US 20210049437A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0049437 A1**

(43) **Pub. Date: Feb. 18, 2021**

**Virtanen et al.**

(54) **RFID LABEL AND USE**

(71) Applicant: **Confidex Oy**, Tampere (FI)

(72) Inventors: **Juha Virtanen**, TAMPERE (FI); **Heikki AHOKAS**, TAMPERE (FI)

(21) Appl. No.: **16/967,877**

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

(86) PCT No.: **PCT/FI2018/050130**

§ 371 (c)(1),
(2) Date: **Aug. 6, 2020**

**Publication Classification**

(51) **Int. Cl.**
***G06K 19/077*** (2006.01)

(52) **U.S. Cl.**
CPC ... ***G06K 19/0776*** (2013.01); ***G06K 19/07786*** (2013.01); ***G06K 19/07794*** (2013.01)

(57) **ABSTRACT**

An arrangement of a RFID label (**100**), the RFID label comprising a chip (**3**), an antenna (**1**) coupled to the chip, an RFID inlay (**6**), and an antenna extender label (**7**), the antenna extender label being attached to the RFID inlay, and comprising an extender antenna (**8**), and a RF coupling element (**9**) arranged to couple with the antenna. At least part of the antenna extender label is attached removably to the RFID inlay such that the extender antenna is detachable from the RFID label without destroying the transmission capability of the antenna.

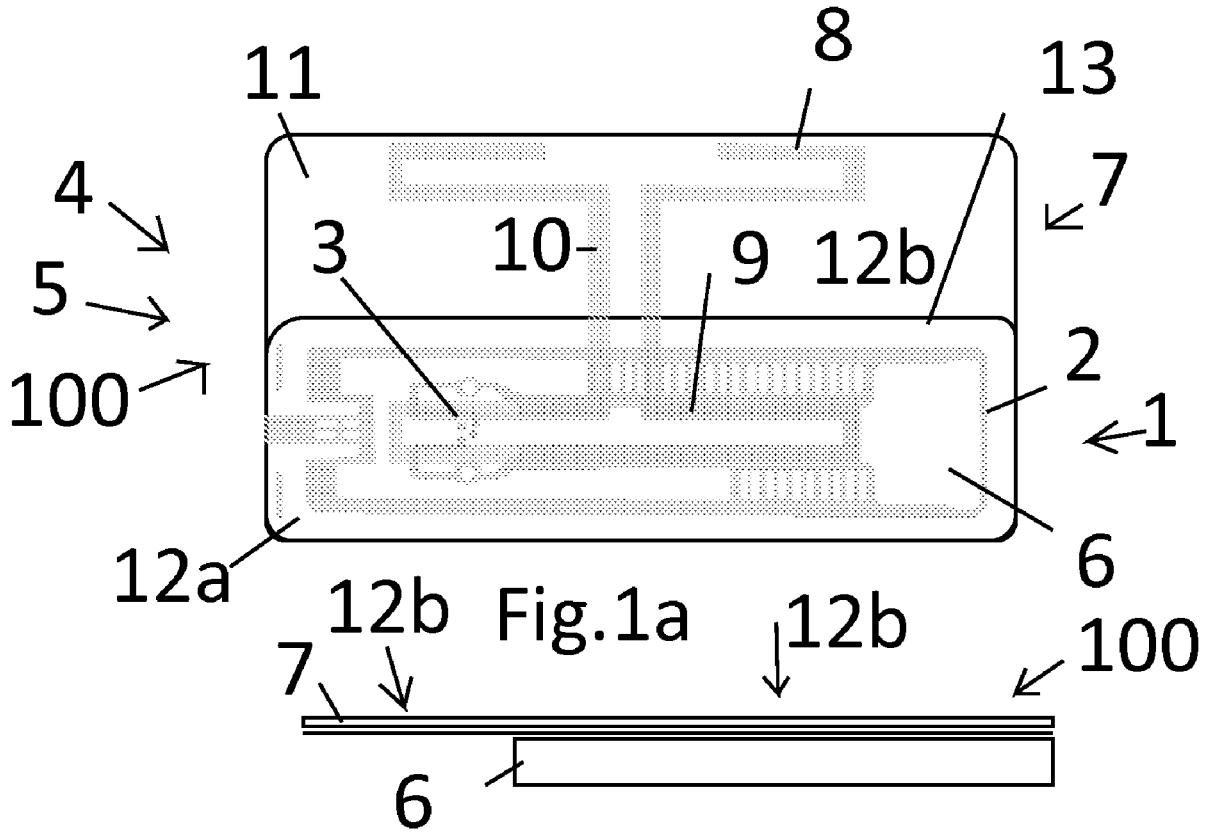



Fig.1a

US 20210050649A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0050649 A1**

**HSU et al.** (43) **Pub. Date: Feb. 18, 2021**

(54) **SEMICONDUCTOR DEVICE PACKAGE AND METHOD OF MANUFACTURING THE SAME**

(71) Applicant: **Advanced Semiconductor Engineering, Inc.**, Kaohsiung (TW)

(72) Inventors: **Shao-En HSU**, Kaohsiung (TW); **Huei-Shyong CHO**, Kaohsiung (TW); **Shih-Wen LU**, Kaohsiung (TW)

(73) Assignee: **Advanced Semiconductor Engineering, Inc.**, Kaohsiung (TW)

(21) Appl. No.: **16/538,592**

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

**Publication Classification**

(51) **Int. Cl.**

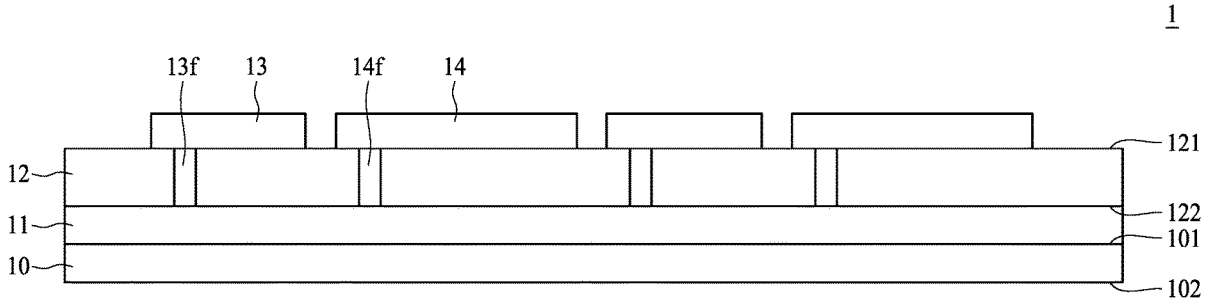
| | |
|---|---|
| ***H01Q 1/22*** | (2006.01) |
| ***H01Q 9/04*** | (2006.01) |
| ***H01L 23/31*** | (2006.01) |
| ***H01Q 1/38*** | (2006.01) |
| ***H01L 23/66*** | (2006.01) |

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

CPC ..... ***H01Q 1/2283*** (2013.01); ***H01Q 9/0407*** (2013.01); *H01L 2223/6677* (2013.01); ***H01Q 1/38*** (2013.01); ***H01L 23/66*** (2013.01); ***H01L 23/3121*** (2013.01)

(57) **ABSTRACT**

A semiconductor device package includes a substrate, a first antenna and a second antenna. The substrate has a first surface and a second surface opposite to the first surface. The first antenna pattern is disposed over the first surface of the substrate. The first antenna pattern has a first bandwidth. The first antenna pattern has a first port configured to generate a magnetic field. The second antenna pattern is disposed over the first surface of the substrate. The second antenna pattern has a second bandwidth different from the first bandwidth. A prolonged line of an edge of the first antenna pattern parallel to the magnetic field generated by the first port of the first antenna pattern is spaced apart from the second antenna pattern.



US 20210050654A1

(19) **United States**

(12) **Patent Application Publication**

**Bane et al.**

(10) **Pub. No.: US 2021/0050654 A1**

(43) **Pub. Date: Feb. 18, 2021**

(54) **OMNIDIRECTIONAL ANTENNA SYSTEM FOR MACRO-MACRO CELL DEPLOYMENT WITH CONCURRENT BAND OPERATION**

(71) Applicant: **CISCO TECHNOLOGY, INC.**, San Jose, CA (US)

(72) Inventors: **Danielle Bane**, Cleveland, OH (US); **John Martin Blosco**, Norton, OH (US); **Jonathan Michael Cyphert**, Ravenna, OH (US); **Benjamin Thomas Pleso**, Fairlawn, OH (US)

(73) Assignee: **CISCO TECHNOLOGY, INC.**, San Jose, CA (US)

(21) Appl. No.: **16/540,424**

(22) Filed: **Aug. 14, 2019**

**Publication Classification**

(51) **Int. Cl.**

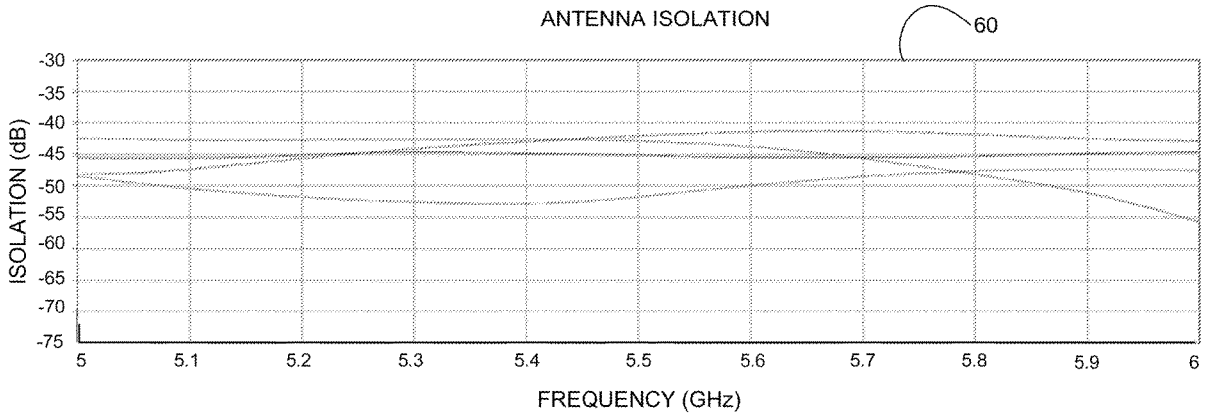
| | |
|---|---|
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 1/52*** | (2006.01) |
| ***H01Q 5/30*** | (2006.01) |
| ***H01Q 1/48*** | (2006.01) |
| ***H01Q 21/06*** | (2006.01) |

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

CPC ..... ***H01Q 1/246*** (2013.01); ***H01Q 1/521*** (2013.01); ***H01Q 21/062*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 5/30*** (2015.01)

(57) **ABSTRACT**

In one embodiment, an apparatus includes a first omnidirectional antenna for coupling to a first radio to establish a first macro cell and a second omnidirectional antenna for coupling to a second radio to establish a second macro cell. The first and second omnidirectional antennas are configured for concurrent 5 GHz radio operation while maintaining at least 40 dB of isolation between the first and second omnidirectional antennas. An antenna system and network device are also disclosed herein.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0050657 A1**

**Lin et al.** (43) **Pub. Date: Feb. 18, 2021**

(54) **ANTENNA DEVICE**

(71) Applicant: **Innolux Corporation**, Miao-Li County (TW)

(72) Inventors: **Yi Hung Lin**, Miao-Li County (TW); **Chung-Kuang Wei**, Miao-Li County (TW); **Tang Chin Hung**, Miao-Li County (TW); **I-Yin Li**, Miao-Li County (TW); **Chia-Chi Ho**, Miao-Li County (TW)

(73) Assignee: **Innolux Corporation**, Miao-Li County (TW)

(21) Appl. No.: **16/932,862**

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

**Related U.S. Application Data**

(60) Provisional application No. 62/885,351, filed on Aug. 12, 2019.

(30) **Foreign Application Priority Data**

May 25, 2020 (CN) ..... 202010450248.3

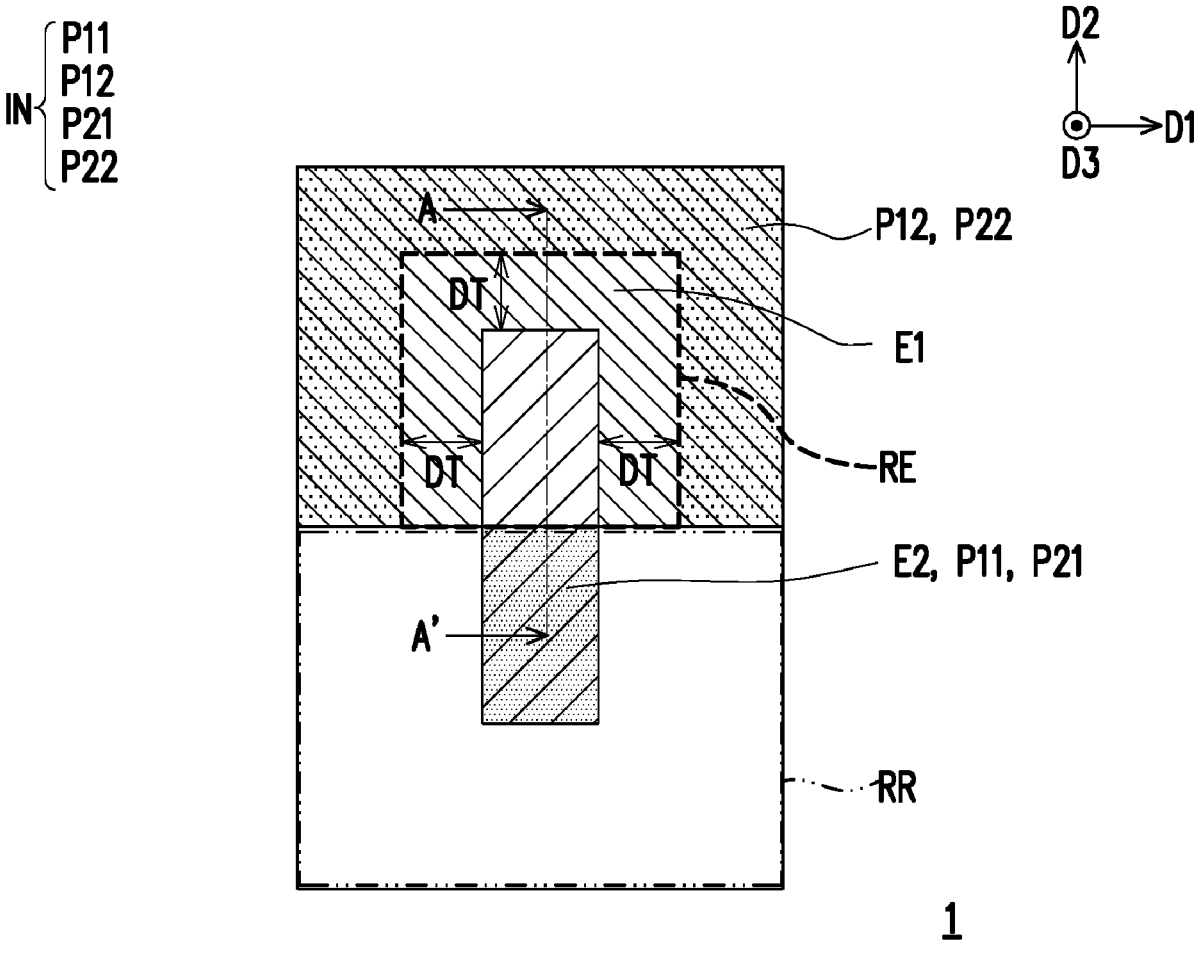
**Publication Classification**

(51) **Int. Cl.**
*H01Q 1/38* (2006.01)
*H01Q 1/40* (2006.01)

(52) **U.S. Cl.**
CPC ..... ***H01Q 1/38*** (2013.01); ***H01Q 1/40*** (2013.01)

(57) **ABSTRACT**

An antenna device is provided, including a first substrate, a first conductive element, a second substrate, a second conductive element, and an insulating layer. The first conductive element is disposed on the first substrate to define, on the first substrate, a recessed region adjacent to the first conductive element. The second substrate faces the first substrate. The second conductive element is disposed on the second substrate and located between the first substrate and the second substrate. The insulating layer is disposed between the first substrate and the second substrate. In a top view of the antenna device, the second conductive element overlaps the first conductive element and the recessed region, and the insulating layer at least partially overlaps the recessed region.



US 20210050659A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0050659 A1**

(43) **Pub. Date: Feb. 18, 2021**

**Yu et al.**

(54) **ANTENNA AND MOBILE TERMINAL**

(71) Applicant: **Huawei Device Co., Ltd.**, Dongguan (CN)

(72) Inventors: **Dong Yu**, Shanghai (CN); **Hanyang Wang**, Reading (GB); **Jianming Li**, Taipei (TW)

(21) Appl. No.: **17/087,090**

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

**Related U.S. Application Data**

(63) Continuation of application No. 16/526,450, filed on Jul. 30, 2019, now Pat. No. 10,826,170, which is a continuation of application No. 15/112,635, filed on Jul. 19, 2016, now Pat. No. 10,403,971, filed as application No. PCT/CN2015/072406 on Feb. 6, 2015.

(30) **Foreign Application Priority Data**

Feb. 12, 2014 (CN) ..... 201410049186.X

**Publication Classification**

(51) **Int. Cl.**

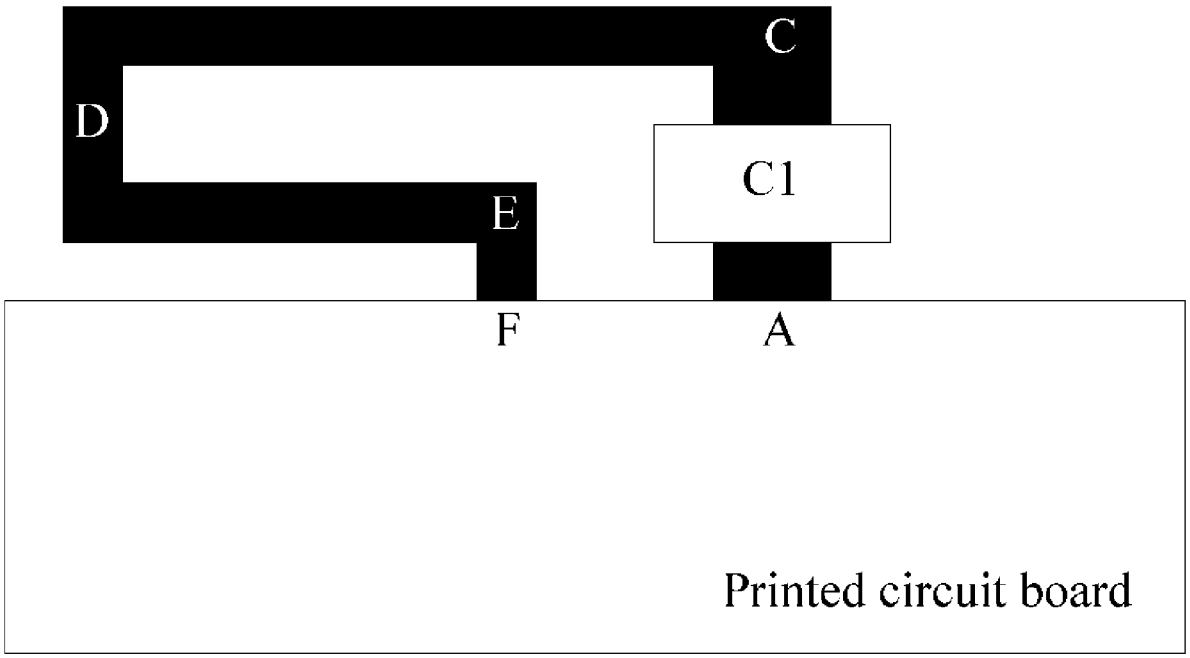
| | |
|---|---|
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 7/00*** | (2006.01) |
| ***H01Q 9/42*** | (2006.01) |
| ***H01Q 5/335*** | (2006.01) |
| ***H01Q 5/328*** | (2006.01) |
| ***H01Q 5/371*** | (2006.01) |
| ***H01Q 5/378*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 1/48*** | (2006.01) |

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

CPC ..... ***H01Q 1/38*** (2013.01); ***H01Q 7/00*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 5/335*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 5/371*** (2015.01); ***H01Q 5/378*** (2015.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/328*** (2015.01)

(57) **ABSTRACT**

An antenna includes a first radiator and a first capacitor structure. A first end of the first radiator is electrically connected to a signal feed end of a printed circuit board by means of the first capacitor structure, and a second end of the first radiator is electrically connected to a ground end of the printed circuit board. The first radiator, the first capacitor structure, the signal feed end, and the ground end form a first antenna configured to produce a first resonance frequency. An electrical length of the first radiator is greater than one eighth of a wavelength corresponding to the first resonance frequency, and the electrical length of the first radiator is less than a quarter of the wavelength corresponding to the first resonance frequency.



US 20210055767A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0055767 A1**

**Chang et al.** (43) **Pub. Date: Feb. 25, 2021**

(54) **INFORMATION HANDLING SYSTEM ANTENNA ISOLATION WITH INTEGRATED COOLING FAN**

(71) Applicant: **Dell Products L.P.**, Round Rock, TX (US)

(72) Inventors: **Ching Wei Chang**, Cedar Park, TX (US); **Suresh Ramasamy**, Cedar Park, TX (US); **Allen B. McKittrick**, Cedar Park, TX (US); **Jeffery D. Kane**, Austin, TX (US)

(73) Assignee: **Dell Products L.P.**, Round Rock, TX (US)

(21) Appl. No.: **17/090,406**

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

**Related U.S. Application Data**

(62) Division of application No. 16/220,653, filed on Dec. 14, 2018, now Pat. No. 10,852,782.

**Publication Classification**

(51) **Int. Cl.**

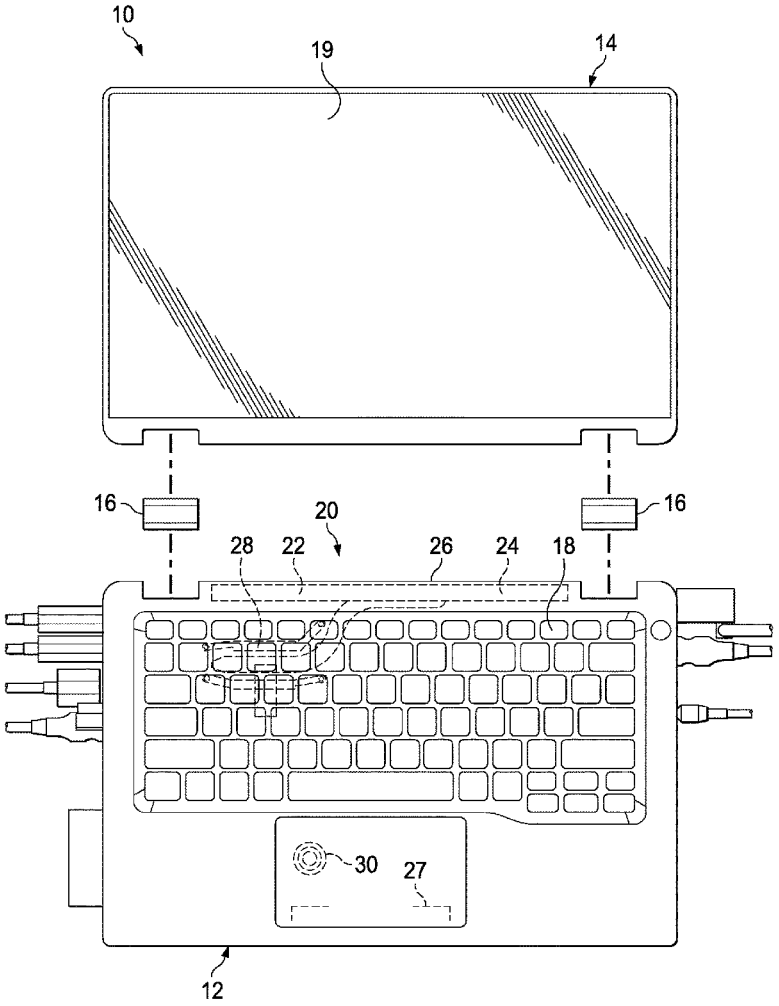
| | |
|---|---|
| ***G06F 1/16*** | (2006.01) |
| ***G06F 1/20*** | (2006.01) |
| ***H05K 7/20*** | (2006.01) |
| ***H05K 5/02*** | (2006.01) |
| ***H05K 5/03*** | (2006.01) |

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

CPC ..... ***G06F 1/1698*** (2013.01); ***G06F 1/203*** (2013.01); ***H05K 7/20163*** (2013.01); ***G06F 1/1662*** (2013.01); ***H05K 5/03*** (2013.01); ***G06F 1/1681*** (2013.01); ***H05K 5/0226*** (2013.01); ***H05K 5/0239*** (2013.01)

(57) **ABSTRACT**

A portable information handling system structure located between housing hinges along one side of the housing has first and second antenna disposed at opposing ends with a cooling fan between the first and second antenna and over the antenna structure to isolate the first and second antenna. In one embodiment, a parasitic element disposed between the first and second antenna and under the cooling fan has resonance tuned to isolate wireless signals of a frequency supported by the first and second antenna.



US 20210057811A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0057811 A1**

(43) **Pub. Date: Feb. 25, 2021**

**Kim**

(54) **POLYMER COMPOSITION FOR USE IN AN ANTENNA SYSTEM**

(71) Applicant: **Ticona LLC**, Florence, KY (US)

(72) Inventor: **Young Shin Kim**, Cincinnati, OH (US)

(21) Appl. No.: **16/995,958**

(22) Filed: **Aug. 18, 2020**

**Related U.S. Application Data**

(60) Provisional application No. 62/889,792, filed on Aug. 21, 2019, provisional application No. 62/898,188, filed on Sep. 10, 2019, provisional application No. 62/925,271, filed on Oct. 24, 2019, provisional application No. 62/951,033, filed on Dec. 20, 2019, provisional application No. 62/958,003, filed on Jan. 7, 2020, provisional application No. 62/972,201, filed on Feb. 10, 2020, provisional application No. 63/024,579, filed on May 14, 2020, provisional application No. 63/038,980, filed on Jun. 15, 2020.

**Publication Classification**

(51) **Int. Cl.**

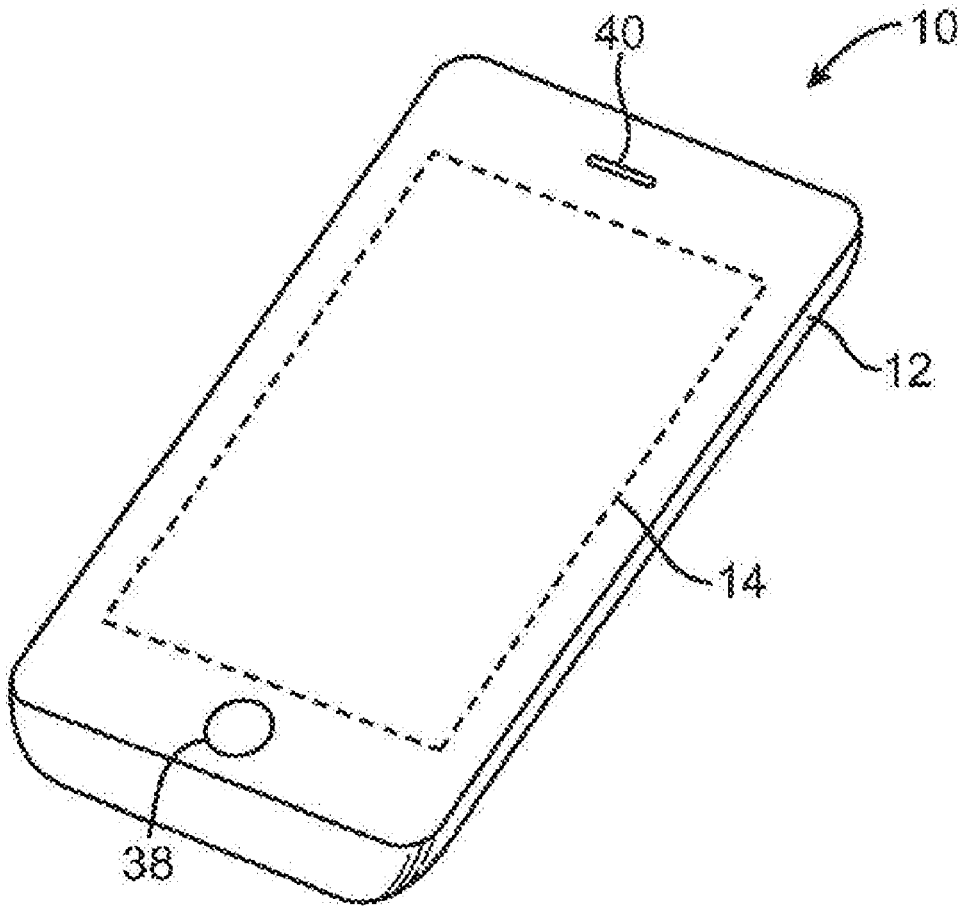
| | |
|---|---|
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 21/00*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 1/36*** | (2006.01) |
| ***C08K 3/22*** | (2006.01) |
| ***C08K 7/08*** | (2006.01) |
| ***C08K 7/14*** | (2006.01) |
| ***C08G 63/06*** | (2006.01) |

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

CPC ..... ***H01Q 1/38*** (2013.01); ***H01Q 21/0087*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 1/246*** (2013.01); ***H01Q 1/368*** (2013.01); *C08G 2250/00* (2013.01); ***C08K 7/08*** (2013.01); ***C08K 7/14*** (2013.01); ***C08G 63/06*** (2013.01); *C08K 2003/2296* (2013.01); *C08K 2201/001* (2013.01); ***C08K 3/22*** (2013.01)

(57) **ABSTRACT**

A polymer composition comprising a dielectric material distributed within a polymer matrix is provided. The dielectric material has a volume resistivity of from about 0.1 ohm-cm to about $1\times10^{12}$ ohm-cm, wherein the polymer matrix contains at least one thermotropic liquid crystalline polymer, and further wherein the polymer composition exhibits a dielectric constant of about 4 or more and a dissipation factor of about 0.3 or less, as determined at a frequency of 2 GHz.



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(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0057812 A1**

(43) **Pub. Date: Feb. 25, 2021**

**YUN et al.**

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

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

(72) Inventors: **Sumin YUN**, Suwon-si (KR); **Sehyun PARK**, Suwon-si (KR); **Myunghun JEONG**, Suwon-si (KR); **Jehun JONG**, Suwon-si (KR); **Jaehoon JO**, Suwon-si (KR); **Jinwoo JUNG**, Suwon-si (KR); **Jaebong CHUN**, Suwon-si (KR)

(21) Appl. No.: **17/094,136**

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

**Related U.S. Application Data**

(63) Continuation of application No. 16/510,209, filed on Jul. 12, 2019, now Pat. No. 10,868,362.

(30) **Foreign Application Priority Data**

Jul. 13, 2018 (KR) ..... 10-2018-0081419

**Publication Classification**

(51) **Int. Cl.**

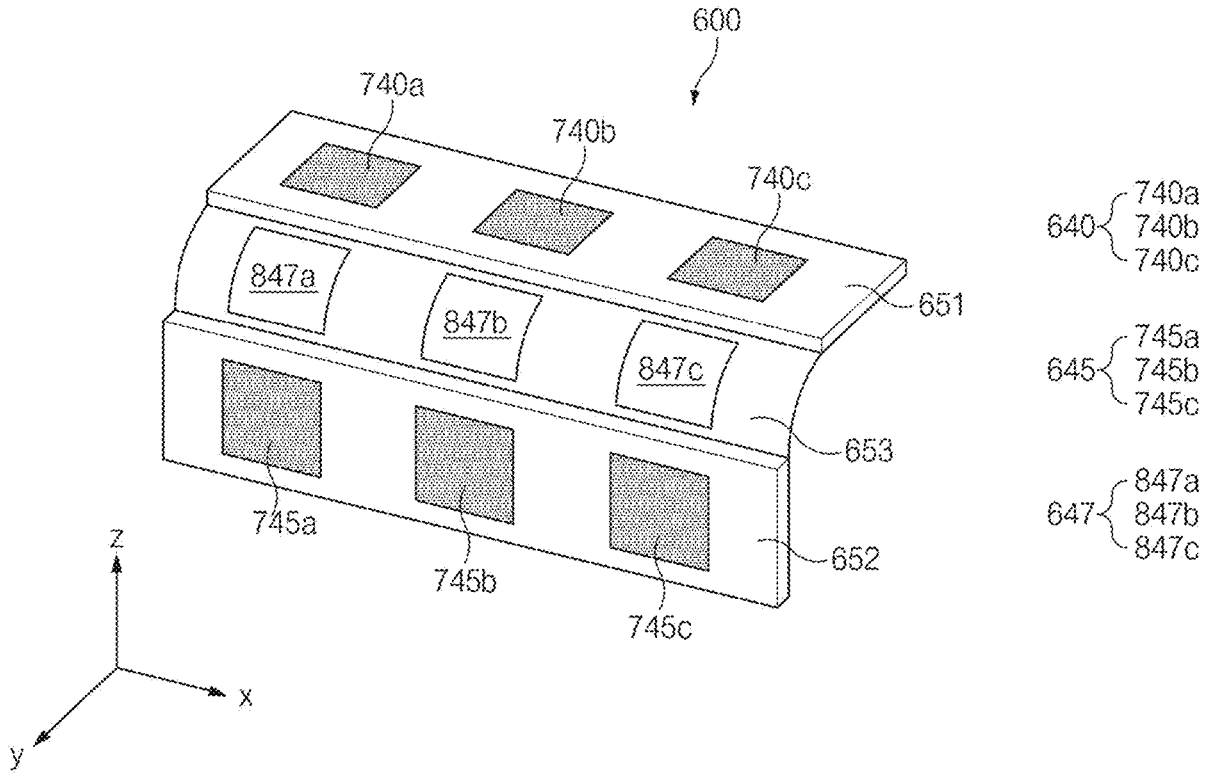
| | |
|---|---|
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 21/00*** | (2006.01) |
| ***H01Q 21/24*** | (2006.01) |
| ***H01Q 9/04*** | (2006.01) |
| ***H01Q 21/06*** | (2006.01) |

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

CPC ..... ***H01Q 1/38*** (2013.01); ***H01Q 21/0025*** (2013.01); ***H01Q 21/24*** (2013.01); *H01Q 1/2266* (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 21/06*** (2013.01); ***H01Q 9/0407*** (2013.01)

(57) **ABSTRACT**

An electronic device capable of radiating signals toward a plurality of planes is provided, and includes a housing including a first plate and a second plate facing away from the first plate, and an antenna structure positioned in the housing. The antenna structure includes a first printed circuit board (PCB) that includes a first surface facing a first direction, a second PCB that includes a second surface facing a second direction different from the first direction, a flexible PCB (FPCB) that is extended between a first periphery of the first PCB and a second periphery of the second PCB, a first conductive pattern that is formed in the first PCB or on the first surface, a second conductive pattern that is formed in the second PCB or on the second surface, and a wireless communication circuit that is mounted on the first PCB and/or the second PCB.



US 20210057820A1

(19) **United States**

(12) **Patent Application Publication**

**SUDO et al.**

(10) **Pub. No.: US 2021/0057820 A1**

(43) **Pub. Date: Feb. 25, 2021**

(54) **ANTENNA MODULE AND COMMUNICATION APPARATUS EQUIPPED WITH THE SAME**

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

(72) Inventors: **Kaoru SUDO**, Kyoto (JP); **Hirotsugu MORI**, Kyoto (JP)

(21) Appl. No.: **17/093,692**

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

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2020/015660, filed on Apr. 7, 2020.

(30) **Foreign Application Priority Data**

Apr. 24, 2019 (JP) ..... 2019-082699

**Publication Classification**

(51) **Int. Cl.**

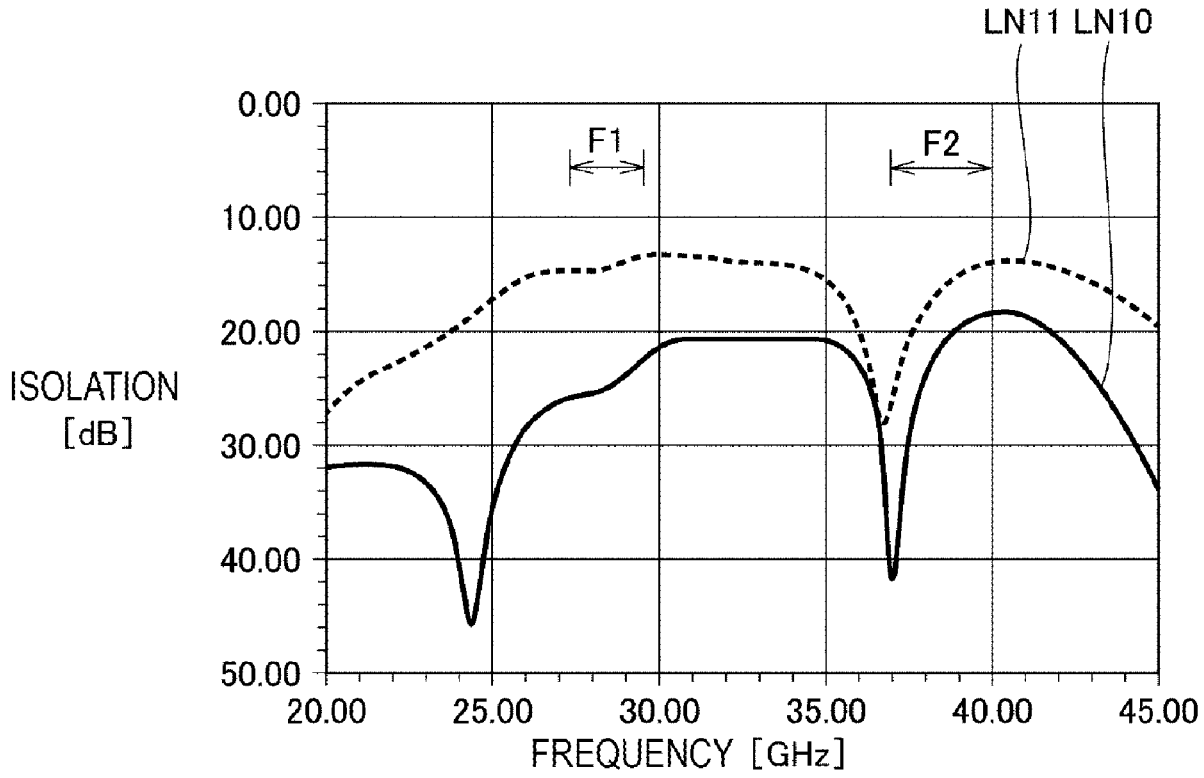
| | |
|---|---|
| ***H01Q 5/35*** | (2006.01) |
| ***H04B 1/04*** | (2006.01) |
| ***H01Q 1/52*** | (2006.01) |

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

CPC ..... ***H01Q 5/35*** (2015.01); *G16Y 10/75* (2020.01); ***H01Q 1/52*** (2013.01); ***H04B 1/0475*** (2013.01)

(57) **ABSTRACT**

An antenna module includes a dielectric substrate, a ground electrode, a power feeding element (**121**) and a power feeding element (**122**) each facing the ground electrode, and power feeding wirings (**141**) and (**142**). The power feeding wiring (**141**) transmits a radio frequency signal to a power feeding point (SP**1**) of the power feeding element (**121**). The power feeding wiring (**142**) transmits a radio frequency signal to a power feeding point (SP**2**) of the power feeding element (**122**). A frequency of a radio wave from the power feeding element (**122**) is higher than a frequency of a radio wave from the power feeding element (**121**). The power feeding wiring (**142**) includes a via rises from the ground electrode side to the power feeding element (**122**) at a position different from the power feeding point (SP**2**) and a wiring pattern that connects the via and the power feeding point (SP**2**).



US 20210057821A1

(19) **United States**

(12) **Patent Application Publication**

**JAN et al.**

(10) **Pub. No.: US 2021/0057821 A1**

(43) **Pub. Date: Feb. 25, 2021**

(54) **ANTENNA SYSTEM**

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

(72) Inventors: **Cheng-Geng JAN**, Hsinchu (TW); **Chieh-Sheng HSU**, Hsinchu (TW)

(21) Appl. No.: **16/867,930**

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

(30) **Foreign Application Priority Data**

Aug. 23, 2019 (TW) ..... 108130198

**Publication Classification**

(51) **Int. Cl.**

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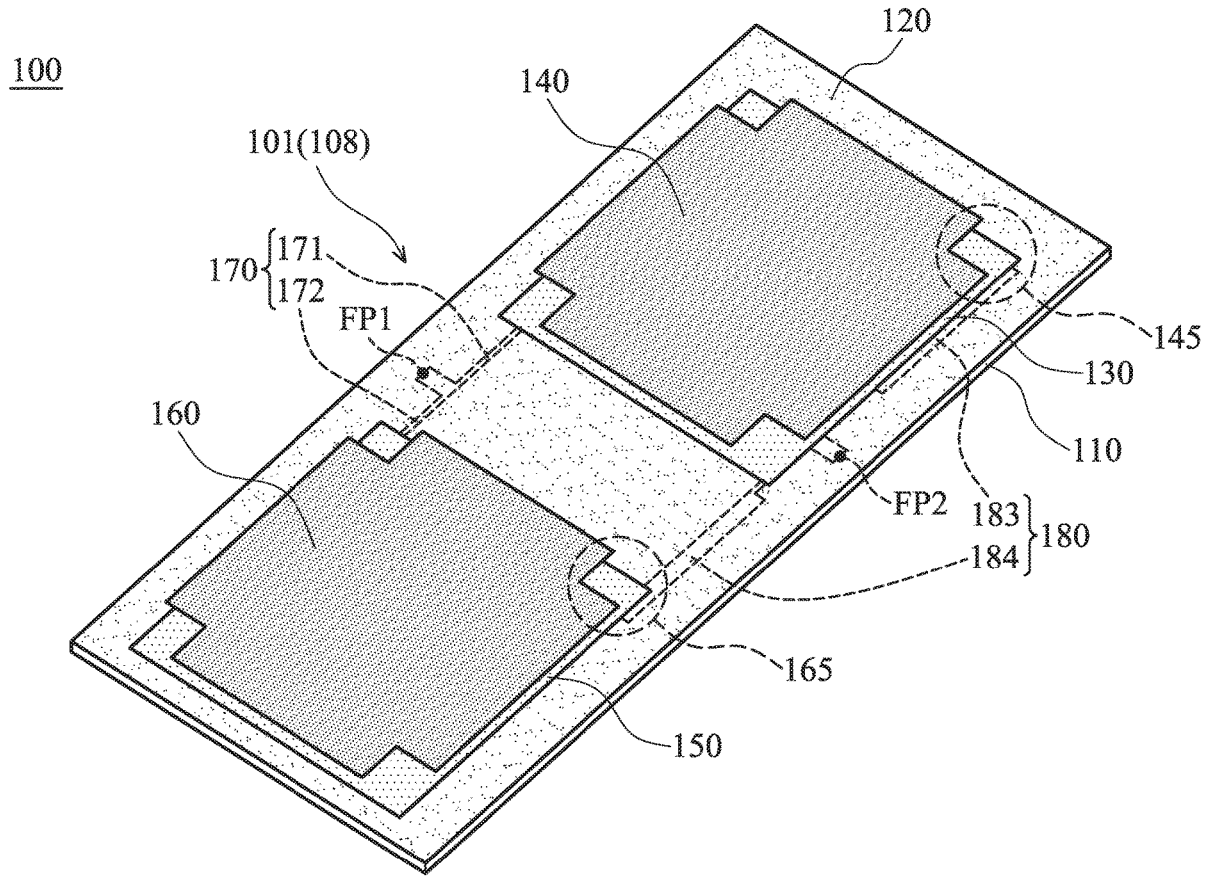
|---|---|
| ***H01Q 5/371*** | (2006.01) |
| ***H01Q 5/321*** | (2006.01) |
| ***H01Q 5/50*** | (2006.01) |

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

CPC ..... ***H01Q 5/371*** (2015.01); ***H01Q 5/50*** (2015.01); ***H01Q 5/321*** (2015.01)

(57) **ABSTRACT**

An antenna system includes at least one antenna array. The antenna array includes a dielectric substrate, a ground plane, a first radiation element, a second radiation element, a third radiation element, a fourth radiation element, a first feeding element, and a second feeding element. The second radiation element is adjacent to the first radiation element. The first radiation element is positioned between the second radiation element and the ground plane. The fourth radiation element is adjacent to the third radiation element. The third radiation element is positioned between the fourth radiation element and the ground plane. The first feeding element is coupled to a first connection point on the first radiation element and a second connection point on the third radiation element. The second feeding element is coupled to a third connection point on the first radiation element and a fourth connection point on the third radiation element.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0057822 A1**

**KARIYA et al.** (43) **Pub. Date: Feb. 25, 2021**

(54) **WIRELESS COMMUNICATION DEVICE**

(71) Applicant: **TORAY INDUSTRIES, INC.**, Tokyo (JP)

(72) Inventors: **Yoshihiro KARIYA**, Shiga (JP); **Kenta NOGUCHI**, Shiga (JP); **Hiroji SHIMIZU**, Shiga (JP); **Seiichiro MURASE**, Shiga (JP); **Hisashi NISHIKAWA**, Shiga (JP)

(73) Assignee: **Toray Industries, Inc.**, Tokyo (JP)

(21) Appl. No.: **16/978,490**

(22) PCT Filed: **Mar. 4, 2019**

(86) PCT No.: **PCT/JP2019/008406**

§ 371 (c)(1),
(2) Date: **Sep. 4, 2020**

(30) **Foreign Application Priority Data**

Mar. 9, 2018 (JP) ..... 2018-042688
Nov. 28, 2018 (JP) ..... 2018-222084

**Publication Classification**

(51) **Int. Cl.**

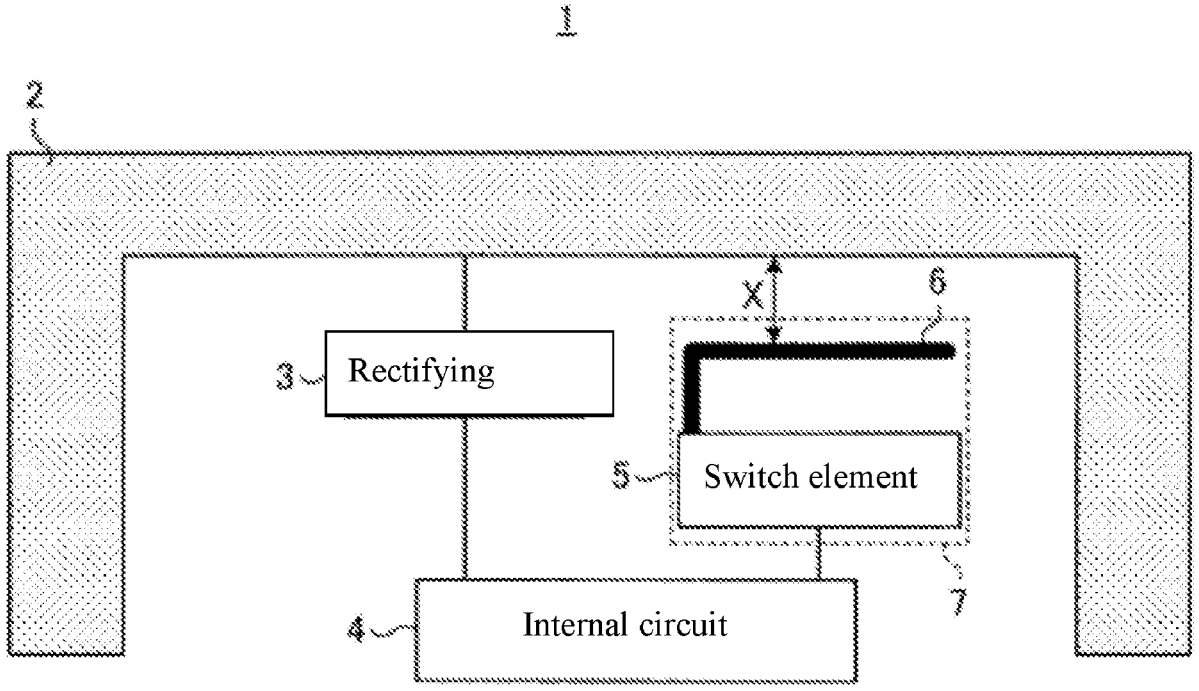
| | |
|---|---|
| ***H01Q 7/00*** | (2006.01) |
| ***H04B 1/59*** | (2006.01) |
| ***H04B 5/00*** | (2006.01) |
| ***H01Q 1/22*** | (2006.01) |
| ***H04B 5/02*** | (2006.01) |

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

CPC ..... ***H01Q 7/00*** (2013.01); ***H04B 1/59*** (2013.01); ***H04B 5/02*** (2013.01); ***H01Q 1/2283*** (2013.01); ***H04B 5/0031*** (2013.01)

(57) **ABSTRACT**

A wireless communication device includes: an antenna for transmitting and receiving a radio wave, a rectifying circuit that is connected to the antenna and rectifies the radio wave received by the antenna to generate voltage, an internal circuit that operates by the voltage generated by the rectifying circuit, and a switch circuit that is disposed contactlessly with respect to the antenna and operates on the basis of an output signal of the internal circuit, wherein the switch circuit includes a coupling wiring and a switch element, and the operation of the switch element varies the impedance of the antenna so that communication can be carried out.



US 20210057823A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0057823 A1**

(43) **Pub. Date: Feb. 25, 2021**

**ZHANG et al.**

(54) **MILLIMETER WAVE FILTERING ANTENNA AND WIRELESS COMMUNICATION DEVICE**

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

(72) Inventors: **Xiuyin ZHANG**, Guangzhou (CN); **Shengjie YANG**, Guangzhou (CN); **Yihui YAO**, Guangzhou (CN); **Yunfei CAO**, Guangzhou (CN); **Quan XUE**, Guangzhou (CN)

(21) Appl. No.: **16/996,016**

(22) Filed: **Aug. 18, 2020**

(30) **Foreign Application Priority Data**

Aug. 19, 2019 (CN) ..... 201910762377.3

**Publication Classification**

(51) **Int. Cl.**

***H01Q 9/04*** (2006.01)

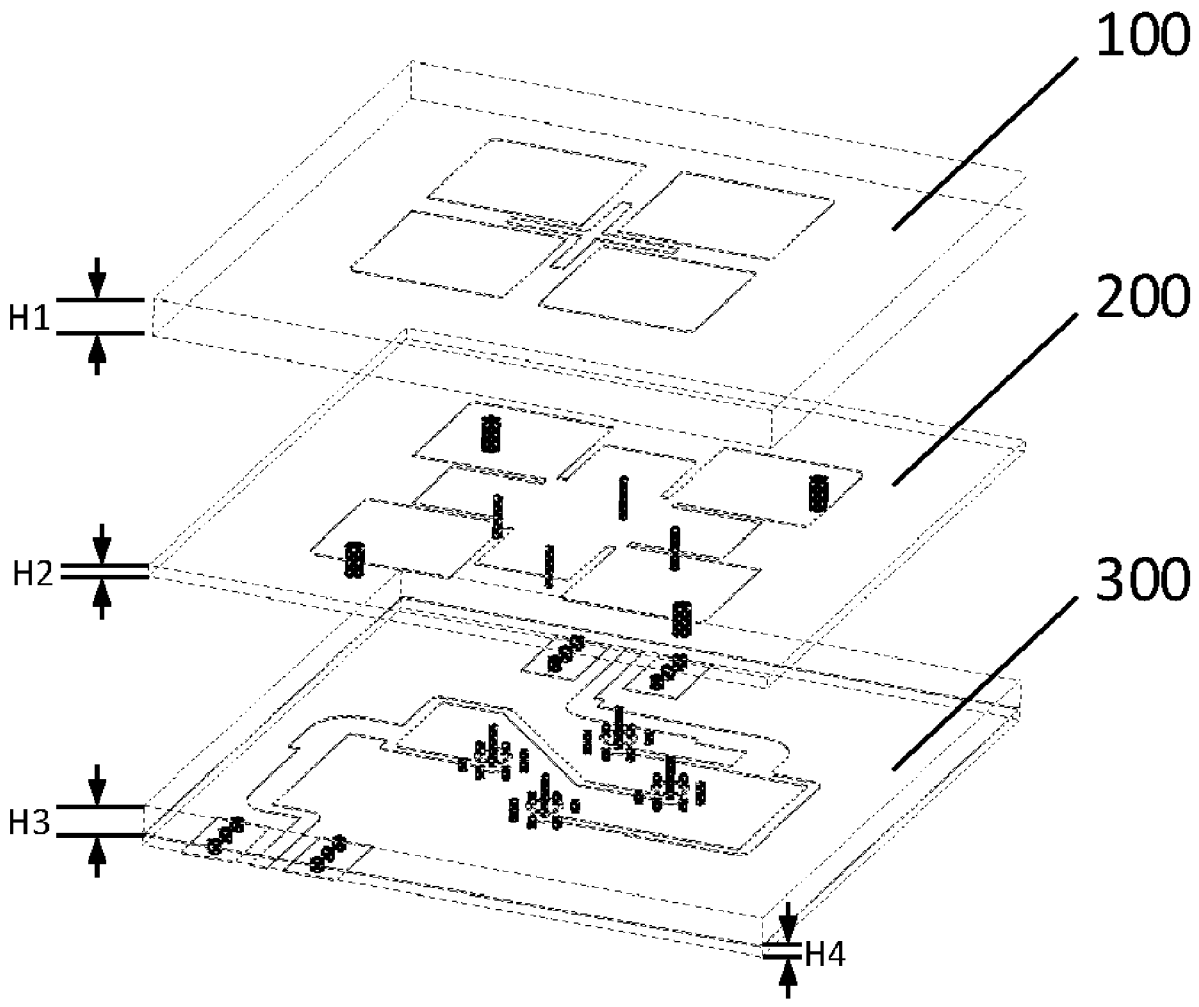
***H01Q 1/36*** (2006.01)

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

CPC ..... ***H01Q 9/0414*** (2013.01); ***H01Q 1/36*** (2013.01)

(57) **ABSTRACT**

A millimeter wave filtering antenna and a wireless communication device are disclosed. The millimeter wave filtering antenna includes a parasitic unit, a feeding unit and a feeding network. The parasitic unit includes at least one quadrilateral parasitic patch and at least one cross shaped parasitic patch, both of which are nested and combined with each other. The feeding unit includes a feeding patch, and the feeding patch is loaded with a short-circuit patch to form coupling. The feeding network feeds the feeding unit. The wireless communication device includes a millimeter wave filtering antenna according to the present disclosure. The radiation performance of the antenna can not only realize the filtering characteristics with high roll-off and high isolation, but also ensure that no additional insertion loss is introduced.



US 20210059076A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2021/0059076 A1

(43) Pub. Date: Feb. 25, 2021

KWON et al.

(54) **ELECTRONIC DEVICE INCLUDING COMPOSITE HEAT DISSIPATION MEMBER AND METHOD OF MANUFACTURING THE SAME**

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

(72) Inventors: **Ohhyuck KWON**, Suwon-si (KR); **Min PARK**, Suwon-si (KR); **Jaeyoung HUH**, Suwon-si (KR); **Daesuk KANG**, Suwon-si (KR); **Ji EOM**, Suwon-si (KR); **Ewidon JEONG**, Suwon-si (KR); **Sungchul PARK**, Suwon-si (KR)

(21) Appl. No.: **16/988,980**

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

(30) **Foreign Application Priority Data**

Aug. 19, 2019 (KR) ..... 10-2019-0100901

**Publication Classification**

(51) **Int. Cl.**

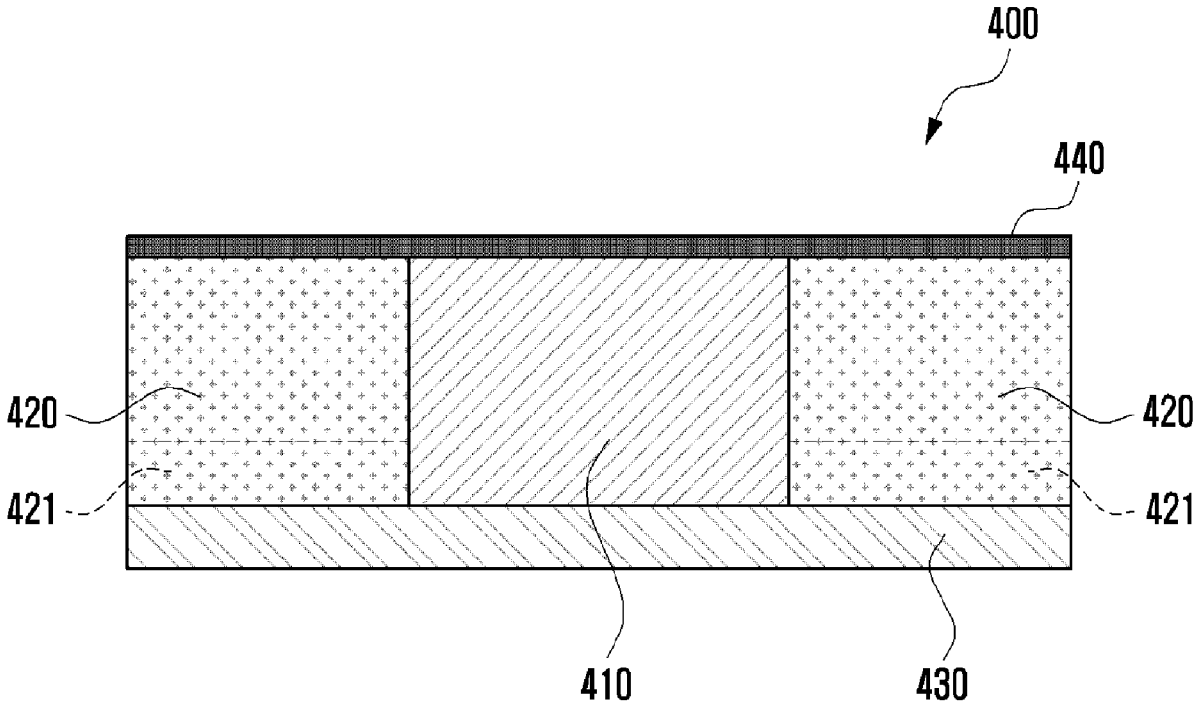
***H05K 7/20*** (2006.01)
***G06F 1/20*** (2006.01)
***H01Q 1/02*** (2006.01)

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

CPC ..... ***H05K 7/20445*** (2013.01); ***H01Q 1/02*** (2013.01); ***G06F 1/203*** (2013.01)

(57) **ABSTRACT**

A composite heat dissipation member and an electronic device comprising the composite heat dissipation member. The composite head dissipation member may include a first heat dissipation sheet disposed to be overlapped with an antenna module, and a second heat dissipation sheet disposed adjacent to the first heat dissipation sheet without an overlap with the first heat dissipation sheet, thermally connected to the first heat dissipation sheet, and having a higher thermal conductivity than the first heat dissipation sheet.



US 20210066781A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066781 A1**

**Oh et al.** (43) **Pub. Date: Mar. 4, 2021**

(54) **DISPLAY MODULE EXCITATION FOR WIRELESS COMMUNICATIONS**

(71) Applicant: **GOOGLE LLC**, Mountain View, CA (US)

(72) Inventors: **Sung Oh**, San Jose, CA (US); **Uei-ming Jow**, San Diego, CA (US); **Huan Liao**, San Jose, CA (US)

(21) Appl. No.: **16/947,222**

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

**Related U.S. Application Data**

(60) Provisional application No. 62/892,068, filed on Aug. 27, 2019.

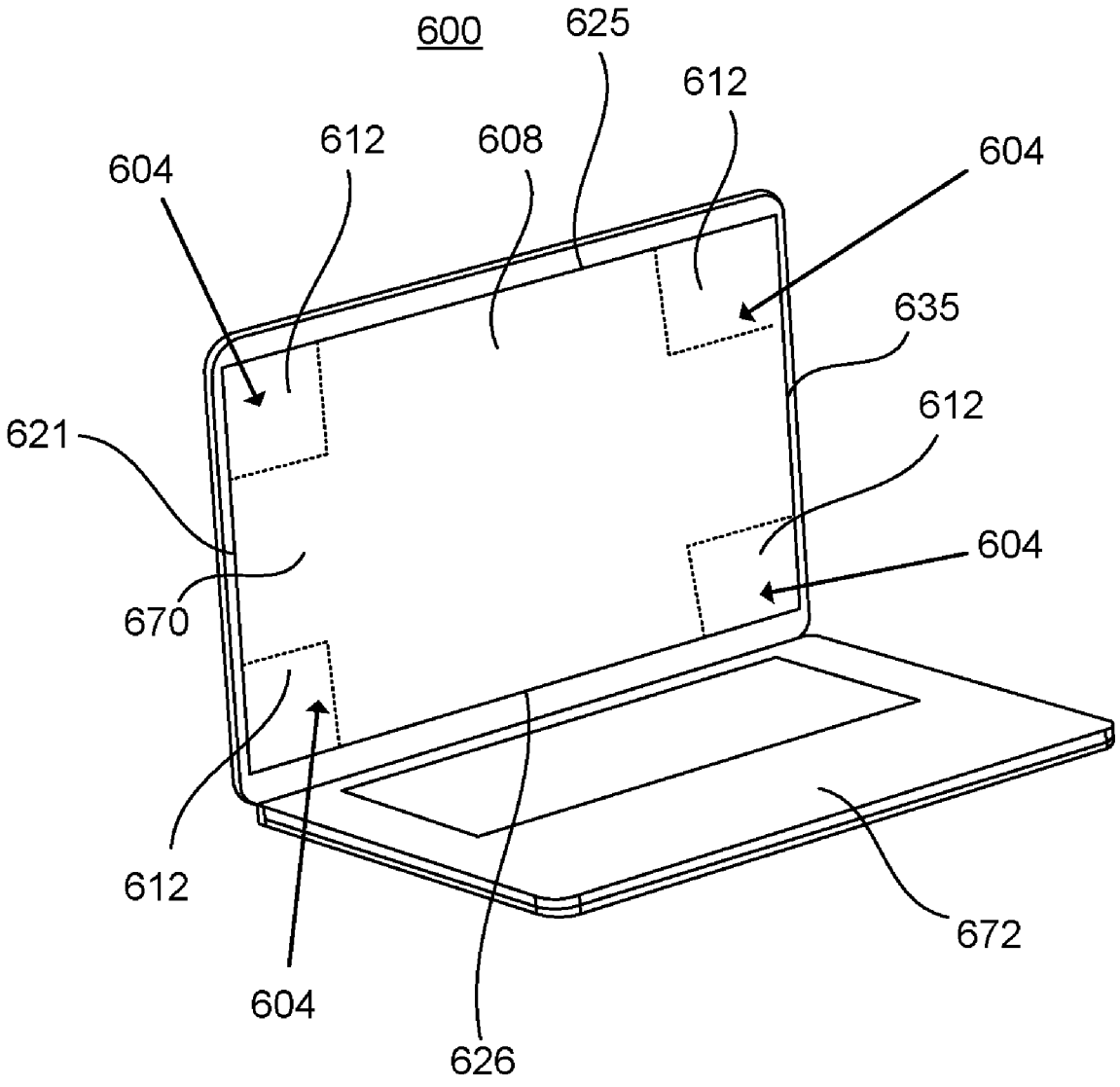
**Publication Classification**

(51) **Int. Cl.**
*H01Q 1/22* (2006.01)
*H01Q 1/48* (2006.01)

(52) **U.S. Cl.**
CPC ..... ***H01Q 1/2266*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

According to an aspect, a display device includes a display module including a display panel and a conductive layer, and an enclosure configured to surround the display module, where the enclosure includes a conductive portion. The display device includes an antenna having a structure formed by an air gap disposed between the conductive layer and the conductive portion of the enclosure. The antenna includes an antenna feed located within the air gap. The antenna feed is coupled to the conductive portion of the enclosure and to the conductive layer such that at least a portion of the display module is configured as a radiating element for wireless communication.



US 20210066786A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066786 A1**

**Yarga et al.** (43) **Pub. Date: Mar. 4, 2021**

(54) **ELECTRONIC DEVICES HAVING MULTI-BAND ANTENNA STRUCTURES**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventors: **Salih Yarga**, Sunnyvale, CA (US); **Jingni Zhong**, Campbell, CA (US); **Bilgehan Avser**, Mountain View, CA (US); **Mattia Pascolini**, San Francisco, CA (US)

(21) Appl. No.: **16/556,026**

(22) Filed: **Aug. 29, 2019**

**Publication Classification**

(51) **Int. Cl.**

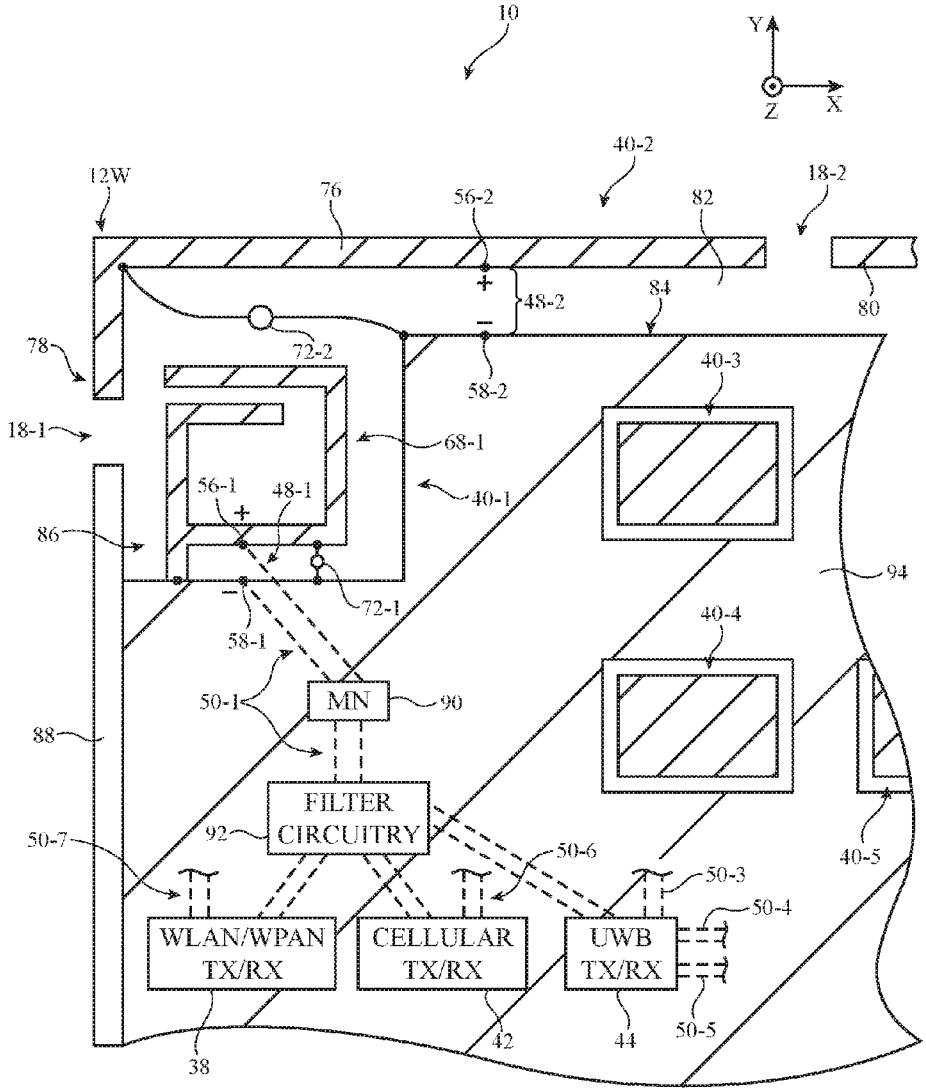
| | |
|---|---|
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 5/30*** | (2006.01) |
| ***H01Q 5/25*** | (2006.01) |

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

CPC ..... ***H01Q 1/243*** (2013.01); ***H01Q 5/25*** (2015.01); ***H01Q 5/30*** (2015.01)

(57) **ABSTRACT**

An electronic device may be provided with an antenna having a resonating element. The resonating element may have first and second arms extending from opposing sides of a feed. The first arm may have a fundamental mode that radiates in a first communications band such as a 5.0 GHz wireless local area network band. The second arm may have a fundamental mode that radiates in a second communications band such as one or more cellular ultra-high bands. The second resonating element arm may have a harmonic mode that radiates in first and second ultra-wideband (UWB) communications bands. The antenna may include a tunable component that is adjustable between first and second states. The second arm may radiate in the first UWB communications band while the tunable component is in the first state and in the second UWB communications band while the tunable component is in the second state.



US 20210066787A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2021/0066787 A1

WANG (43) Pub. Date: Mar. 4, 2021

(54) ANTENNA MODULE AND TERMINAL

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

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

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

(21) Appl. No.: **16/699,388**

(22) Filed: **Nov. 29, 2019**

(30) **Foreign Application Priority Data**

Aug. 30, 2019 (CN) ..... 201910817109.7

**Publication Classification**

(51) **Int. Cl.**

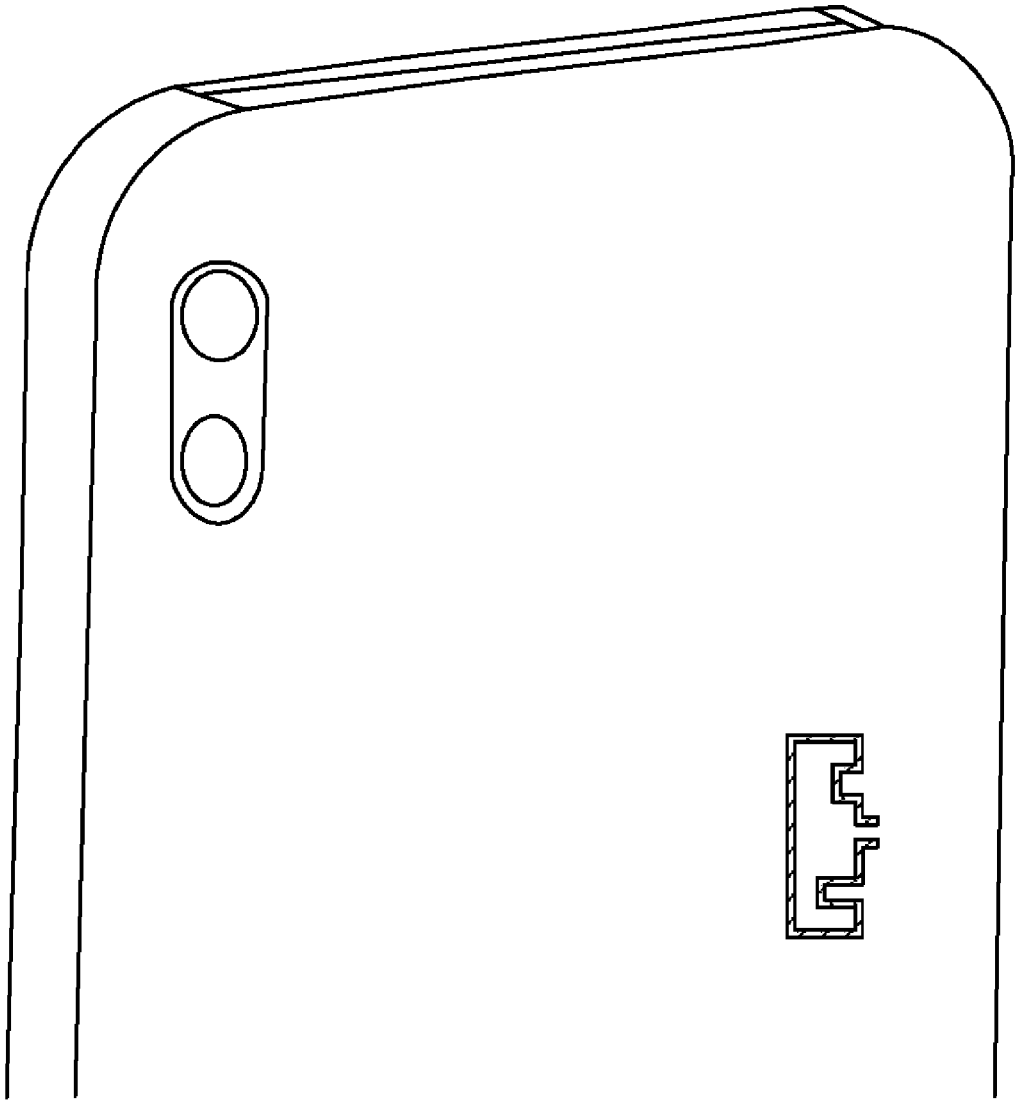
| | |
|---|---|
| ***H01Q 1/24*** | (2006.01) |
| ***H04M 1/02*** | (2006.01) |
| ***H01Q 9/04*** | (2006.01) |

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

CPC ..... ***H01Q 1/243*** (2013.01); ***H01Q 9/0464*** (2013.01); ***H04M 1/026*** (2013.01)

(57) **ABSTRACT**

An antenna module includes: a feeding branch, a first branch, a second branch, a third branch and a grounding branch; the feeding branch is connected to a feeding point, and the grounding branch is connected to a grounding point; the first branch and the third branch are concave branches; the second branch is a bent branch; the feeding branch, the first branch, the second branch, the third branch and the grounding branch are connected in sequence to form an annular structure with a slot, the slot is located between the feeding branch and the grounding branch, and the slot is internally insulated.



US 20210066788A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066788 A1**

**KIM** (43) **Pub. Date: Mar. 4, 2021**

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

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

(72) Inventor: **Yeonwoo KIM**, Gyeonggi-do (KR)

(21) Appl. No.: **16/932,945**

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

(30) **Foreign Application Priority Data**

Aug. 30, 2019 (KR) ..... 10-2019-0106955

**Publication Classification**

(51) **Int. Cl.**

***H01Q 1/24*** (2006.01)

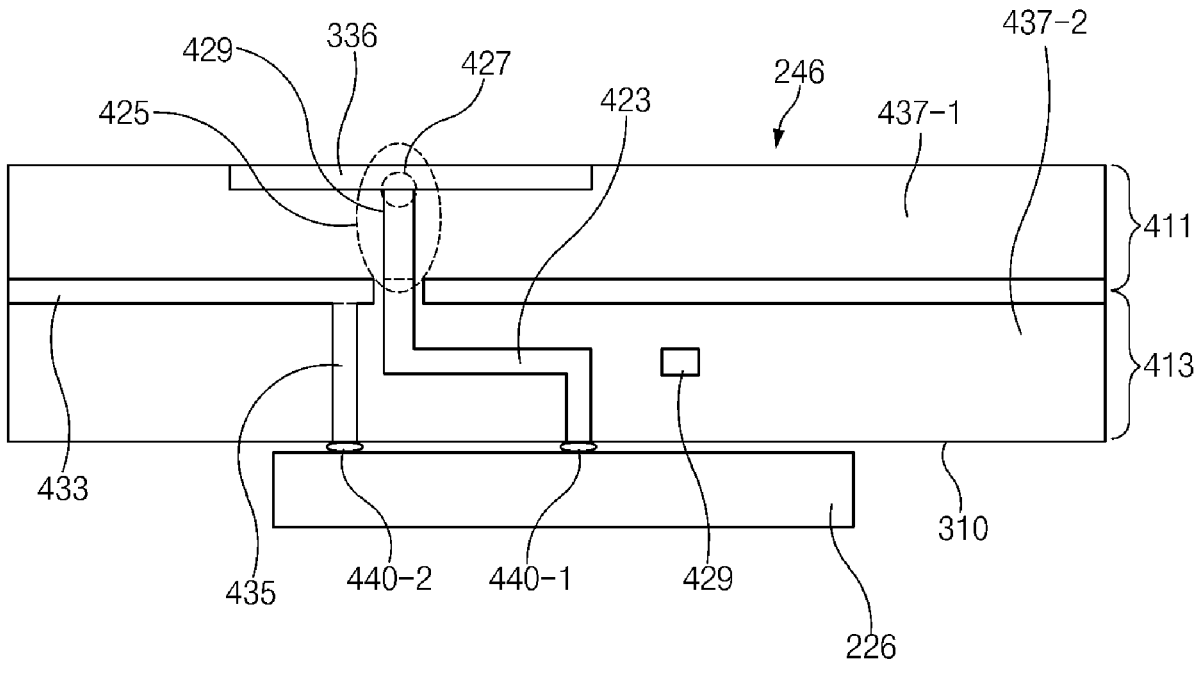
***H01Q 3/34*** (2006.01)

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

CPC ..... ***H01Q 1/243*** (2013.01); ***H01Q 3/34*** (2013.01)

(57) **ABSTRACT**

Disclosed in one embodiment is an antenna module which includes a printed circuit board (PCB) that includes a first surface, a second surface, and a third surface, a first antenna that is disposed on the first surface, a second antenna that includes a first portion disposed on the second surface, a second portion extended from the first portion so as to be adjacent to the third surface, and a third portion extended from the second portion so as to face the first antenna, at least one ground layer that is interposed between the first antenna and the second antenna, and at least one wire that feeds the first antenna and the second antenna. The first antenna and at least a portion of the first portion overlap each other when viewed in the second direction, and the first antenna and the second portion are disposed to be spaced from each other.



US 20210066791A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066791 A1**

**PARK et al.** (43) **Pub. Date: Mar. 4, 2021**

(54) **ANTENNA MODULE COMPRISING DIELECTRIC AND BASE STATION COMPRISING SAME**

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

(72) Inventors: **Jungmin PARK**, Suwon-si, Gyeonggi-do (KR); **Jungyub LEE**, Suwon-si, Gyeonggi-do (KR); **Seungtae KO**, Suwon-si, Gyeonggi-do (KR); **Yoongeon KIM**, Suwon-si, Gyeonggi-do (KR); **Youngju LEE**, Suwon-si, Gyeonggi-do (KR)

(21) Appl. No.: **16/961,756**

(22) PCT Filed: **Jan. 14, 2019**

(86) PCT No.: **PCT/KR2019/000539**

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

(30) **Foreign Application Priority Data**

Jan. 12, 2018 (KR) ..... 10-2018-0004601

**Publication Classification**

(51) **Int. Cl.**

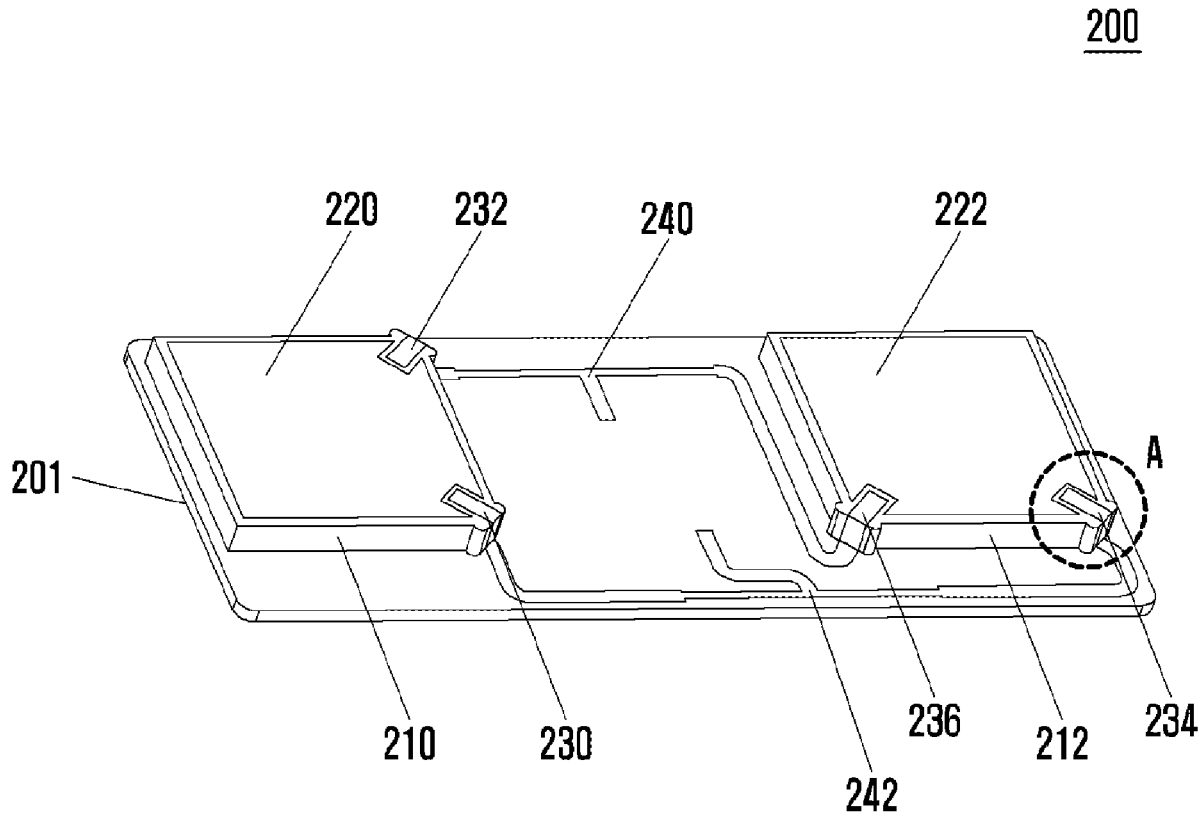
| | |
|---|---|
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 1/46*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 21/06*** | (2006.01) |
| ***H01Q 21/24*** | (2006.01) |

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

CPC ..... ***H01Q 1/38*** (2013.01); ***H01Q 1/46*** (2013.01); ***H01Q 21/24*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 1/246*** (2013.01)

(57) **ABSTRACT**

The present invention relates to a communication technique for fusing a 5G communication system with IoT technology to support a higher data rate than a 4G system, and a system therefore. The present disclosure may be applied to intelligent services (for example, smart home, smart building, smart city, smart car or connected car, health care, digital education, retailing, security and safety related services, and the like) on the basis of 5G communication technology and IoT related technology. The present invention provides an antenna module including at least one antenna array comprising: a first dielectric having a plate shape; a second dielectric disposed on a top of the first dielectric, wherein a top of the second dielectric is separated from the top of the first dielectric by a first distance; a first radiator disposed on the top surface of the second dielectric; and a feeder disposed on the first dielectric and on the second dielectric to supply an RF signal to the first radiator; and a feeder disposed on the first dielectric and the second dielectric and configured to supply a radio frequency (RF) signal to the first radiator.



US 20210066799A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066799 A1**

**Avser et al.** (43) **Pub. Date: Mar. 4, 2021**

(54) **ELECTRONIC DEVICES HAVING ENCLOSURE-COUPLED MULTI-BAND ANTENNA STRUCTURES**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventors: **Bilgehan Avser**, Mountain View, CA (US); **Xu Han**, Santa Clara, CA (US); **Salih Yarga**, Sunnyvale, CA (US); **Jingni Zhong**, Campbell, CA (US); **Hao Xu**, Cupertino, CA (US); **Mattia Pascolini**, San Francisco, CA (US)

(21) Appl. No.: **16/553,045**

(22) Filed: **Aug. 27, 2019**

**Publication Classification**

(51) **Int. Cl.**

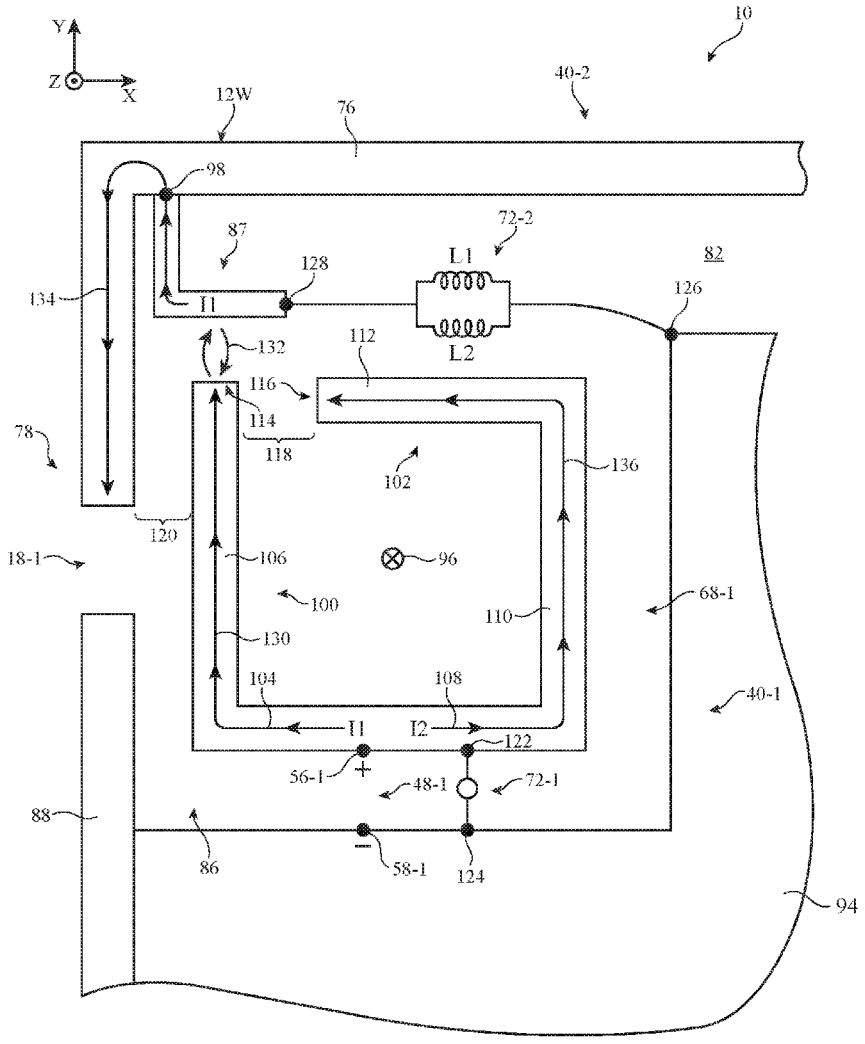
| | |
|---|---|
| ***H01Q 5/25*** | (2006.01) |
| ***H04B 1/38*** | (2006.01) |
| ***H01Q 23/00*** | (2006.01) |
| ***H01Q 1/48*** | (2006.01) |

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

CPC ..... ***H01Q 5/25*** (2015.01); ***H01Q 1/48*** (2013.01); ***H01Q 23/00*** (2013.01); ***H04B 1/38*** (2013.01)

(57) **ABSTRACT**

An electronic device may be provided with a housing and an antenna having a resonating element. The resonating element may have first and second arms extending from opposing sides of a feed. The first arm and a portion of the housing may radiate in a cellular ultra-high band. The first arm may have a fundamental mode that radiates in a first ultra-wideband (UWB) communications band at 6.5 GHz. The second arm may have a fundamental mode that radiates in a 5.0 GHz wireless local area network band. The first and second arms may have a harmonic mode that radiates in a second UWB communications band at 8.0 GHz. The antenna may convey radio-frequency signals in each of these communications bands without the need for adjusting components in the antenna to switch between the UWB communications bands.



US 20210066800A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066800 A1**

**SUH** (43) **Pub. Date: Mar. 4, 2021**

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

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

(72) Inventor: **Younghoon SUH**, Gyeonggi-do (KR)

(21) Appl. No.: **17/005,460**

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

(30) **Foreign Application Priority Data**

Aug. 30, 2019 (KR) ..... 10-2019-0107291

**Publication Classification**

(51) **Int. Cl.**

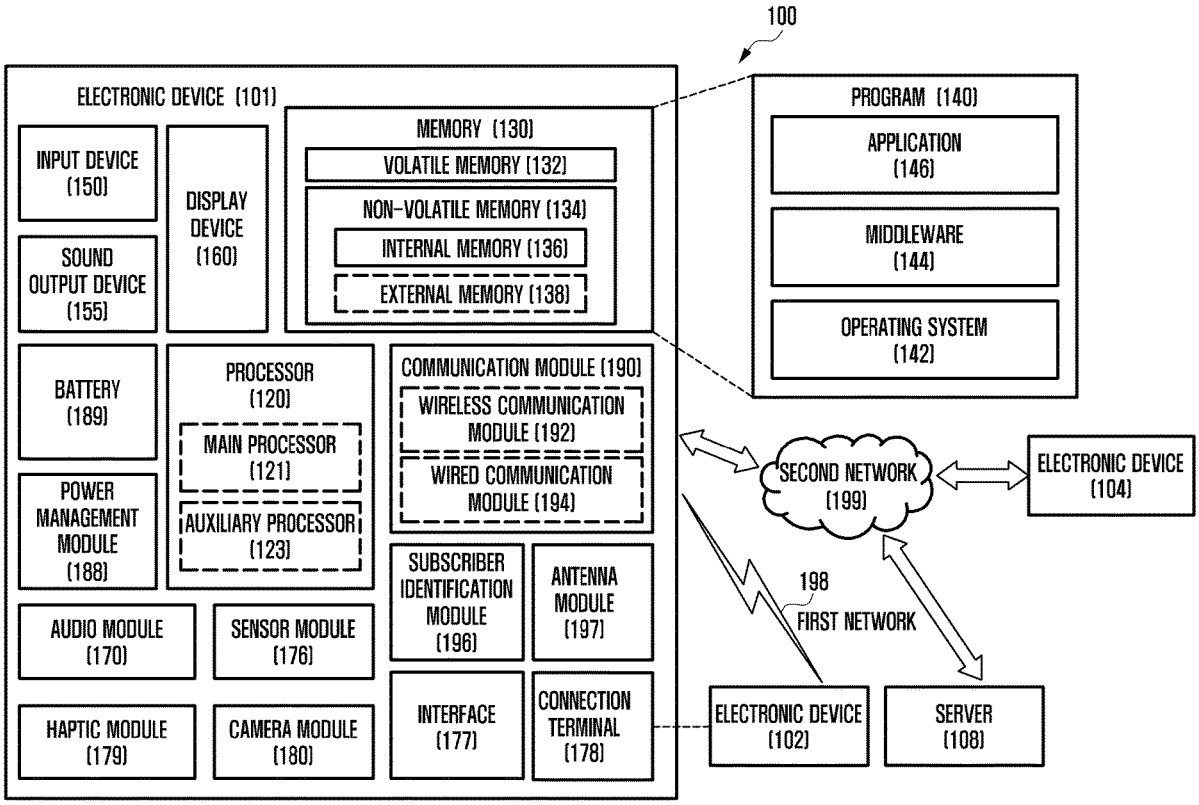
| | |
|---|---|
| ***H01Q 5/371*** | (2006.01) |
| ***H01Q 1/22*** | (2006.01) |
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 5/47*** | (2006.01) |

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

CPC ..... ***H01Q 5/371*** (2015.01); ***H01Q 5/47*** (2015.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/2283*** (2013.01)

(57) **ABSTRACT**

In an embodiment, an electronic device may include a housing having an inner space, a first printed circuit board including a wireless communication circuit, an antenna structure connected to the wireless communication circuit through a first electrical path, and a tunable circuit having a first resistance value and disposed on a second electrical path. The electronic device may further include a low-resistance circuit disposed on a third electrical path branched from the second electrical path, and including a resistor and an inductor, the resistor having a second resistance value determined based on the first resistance value, and the inductor having a constant inductance value and disposed between the resistor and the ground. The electronic device may also include at least one processor configured to control the tunable circuit.



US 20210066801A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0066801 A1**

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

**TSAI et al.**

(54) **ANTENNA STRUCTURE**

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

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

(21) Appl. No.: **16/747,124**

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

(30) **Foreign Application Priority Data**

Aug. 30, 2019 (TW) ..... 108131157

**Publication Classification**

(51) **Int. Cl.**

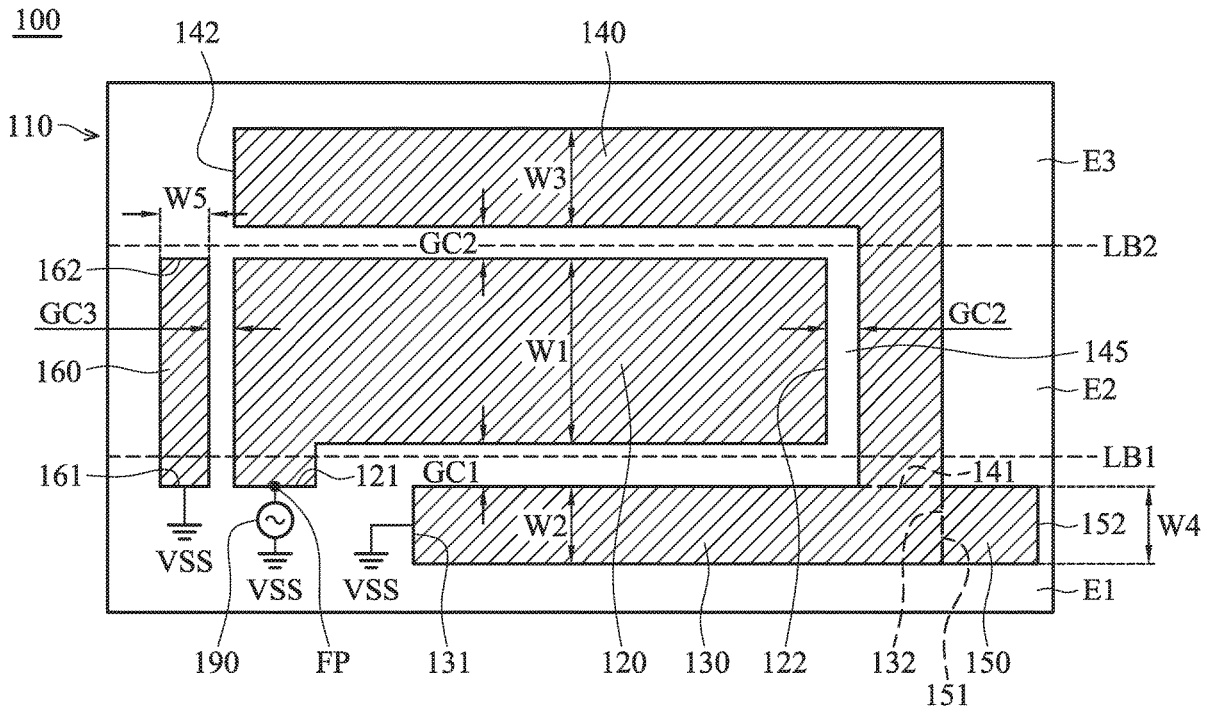
| | |
|---|---|
| ***H01Q 5/385*** | (2006.01) |
| ***H01Q 9/30*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |

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

CPC ..... ***H01Q 5/385*** (2015.01); ***H01Q 1/243*** (2013.01); ***H01Q 9/30*** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a nonconductive supporting element, a feeding radiation element, a first radiation element, a second radiation element, a third radiation element, and a fourth radiation element. The first radiation element is coupled to a ground voltage. A first coupling gap is formed between the first radiation element and the feeding radiation element. The second radiation element is coupled to the first radiation element. A second coupling gap is formed between the second radiation element and the feeding radiation element. The third radiation element is coupled to the first radiation element. The fourth radiation element is coupled to the ground voltage. A third coupling gap is formed between the fourth radiation element and the feeding radiation element. The feeding radiation element, the first radiation element, the second radiation element, the third radiation element, and the fourth radiation element are all disposed on the nonconductive supporting element.



US 20210066807A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0066807 A1**

**LEE et al.** (43) **Pub. Date: Mar. 4, 2021**

(54) **ELECTRONIC DEVICE INCLUDING HELICAL ANTENNA**

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

(72) Inventors: **Seunghak LEE**, Suwon-si (KR); **Jaerok CHO**, Suwon-si (KR); **Wanjae JU**, Suwon-si (KR); **Jaehan KIM**, Suwon-si (KR); **Jungyong YUN**, Suwon-si (KR)

(21) Appl. No.: **17/011,328**

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

(30) **Foreign Application Priority Data**

Sep. 3, 2019 (KR) ..... 10-2019-0109180

**Publication Classification**

(51) **Int. Cl.**

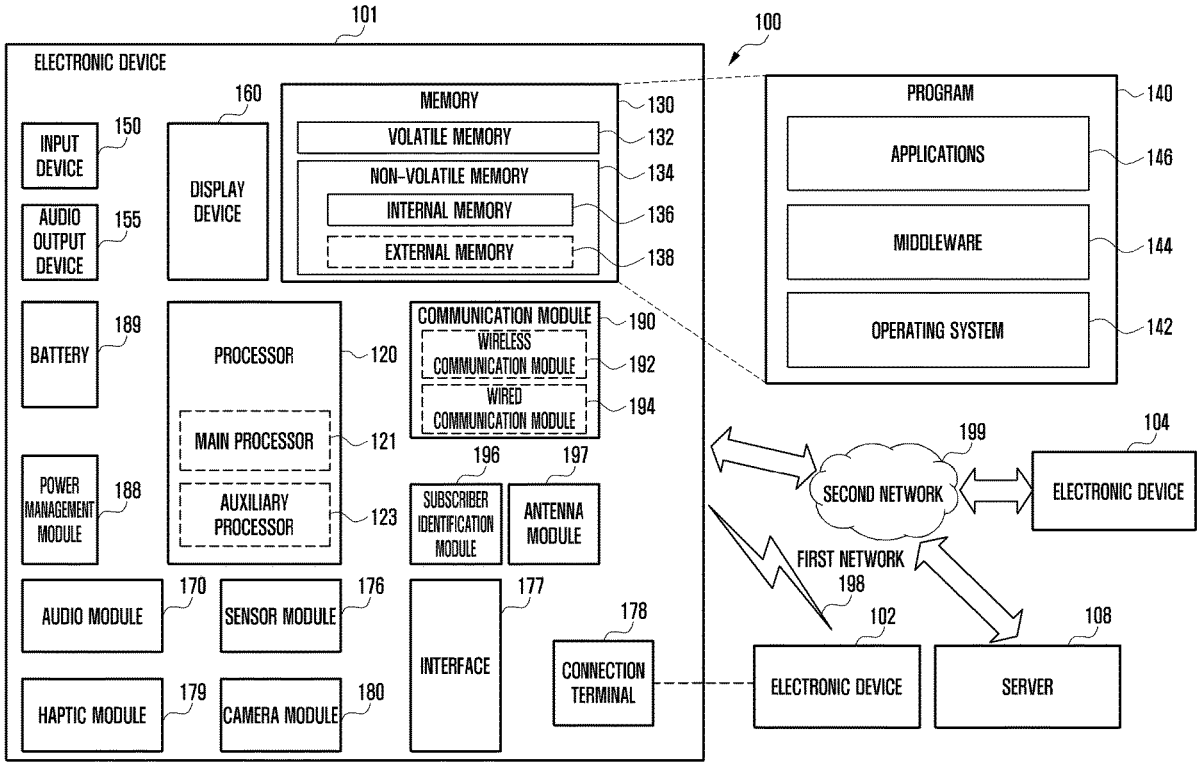
| | |
|---|---|
| ***H01Q 11/08*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 1/22*** | (2006.01) |
| ***H01Q 1/38*** | (2006.01) |

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

CPC ..... ***H01Q 11/08*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/2208*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

According to various embodiments, an electronic device may include: a housing including a front plate and a rear plate disposed opposite the front plate; a display disposed in a space between the front plate and the rear plate and viewable through at least a portion of the front plate; an antenna structure including at least one coil having a first surface facing the rear plate in the space and a second surface facing a direction opposite the first surface, the antenna structure configured to transmit and/or receive a signal of a selected or designated frequency; a first magnetic sheet disposed at the first surface; a second magnetic sheet at least partially overlapping the first magnetic sheet when viewed from above the rear plate, the second magnetic sheet being disposed at the second surface; and a third magnetic sheet disposed closer to the rear plate than the second surface, and spaced apart from the first magnetic sheet to have electromagnetically designated isolation with the first magnetic sheet with the second magnetic sheet interposed therebetween, when viewed from above the rear plate.



US 20210066816A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0066816 A1**

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

**Leung et al.**

(54) **DIELECTRIC RESONATOR ANTENNA**

(71) Applicant: **City University of Hong Kong**, Kowloon (HK)

(72) Inventors: **Kwok Wa Leung**, Kowloon Tong (HK); **Nan Yang**, Sham Shui Po (HK); **Weiwei Li**, Toronto (CA)

(21) Appl. No.: **16/556,499**

(22) Filed: **Aug. 30, 2019**

**Publication Classification**

(51) **Int. Cl.**

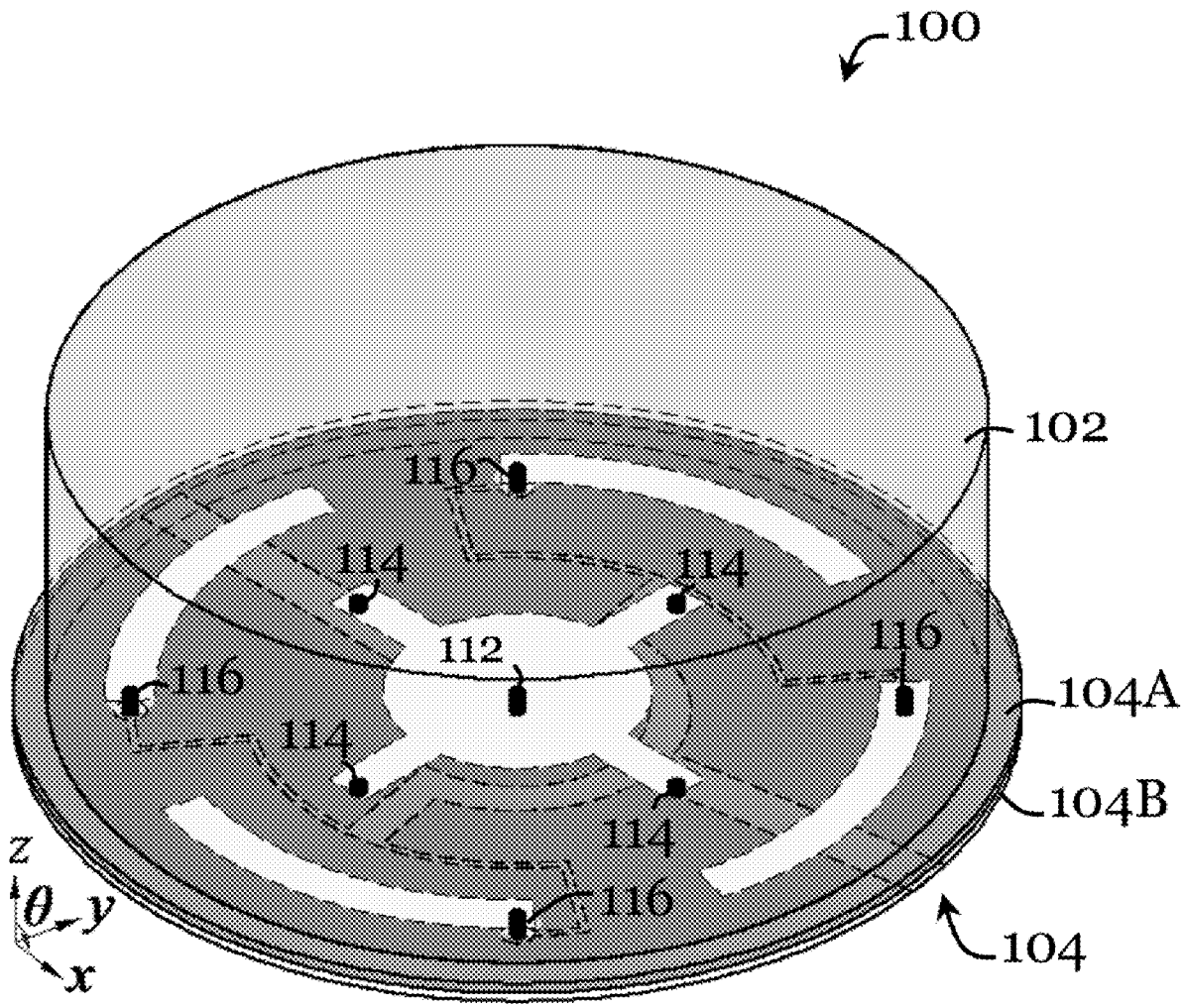
| | |
|---|---|
| ***H01Q 21/24*** | (2006.01) |
| ***H01Q 21/00*** | (2006.01) |
| ***H01Q 9/04*** | (2006.01) |
| ***H01Q 1/50*** | (2006.01) |
| ***H01Q 1/38*** | (2006.01) |

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

CPC ..... ***H01Q 21/24*** (2013.01); ***H01Q 21/0075*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/50*** (2013.01); ***H01Q 9/045*** (2013.01)

(57) **ABSTRACT**

A dielectric resonator antenna having a dielectric resonator element and a substrate assembly attached to the dielectric resonator element. The substrate assembly includes a feeding network arranged to: feed the dielectric resonator element to produce a first linearly-polarized omnidirectional radiation pattern at a first resonant mode, and feed the dielectric resonator element to produce a second linearly-polarized omnidirectional radiation pattern at a second resonant mode different from the first resonant mode.



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(19) **United States**

(12) **Patent Application Publication**

**Tehran et al.**

(10) **Pub. No.: US 2021/0066817 A1**

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

(54) **DUAL-BAND AND DUAL-POLARIZED MM-WAVE ARRAY ANTENNAS WITH IMPROVED SIDE LOBE LEVEL (SLL) FOR 5G TERMINALS**

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

(72) Inventors: **Hamid Reza Memar Zadeh Tehran**, Frisco, TX (US); **Sung-Chul Park**, Seoul (KR); **Gary Xu**, Allen, TX (US)

(21) Appl. No.: **16/856,771**

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

**Related U.S. Application Data**

(60) Provisional application No. 62/894,322, filed on Aug. 30, 2019, provisional application No. 62/912,851, filed on Oct. 9, 2019, provisional application No. 62/924,397, filed on Oct. 22, 2019.

**Publication Classification**

(51) **Int. Cl.**

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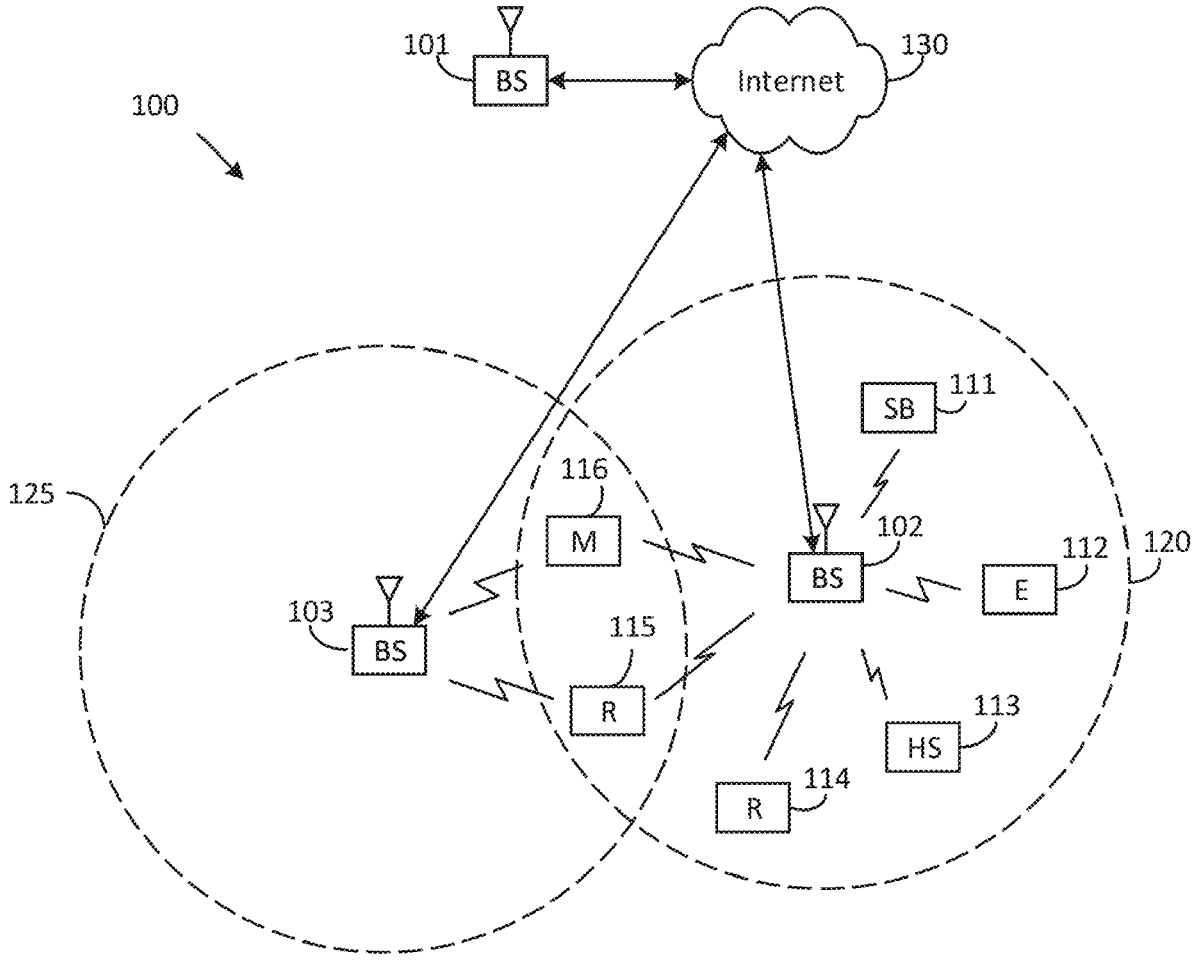
| ***H01Q 21/24*** | (2006.01) |
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 21/06*** | (2006.01) |
| ***H01Q 9/04*** | (2006.01) |

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

CPC ..... ***H01Q 21/24*** (2013.01); ***H01Q 9/0414*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 1/38*** (2013.01)

(57) **ABSTRACT**

An antenna array and a user equipment (UE) including the antenna array. The antenna array includes a plurality of unit cells. Each unit cells includes first and second patches, phase shift transmission lines, a third patch, and a transmission line. The first and second patches radiate at a first frequency band and positioned in a first plane of the antenna array. The phase shift transmission lines connect the first and second patches and shift a phase of a signal between the first and second patches. The third patch is positioned in a second plane of the antenna array and beneath the first patch and radiates at a second frequency band that is lower than the first frequency band. The transmission line excites at least the third patch.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0067180 A1**

**Svendsen et al.** (43) **Pub. Date: Mar. 4, 2021**

(54) **ANTENNA BANDWIDTH ENHANCEMENT FOR AN ELECTRONIC DEVICE**

(71) Applicant: **INTEL CORPORATION**, Santa Clara, CA (US)

(72) Inventors: **Simon Svendsen**, Aalborg (DK); **Ole Jagielski**, Viborg (DK)

(73) Assignee: **INTEL CORPORATION**, Santa Clara, CA (US)

(21) Appl. No.: **16/926,971**

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

**Related U.S. Application Data**

(63) Continuation of application No. 15/719,781, filed on Sep. 29, 2017, now Pat. No. 10,715,187.

**Publication Classification**

(51) **Int. Cl.**

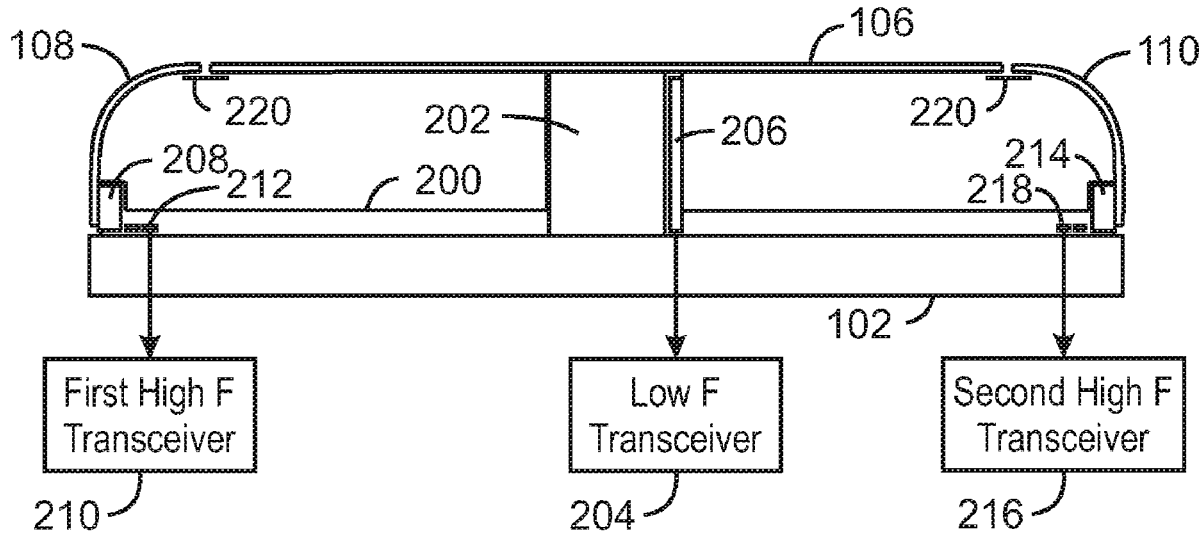
| | |
|---|---|
| ***H04B 1/00*** | (2006.01) |
| ***H04B 1/401*** | (2006.01) |
| ***H01Q 1/38*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 5/50*** | (2006.01) |
| ***H01Q 5/321*** | (2006.01) |
| ***H04B 1/3888*** | (2006.01) |
| ***H01Q 5/335*** | (2006.01) |
| ***H01Q 9/30*** | (2006.01) |
| ***H01Q 21/28*** | (2006.01) |

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

CPC ..... ***H04B 1/0064*** (2013.01); ***H04B 1/401*** (2013.01); ***H01Q 1/38*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 21/28*** (2013.01); ***H01Q 5/321*** (2015.01); ***H04B 1/3888*** (2013.01); ***H01Q 5/335*** (2015.01); ***H01Q 9/30*** (2013.01); ***H01Q 5/50*** (2015.01)

(57) **ABSTRACT**

Techniques are disclosed for configuring a broadband antenna system. An example electronic device includes a first antenna operating at a first frequency range and coupled to a first transceiver via a first signal path comprising a first indirect feed. The electronic device also includes a second antenna operating at a second frequency range and coupled to a second transceiver via a second signal path comprising a second indirect feed, wherein the first frequency range is lower than the first frequency range. The electronic device also includes a third antenna operating at the second frequency range and coupled to a third transceiver via a second signal path comprising a third indirect feed. Additionally, the first antenna is coupled to the first antenna and the second antenna by a capacitive coupling element.



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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0075085 A1**

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

(54) **ELECTRONIC DEVICE**

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

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

(21) Appl. No.: **16/710,609**

(22) Filed: **Dec. 11, 2019**

(30) **Foreign Application Priority Data**

Sep. 10, 2019 (TW) ..... 108132544

**Publication Classification**

(51) **Int. Cl.**

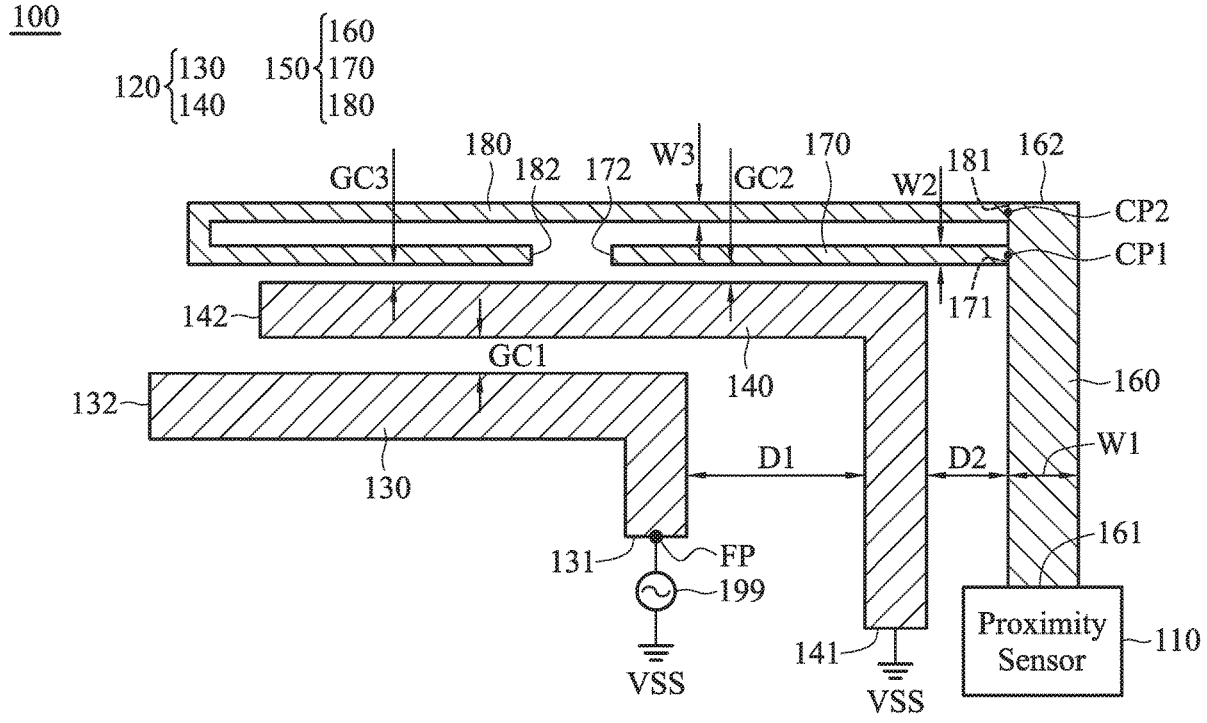
| | |
|---|---|
| ***H01Q 1/22*** | (2006.01) |
| ***H01Q 21/28*** | (2006.01) |
| ***H01Q 5/307*** | (2006.01) |

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

CPC ..... ***H01Q 1/22*** (2013.01); ***H01Q 5/307*** (2015.01); ***H01Q 21/28*** (2013.01)

(57) **ABSTRACT**

An electronic device includes a proximity sensor, an antenna structure, and a sensing pad. The antenna structure includes a first radiation element and a second radiation element which are separate from and adjacent to each other. The first radiation element has a feeding point. The second radiation element is coupled to a ground voltage. The sensing pad is adjacent to the antenna structure. The sensing pad includes a main branch, a first branch, and a second branch. The main branch is coupled to the proximity sensor. The first branch and the second branch are coupled to the main branch. The second branch has a meandering shape. The antenna structure covers a first frequency band and a second frequency band. The resonant frequency of the sensing pad is neither within the first frequency band nor within the second frequency band.



US 20210075089A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0075089 A1**

**Chang et al.** (43) **Pub. Date: Mar. 11, 2021**

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

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

(72) Inventors: **Chih-Hua Chang**, Taiwan (CN); **Chien-Ming Lee**, Shenzhen (CN); **Dong Yu**, Shanghai (CN); **Hanyang Wang**, Reading (GB); **Yen-Cheng Lai**, Shenzhen (CN)

(21) Appl. No.: **17/053,678**

(22) PCT Filed: **May 8, 2018**

(86) PCT No.: **PCT/CN2018/086083**

§ 371 (c)(1),
(2) Date: **Nov. 6, 2020**

**Publication Classification**

(51) **Int. Cl.**

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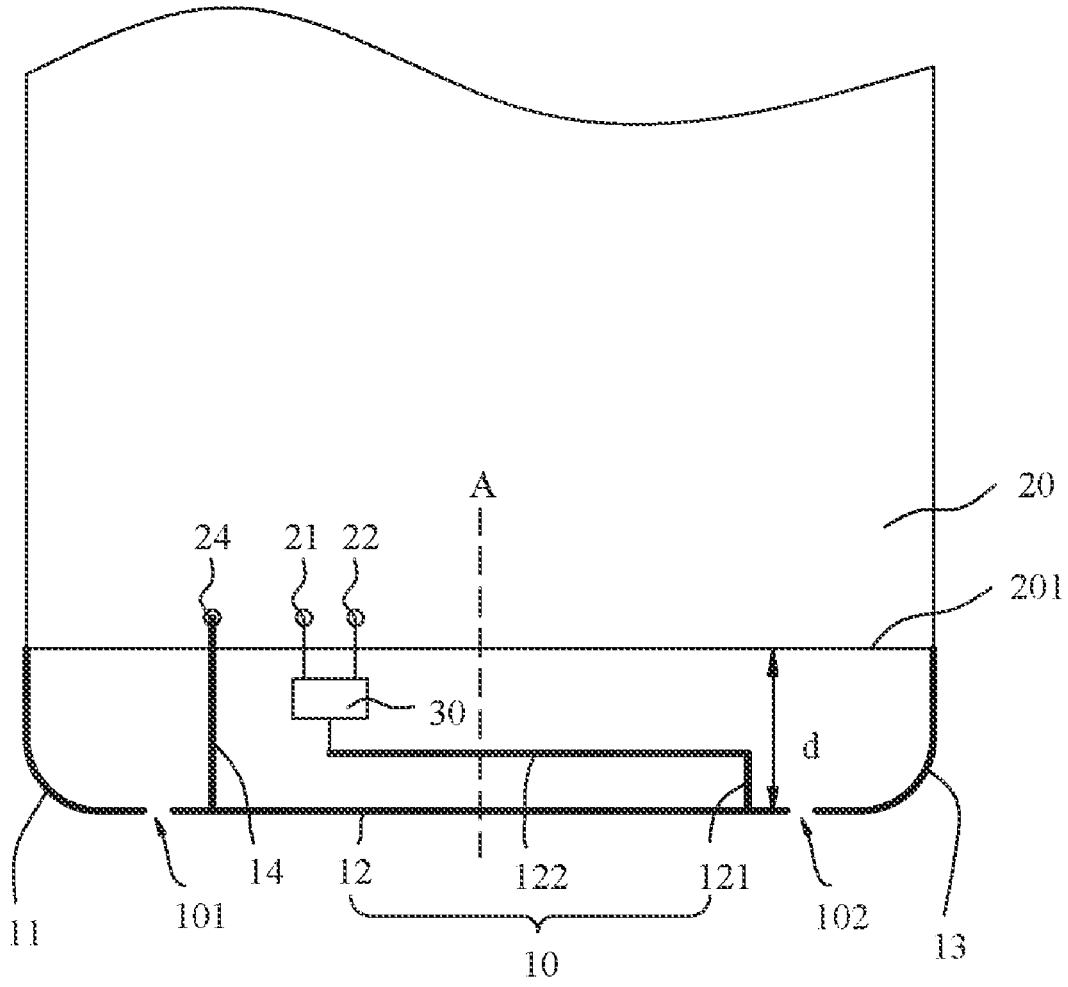
|---|---|
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 21/00*** | (2006.01) |
| ***H01Q 21/28*** | (2006.01) |

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

CPC ..... ***H01Q 1/242*** (2013.01); ***H01Q 21/28*** (2013.01); ***H01Q 21/0006*** (2013.01)

(57) **ABSTRACT**

An antenna apparatus includes two feeding parts, a filter matching network, and a radiator. The filter matching network includes a first port, a second port, and a third port. A first feeding part is electrically connected to the first port, a second feeding part is electrically connected to the second port, and the radiator is electrically connected to the third port. The first feeding part is configured to feed a low frequency signal and an intermediate frequency signal, the second feeding part is configured to feed a high frequency signal, the low frequency signal, the intermediate frequency signal, and the high frequency signal are respectively fed into the filter matching network by using the first feeding part and the second feeding part, and the filter matching network is configured to improve isolation between the low frequency signal and the intermediate frequency signal, and the high frequency signal.



US 20210075091A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2021/0075091 A1

(43) Pub. Date: Mar. 11, 2021

LEE et al.

(54) **ARRANGEMENT STRUCTURE FOR COMMUNICATION DEVICE AND ELECTRONIC DEVICE INCLUDING THE SAME**

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

(72) Inventors: **Jong Hyuck LEE**, Seongnam-si (KR); **Sehyun PARK**, Suwon-si (KR); **Jae-Bong CHUN**, Suwon-si (KR)

(21) Appl. No.: **17/099,615**

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

**Related U.S. Application Data**

(63) Continuation of application No. 16/201,500, filed on Nov. 27, 2018, now Pat. No. 10,840,583.

(30) **Foreign Application Priority Data**

Nov. 27, 2017 (KR) ..... 10-2017-0159219

**Publication Classification**

(51) **Int. Cl.**

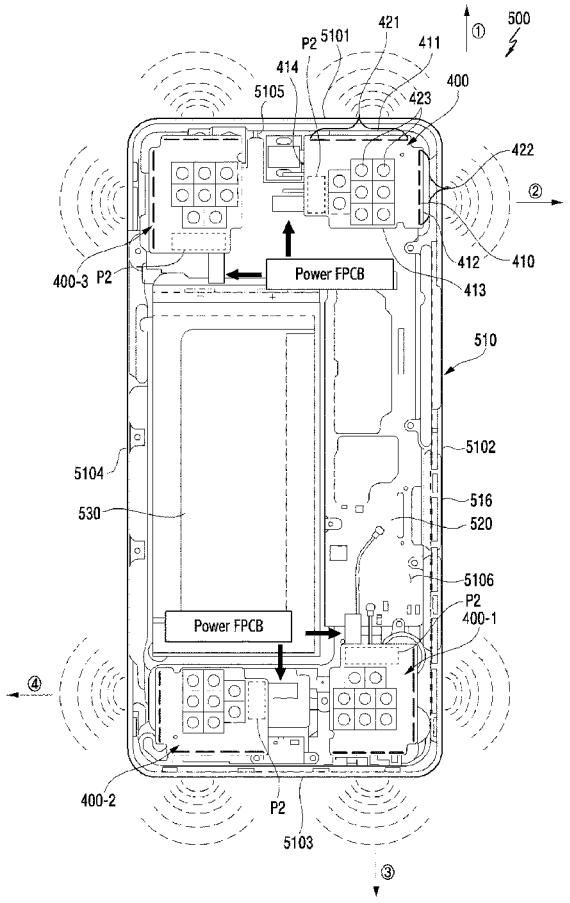
| | |
|---|---|
| ***H01Q 1/24*** | (2006.01) |
| ***H01Q 21/06*** | (2006.01) |
| ***H01Q 21/28*** | (2006.01) |
| ***H01Q 9/04*** | (2006.01) |

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

CPC ..... ***H01Q 1/245*** (2013.01); ***H01Q 21/067*** (2013.01); ***H01Q 21/28*** (2013.01); ***H01Q 21/065*** (2013.01); ***H01Q 9/0407*** (2013.01); ***H01Q 21/062*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

According to various embodiments, an electronic device includes a housing including a front surface plate; a rear surface plate facing toward the opposite direction of the front surface plate; and a side surface member surrounding a space between the front surface plate and the rear surface plate, the side surface member having a substantially rectangular shape when viewed above the front surface plate; a first PCB arranged in the space; a first wireless communication circuit; a substrate; a first antenna array protruding from the first side of the substrate toward the first portion; a second antenna array protruding from the second side of the substrate toward the second portion; and a second wireless communication circuit. Various other embodiments are possible.



US 20210075106A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0075106 A1**

(43) **Pub. Date: Mar. 11, 2021**

**Samardzija et al.**

(54) **DUAL-BAND ANTENNA, DEVICE AND METHOD FOR MANUFACTURING**

(71) Applicant: **Plume Design, Inc.**, Palo Alto, CA (US)

(72) Inventors: **Miroslav Samardzija**, Mountain View, CA (US); **Brian Nam**, San Jose, CA (US); **Ming-Tsung Su**, Palo Alto, CA (US); **Liem Hieu Dinh Vo**, San Jose, CA (US)

(21) Appl. No.: **16/565,573**

(22) Filed: **Sep. 10, 2019**

**Publication Classification**

(51) **Int. Cl.**

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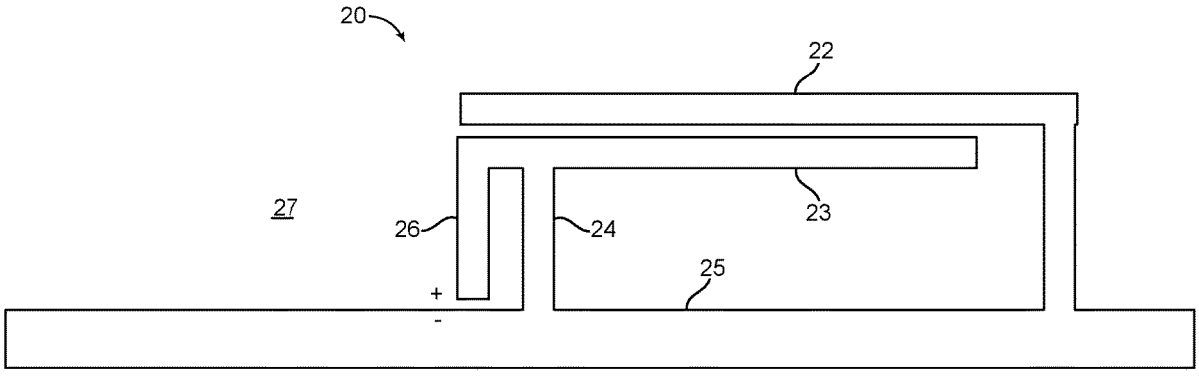
|---|---|
| ***H01Q 5/30*** | (2006.01) |
| ***H01Q 5/10*** | (2006.01) |
| ***H01Q 7/00*** | (2006.01) |
| ***H01Q 5/378*** | (2006.01) |
| ***H01Q 1/24*** | (2006.01) |

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

CPC ..... ***H01Q 5/30*** (2015.01); ***H01Q 5/10*** (2015.01); ***H01Q 1/24*** (2013.01); ***H01Q 5/378*** (2015.01); ***H01Q 7/00*** (2013.01)

(57) **ABSTRACT**

A dual-band antenna or coupled resonators, related wireless device applications, and methods of manufacturing the same are provided. Embodiments of the antenna have resonant frequencies in a lower 2-3 GHz frequency band and a higher 5-6 GHz frequency band range. The antenna has a high frequency portion that may be configured to operate as an inverted F antenna. The high frequency element is also positioned adjacent to a nearby parasitic element. In operation, the high frequency element and the parasitic element couple together and form a current loop, or loop antenna which is configured to resonate at a low frequency band.



US 20210075108A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0075108 A1**

**Lin et al.** (43) **Pub. Date: Mar. 11, 2021**

(54) **COMMUNICATION DEVICE**

(71) Applicants: **ASKEY COMPUTER CORP.**, New Taipei City (TW); **ASKEY TECHNOLOGY (JIANGSU) LTD.**, Jiangsu Province (CN)

(72) Inventors: **Chih-Chung Lin**, New Taipei City (TW); **Chih-Cheng Chien**, Taoyuan City (TW)

(73) Assignees: **ASKEY COMPUTER CORP.**, NEW TAIPEI CITY (TW); **ASKEY TECHNOLOGY (JIANGSU) LTD.**, Jiangsu Province (CN)

(21) Appl. No.: **16/821,982**

(22) Filed: **Mar. 17, 2020**

(30) **Foreign Application Priority Data**

Sep. 5, 2019 (TW) ..... 108131985

**Publication Classification**

(51) **Int. Cl.**

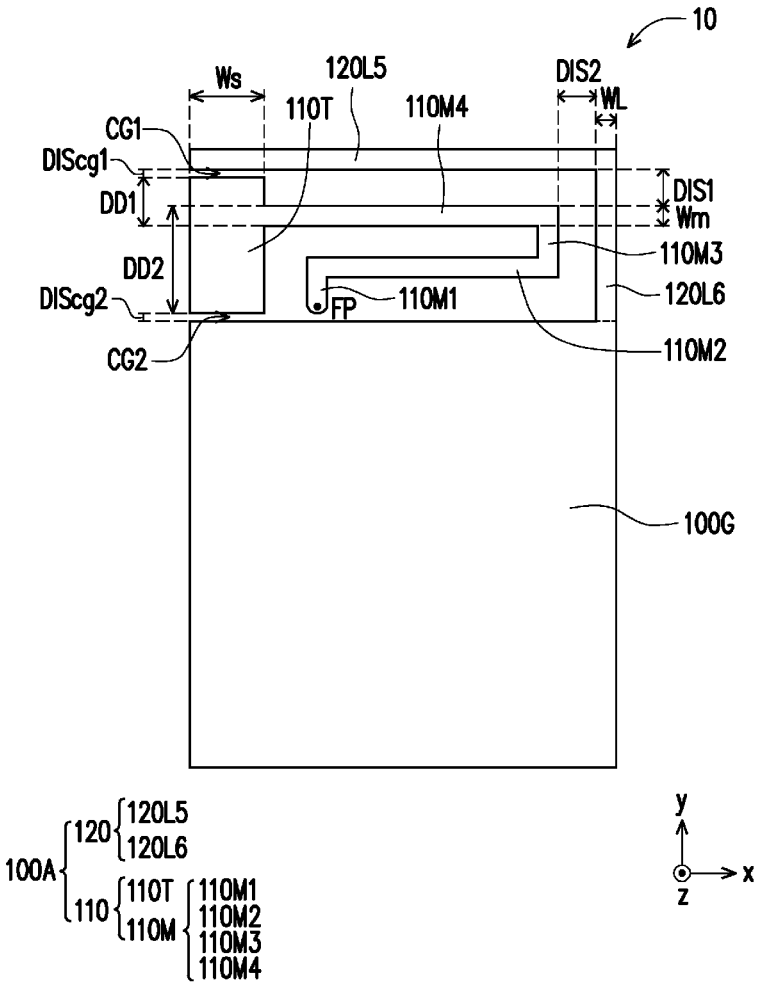
| | |
|---|---|
| ***H01Q 7/00*** | (2006.01) |
| ***H01Q 1/48*** | (2006.01) |
| ***H01Q 5/307*** | (2006.01) |

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

CPC ..... ***H01Q 7/00*** (2013.01); ***H01Q 5/307*** (2015.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

A communication device includes a ground plane and an antenna element. The antenna element includes a first radiation portion and a second radiation portion. The first radiation portion includes a meander section and a rectangular metal section. The meander section has a rectangular hook-shaped structure. A feed point is disposed at a first end of the meander section, and a second end of the meander section is electrically connected to the rectangular metal section. A first end of the second radiation portion of an L-shaped structure is electrically connected to the ground plane. A first end of the rectangular metal section is spaced apart from a second end of the second radiation portion by a first parallel slot. The communication device operates in a first frequency band with the first radiation portion and the second radiation portion, and operates in a second frequency band with the first radiation portion.



US 20210075087A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0075087 A1**

**Nguyen** (43) **Pub. Date: Mar. 11, 2021**

(54) **RADIO FREQUENCY ANTENNA FOR SHORT RANGE COMMUNICATIONS**

(71) Applicant: **DISH Technologies L.L.C.**, Englewood, CO (US)

(72) Inventor: **Phuc H. Nguyen**, Parker, CO (US)

(21) Appl. No.: **17/100,494**

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

**Related U.S. Application Data**

(60) Division of application No. 16/393,873, filed on Apr. 24, 2019, now Pat. No. 10,862,191, which is a continuation of application No. 15/582,360, filed on Apr. 28, 2017, now Pat. No. 10,320,055.

**Publication Classification**

(51) **Int. Cl.**

| | |
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| ***H01Q 1/22*** | (2006.01) |
| ***H01Q 5/30*** | (2006.01) |
| ***H01Q 1/52*** | (2006.01) |
| ***H01Q 1/42*** | (2006.01) |
| ***H01Q 9/40*** | (2006.01) |
| ***H01Q 9/42*** | (2006.01) |
| ***H01Q 21/24*** | (2006.01) |

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

CPC ..... ***H01Q 1/2266*** (2013.01); ***H01Q 5/30*** (2015.01); ***H01Q 1/521*** (2013.01); ***H01Q 21/24*** (2013.01); ***H01Q 9/40*** (2013.01); ***H01Q 9/42*** (2013.01); ***H01Q 1/42*** (2013.01)

(57) **ABSTRACT**

An antenna assembly includes a substrate, a first antenna having a first, second, third, fourth sections, which have different configuration respectively, and a first transmission cable, a second antenna having a fifth, sixth, seventh, eighth sections, which have different configuration respectively, and a second transmission cable. The first and fifth sections extend vertically from a surface of the substrate respectively. The second, third and fourth sections extend in parallel with the first section and extend from its next section. The sixth, seventh, eighth sections extend in parallel with the fifth section and extend from its next section. The first and second transmission cables physically and electrically are connected to the first and second antenna respectively. The second antenna is spaced away from the first antenna a selected distance. The first antenna is arranged having each of its sections extending perpendicular to each of its sections of the second antenna.