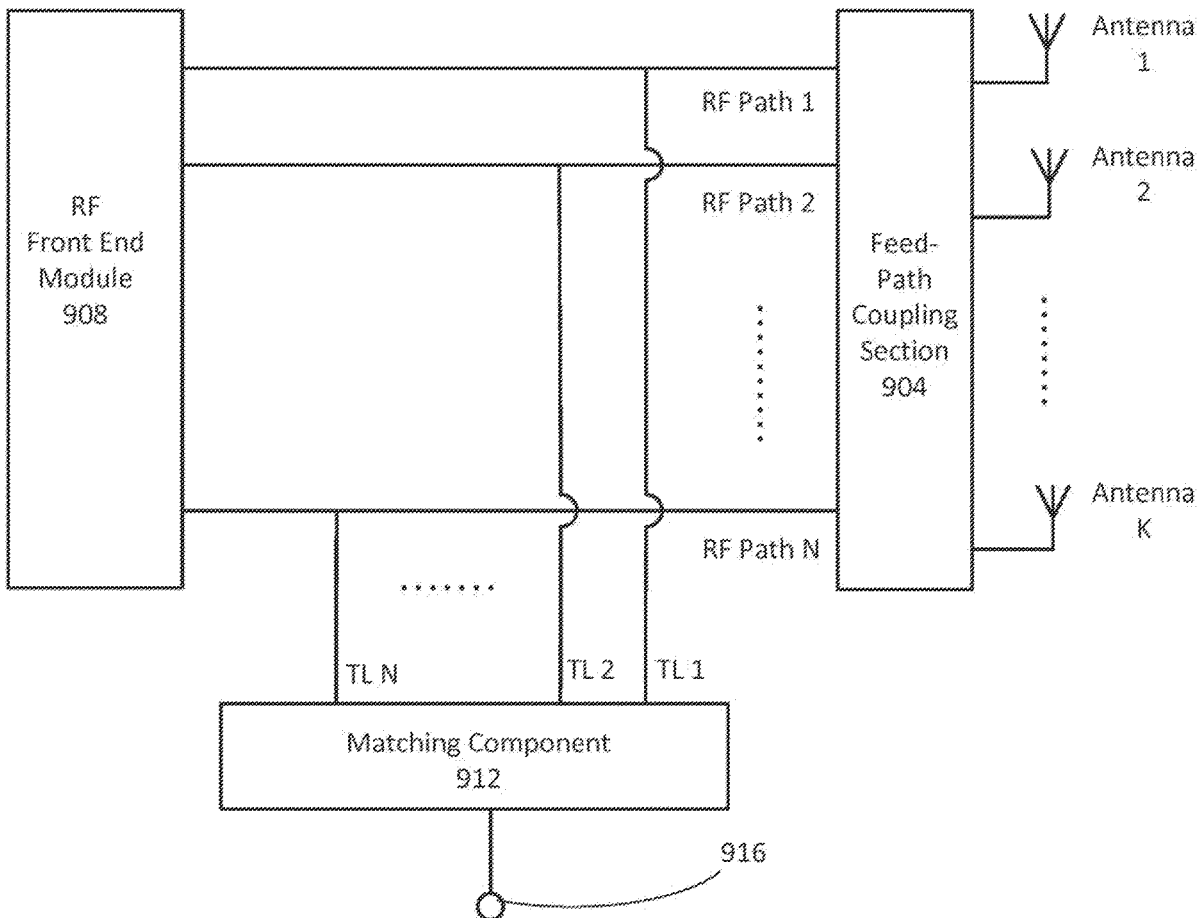
(60) Provisional application No. 61/838,555, filed on Jun. 24, 2013, provisional application No. 61/785,405, filed on Mar. 14, 2013.

Publication Classification(51) **Int. Cl.**
H01Q 9/36 (2006.01)**H01Q 5/50** (2006.01)(52) **U.S. Cl.**
CPC **H01Q 9/36** (2013.01); **H01Q 5/50** (2015.01)**Related U.S. Application Data**

(63) Continuation of application No. 16/437,531, filed on Jun. 11, 2019, now Pat. No. 11,171,422, which is a continuation of application No. 15/862,553, filed on Jan. 4, 2018, now Pat. No. 10,355,363, which is a continuation of application No. 14/213,959, filed on Mar. 14, 2014, now Pat. No. 9,893,427.

(57) **ABSTRACT**

An antenna-like matching component is provided, comprising one or more conductive portions formed on a substrate. Shapes and dimensions of the one or more conductive portions are determined to provide impedance matching for one or more antennas coupled to the matching component.





US 20220059943A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0059943 A1**

(43) **Pub. Date: Feb. 24, 2022**

(54) **MULTI-LAYER RECONFIGURABLE
SURFACE FOR AN ANTENNA**

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

(72) Inventors: **Sandy Saab**, Austin, TX (US);
Mohammed Reza Hashemi, Allen, TX
(US); **Shadi Abu-Surra**, Plano, TX
(US); **Gang Xu**, Allen, TX (US)

(21) Appl. No.: **17/384,684**

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

Related U.S. Application Data

(60) Provisional application No. 63/066,956, filed on Aug.
18, 2020.

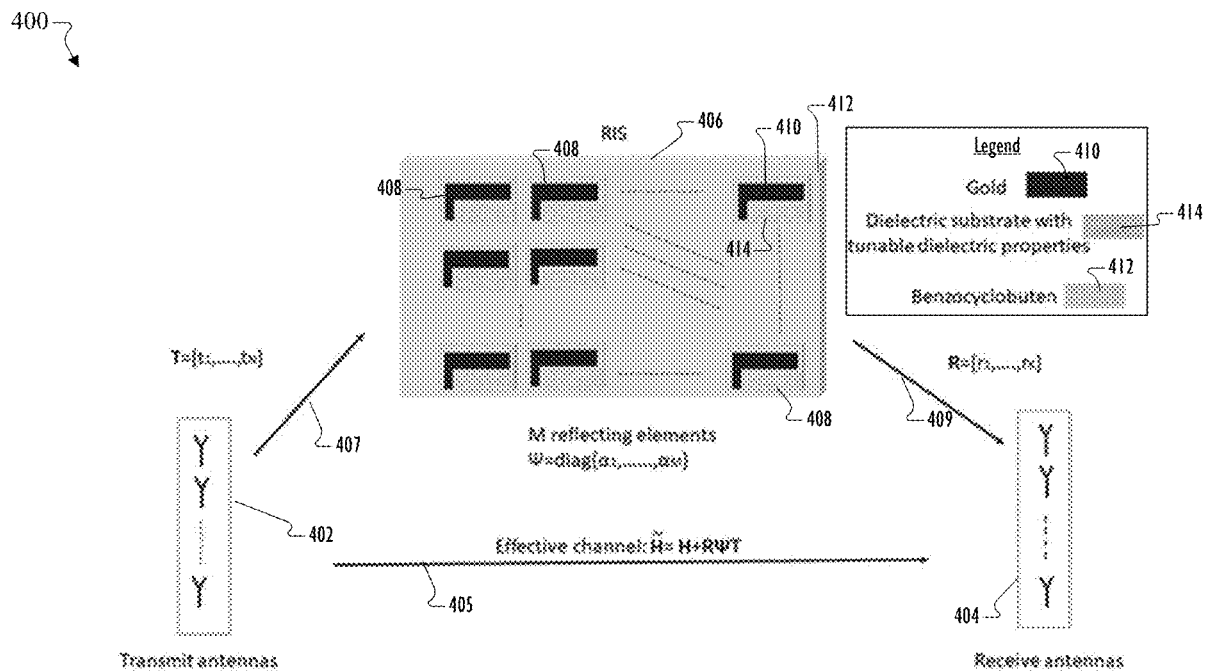
Publication Classification

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

(52) **U.S. Cl.**
CPC **H01Q 15/148** (2013.01)

(57) **ABSTRACT**

A multi-layer reconfigurable reflective intelligent surface (RIS). The RIS includes a unit-cell of a reconfigurable intelligent surface. The unit-cell includes a first layer composed of a conductive material and structured according to a sub-wavelength reflective pattern. The first layer reflects an impinging wave at a predetermined phase and steers the reflected impinging wave toward an intended receiver. The unit-cell includes a second layer composed of a first dielectric substrate material. Between the first and second layers, the unit-cell includes a middle layer composed of a second dielectric material having tunable dielectric properties. Tuning a dielectric constant of the second dielectric material modifies the predetermined phase of reflection of the impinging wave.





US 20220061175A1

(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2022/0061175 A1**
OH et al. (43) **Pub. Date: Feb. 24, 2022**(54) **ANTENNA AND ELECTRONIC DEVICE INCLUDING SAME**(52) **U.S. Cl.**CPC **H05K 5/0226** (2013.01); **H04B 1/40** (2013.01); **H05K 5/03** (2013.01); **H05K 5/0017** (2013.01)(71) Applicant: **Samsung Electronics Co., Ltd.**,
Suwon-si, Gyeonggi-do (KR)(57) **ABSTRACT**(72) Inventors: **Myeongsu OH**, Suwon-si (KR);
Yongyoun KIM, Suwon-si (KR);
Jaesung SHIM, Suwon-si (KR); **Hojin JUNG**, Suwon-si (KR); **Duho CHU**,
Suwon-si (KR)

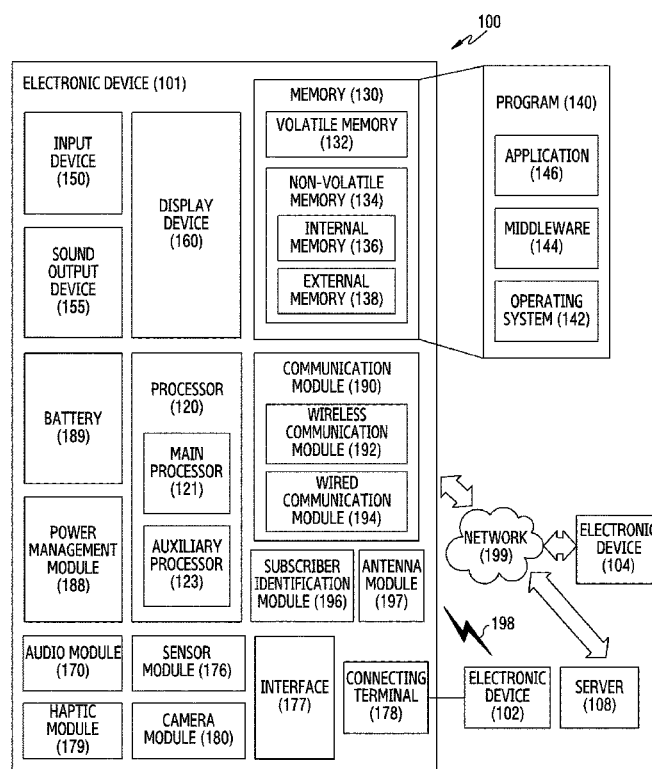
According to an embodiment of the present invention, an electronic device may include: a foldable housing including a hinge structure, a first housing structure, and a second housing structure, wherein the hinge structure includes at least one first conductive portion, the first housing structure is connected to the hinge structure and includes a first surface oriented in a first direction, a second surface oriented in a second direction opposite the first direction, and a first side member surrounding at least a part of a space between the first surface and the second surface and including at least one second conductive portion, the second housing structure is connected to the hinge structure, includes a third surface oriented in a third direction, a fourth surface oriented in a fourth direction opposite the third direction, and a second side member surrounding at least a part of a space between the third surface and the fourth surface, and is folded onto the first housing structure about the hinge structure, the first surface faces the third surface in a folded state of the foldable housing, and the third direction is identical to the first direction in an unfolded state of the foldable housing; a flexible display extending from the first surface to the third surface; and a wireless communication circuit electrically connected to the first conductive portion in the folded state of the foldable housing, and electrically connected to the second conductive portion in the unfolded state of the foldable housing, wherein the wireless communication circuit is configured to transmit and/or receive a signal having a selected frequency. Various other embodiments may be possible.

(21) Appl. No.: **17/413,279**(22) PCT Filed: **Dec. 11, 2019**(86) PCT No.: **PCT/KR2019/017498**

§ 371 (c)(1),

(2) Date: **Jun. 11, 2021**(30) **Foreign Application Priority Data**

Dec. 12, 2018 (KR) 10-2018-0160098

Publication Classification(51) **Int. Cl.****H05K 5/02** (2006.01)**H05K 5/00** (2006.01)**H05K 5/03** (2006.01)**H04B 1/40** (2006.01)



US 20220069019A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0069019 A1**

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

(54) **ELECTRONIC DEVICE**

H01L 51/52 (2006.01)

G06F 3/044 (2006.01)

(71) Applicant: **SAMSUNG DISPLAY CO., LTD.,**
YONGIN-SI (KR)

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

CPC **H01L 27/323** (2013.01); **H01Q 1/243**
(2013.01); **G06F 2203/04112** (2013.01); **G06F**
3/0446 (2019.05); **G06F 2203/04111**
(2013.01); **H01L 51/5237** (2013.01)

(72) Inventors: **JAЕ-KYOUNG KIM, HWASEONG-SI**
(KR); KISEO KIM, YONGIN-SI (KR);
WONSANG PARK, YONGIN-SI
(KR); BONGHYUN YOU, SEOUL
(KR)

(57)

ABSTRACT

(21) Appl. No.: **17/454,075**

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

Related U.S. Application Data

(63) Continuation of application No. 16/933,026, filed on
Jul. 20, 2020, now Pat. No. 11,169,644.

(30) **Foreign Application Priority Data**

Nov. 5, 2019 (KR) 10-2019-0140246

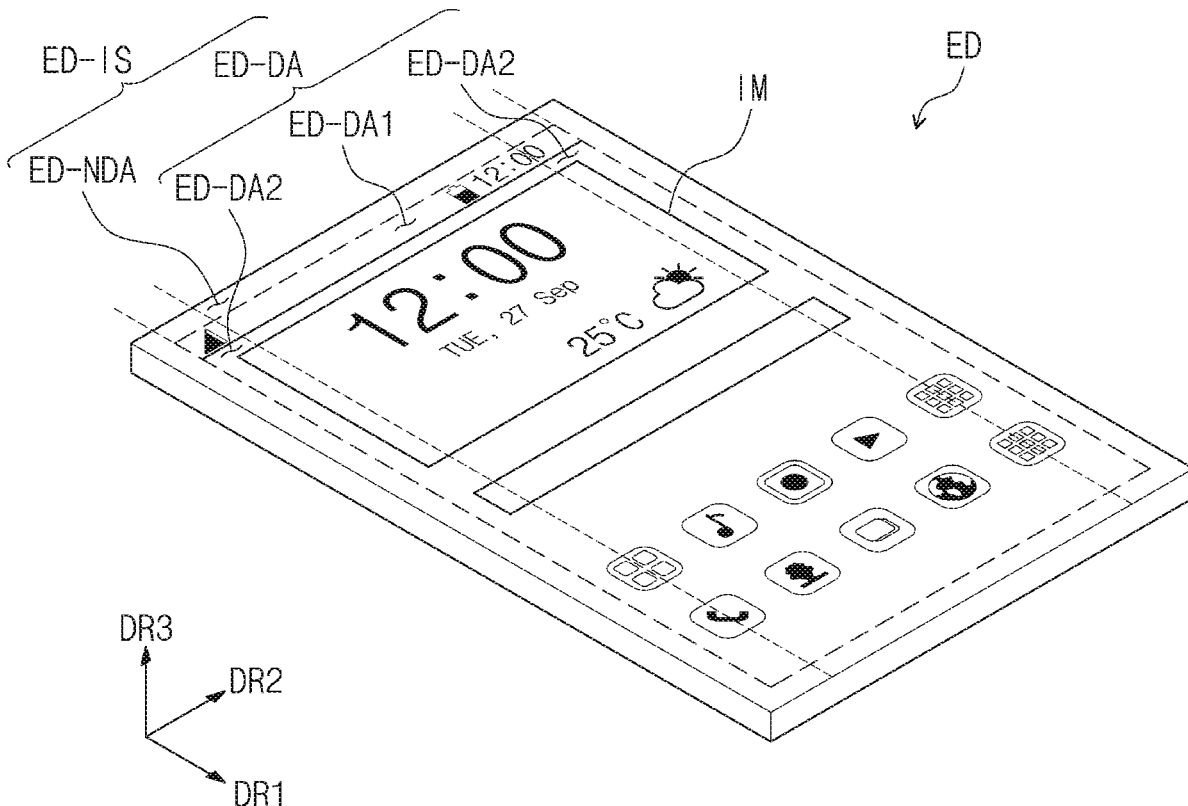
Publication Classification

(51) **Int. Cl.**

H01L 27/32 (2006.01)

H01Q 1/24 (2006.01)

An electronic device includes a display panel including a display region and a non-display region adjacent thereto, an input sensor overlapping a first region of the display region, and an antenna overlapping a second region of the display region. The input sensor includes a first sensing layer including a bridge pattern and a second sensing layer including sensor electrodes and disposed on a different layer from the first sensing layer. The bridge pattern connects two adjacent sensor electrodes. The antenna includes a first antenna layer including a first antenna with a first frequency band, the first antenna layer and the first sensing layer disposed on the same layer, and a second antenna layer including a second antenna with a second frequency band different from the first frequency band. The second antenna layer and the second sensing layer are disposed on the same layer.





US 20220069437A1

(19) **United States**(12) **Patent Application Publication**
YOO et al.(10) **Pub. No.: US 2022/0069437 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**(52) **U.S. Cl.**CPC **H01Q 1/2266** (2013.01); **G06F 1/1681** (2013.01)(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(72) Inventors: **Jangsun YOO**, Gyeonggi-do (KR);
Jingyu CHOI, Gyeonggi-do (KR);
Jongmyung KIM, Gyeonggi-do (KR);
Jihye MOON, Gyeonggi-do (KR);
Cheehwan YANG, Gyeonggi-do (KR);
Kwangyong LEE, Gyeonggi-do (KR);
Myeonggil LEE, Gyeonggi-do (KR);
Seungwoon LEE, Gyeonggi-do (KR)

(57)

ABSTRACT

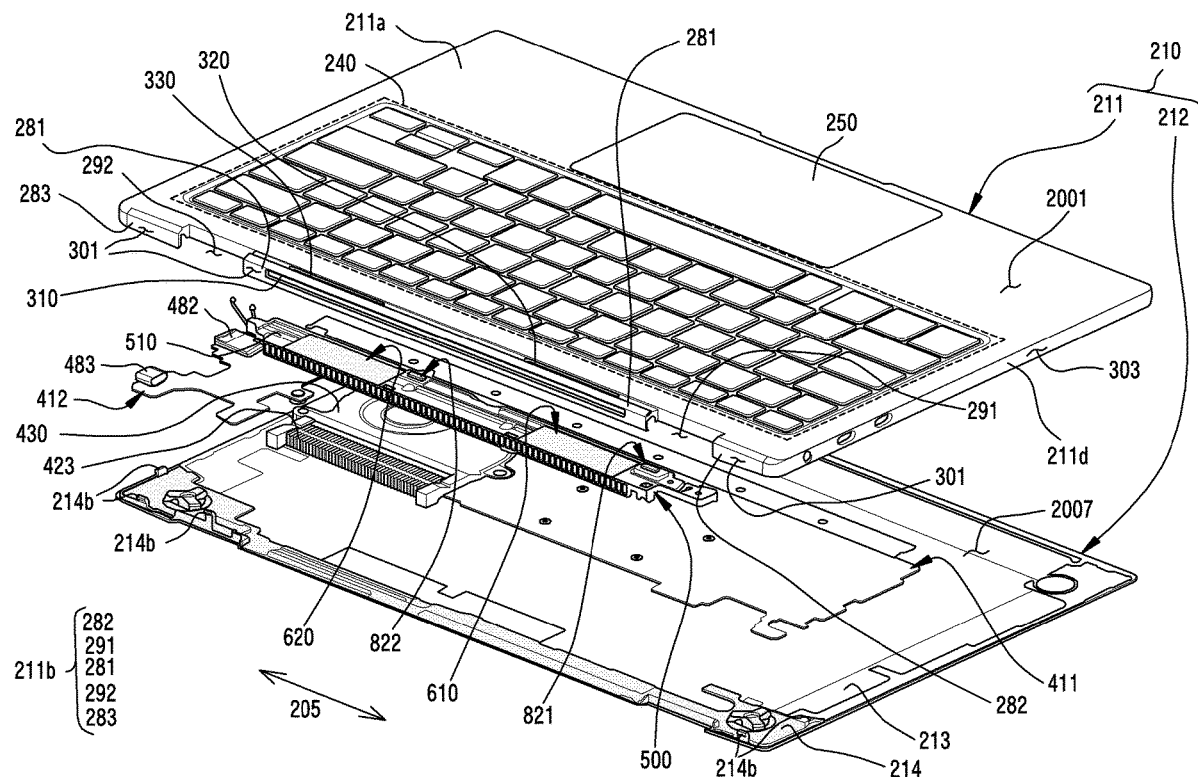
According to an embodiment, an electronic device may comprise: a first housing structure comprising a first surface facing in a first direction, a second surface facing in a second direction opposite to the first direction, a first side surface and a second side surface facing opposite to each other and surrounding at least a part of the space between the first surface and the second surface, and a third side surface and a fourth side surface facing opposite to each other while being perpendicular to the first side surface; a second housing structure comprising a third surface facing in a third direction, a fourth surface facing in a fourth direction opposite to the third direction, a fifth side surface and a sixth side surface facing opposite to each other and surrounding at least a part of the space between the third surface and the fourth surface, and a seventh side surface and an eighth side surface facing opposite to each other while being perpendicular to the fifth side surface; a hinge structure connecting between the first side surface and the fifth side surface; a display disposed along at least a part of the third surface; at least one antenna disposed near the first side surface inside the first housing structure; and at least one wireless communication module configured to transmit and/or receive a signal in a selected or designated frequency band through the at least one antenna. Various other embodiments may be possible.

(21) Appl. No.: **17/438,976**(22) PCT Filed: **Mar. 13, 2020**(86) PCT No.: **PCT/KR2020/003563**

§ 371 (c)(1),

(2) Date: **Sep. 14, 2021**(30) **Foreign Application Priority Data**

Mar. 15, 2019 (KR) 10-2019-0030140

Publication Classification(51) **Int. Cl.****H01Q 1/22** (2006.01)**G06F 1/16** (2006.01)



US 20220069440A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0069440 A1**

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

(54) **RADIO FREQUENCY DEVICE AND
ELECTRONIC DEVICE HAVING THE SAME**

(71) Applicants: **Samsung Display Co., Ltd.**, Yongin-si
(KR); **UNIST (ULSAN NATIONAL
INSTITUTE OF SCIENCE AND
TECHNOLOGY)**, Ulsan (KR)

(72) Inventors: **Gangil BYUN**, Ulsan (KR);
SANGROCK YOON, Osan-si (KR);
KISEO KIM, Yongin-si (KR);
Donghyee HWANG, Ulsan (KR)

(21) Appl. No.: **17/325,841**

(22) Filed: **May 20, 2021**

(30) **Foreign Application Priority Data**

Aug. 31, 2020 (KR) 10-2020-0110092

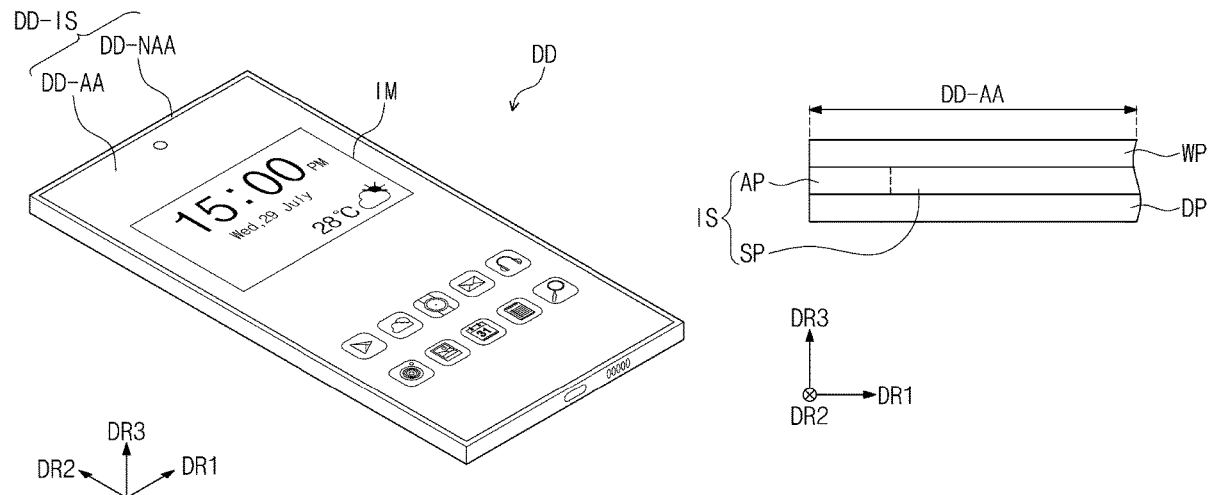
Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/44 (2006.01)

H01Q 9/04 (2006.01)
H01Q 5/35 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 5/35**
(2015.01); **H01Q 9/0407** (2013.01); **H01Q**
1/44 (2013.01)

(57) **ABSTRACT**

An electronic device includes a display panel including an antenna. The antenna includes a first antenna portion. A second antenna portion is spaced apart from the first antenna portion in a first direction. A plurality of intermediate antenna portions is disposed between the first antenna portion and the second antenna portion and is electrically connected to the first antenna portion and the second antenna portion. The first antenna portion includes a first pattern portion and a first line portion having a first width in a second direction crossing the first direction. The second antenna portion includes a second pattern portion and a second line portion having a second width in the second direction that is larger than the first width.





US 20220069441A1

(19) **United States**(12) **Patent Application Publication**
KIM et al.(10) **Pub. No.: US 2022/0069441 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ELECTRONIC DEVICE COMPRISING
ANTENNA MODULE**(52) **U.S. Cl.**CPC *H01Q 1/243* (2013.01); *H01Q 9/0407*
(2013.01); *H01Q 9/16* (2013.01); *H01Q 9/065*
(2013.01)(71) Applicants: **Samsung Electronics Co., Ltd.**,
Suwon-si, Gyeonggi-do (KR);
**POSTECH ACADEMY-INDUSTRY
FOUNDATION**, Pohang-si
Gyeongsangbuk-do (KR)

(57)

ABSTRACT

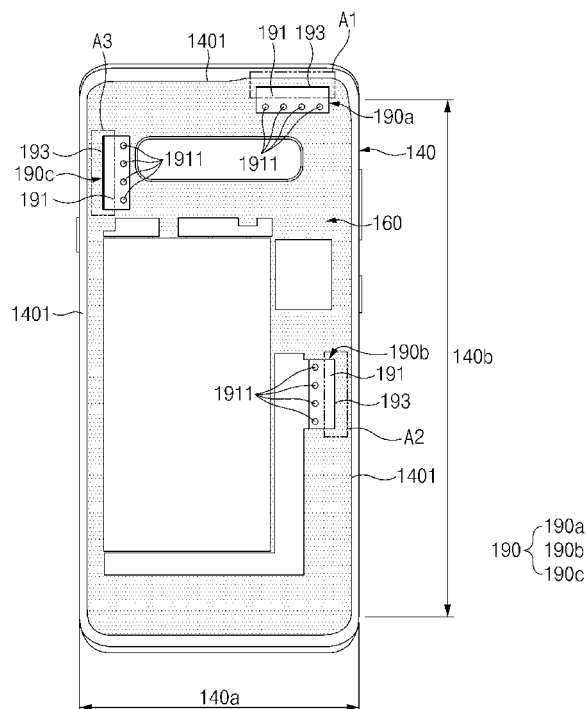
An electronic device is disclosed. The electronic device comprises: a first plate including a first planar region facing a first direction; a second plate comprising a second planar region facing a second direction opposite to the first direction; a housing including a side member surrounding an inner space between the first plate and the second plate; a display disposed between the first plate and the second plate and viewed through the first plate; and an antenna module disposed between the display and the second plate and configured to emit electromagnetic waves to the outside of the housing. The antenna module comprises: an antenna substrate including a first surface facing the first plate, a second surface facing the second plate, and a third surface facing the inner surface of the side member; and a wireless communication circuit disposed on the first surface of the antenna substrate. The antenna substrate comprises: a first antenna adjacent to the first surface or formed on the first surface; a second antenna adjacent to the second surface or formed on the second surface; and a third antenna formed between the first antenna and the second antenna. The first antenna is formed at a first distance from the third surface, the second antenna is formed at a second distance from the third surface, and the third antenna may be formed at a third distance that is greater than the first distance and the second distance from the third surface. Various other embodiments inferred from the present specification are also possible.

(72) Inventors: **Yeonwoo KIM**, Suwon-si (KR);
Wonbin HONG, Pohang-si (KR);
Wonpyo KWON, Pohang-si (KR);
Sehyun PARK, Suwon-si (KR); **Sumin
YUN**, Suwon-si (KR)(21) Appl. No.: **17/418,588**(22) PCT Filed: **Dec. 31, 2019**(86) PCT No.: **PCT/KR2019/018809**

§ 371 (c)(1),

(2) Date: **Jun. 25, 2021**(30) **Foreign Application Priority Data**

Dec. 31, 2018 (KR) 10-2018-0174050

Publication Classification(51) **Int. Cl.***H01Q 1/24* (2006.01)*H01Q 9/06* (2006.01)*H01Q 9/16* (2006.01)*H01Q 9/04* (2006.01)100



US 20220069443A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0069443 A1**

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

(54) **ELECTRONIC DEVICE HAVING SIDE KEY
COMPRISING ANTENNA**

(57) **ABSTRACT**

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

(72) Inventors: **Seunggil JEON**, Suwon-si (KR);
Wonjoon CHOI, Suwon-si (KR);
Seongbeom HONG, Suwon-si (KR)

(21) Appl. No.: **17/424,375**

(22) PCT Filed: **Jan. 21, 2020**

(86) PCT No.: **PCT/KR2020/000978**

§ 371 (c)(1),

(2) Date: **Jul. 20, 2021**

(30) **Foreign Application Priority Data**

Jan. 25, 2019 (KR) 10-2019-0009990

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H04M 1/23 (2006.01)

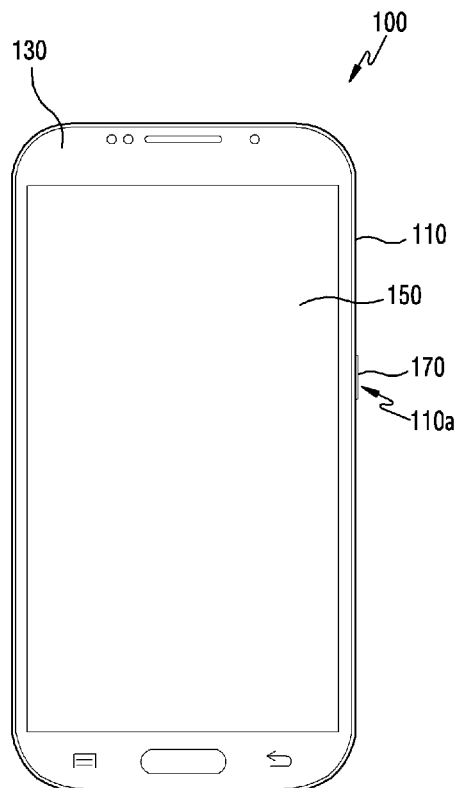
H04M 1/02 (2006.01)

H04B 1/3827 (2006.01)

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

CPC **H01Q 1/243** (2013.01); **H04M 1/236**
(2013.01); **H04B 1/3838** (2013.01); **H04M**
1/0277 (2013.01); **H04M 1/0249** (2013.01)

Provided is an electronic device including a conductive housing including a first face facing a first direction, a second face facing a second direction opposite to the first direction, and a lateral face surrounding at least part of a space constructed between the first face and the second face, a printed circuit board seated inside the housing, and a side key fastened to an edge region of the housing, wherein the side key include a button portion of which one face covers a first through-hole constructed on the lateral face and the other face is exposed to the outside, an actuation portion extending from the face of the button portion covering the first through-hole towards the inside of the housing in such a manner that at least part of the extending portion is inserted to the first through-hole and at least part of the inserted portion moves in a third direction parallel to a normal direction of the lateral face of the housing according to whether the button portion is pressed, a side key circuit board including an outer contact portion pressed by a movement of the actuation portion and an inner contact portion which is in contact with the outer contact portion according to whether the outer contact portion is pressed, and including a switch module which produces an electric signal due to the contact of the outer contact portion and the inner contact portion, a side key bracket on which at least part of the side key circuit board is seated and which fixes and supports the side key circuit board, and an antenna which uses the first through-hole as an antenna aperture for transmitting/receiving radio waves. In addition thereto, various embodiments understood through this document are possible.





US 20220069444A1

(19) **United States**

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

(10) **Pub. No.: US 2022/0069444 A1**

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

(54) **ANTENNA PLACEMENT ARRANGEMENTS
ON DEVICE WITH EXTENDABLE DISPLAY**

H04B 7/02 (2006.01)

G06F 1/16 (2006.01)

H01Q 1/22 (2006.01)

(71) Applicant: **Futurewei Technologies, Inc.**, Plano,
TX (US)

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

CPC *H01Q 1/243* (2013.01); *H04W 88/02*

(2013.01); *H04B 7/02* (2013.01); *H01Q 3/24*

(2013.01); *G06F 1/1618* (2013.01); *G06F*

1/1681 (2013.01); *H01Q 1/2266* (2013.01);

G06F 1/16 (2013.01)

(72) Inventors: **Ping Shi**, San Diego, CA (US); **Wei
Huang**, San Diego, CA (US)

(21) Appl. No.: **17/486,484**

(22) Filed: **Sep. 27, 2021**

Related U.S. Application Data

(62) Division of application No. 15/720,964, filed on Sep.
29, 2017, now Pat. No. 11,158,929.

Publication Classification

(51) **Int. Cl.**

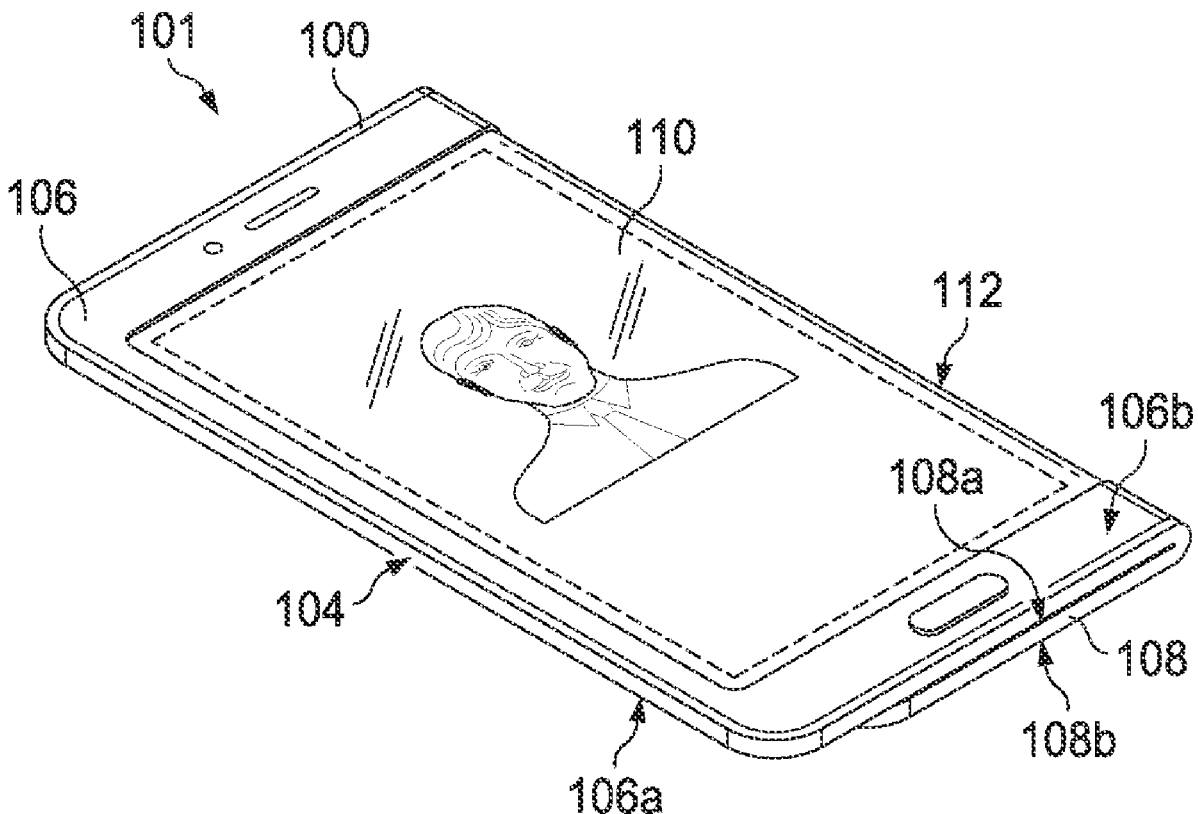
H01Q 1/24 (2006.01)

H04W 88/02 (2006.01)

(57)

ABSTRACT

An electronic device includes a housing having a first panel connected to a second panel movable between folded and unfolded configurations. A first antenna is located adjacent to the first panel and a second antenna is located adjacent to the second panel. The second antenna is activated when the housing is in an unfolded configuration and is deactivated when the housing is in a folded configuration.





US 20220069451A1

(19) **United States**

(12) **Patent Application Publication**
Chang

(10) **Pub. No.: US 2022/0069451 A1**

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

(54) **SINGLE ANTENNA WITH A SHARED RADIATOR**

Publication Classification

(71) Applicant: **NANJING SILERGY MICRO (HK) CO., LIMITED**, Causeway Bay (HK)

(72) Inventor: **Chia-Lin Chang**, Causeway Bay (HK)

(51) **Int. Cl.**

H01Q 1/36 (2006.01)

H01Q 5/328 (2006.01)

H01Q 5/335 (2006.01)

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

CPC **H01Q 1/36** (2013.01); **H01Q 5/335** (2015.01); **H01Q 5/328** (2015.01)

(21) Appl. No.: **17/396,821**

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

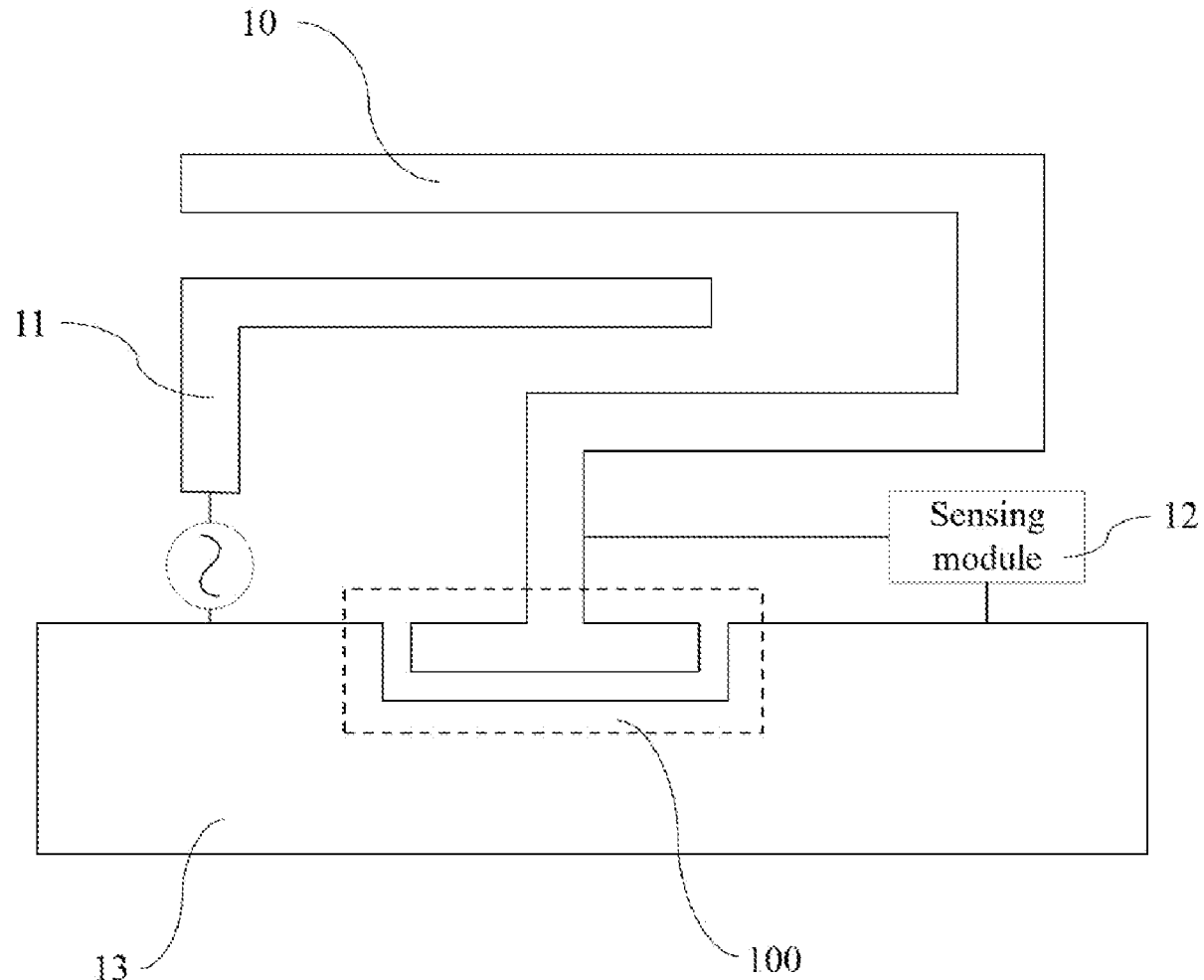
(30) **Foreign Application Priority Data**

Aug. 25, 2020 (CN) 202010863299.9

(57)

ABSTRACT

A single antenna with a shared radiator includes a radiator unit, a feed-in unit, a sensing module and a ground unit. The feed-in unit is coupled with the radiator unit and used to send or receive radio frequency signals together with the radiator unit. The sensing module is connected to the radiator unit and used for sensing a distance between the radiator unit and an object by the radiator unit. A distributed capacitor structure is formed between the ground unit and the radiator unit.





US 20220069466A1

(19) **United States**(12) **Patent Application Publication**
Chang(10) **Pub. No.: US 2022/0069466 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **DUAL ANTENNA WITH A SHARED**
RADIATOR(52) **U.S. Cl.**CPC **H01Q 5/314** (2015.01); **G01D 5/24**
(2013.01)(71) Applicant: **NANJING SILERGY MICRO (HK)**
CO., LIMITED, Causeway Bay (HK)

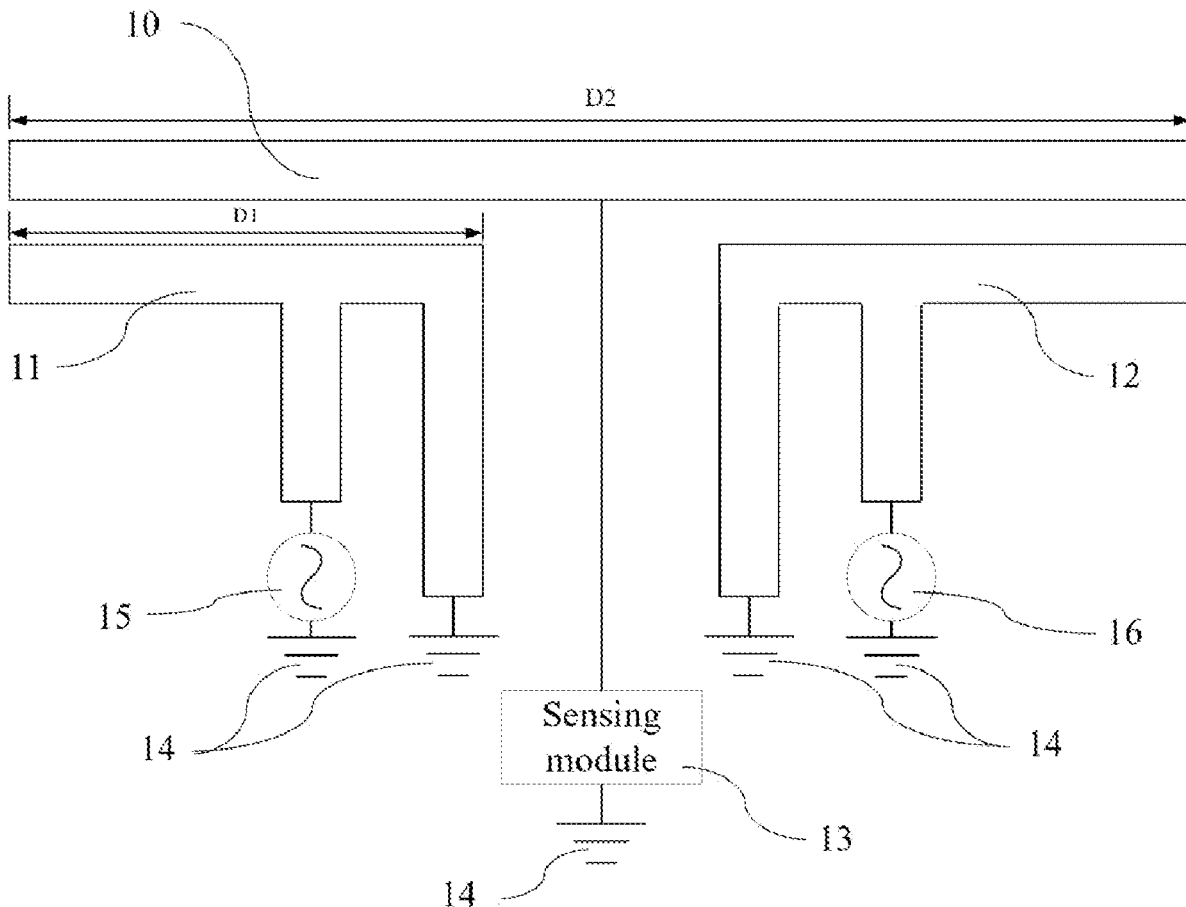
(57)

ABSTRACT(72) Inventor: **Chia-Lin Chang**, Causeway Bay (HK)(21) Appl. No.: **17/396,824**(22) Filed: **Aug. 9, 2021**(30) **Foreign Application Priority Data**

Aug. 25, 2020 (CN) 202010863280.4

Publication Classification(51) **Int. Cl.****H01Q 5/314** (2006.01)**G01D 5/24** (2006.01)

A dual antenna with a shared radiator includes a radiator unit, a first feed-in unit, a second feed-in unit, a sensing module and a ground unit. The first feed-in unit and the second feed-in unit are respectively coupled with the radiator unit. The sensing module is connected to a substantial center of the radiator unit and used for sensing a distance between the radiator unit and an external object through the radiator unit. The ground unit is connected to the sensing module. The first feed-in unit is used to send or receive a first radio frequency signal together with the radiator unit, and the second feed-in unit is used to send or receive a second radio frequency signal together with the radiator unit.





US 20220069467A1

(19) **United States**(12) **Patent Application Publication**
HIRAOKA et al.(10) **Pub. No.: US 2022/0069467 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ANTENNA DEVICE****Publication Classification**(71) Applicant: **Sony Group Corporation**, Tokyo (JP)(72) Inventors: **Yoshiaki HIRAOKA**, Tokyo (JP);
Yuichiro SUZUKI, Tokyo (JP);
Takayoshi ITO, Tokyo (JP); **Tomihiko**
OMURO, Tokyo (JP); **Toru OZONE**,
Tokyo (JP); **Jin SATO**, Tokyo (JP)(51) **Int. Cl.****H01Q 5/35** (2006.01)**H01Q 13/10** (2006.01)**H01Q 9/42** (2006.01)**H01Q 1/22** (2006.01)**H01Q 1/24** (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/35** (2015.01); **H01Q 13/10**(2013.01); **H01Q 1/48** (2013.01); **H01Q****1/2291** (2013.01); **H01Q 1/243** (2013.01);**H01Q 9/42** (2013.01)(73) Assignee: **Sony Group Corporation**, Tokyo (JP)(21) Appl. No.: **17/298,949**(22) PCT Filed: **Dec. 13, 2018**(86) PCT No.: **PCT/JP2018/045876**

§ 371 (c)(1),

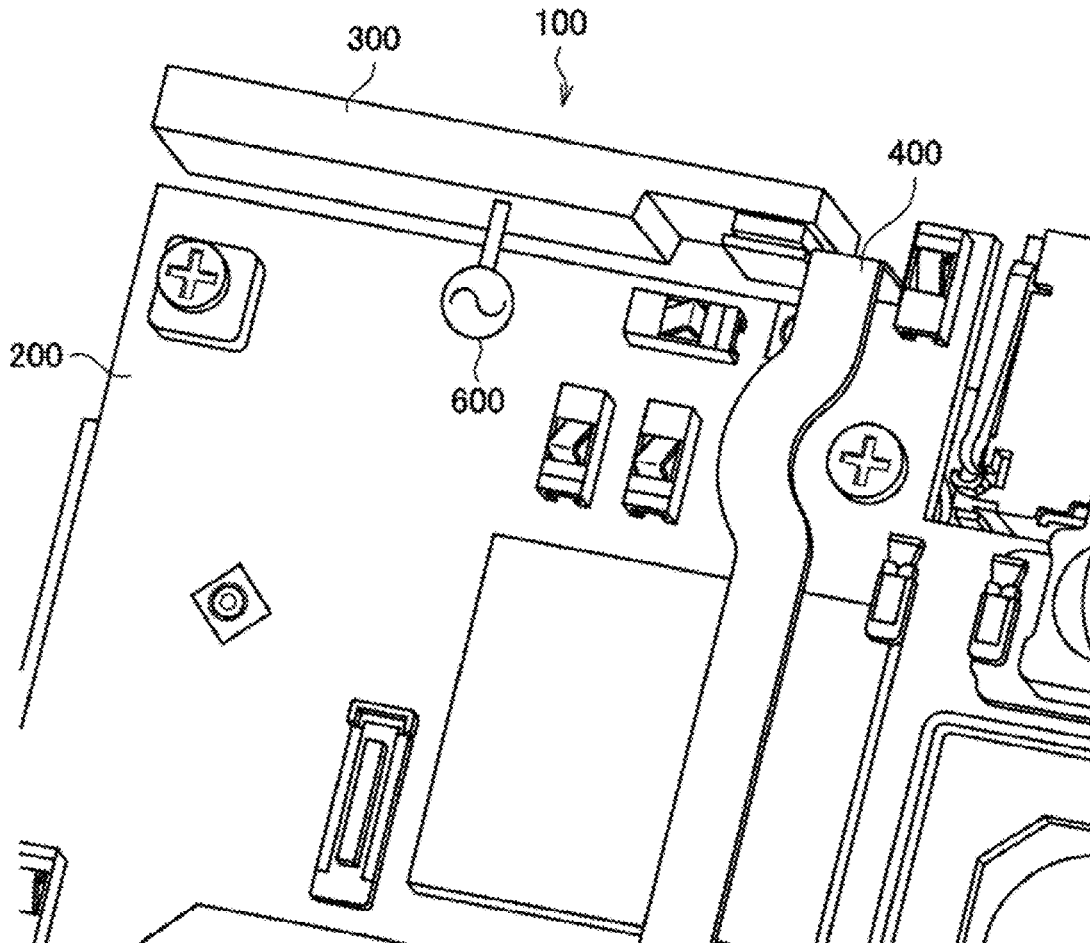
(2) Date: **Jun. 2, 2021**

(57)

ABSTRACT

To optimize space efficiency in mounting a plurality of antennas compatible with different frequencies.

According to the present disclosure, provided is an antenna device including a first antenna that operates at a first frequency, and a second antenna that is provided adjacent to the first antenna, operates at a second frequency lower than the first frequency, and has a ground potential connected to a grounding wire provided at the first antenna.





US 20220069469A1

(19) **United States**

(12) **Patent Application Publication**
TENG

(10) **Pub. No.: US 2022/0069469 A1**

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

(54) **ANTENNA STRUCTURE**

Publication Classification

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

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

H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 5/371** (2015.01); **H01Q 9/0421** (2013.01); **H01Q 9/0442** (2013.01)

(72) Inventor: **Pei-Ling TENG**, TAIPEI CITY (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/013,678**

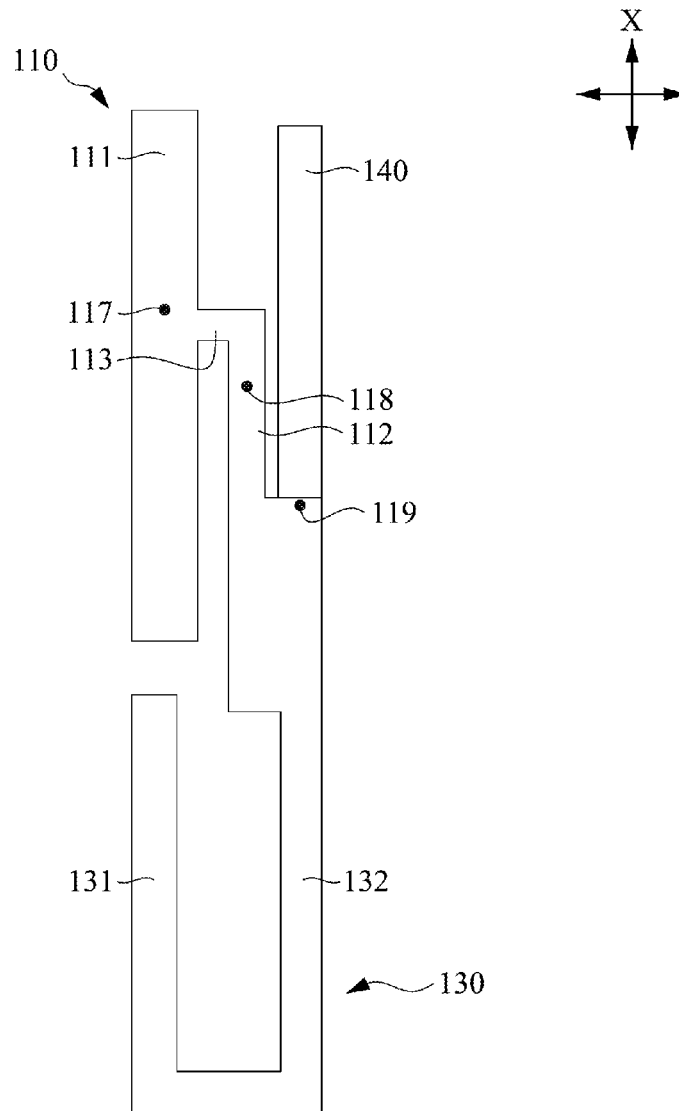
An antenna structure includes a h-shaped radiator and a first radiator. The h-shaped radiator has a first segment, a second segment opposite to the first segment, a first end and a second end which are located at the first segment, a third end located at the second segment, a short-circuit point at the first segment, and a feeding point at the second segment, in which the first segment is longer than the second segment. The first radiator is connected to the second segment.

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

(30) **Foreign Application Priority Data**

Aug. 25, 2020 (CN) 202010860781.7

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US 20220069471A1

(19) **United States**(12) **Patent Application Publication**
LEE et al.(10) **Pub. No.: US 2022/0069471 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ANTENNA DEVICE**(52) **U.S. Cl.**(71) Applicant: **DENSO CORPORATION,**
Kariya-City (JP)CPC **H01Q 9/045** (2013.01); **H01Q 1/48**
(2013.01)(72) Inventors: **JUNGAUN LEE,** Kariya-city (JP);
SHO MATSUMOTO, Kariya-city (JP)

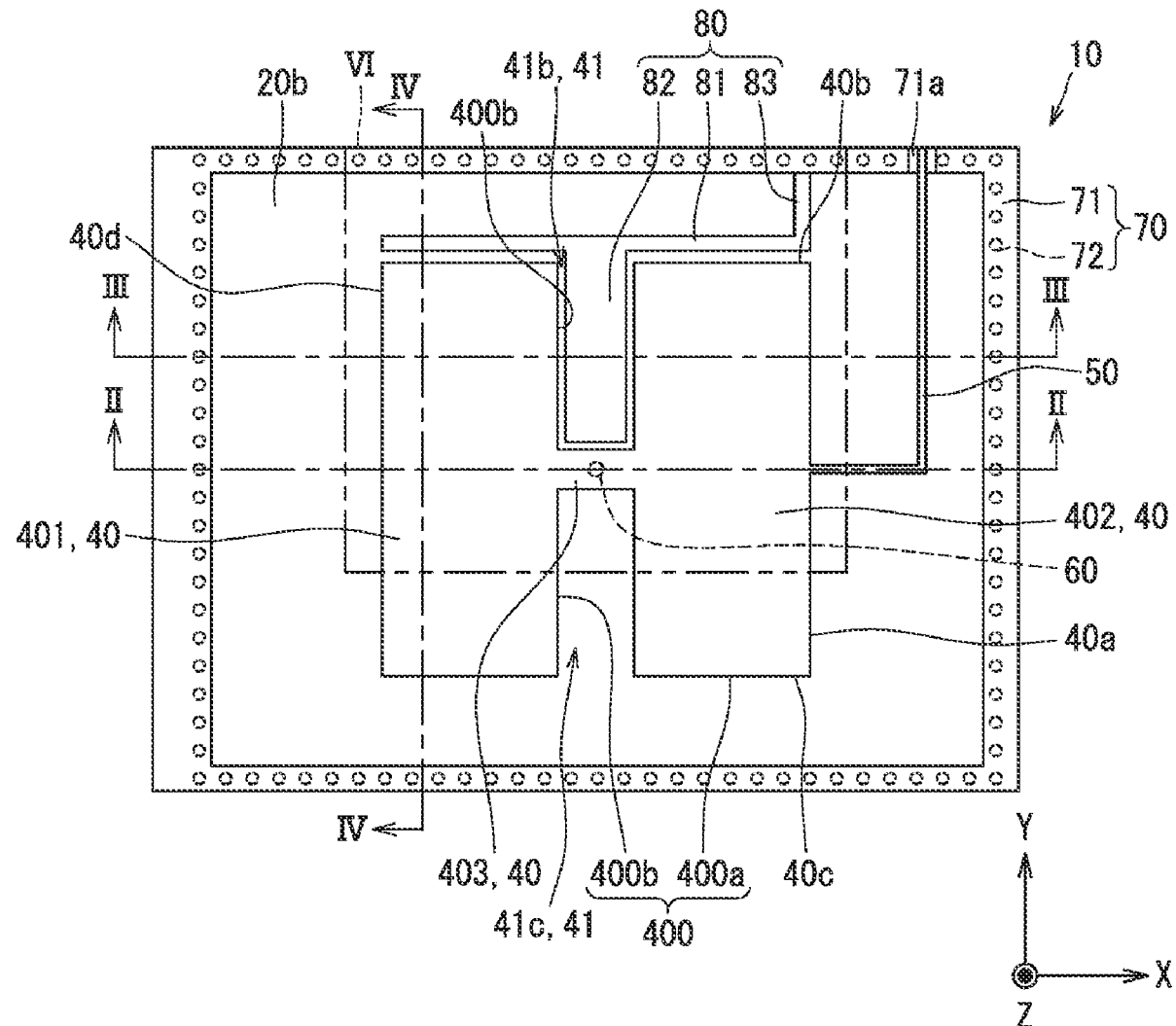
(57)

ABSTRACT(21) Appl. No.: **17/409,881**(22) Filed: **Aug. 24, 2021**(30) **Foreign Application Priority Data**

Aug. 26, 2020 (JP) 2020-142758

Publication Classification(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)

An antenna device includes a main board, a ground board, a patch, a power feeder, a short-circuit portion and an additional conductor. The main board is made of a dielectric material. The ground board is disposed at the main board and supplies a ground potential. The patch is disposed at the main board to face the ground board in a thickness direction of the main board. The power feeder is disposed at the main board and electrically connected to the patch. The short-circuit portion is a via conductor disposed at the main board, and is electrically connected to the patch and the ground board. The additional conductor is disposed at the main board such that a side surface of the additional conductor faces a side surface of the patch, and has a potential identical to the ground potential of the ground board.





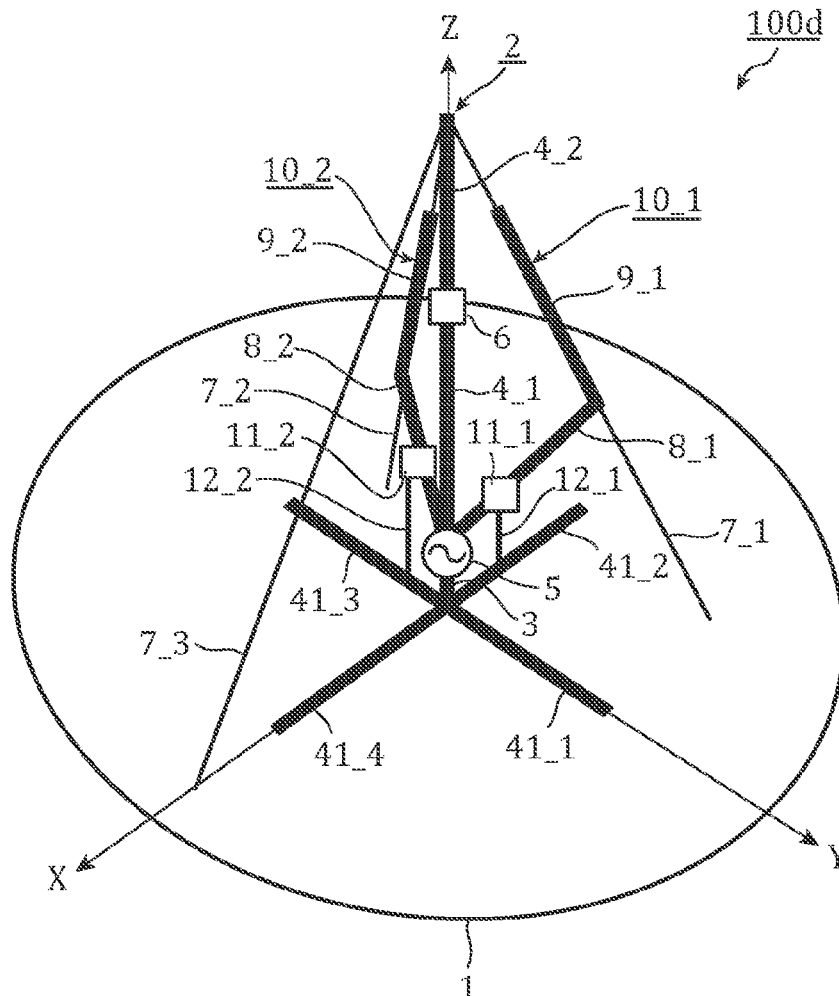
US 20220069472A1

(19) **United States**(12) **Patent Application Publication**
YAMAURA et al.(10) **Pub. No.: US 2022/0069472 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ANTENNA DEVICE**(52) **U.S. Cl.**CPC **H01Q 9/30** (2013.01); **H01Q 1/50**
(2013.01)(71) Applicant: **MITSUBISHI ELECTRIC CORPORATION**, Tokyo (JP)(72) Inventors: **Shingo YAMAURA**, Tokyo (JP);
Kengo NISHIMOTO, Tokyo (JP);
Yasuhiro NISHIOKA, Tokyo (JP)(73) Assignee: **MITSUBISHI ELECTRIC CORPORATION**, Tokyo (JP)(21) Appl. No.: **17/523,446**(22) Filed: **Nov. 10, 2021****Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2019/023507, filed on Jun. 13, 2019.

Publication Classification(51) **Int. Cl.**
H01Q 9/30 (2006.01)
H01Q 1/50 (2006.01)(57) **ABSTRACT**

An antenna device includes: a rod-shaped conductor disposed perpendicularly to a grounding face part; a plurality of first linear members supporting the rod-shaped conductor by a tension structure; a first bent conductor having a first linear conductor disposed so as to branch from the rod-shaped conductor and disposed so as to be inclined with respect to the grounding face part, and a second linear conductor disposed so as to be continuous with a distal end of the first linear conductor and disposed along a first linear member selected from among the plurality of first linear members; a first selective transmission part disposed at an end of the first linear conductor on the same side as the rod-shaped conductor; and a second selective transmission part disposed in the rod-shaped conductor. The rod-shaped conductor and the first bent conductor constitute a first antenna element part having a first electrical length corresponding to a first operation frequency, and a second antenna element part having a second electrical length corresponding to a second operation frequency.





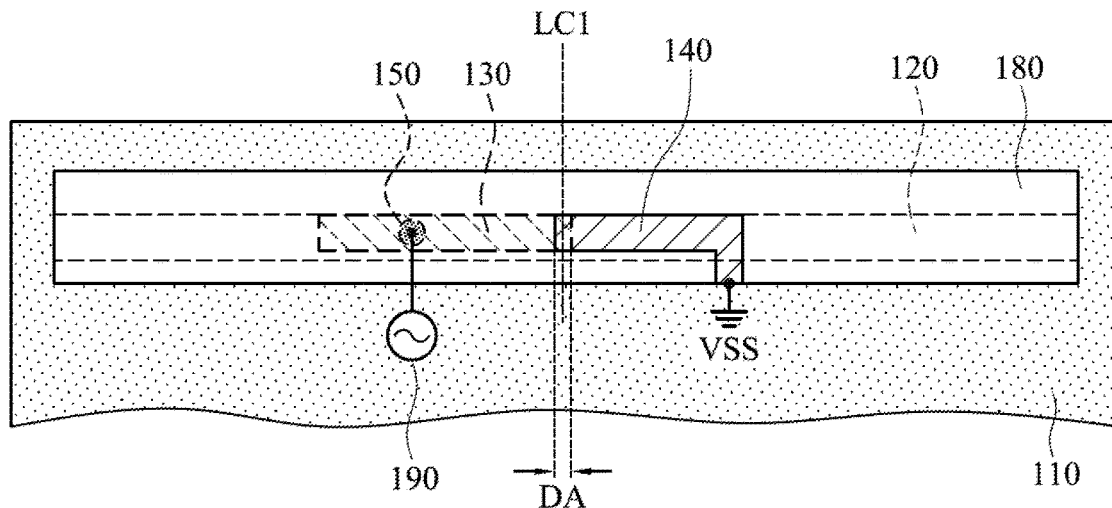
US 20220069473A1

(19) **United States**(12) **Patent Application Publication**
LAI et al.(10) **Pub. No.: US 2022/0069473 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ANTENNA STRUCTURE**(71) Applicant: **Wistron NeWeb Corp.**, Hsinchu (TW)(72) Inventors: **Kuo-Jen LAI**, Hsinchu (TW);
Kuang-Yuan KU, Hsinchu (TW);
Chiung-Hung LI, Hsinchu (TW)(21) Appl. No.: **17/349,208**(22) Filed: **Jun. 16, 2021**(30) **Foreign Application Priority Data**

Sep. 1, 2020 (TW) 109129823

Publication Classification(51) **Int. Cl.****H01Q 13/10** (2006.01)**H01Q 1/48** (2006.01)**H01Q 5/357** (2006.01)(52) **U.S. Cl.**CPC **H01Q 13/106** (2013.01); **H01Q 1/243**
(2013.01); **H01Q 5/357** (2015.01); **H01Q 1/48**
(2013.01)(57) **ABSTRACT**

An antenna structure includes a metal mechanism element, a dielectric substrate, a feeding radiation element, and a coupling radiation element. The metal mechanism element has a slot. The slot has a first closed end and a second closed end. The dielectric substrate has a first surface and a second surface which are opposite to each other. The feeding radiation element is coupled to a signal source, and is disposed on the second surface of the dielectric substrate. The feeding radiation element has a first vertical projection on the metal mechanism element. The coupling radiation element is coupled to a ground voltage, and is disposed on the first surface of the dielectric substrate. The coupling radiation element has a second vertical projection on the metal mechanism element. The second vertical projection of the coupling radiation element at least partially overlaps the first vertical projection of the feeding radiation element.

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US 20220069481A1

(19) **United States**(12) **Patent Application Publication**
HIRABE et al.(10) **Pub. No.: US 2022/0069481 A1**(43) **Pub. Date: Mar. 3, 2022**(54) **ANTENNA DEVICE AND COMMUNICATION METHOD****Publication Classification**(71) Applicant: **NEC Corporation**, Minato-ku, Tokyo (JP)(72) Inventors: **Masashi HIRABE**, Tokyo (JP); **Tetsuo YAMA**, Tokyo (JP); **Hiroki TAKEDA**, Kanagawa (JP)(73) Assignee: **NEC Corporation**, Minato-ku, Tokyo (JP)(21) Appl. No.: **17/299,060**(22) PCT Filed: **Dec. 10, 2019**(86) PCT No.: **PCT/JP2019/048294**

§ 371 (c)(1),

(2) Date: **Jun. 2, 2021**(30) **Foreign Application Priority Data**

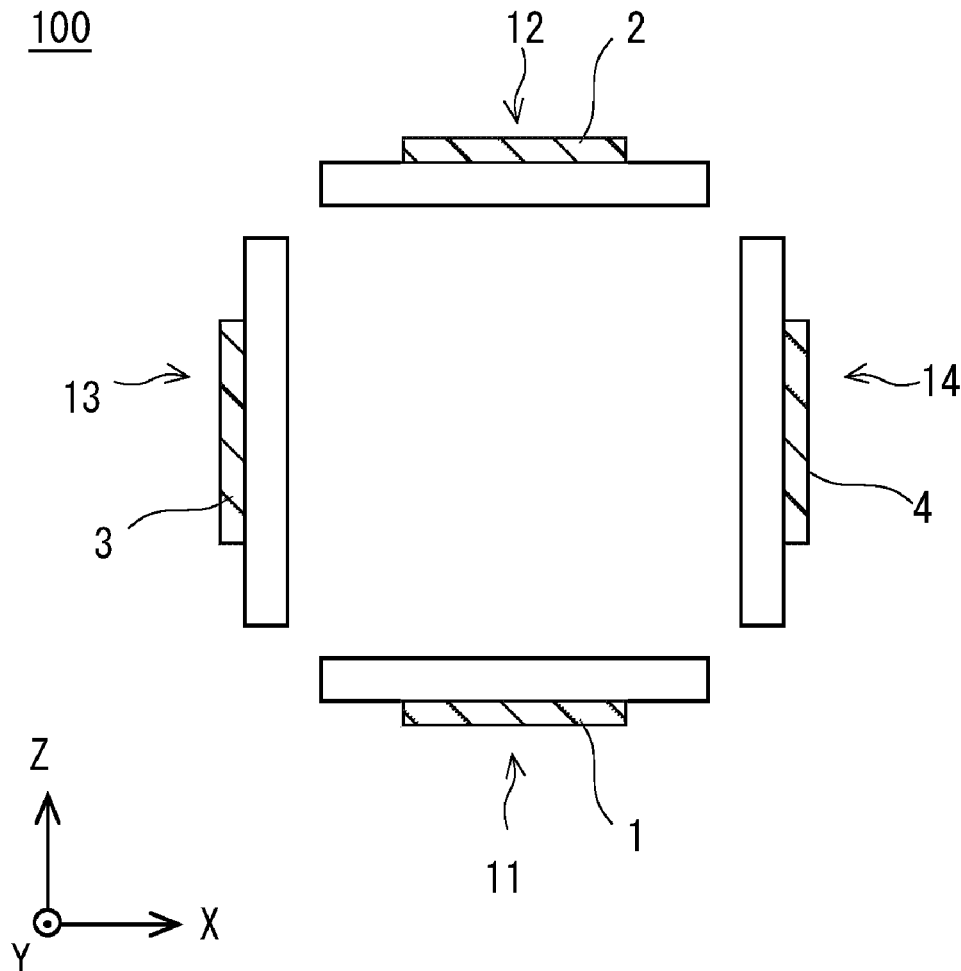
Dec. 12, 2018 (JP) 2018-232935

(51) **Int. Cl.****H01Q 21/24** (2006.01)**H01Q 9/04** (2006.01)**H01Q 25/00** (2006.01)(52) **U.S. Cl.**CPC **H01Q 21/24** (2013.01); **H01Q 25/005** (2013.01); **H01Q 9/0407** (2013.01)

(57)

ABSTRACT

An antenna device according to the present disclosure includes a first antenna that is oriented in a first direction and transmits and receives a signal with a first polarization, a second antenna that is oriented in a second direction opposite to the first direction, a third antenna that is oriented in a third direction obtained by horizontally rotating the second direction by 90° or 180° and transmits and receives a signal with a second polarization orthogonal to the first polarization, a fourth antenna that is oriented in a fourth direction opposite to the third direction and transmits and receives a signal with the second polarization. The second antenna is provided with a feeding point placed in phase with a feeding point of the first antenna. The fourth antenna is provided with a feeding point placed in opposite phase to a feeding point of the third antenna.





US 20220070800A1

(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2022/0070800 A1**
(43) **Pub. Date:** **Mar. 3, 2022**(54) **ELECTRONIC DEVICE FOR PERFORMING
BEAMFORMING-BASED
COMMUNICATION, AND METHOD
THEREFOR**(30) **Foreign Application Priority Data**

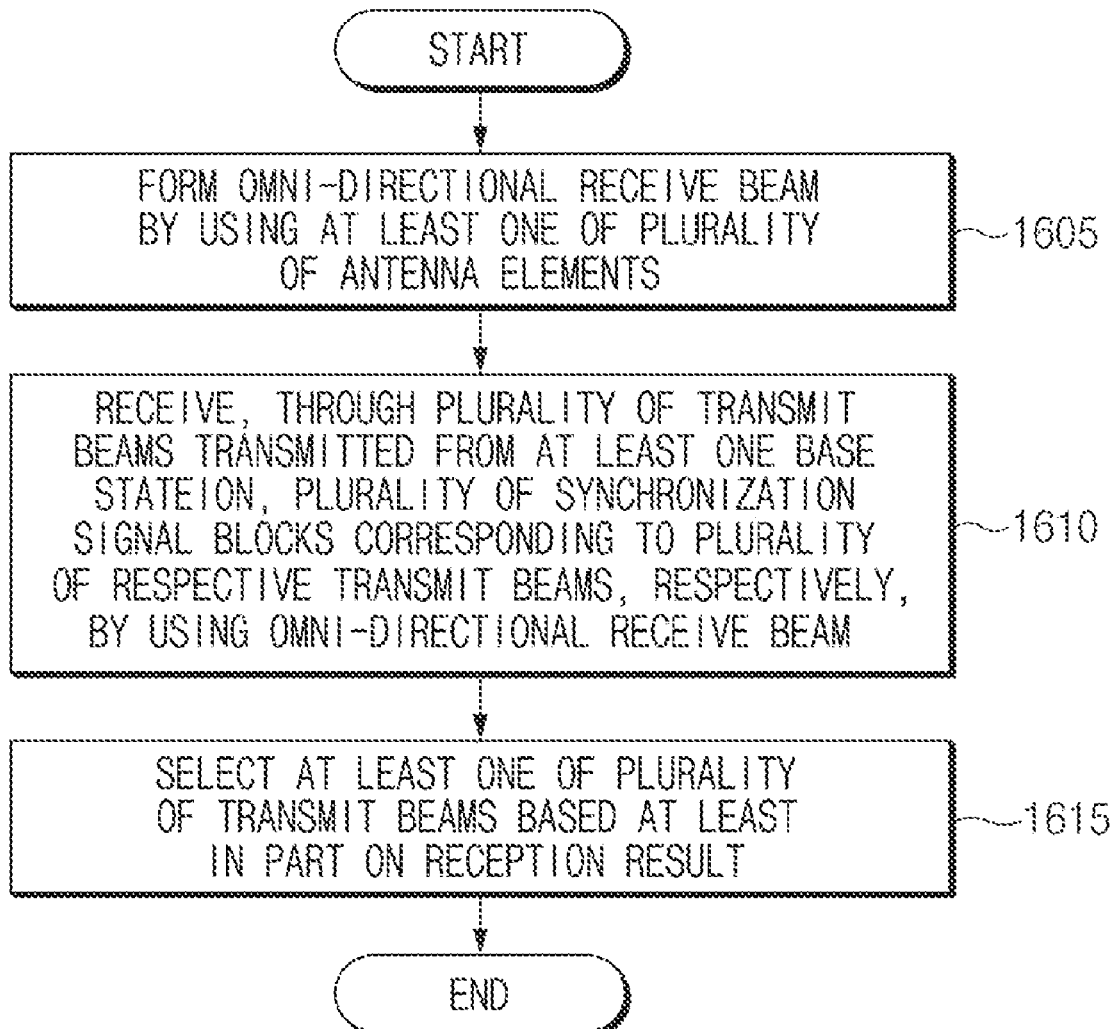
Dec. 31, 2018 (KR) 10-2018-0173439

Publication Classification(71) Applicant: **Samsung Electronics Co., Ltd.**,
Suwon-si, Gyeonggi-do (KR)(51) **Int. Cl.**
H04W 56/00 (2006.01)
H04B 7/06 (2006.01)
H04B 7/08 (2006.01)(72) Inventors: **Junyoung WOO**, Suwon-si (KR);
Youngpo LEE, Suwon-si (KR);
Hyoungjoo LEE, Suwon-si (KR);
Chaiman LIM, Suwon-si (KR);
Euichang JUNG, Suwon-si (KR)(52) **U.S. Cl.**
CPC **H04W 56/001** (2013.01); **H04B 7/0897**
(2013.01); **H04B 7/088** (2013.01); **H04B**
7/0695 (2013.01)(21) Appl. No.: **17/418,522**(22) PCT Filed: **Dec. 12, 2019**(86) PCT No.: **PCT/KR2019/017570**

§ 371 (c)(1),

(2) Date: **Jun. 25, 2021**(57) **ABSTRACT**

An electronic device includes a housing, at least one antenna array disposed in the housing or formed on a part of the housing and including a plurality of antenna elements, a processor electrically or operatively connected to the antenna array, and a memory operatively connected to the at least one processor. In addition to the above, various embodiments identified through the specification are possible.





US 20220076093A1

(19) **United States**(12) **Patent Application Publication**
ESCARO(10) **Pub. No.: US 2022/0076093 A1**(43) **Pub. Date: Mar. 10, 2022**(54) **RFID LABEL AND RFID TAG****Publication Classification**(71) Applicant: **SATO HOLDINGS KABUSHIKI**
KAISHA, Tokyo (JP)(72) Inventor: **Rodly ESCARO, Tokyo (JP)**(73) Assignee: **SATO HOLDINGS KABUSHIKI**
KAISHA, Tokyo (JP)(51) **Int. Cl.****G06K 19/077** (2006.01)**G06K 19/07** (2006.01)**H01Q 1/22** (2006.01)**H01Q 9/28** (2006.01)(52) **U.S. Cl.****CPC ... G06K 19/07786** (2013.01); **G06K 19/0776**(2013.01); **H01Q 9/285** (2013.01); **H01Q****1/2208** (2013.01); **G06K 19/0723** (2013.01)

(57)

ABSTRACT

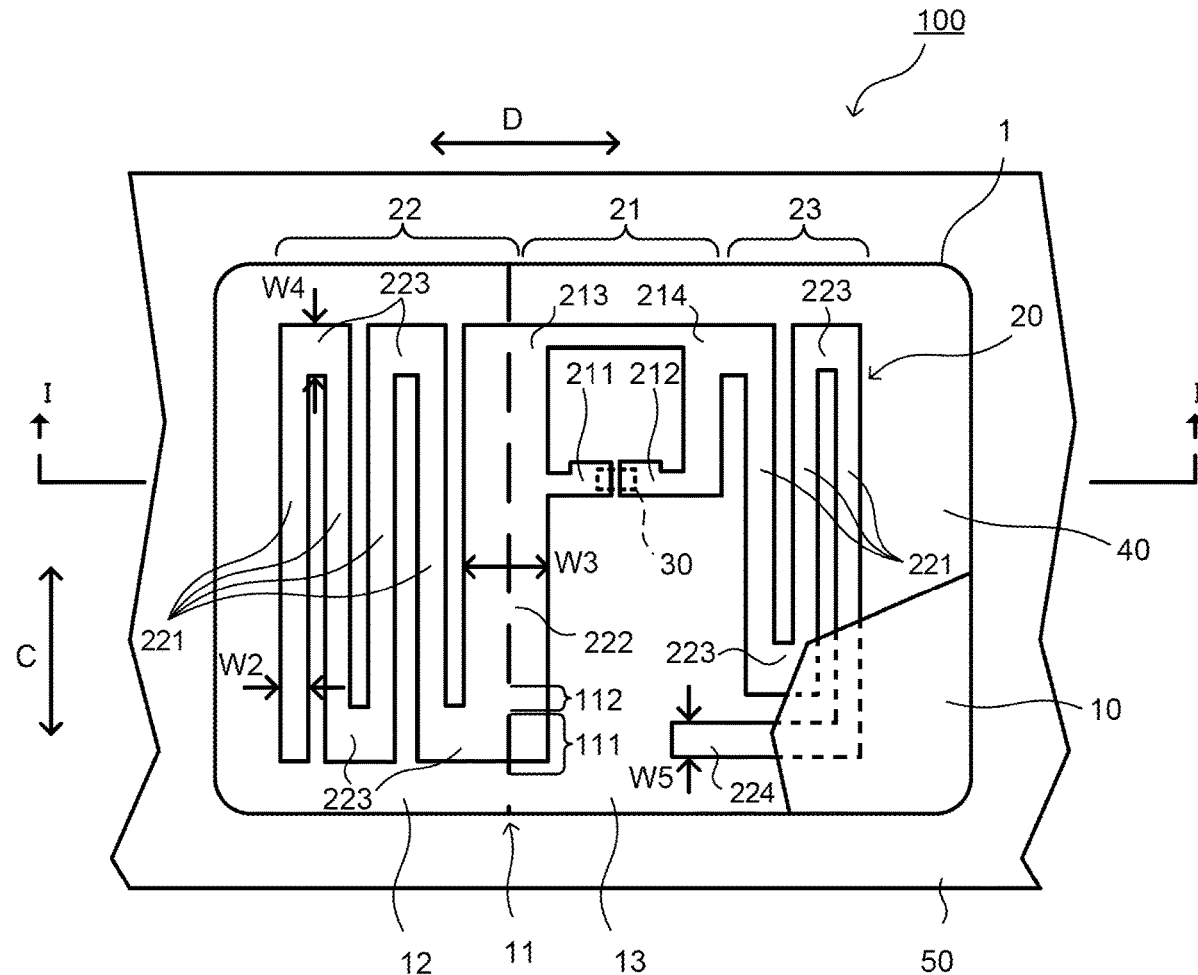
An RFID label includes: a substrate; a dipole antenna formed of a metal foil so as to have a predetermined antenna length and a predetermined antenna width, the dipole antenna being arranged on a surface of the substrate; an IC chip connected to the dipole antenna; and a separator temporarily adhered to an adhesive agent overlaid on the surface of the substrate on which the dipole antenna is arranged, wherein a tear off line cuts through the substrate and the dipole antenna, in at least a part of the dipole antenna, so as to extend along an antenna length direction and so as to be superimposed with the part of the dipole antenna.

(21) Appl. No.: **17/417,874**(22) PCT Filed: **Sep. 18, 2019**(86) PCT No.: **PCT/JP2019/036641**

§ 371 (c)(1),

(2) Date: **Jun. 24, 2021**(30) **Foreign Application Priority Data**

Dec. 28, 2018 (JP) 2018-248103





US 20220077593A1

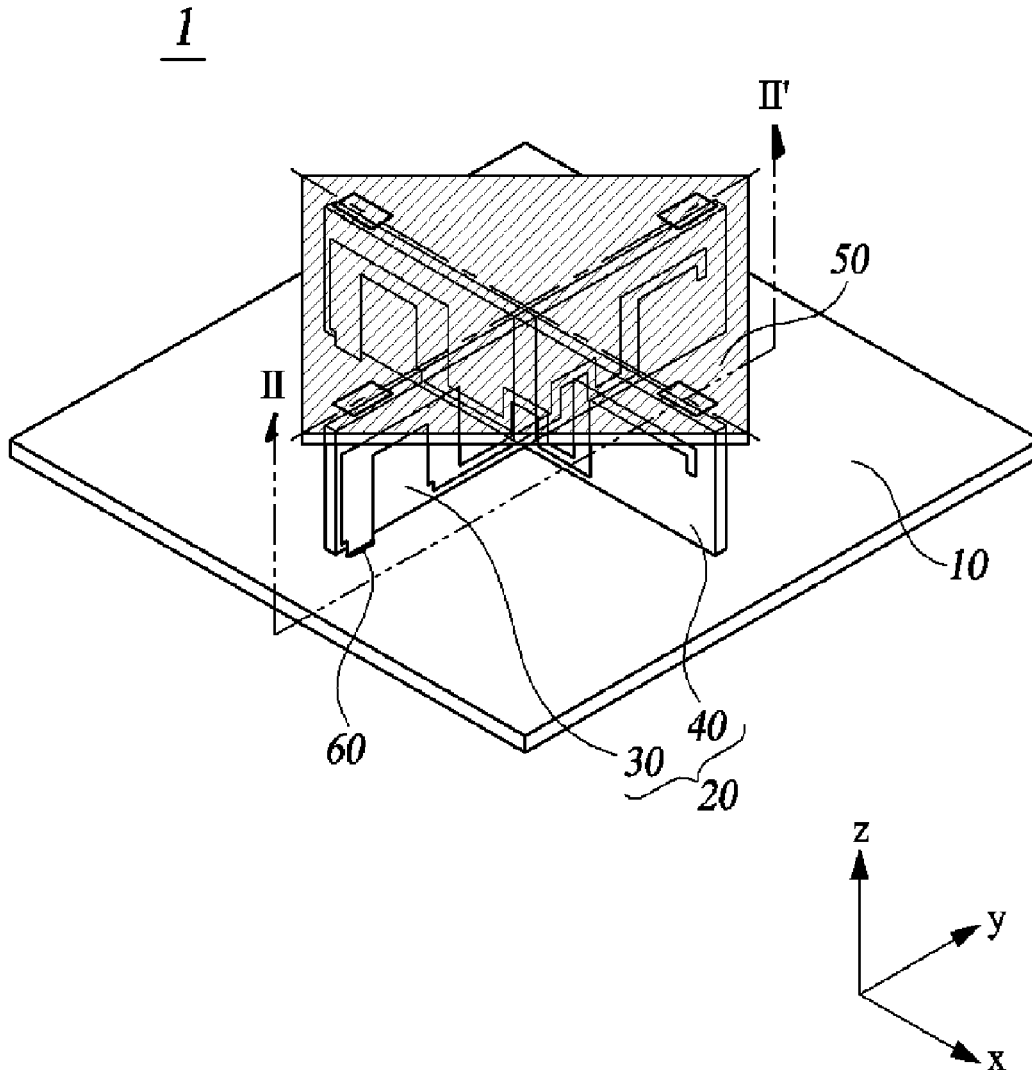
(19) **United States**(12) **Patent Application Publication**
LEE et al.(10) **Pub. No.: US 2022/0077593 A1**(43) **Pub. Date: Mar. 10, 2022**(54) **DUAL POLARIZED ANTENNA USING SHIFT
SERIES FEED**(30) **Foreign Application Priority Data**

May 16, 2019 (KR) 10-2019-0057260

Jul. 16, 2019 (KR) 10-2019-0085446

(71) Applicant: **KMW INC.**, Hwaseong-si (KR)(72) Inventors: **Su Won LEE**, Yongin-si (KR); **Yong
Won SEO**, Daejeon (KR); **Oh Seog
CHOI**, Hwaseong-si (KR); **Young
Chan MOON**, Suwon-si (KR)**Publication Classification**(51) **Int. Cl.****H01Q 21/06** (2006.01)**H01Q 25/00** (2006.01)**H01Q 21/26** (2006.01)(52) **U.S. Cl.**CPC **H01Q 21/062** (2013.01); **H01Q 21/26**
(2013.01); **H01Q 25/001** (2013.01)(73) Assignee: **KMW INC.**, Hwaseong-si (KR)(21) Appl. No.: **17/528,147**(22) Filed: **Nov. 16, 2021****Related U.S. Application Data**(63) Continuation of application No. PCT/KR2020/
005558, filed on Apr. 28, 2020.(57) **ABSTRACT**

The present disclosure provides a dual-polarized antenna, which is advantageous for a reduction in size by significantly reducing the complexity of a structure while satisfying a Cross Polarization ratio (CPR) characteristic and an isolation characteristic, that is, advantages of a dual feed, by enabling a dual feed using a shift series feed even without another structure in one antenna structure.





US 20220077596A1

(19) **United States**(12) **Patent Application Publication****Xi et al.**(10) **Pub. No.: US 2022/0077596 A1**(43) **Pub. Date: Mar. 10, 2022**(54) **ANTENNA UNIT, ANTENNA APPARATUS
AND ELECTRONIC DEVICE**(71) Applicants: **Shanghai AVIC OPTO Electronics
Co., Ltd.**, Shanghai (CN); **Shanghai
Tianma Micro-Electronics Co., Ltd.**,
Shanghai (CN)(72) Inventors: **Kerui Xi**, Shanghai (CN); **Xuhui Peng**,
Shanghai (CN); **Feng Qin**, Shanghai
(CN); **Tingting Cui**, Shanghai (CN);
Zhenyu Jia, Shanghai (CN)(73) Assignees: **Shanghai AVIC OPTO Electronics
Co., Ltd.**, Shanghai (CN); **Shanghai
Tianma Micro-Electronics Co., Ltd.**,
Shanghai (CN)(21) Appl. No.: **17/530,425**(22) Filed: **Nov. 18, 2021**(30) **Foreign Application Priority Data**

Jun. 30, 2021 (CN) 202110741875.7

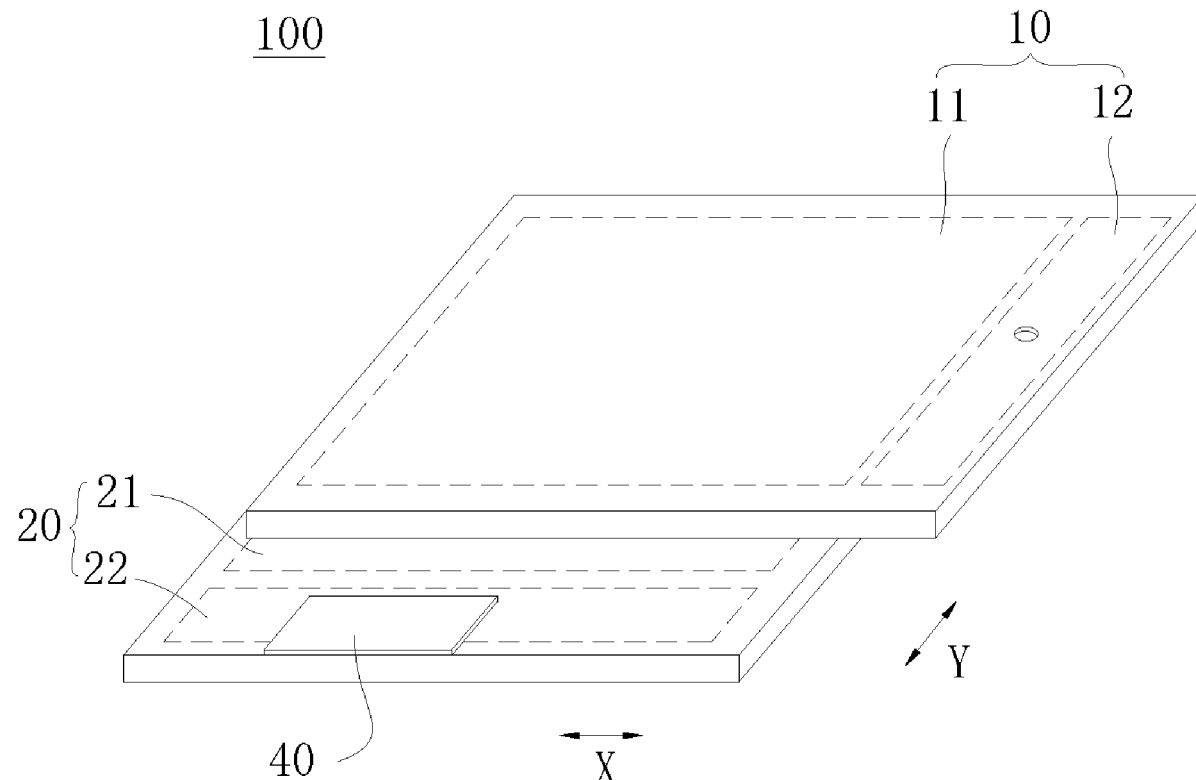
Publication Classification(51) **Int. Cl.****H01Q 21/06** (2006.01)**H01Q 1/42** (2006.01)**H01Q 1/38** (2006.01)**H01Q 3/36** (2006.01)(52) **U.S. Cl.**CPC **H01Q 21/065** (2013.01); **H01Q 3/36**(2013.01); **H01Q 1/38** (2013.01); **H01Q 1/422**

(2013.01)

(57)

ABSTRACT

Disclosed antenna unit includes first substrate and second substrate opposite to each other, phase shifting units and driver circuit. Region facing the first substrate and the second substrate form phase shifting region. In first direction, the first substrate formed with first step region, and used for connecting radio-frequency signal terminal; in second direction, the second substrate formed with second step region, and included angle between the first direction and the second direction greater than or equal to 0° and smaller than 180° . At least part of the first step region does not overlap at least part of the second step region. Phase shifting units used for radiating radio-frequency signal and distributed in phase shifting region, each phase shifting unit. At least part of the driver circuit disposed in the second step region and the driver circuit electrically connected to each phase shifting unit to adjust radio-frequency signal.





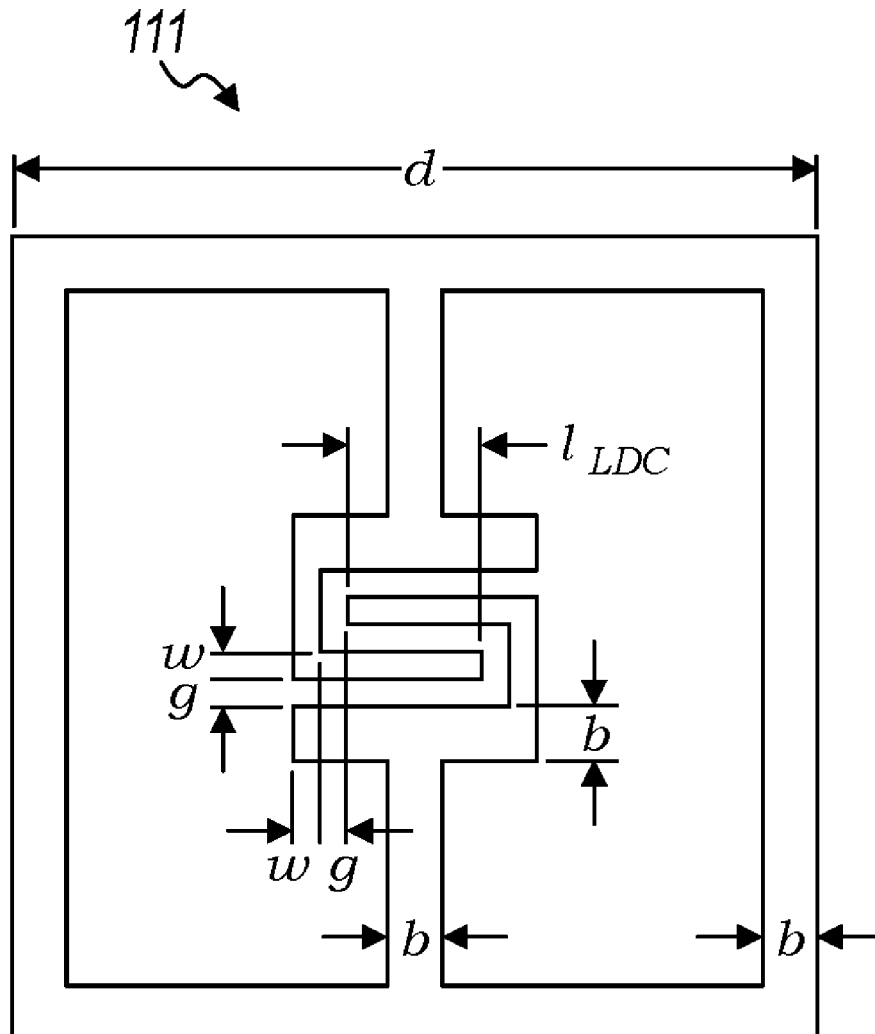
US 20220077718A1

(19) **United States**(12) **Patent Application Publication**
Davlantes(10) **Pub. No.: US 2022/0077718 A1**(43) **Pub. Date: Mar. 10, 2022**(54) **SYSTEM AND METHOD FOR WIRELESS
POWER RECEPTION****Publication Classification**(71) Applicant: **Supply, Inc.**, Emeryville, CA (US)(72) Inventor: **Christopher Joseph Davlantes**,
Oakland, CA (US)(21) Appl. No.: **17/528,869**(22) Filed: **Nov. 17, 2021**(51) **Int. Cl.****H02J 50/12** (2006.01)**G01R 31/28** (2006.01)**H02J 50/20** (2006.01)**H02J 50/05** (2006.01)(52) **U.S. Cl.**CPC **H02J 50/12** (2016.02); **G01R 31/2822**(2013.01); **H02J 7/007** (2013.01); **H02J 50/05**(2016.02); **H02J 50/20** (2016.02)**Related U.S. Application Data**(63) Continuation of application No. 17/015,473, filed on
Sep. 9, 2020, now Pat. No. 11,211,826, which is a
continuation of application No. 16/001,628, filed on
Jun. 6, 2018, now Pat. No. 10,811,908, which is a
continuation-in-part of application No. 14/865,489,
filed on Sep. 25, 2015, now Pat. No. 10,090,707.(60) Provisional application No. 62/055,283, filed on Sep.
25, 2014, provisional application No. 62/515,962,
filed on Jun. 6, 2017.

(57)

ABSTRACT

A system for wireless power reception, preferably including one or more: antennas, dynamic impedance matches, RF-DC converters, DC impedance converters, and/or DC power outputs. A method for wireless power reception, preferably including: receiving power wirelessly at an antenna, dynamically adjusting an input impedance of a dynamic impedance match coupled to the antenna, and/or delivering the power to a load.





US 20220077880A1

(19) **United States**

(12) **Patent Application Publication**
WANG

(10) **Pub. No.: US 2022/0077880 A1**

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

(54) **TERMINAL**

Publication Classification

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

(72) Inventor: **Lirong WANG**, Guangdong (CN)

(21) Appl. No.: **17/528,348**

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

(51) **Int. Cl.**

H04B 1/00 (2006.01)

H04B 1/40 (2006.01)

H01Q 1/24 (2006.01)

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

CPC **H04B 1/0064** (2013.01); **H01Q 1/241** (2013.01); **H04B 1/40** (2013.01)

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2020/081034, filed on Mar. 25, 2020.

Foreign Application Priority Data

May 20, 2019 (CN) 201910418743.3

ABSTRACT

The present application relates to a terminal, including: a main board, a middle frame, a radio frequency circuit layer, a screen, and a plurality of antennas, where the middle frame is located between the main board and the radio frequency circuit layer, the radio frequency circuit layer is located between the screen and the middle frame, and the plurality of antennas are connected to the main board by using radio frequency lines in the radio frequency circuit layer.

