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(19) **United States**

(12) **Patent Application Publication**

CHA et al.

(10) **Pub. No.: US 2020/0235463 A1**

(43) **Pub. Date: Jul. 23, 2020**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA USING STRUCTURE OF DISPLAY PANEL**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/22 (2006.01)
H01Q 1/38 (2006.01)

(52) **U.S. Cl.**
 CPC *H01Q 1/243* (2013.01); *H01Q 1/38* (2013.01); *H01Q 1/2266* (2013.01)

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

(72) Inventors: **Do Hun CHA**, Yongin-si, Gyeonggi-do (KR); **Jung Sik PARK**, Suwon-si, Gyeonggi-do (KR); **Se Hwan CHOI**, Suwon-si, Gyeonggi-do (KR)

(57) **ABSTRACT**

Disclosed is an electronic device, which includes a housing, a display that is exposed through a first region of a front surface of the housing, a first antenna radiator that is positioned within the housing, and a communication circuit that is positioned within the housing. The display includes a pixel layer including pixels and a conductive sheet layer under the pixel layer. The conductive sheet layer includes a first conductive region, a second conductive region, and a slit interposed between the first conductive region and the second conductive region. The first antenna radiator is electrically connected with the first conductive region of the conductive sheet layer. The communication circuit receives a signal in a specified frequency band through the first antenna radiator and the first conductive region. Above this, various embodiments figured out through the specification are possible.

(21) Appl. No.: **16/634,347**

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

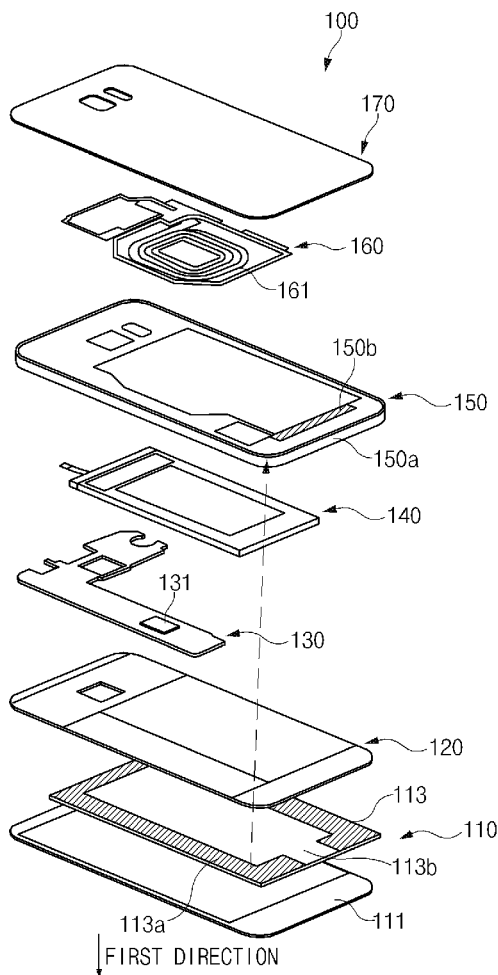
(86) PCT No.: **PCT/KR2018/010078**

§ 371 (c)(1),

(2) Date: **Jan. 27, 2020**

(30) **Foreign Application Priority Data**

Aug. 31, 2017 (KR) 10-2017-0110910





(19) **United States**

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

(10) **Pub. No.: US 2020/0243959 A1**

(43) **Pub. Date: Jul. 30, 2020**

(54) **ANTENNA STRUCTURE AND DISPLAY DEVICE INCLUDING THE SAME**

(30) **Foreign Application Priority Data**

Jan. 22, 2019 (KR) 10-2019-0008181

(71) Applicants: **DONGWOO FINE-CHEM CO., LTD.**, Jeollabuk-do (KR); **POSTECH RESEARCH AND BUSINESS DEVELOPMENT FOUNDATION**, Gyeongsangbuk-do (KR)

Publication Classification

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/38* (2013.01); *H01Q 9/0407* (2013.01); *H01Q 1/22* (2013.01)

(72) Inventors: **Han Sub RYU**, Gyeongsangbuk-do (KR); **Yun Seok OH**, Gyeonggi-do (KR); **Young Jun LEE**, Seoul (KR); **Won Bin HONG**, Seoul (KR)

(57) **ABSTRACT**

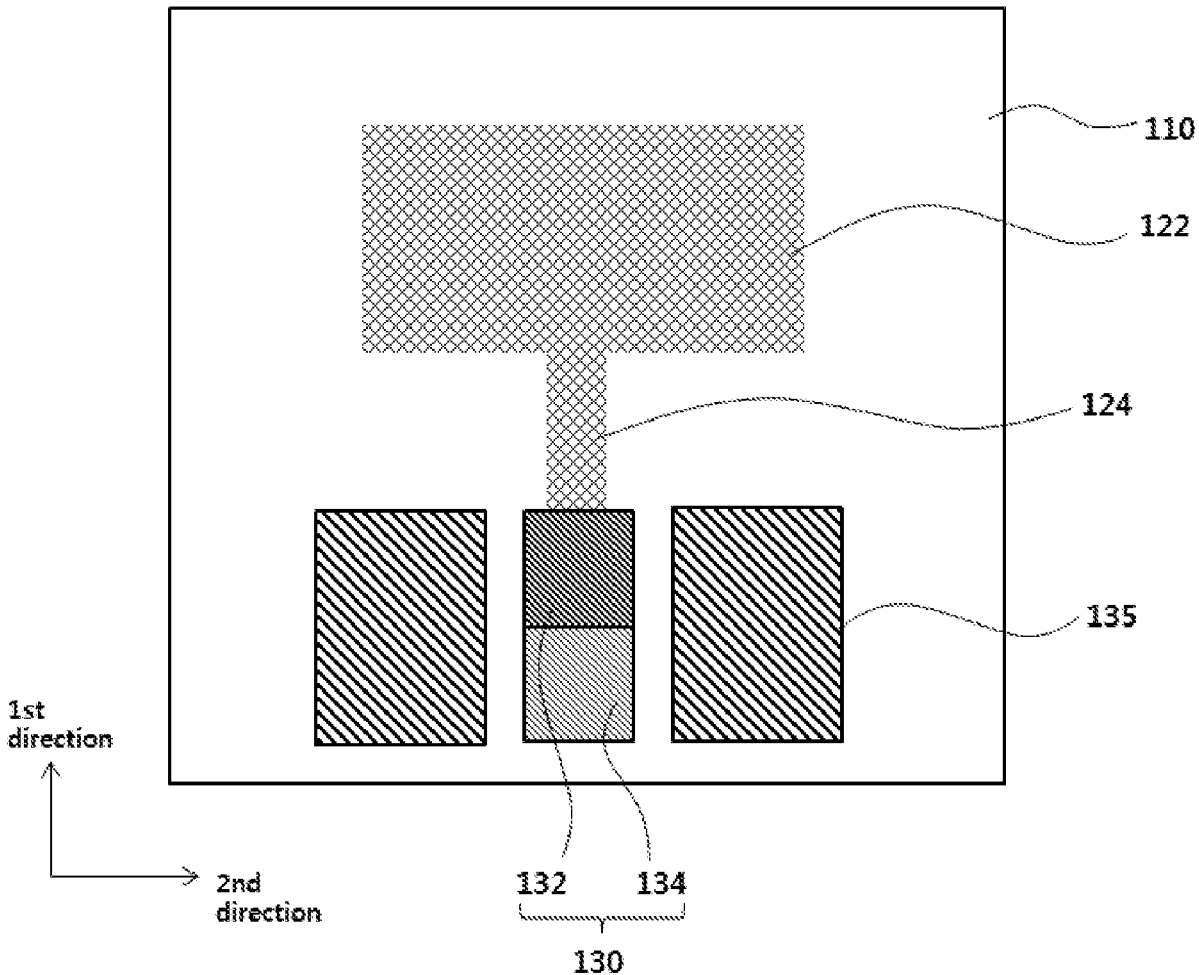
An antenna structure includes a dielectric layer, a radiation pattern on the dielectric layer and a signal pad on the dielectric layer. The signal pad includes a bonding region that is electrically connected to the radiation pattern and is configured to be bonded to an external circuit structure, and a margin region adjacent to the bonding region. Impedance mismatching is prevented by the margin region so that radiation efficiency is improved.

(21) Appl. No.: **16/852,912**

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

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2020/000592, filed on Jan. 13, 2020.





(19) **United States**

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

(10) **Pub. No.: US 2020/0243962 A1**

(43) **Pub. Date: Jul. 30, 2020**

(54) **MOBILE DEVICE**

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

(72) Inventors: **Wen-Yuan LO**, Taoyuan City (TW);
Jui-Chun JAO, Taoyuan City (TW);
Kuo-Jung TSENG, Taoyuan City (TW)

(21) Appl. No.: **16/410,177**

(22) Filed: **May 13, 2019**

(30) **Foreign Application Priority Data**

Jan. 24, 2019 (TW) 108102627

Publication Classification

(51) **Int. Cl.**

<i>H01Q 1/48</i>	(2006.01)
<i>H01Q 1/22</i>	(2006.01)
<i>H01Q 5/10</i>	(2006.01)

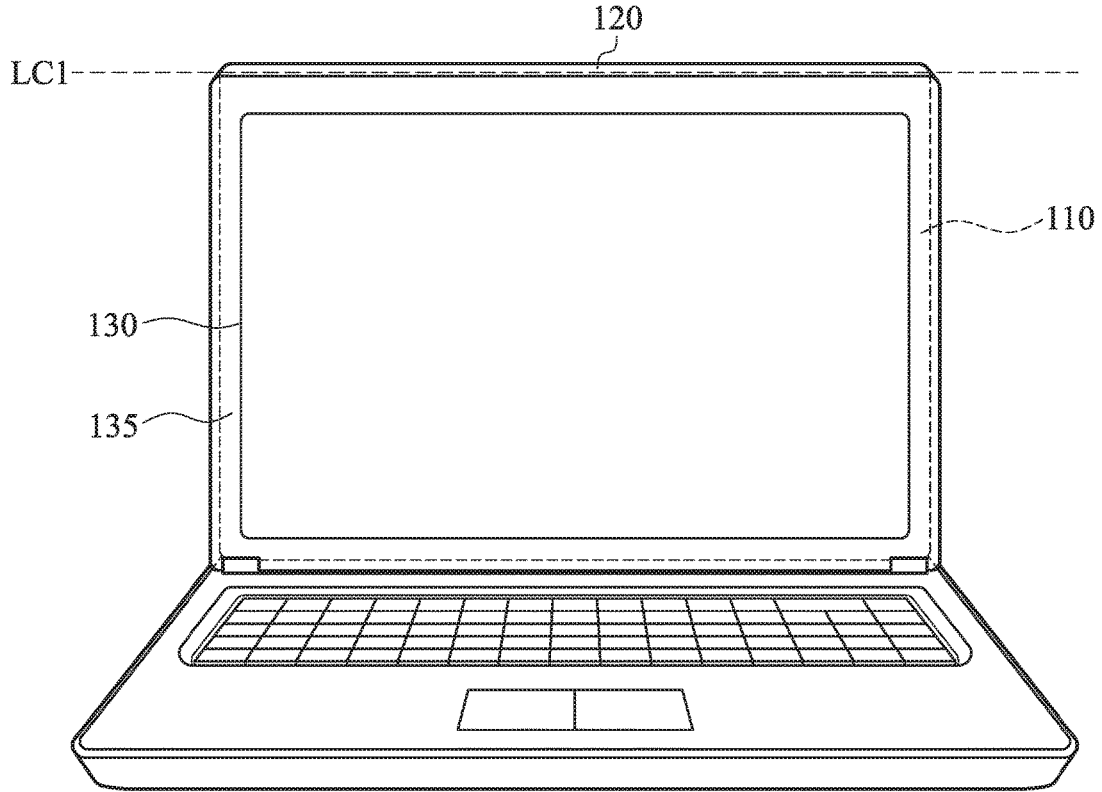
(52) **U.S. Cl.**

CPC *H01Q 1/48* (2013.01); *H01Q 5/10* (2015.01); *H01Q 1/2266* (2013.01)

(57) **ABSTRACT**

A mobile device includes a metal back cover, an edge appearance element, a display device, a supporting element, an antenna structure, and a ground element. The edge appearance element is made of a nonconductive material. The edge appearance element is connected to the metal back cover. The display device is disposed opposite to the metal back cover. The antenna structure is disposed on the supporting element. The antenna structure is positioned between the edge appearance element and the display device. The ground element is coupled to the metal back cover. The electromagnetic waves of the antenna structure are transmitted through the edge appearance element, such that the mobile device supports wireless communication.

100





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(19) **United States**

(12) **Patent Application Publication**

REN et al.

(10) **Pub. No.: US 2020/0243984 A1**

(43) **Pub. Date: Jul. 30, 2020**

(54) **ANTENNA UNIT, MIMO ANTENNA AND HANDHELD DEVICE**

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

(72) Inventors: **Zhouyou REN**, Shenzhen (CN); **Anping ZHAO**, Shenzhen (CN)

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

(21) Appl. No.: **16/474,818**

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

(86) PCT No.: **PCT/CN2019/071574**

§ 371 (c)(1),

(2) Date: **Jun. 28, 2019**

(30) **Foreign Application Priority Data**

Jan. 15, 2018 (CN) 201810035964.8

Publication Classification

(51) **Int. Cl.**

H01Q 21/08 (2006.01)

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

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

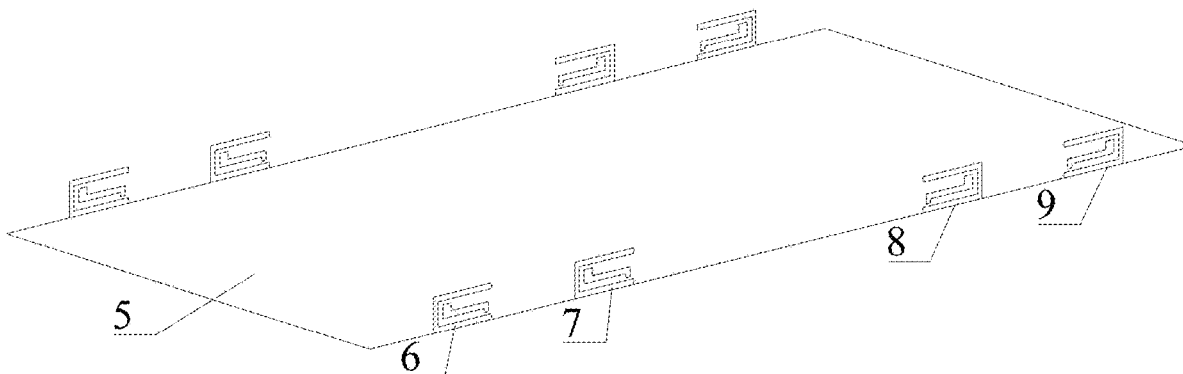
CPC **H01Q 21/08** (2013.01); **H01Q 1/48**

(2013.01); **H01Q 1/243** (2013.01)

(57)

ABSTRACT

An antenna unit, a MIMO antenna and a handheld device. The antenna unit includes a feeder and a radiator, wherein the radiator is in a 90°-rotated U shape and includes a first horizontal part, a first vertical part and a second horizontal part, two ends of the first vertical part are respectively connected to the first horizontal part and the second horizontal part; the feeder is located in the U shape and includes a second vertical part, a third horizontal part and a third vertical part, two ends of the third horizontal part are respectively connected to the second vertical part and the third vertical part, and the second vertical part and the third vertical part are located on different sides of the third horizontal part. The MIMO antenna has an ultra wideband.





(19) **United States**

(12) **Patent Application Publication**
Singh

(10) **Pub. No.: US 2020/0251823 A1**

(43) **Pub. Date: Aug. 6, 2020**

(54) **MOBILE COMPUTING DEVICE HAVING A MODAL ANTENNA**

(52) **U.S. CL.**
CPC *H01Q 5/314* (2015.01); *H04L 27/02* (2013.01); *H01Q 9/0442* (2013.01); *H01Q 5/378* (2015.01)

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

(72) Inventor: **Abhishek Singh**, San Diego, CA (US)

(21) Appl. No.: **16/745,547**

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

Related U.S. Application Data

(60) Provisional application No. 62/799,071, filed on Jan. 31, 2019.

Publication Classification

(51) **Int. Cl.**
H01Q 5/314 (2006.01)
H01Q 5/378 (2006.01)
H01Q 9/04 (2006.01)
H04L 27/02 (2006.01)

(57) **ABSTRACT**

A mobile computing device including a modal antenna is disclosed. The mobile computing device may include a radio frequency circuit and a modal antenna mechanically coupled to a portion of the mobile computing at a location that is remote from the radio frequency circuit. The modal antenna may include a driven element and a parasitic element positioned proximate to the driven element. The modal antenna may be operable in a plurality of different modes. Each mode may be associated with a different radiation pattern. The mobile computing device may include a transmission line coupling the radio frequency circuit to the modal antenna. The radio frequency circuit may be configured to transmit an RF signal over the transmission line to the modal antenna and configured to communicate a control signal to adjust the mode of the modal antenna over the transmission line.

1200



Communicating an RF Signal from a Radio Frequency Circuit to a Modal Antenna Coupled to a Portion of the Mobile Computing Device at a Location that is Remote from the Radio Frequency Circuit

1202

Controlling, from the Radio Frequency Circuit, an Electrical Characteristic Associated with a Parasitic Element of the Modal Antenna to Adjust the Mode of the Modal Antenna

1204



US 20200259260A1

(19) **United States**

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

(10) **Pub. No.: US 2020/0259260 A1**

(43) **Pub. Date: Aug. 13, 2020**

(54) **ANTENNA STRUCTURE**

H01Q 9/04 (2006.01)

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

H01Q 1/36 (2006.01)

(72) Inventors: **Nien-Chao CHUANG**, New Taipei City (TW); **Pei-Cheng HU**, New Taipei City (TW); **Feng-Yi LIN**, New Taipei City (TW)

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

CPC *H01Q 5/30* (2015.01); *H01Q 1/36* (2013.01); *H01Q 9/04* (2013.01); *H01Q 1/241* (2013.01)

(21) Appl. No.: **16/380,117**

(57) **ABSTRACT**

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

(30) **Foreign Application Priority Data**

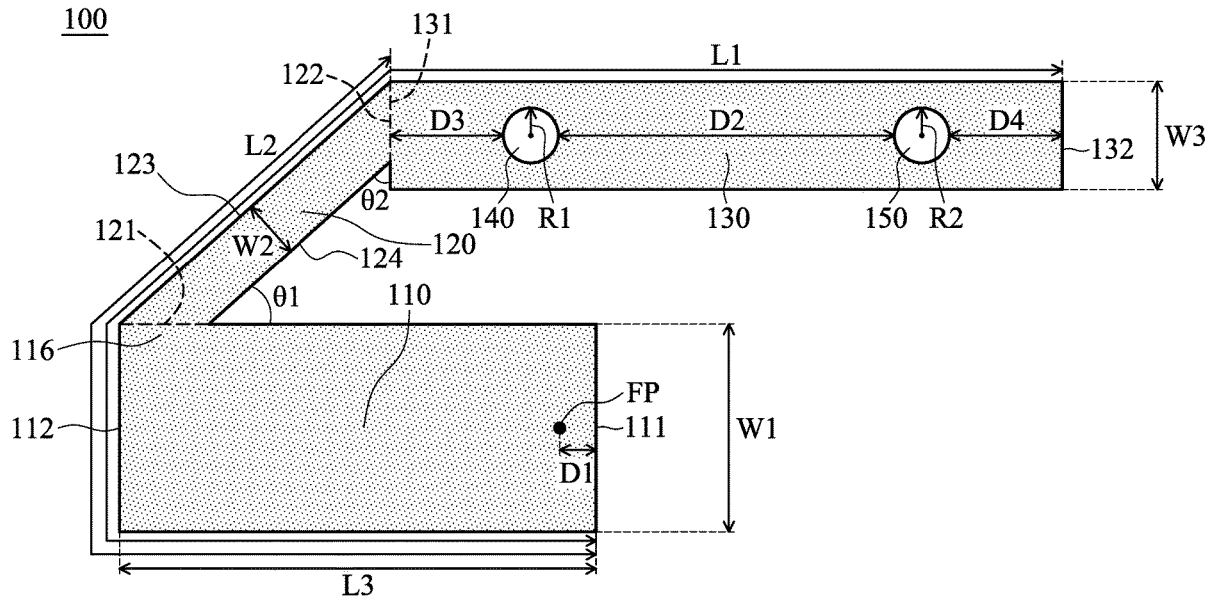
Feb. 13, 2019 (TW) 108104687

An antenna structure includes a first radiation element, a second radiation element, and a third radiation element. The first radiation element has a feeding point. The third radiation element is coupled through the second radiation element to the first radiation element. The third radiation element has a first opening and a second opening which are separate from each other. The antenna structure covers a first frequency band, a second frequency band, and a third frequency band.

Publication Classification

(51) **Int. Cl.**

H01Q 5/30 (2006.01)
H01Q 1/24 (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2020/0259530 A1**

(43) **Pub. Date: Aug. 13, 2020**

(54) **MULTI INPUT MULTI OUTPUT ANTENNA DEVICE OF TERMINAL AND METHOD FOR REALIZING ANTENNA SIGNAL TRANSMISSION**

H01Q 21/00 (2006.01)
H04B 7/0413 (2006.01)
H01Q 5/35 (2006.01)
H01Q 21/06 (2006.01)
H01Q 7/00 (2006.01)

(71) Applicant: **ZTE CORPORATION**, Shenzhen, Guangdong (CN)

(52) **U.S. Cl.**
CPC *H04B 7/0404* (2013.01); *H01Q 1/48* (2013.01); *H01Q 21/0025* (2013.01); *H01Q 7/00* (2013.01); *H01Q 5/35* (2015.01); *H01Q 21/065* (2013.01); *H04B 7/0413* (2013.01)

(72) Inventors: **Xiaoming WANG**, Shenzhen, Guangdong (CN); **Chuangzhu ZHOU**, Shenzhen, Guangdong (CN); **Zibin WENG**, Shenzhen, Guangdong (CN)

(21) Appl. No.: **16/753,891**

(57) **ABSTRACT**

(22) PCT Filed: **Oct. 15, 2018**

The present disclosure provides a multi input multi output antenna device including a main board, two end areas of the main board are respectively provided with a group of antenna radiating units, a middle area of the main board is provided with a metal ground unit, wherein a first group of antenna radiating units on one end area of the main board includes a first top-layer radiating subunit and a first bottom-layer radiating subunit, a second group of antenna radiating units on the other end area of the main board includes a second top-layer radiating subunit and a second bottom-layer radiating subunit, and the metal ground unit on the middle area of the main board includes a top-layer metal ground and a bottom-layer metal ground, and a first feeding port and a second feeding port are arranged on the bottom metal ground.

(86) PCT No.: **PCT/CN2018/110224**

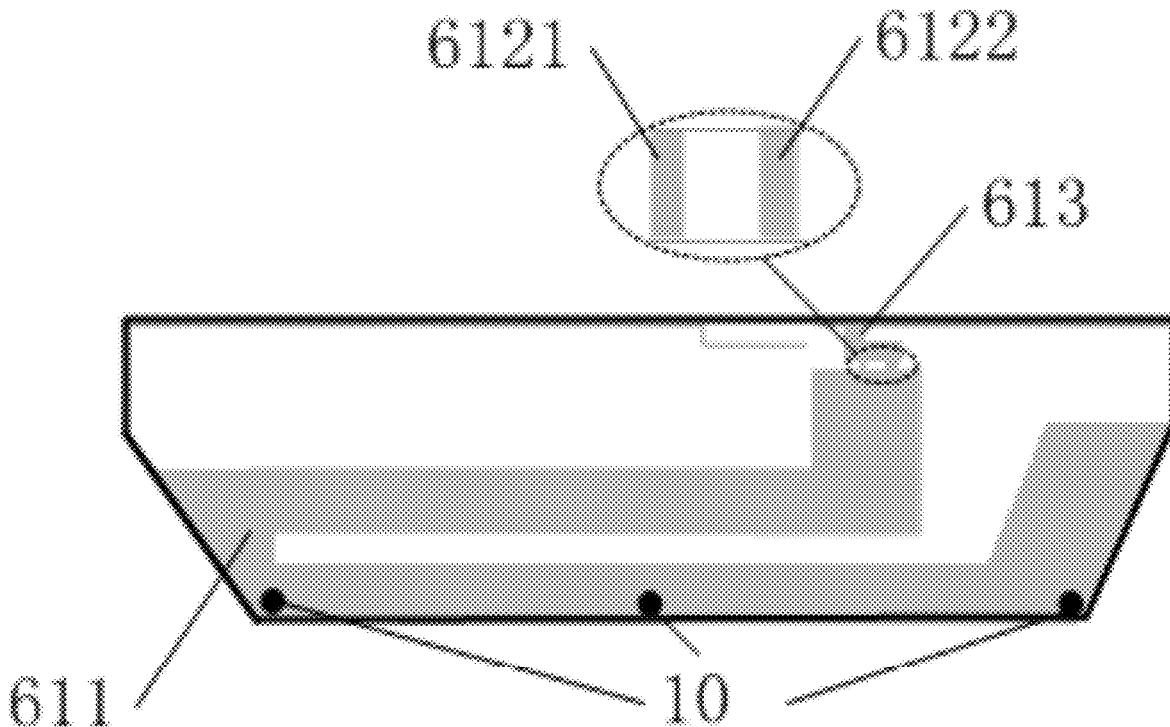
§ 371 (c)(1),
(2) Date: **Apr. 6, 2020**

(30) **Foreign Application Priority Data**

Oct. 17, 2017 (CN) 201710965699.9

Publication Classification

(51) **Int. Cl.**
H04B 7/0404 (2006.01)
H01Q 1/48 (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2020/0243947 A1**

(43) **Pub. Date: Jul. 30, 2020**

(54) **ELECTRONIC DEVICE HAVING AN ANTENNA**

Publication Classification

(71) Applicant: **LENOVO (SINGAPORE) PTE. LTD., SINGAPORE (SG)**

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
G06F 1/18 (2006.01)

(72) Inventors: **OSAMU YAMAMOTO**, Kanagawa (JP); **MASAYUKI AMANO**, Kanagawa (JP); **SARA AKIYAMA**, Kanagawa (JP)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **G06F 1/182** (2013.01)

(21) Appl. No.: **16/747,193**

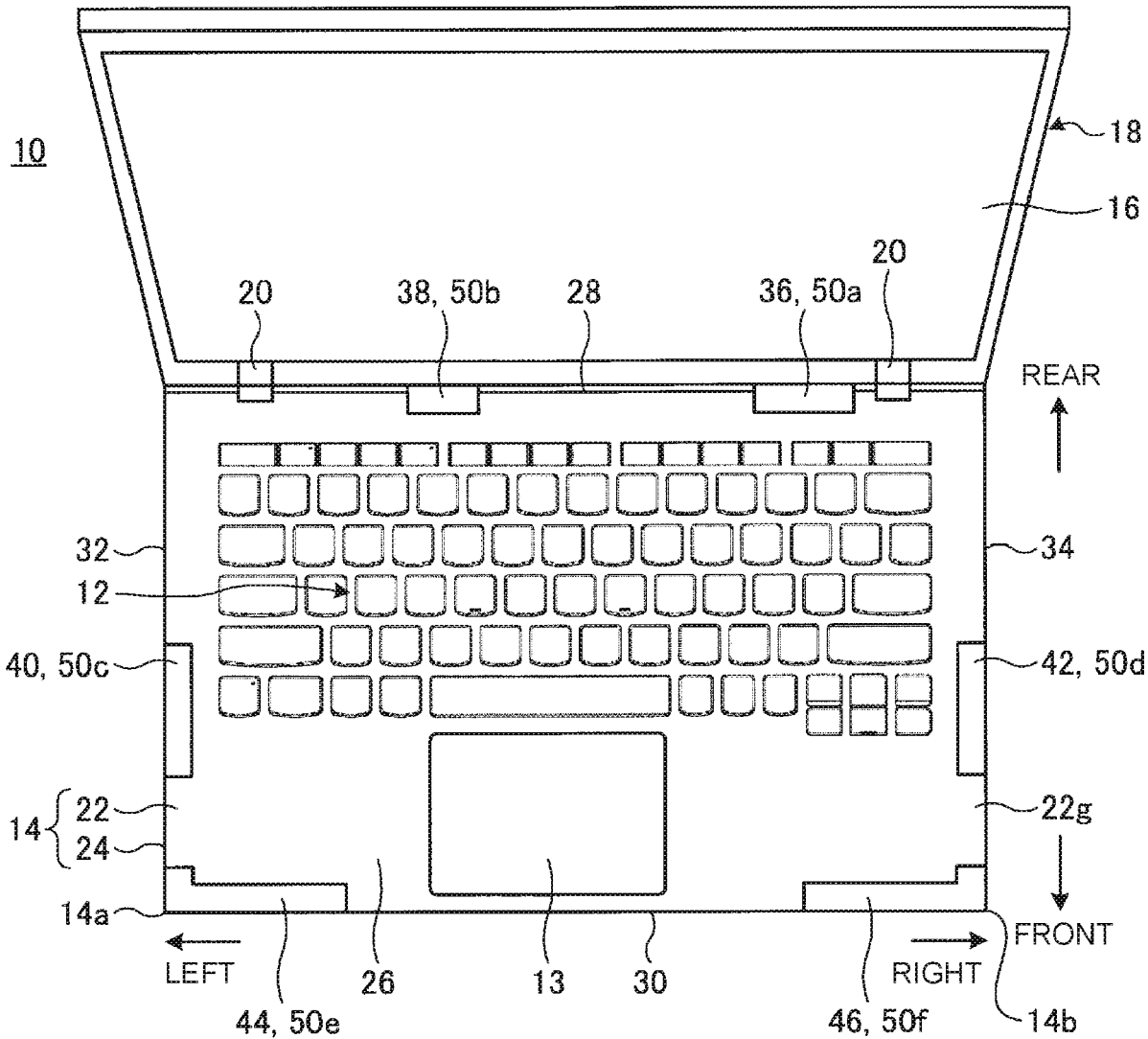
(57) **ABSTRACT**

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

An electronic device is disclosed. The electronic device includes an antenna module having an antenna, and a body chassis storing electronic components. The body chassis, which is made of an electromagnetic shielding material such as metal, has a flat plate with a processor arranged thereon and with a cutout portion formed at an end portion thereof, a rear plate connected to the end portion of the flat plate, and a dent wall connected to the cutout portion and to the rear plate. The antenna module is provided in an antenna section whose front, left, and right sides are enclosed by the dent wall.

(30) **Foreign Application Priority Data**

Jan. 24, 2019 (JP) 2019-10572





(19) **United States**

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

(10) **Pub. No.: US 2020/0235783 A1**

(43) **Pub. Date: Jul. 23, 2020**

(54) **ELECTRONIC DEVICE AND NEAR FIELD COMMUNICATION ANTENNA THEREOF**

H01Q 1/22 (2006.01)

H04W 4/80 (2006.01)

H04M 1/02 (2006.01)

(71) Applicant: **ASUSTeK COMPUTER INC.**, Taipei (TW)

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

CPC *H04B 5/0025* (2013.01); *H01Q 1/44* (2013.01); *H04M 2250/04* (2013.01); *H04W 4/80* (2018.02); *H04M 1/0264* (2013.01); *H01Q 1/22* (2013.01)

(72) Inventors: **Chien-Hung TSAI**, Taipei (TW);
Kuo-Chu LIAO, Taipei (TW);
Wei-Cheng LO, Taipei (TW); **Te-Li LIEN**, Taipei (TW); **Ming-Shan WU**, Taipei (TW)

(57)

ABSTRACT

An electronic device is disclosed. The electronic device includes a conductive plate, an opening, two feeding parts, and an electronic assembly. The opening is disposed at a side of the conductive plate. The opening has a first side and a second side opposite to each other, and the first side and the second side are connected with the side of the conductive plate. The electronic assembly is located in the opening. Two feeding parts are respectively disposed on the first side and the second side of the opening. the feeding parts is used to receive a feeding signal, and the feeding signal is transmitted along the first side of the opening to the second side of the opening and generates a near field magnetic field.

(21) Appl. No.: **16/732,683**

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

(30) **Foreign Application Priority Data**

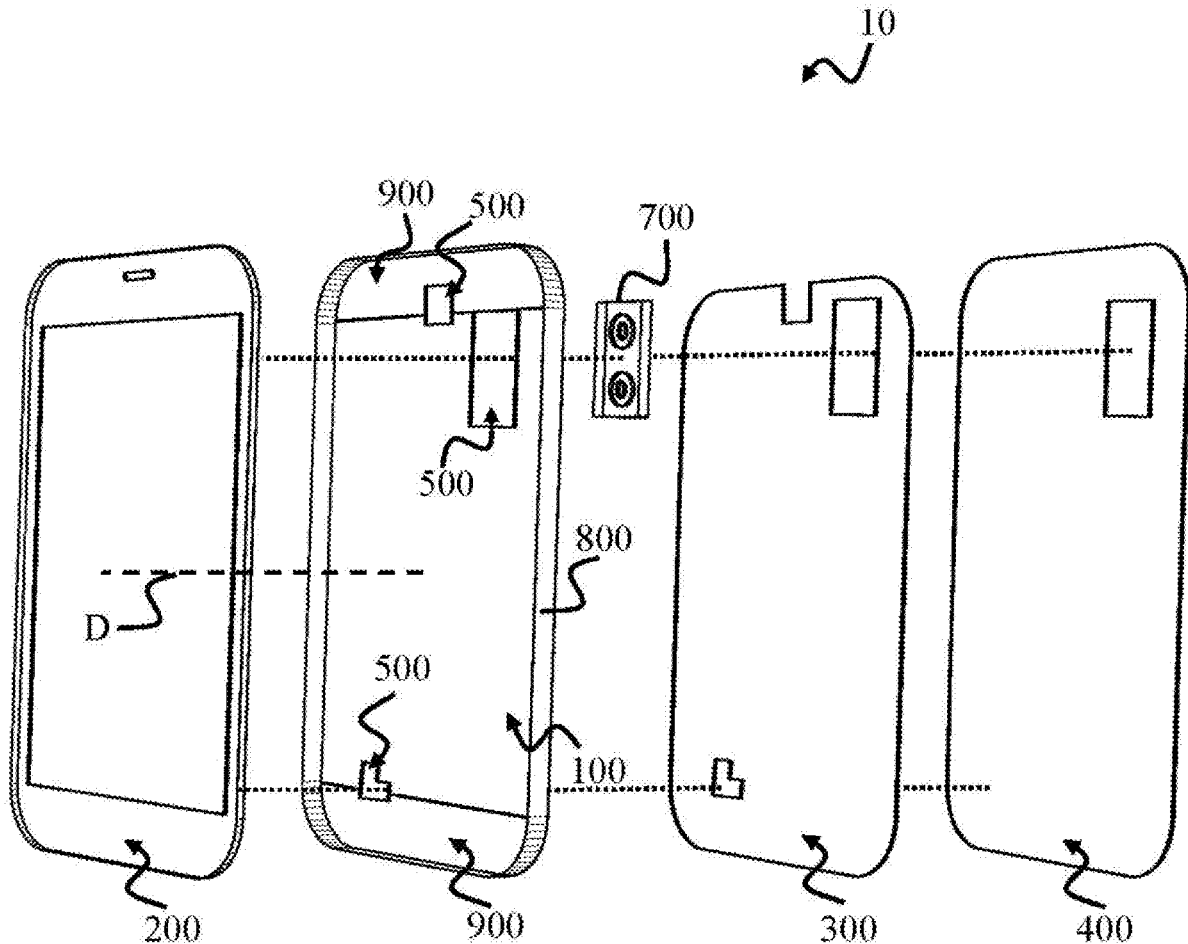
Jan. 18, 2019 (TW) 108102093

Publication Classification

(51) **Int. Cl.**

H04B 5/00 (2006.01)

H01Q 1/44 (2006.01)





(19) **United States**

(12) **Patent Application Publication**
WOO

(10) **Pub. No.: US 2020/0245452 A1**

(43) **Pub. Date: Jul. 30, 2020**

(54) **ELECTRONIC DEVICE**

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

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

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

(21) Appl. No.: **16/852,004**

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

H01Q 21/06 (2006.01)

H01Q 1/48 (2006.01)

H05K 1/18 (2006.01)

H05K 1/11 (2006.01)

H01Q 1/52 (2006.01)

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

CPC **H05K 1/0271** (2013.01); **H01Q 9/045**

(2013.01); **H01Q 21/065** (2013.01); **H01Q**

1/48 (2013.01); **H05K 1/0298** (2013.01);

H05K 1/181 (2013.01); **H05K 1/115**

(2013.01); **H01Q 1/521** (2013.01); **H05K**

2201/10098 (2013.01); **H05K 1/0236**

(2013.01)

Related U.S. Application Data

(63) Continuation of application No. 16/141,841, filed on Sep. 25, 2018, now Pat. No. 10,660,198.

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

Foreign Application Priority Data

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

Publication Classification

(51) **Int. Cl.**

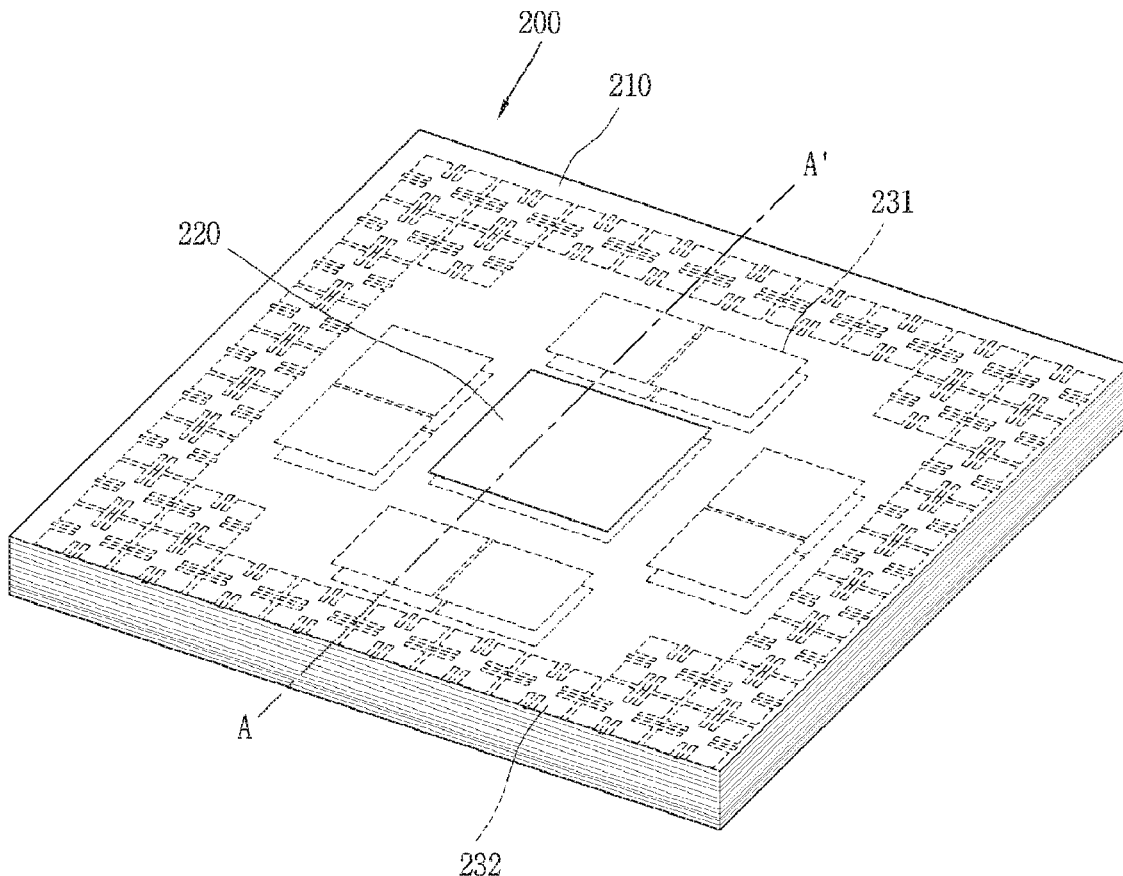
H05K 1/02 (2006.01)

H01Q 9/04 (2006.01)

(57)

ABSTRACT

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





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(19) **United States**

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

(10) **Pub. No.: US 2020/0245481 A1**

(43) **Pub. Date: Jul. 30, 2020**

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

H01Q 1/36 (2006.01)

H01Q 1/22 (2006.01)

H01Q 1/50 (2006.01)

H05K 5/03 (2006.01)

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

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

CPC *H05K 5/0226* (2013.01); *H05K 5/0017*

(2013.01); *H05K 7/1427* (2013.01); *H05K*

1/181 (2013.01); *H05K 2201/10098* (2013.01);

H01Q 1/22 (2013.01); *H01Q 1/50* (2013.01);

H05K 5/03 (2013.01); *H01Q 1/36* (2013.01)

(72) Inventors: **Shinho YOON**, Suwon-si (KR);
Jonghyuck LEE, Suwon-si (KR);
Taeik KIM, Suwon-si (KR); **Haeyeon KIM**,
Suwon-si (KR); **Dongjun OH**, Suwon-si (KR);
Soonho HWANG, Suwon-si (KR)

(57)

ABSTRACT

An electronic device is provided. The electronic device includes a first housing structure including a conductive first side member, a second housing structure including a conductive second side member, a hinge structure rotatably connecting the first housing structure and the second housing structure, and a printed circuit board. The first side member or the second side member may include a first side face, a second side face, a third side face, a fourth side face, a first slit formed in the fourth side face, and a second slit formed in any one of the first side face, the second side face, and the third side face. At least a part of the second side face or the third side face between the first slit and the second slit may be made of a conductive material and electrically connected to the printed circuit board as a radiating conductor.

(21) Appl. No.: **16/742,191**

(22) Filed: **Jan. 14, 2020**

(30) **Foreign Application Priority Data**

Jan. 25, 2019 (KR) 10-2019-0009679

Publication Classification

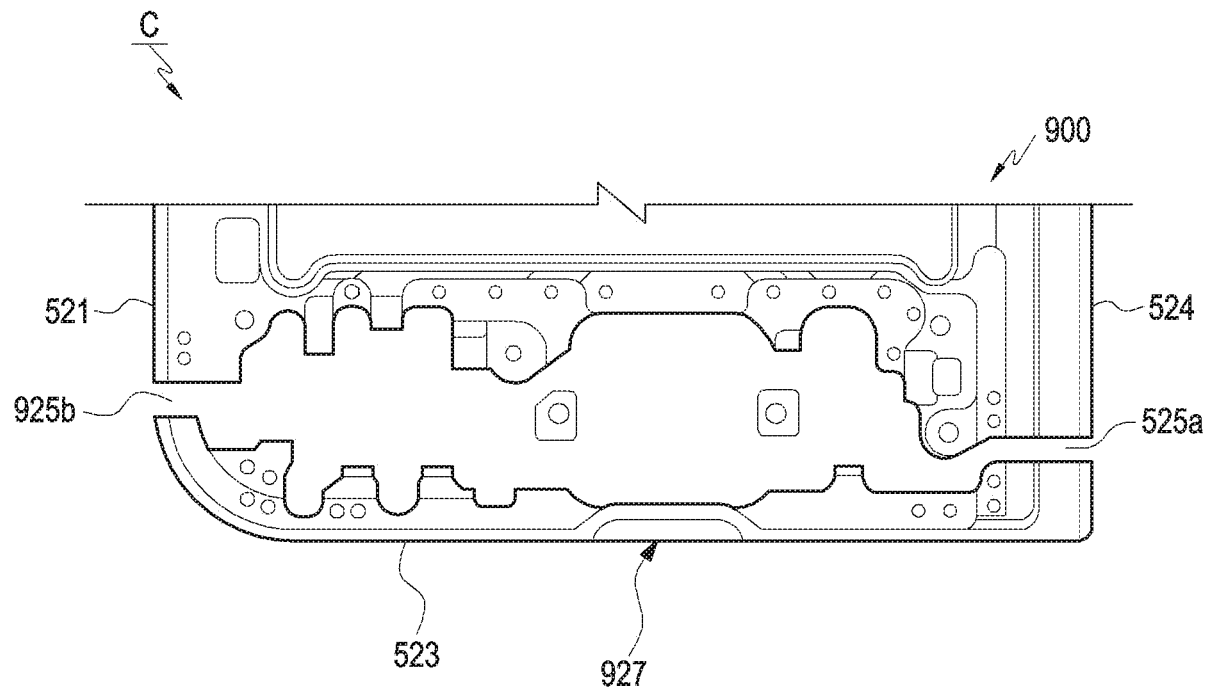
(51) **Int. Cl.**

H05K 5/02 (2006.01)

H05K 5/00 (2006.01)

H05K 7/14 (2006.01)

H05K 1/18 (2006.01)





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(19) **United States**

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

(10) **Pub. No.: US 2020/0251813 A1**

(43) **Pub. Date: Aug. 6, 2020**

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

Publication Classification

(71) Applicant: **DONGWOO FINE-CHEM CO., LTD.**, Jeollabuk-do (KR)

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/40 (2006.01)
H04M 1/02 (2006.01)

(72) Inventors: **Han Sub RYU**, Gyeongsangbuk-do (KR); **Gi Hwan AHN**, Chungcheongnam-do (KR); **Dong Pil PARK**, Incheon (KR); **Sung Ho BAEK**, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC *H01Q 1/38* (2013.01); *H01Q 1/243* (2013.01); *H04M 1/0266* (2013.01); *H01Q 1/40* (2013.01)

(21) Appl. No.: **16/854,415**

(57) **ABSTRACT**

(22) Filed: **Apr. 21, 2020**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2019/012794, filed on Oct. 1, 2019.

Foreign Application Priority Data

Oct. 16, 2018 (KR) 10-2018-0123058

An antenna device includes a dielectric layer and a radiation electrode on an upper surface of the dielectric layer. The radiation electrode includes a plurality of electrode lines therein. The radiation electrode has a visibility index in a range from -1.4 to 1.9. An electrode visibility is suppressed and a signaling sensitivity is enhanced from the radiation electrode. A display device including the antenna device is also provided.

127

