



US 20230152865A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0152865 A1**

(43) **Pub. Date: May 18, 2023**

(54) **ELECTRONIC DEVICE COMPRISING FLEXIBLE DISPLAY AND ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
G06F 1/16 (2006.01)

(72) Inventors: **Sungkoo PARK**, Suwon-si (KR); **Kookjoo LEE**, Suwon-si (KR); **Yongyoun KIM**, Suwon-si (KR); **Chankyu AN**, Suwon-si (KR); **Soonho HWANG**, Suwon-si (KR); **Gun LIM**, Suwon-si (KR); **Hyunju HONG**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **G06F 1/1698** (2013.01); **G06F 1/1656** (2013.01); **G06F 1/1624** (2013.01); **G06F 1/1652** (2013.01)

(57) **ABSTRACT**

(21) Appl. No.: **18/157,574**

An electronic device is provided. The electronic device comprises a housing including a first surface facing a first direction, and a second surface facing a second direction opposite to the first surface, a conductive plate disposed at the first surface of the housing to be slidable in a third direction perpendicular to the first direction and including a slot, a flexible display arranged to be supported by the conductive plate and including a first area facing the first surface and a second area extending from the first area and bendable according to the sliding of the conductive plate, and a wireless communication circuit configured to transmit and/or receive a signal in a selected or designated frequency band through an antenna formed on the basis of at least a part of the conductive plate, which surrounds the slot.

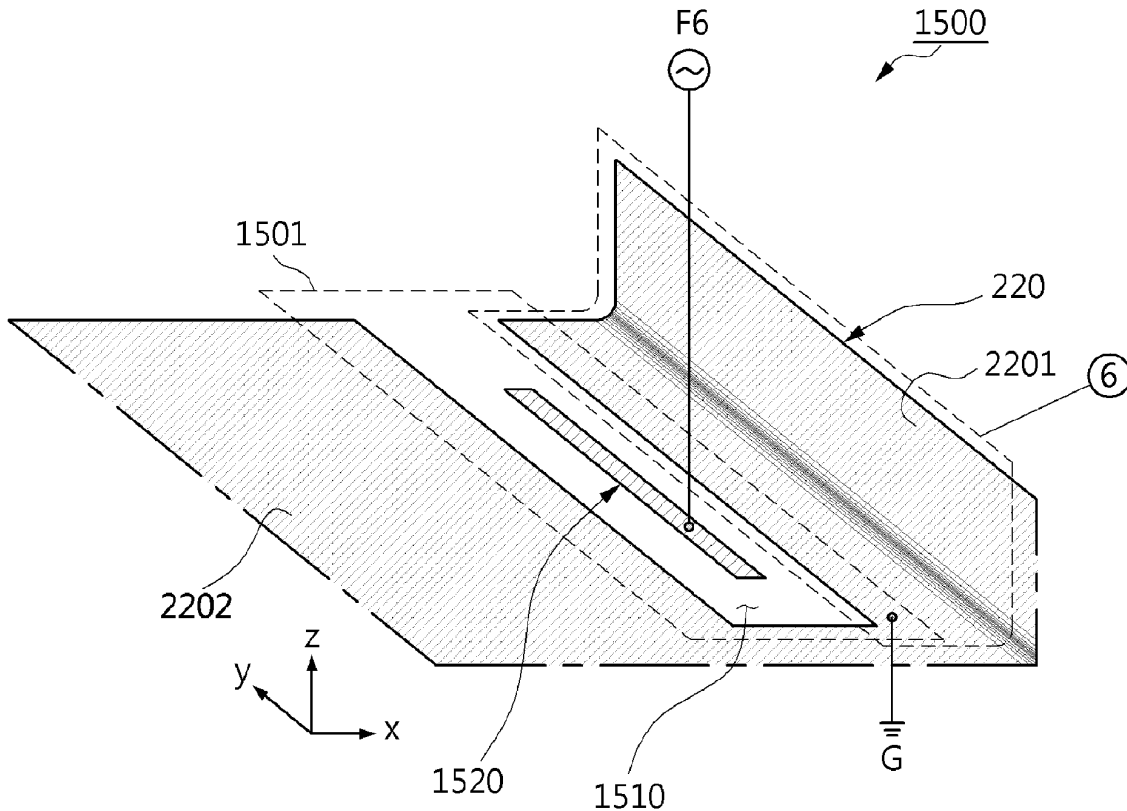
(22) Filed: **Jan. 20, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/009503, filed on Jul. 22, 2021.

Foreign Application Priority Data

Jul. 22, 2020 (KR) 10-2020-0091080





US 20230155275A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0155275 A1**

(43) **Pub. Date: May 18, 2023**

(54) **TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
G06F 3/0354 (2006.01)
H01Q 1/46 (2006.01)

(72) Inventors: **Ben Lai**, Wuhan (CN); **Yuhui Wang**,
Shenzhen (CN); **Ning Ma**, Shenzhen
(CN); **Quan Yu**, Wuhan (CN); **Kemeng**
Wang, Dongguan (CN); **Teng Long**,
Wuhan (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/241* (2013.01); *G06F 3/03545*
(2013.01); *H01Q 1/46* (2013.01)

(21) Appl. No.: **17/802,346**

(57) **ABSTRACT**

(22) PCT Filed: **Dec. 15, 2020**

A terminal includes a terminal body part and an electronic accessory part. A WI-FI antenna apparatus is disposed on the terminal body part. The WI-FI antenna apparatus has a closed slot antenna. The closed slot antenna has an antenna slot that includes a main straight slot and a first slot and a second slot that are separately bent with respect to two ends of the main straight slot and extend to a same side of the main straight slot. The first slot and the second slot are perpendicular to the main straight slot, and the electronic accessory part is located on a side surface of the main straight slot.

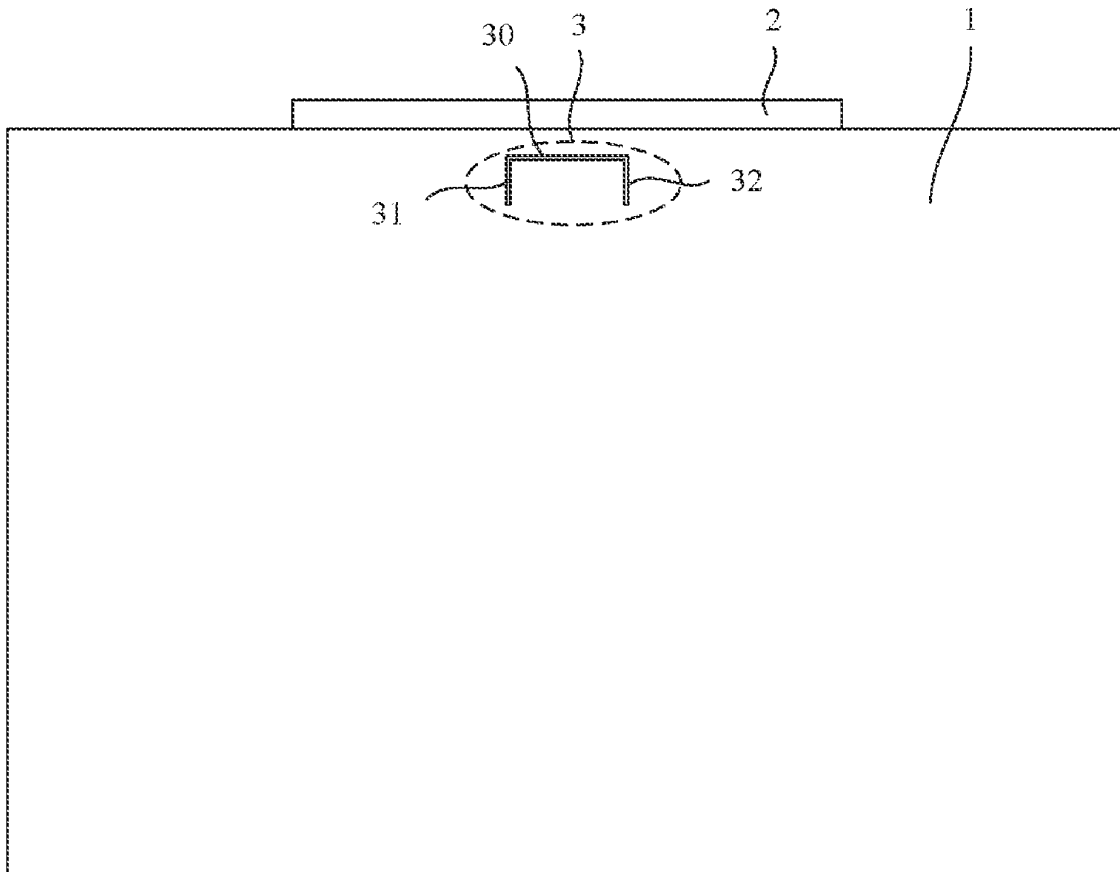
(86) PCT No.: **PCT/CN2020/136405**

§ 371 (c)(1),

(2) Date: **Aug. 25, 2022**

(30) **Foreign Application Priority Data**

Feb. 25, 2020 (CN) 202010117703.8





US 20230155280A1

(19) **United States**

(12) **Patent Application Publication**
LEE

(10) **Pub. No.: US 2023/0155280 A1**

(43) **Pub. Date: May 18, 2023**

(54) **STRUCTURE FOR REDUCING INTERFERENCE BETWEEN ANTENNAS AND ELECTRONIC DEVICE COMPRISING THE SAME**

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

H01Q 5/30 (2006.01)

H01Q 21/28 (2006.01)

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

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

CPC *H01Q 1/523* (2013.01); *H01Q 1/38*

(2013.01); *H01Q 1/243* (2013.01); *H01Q 1/48*

(2013.01); *H01Q 5/30* (2015.01); *H01Q 21/28*

(2013.01)

(72) Inventor: **Minju LEE**, Gyeonggi-do (KR)

(21) Appl. No.: **16/971,912**

(22) PCT Filed: **Jul. 29, 2020**

(57)

ABSTRACT

(86) PCT No.: **PCT/KR2020/009965**

§ 371 (c)(1),

(2) Date: **Aug. 21, 2020**

An electronic device is provided that includes a display disposed to face a first direction, a back plate disposed to face a second direction opposite to the first direction, a support member disposed below the display and configured to be coupled with the display, a printed circuit board disposed between the support member and the back plate, and a first antenna and a second antenna disposed between the printed circuit board and the back plate and configured to emit signals in a radio frequency band, and the first antenna is electrically connected to a first ground region included in the printed circuit board, and the second antenna may be electrically connected to a second ground region included in the support member.

(30) **Foreign Application Priority Data**

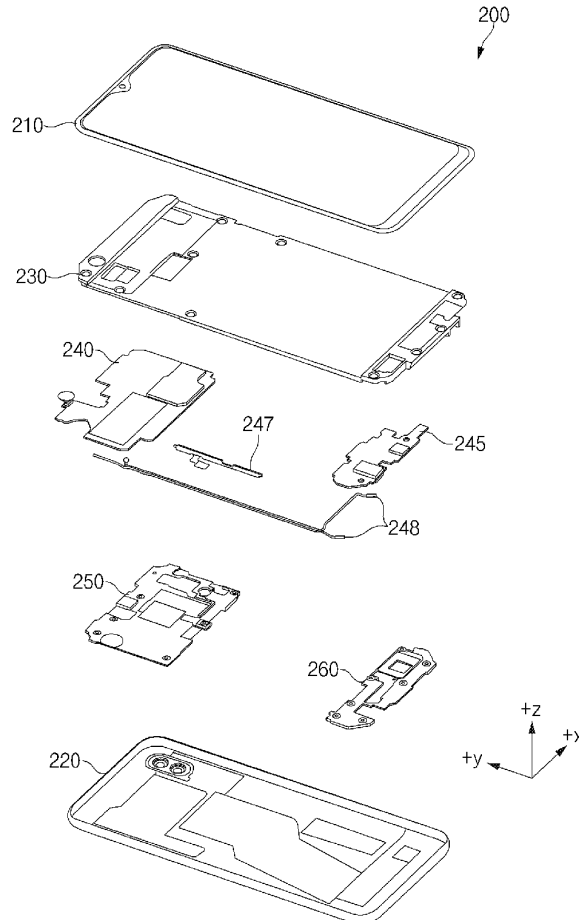
Sep. 9, 2019 (KR) 10-2019-0111338

Publication Classification

(51) **Int. Cl.**

H01Q 1/52 (2006.01)

H01Q 1/38 (2006.01)





US 20230155291A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0155291 A1**
LIN et al. (43) **Pub. Date: May 18, 2023**

(54) **ANTENNA DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/48 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/42 (2006.01)

(52) **U.S. Cl.**
 CPC *H01Q 5/48* (2015.01); *H01Q 1/38* (2013.01); *H01Q 1/422* (2013.01)

(72) Inventors: **Hsin-Hung LIN**, Taipei City (TW); **Wei Chen CHENG**, Taipei City (TW)

(57) **ABSTRACT**

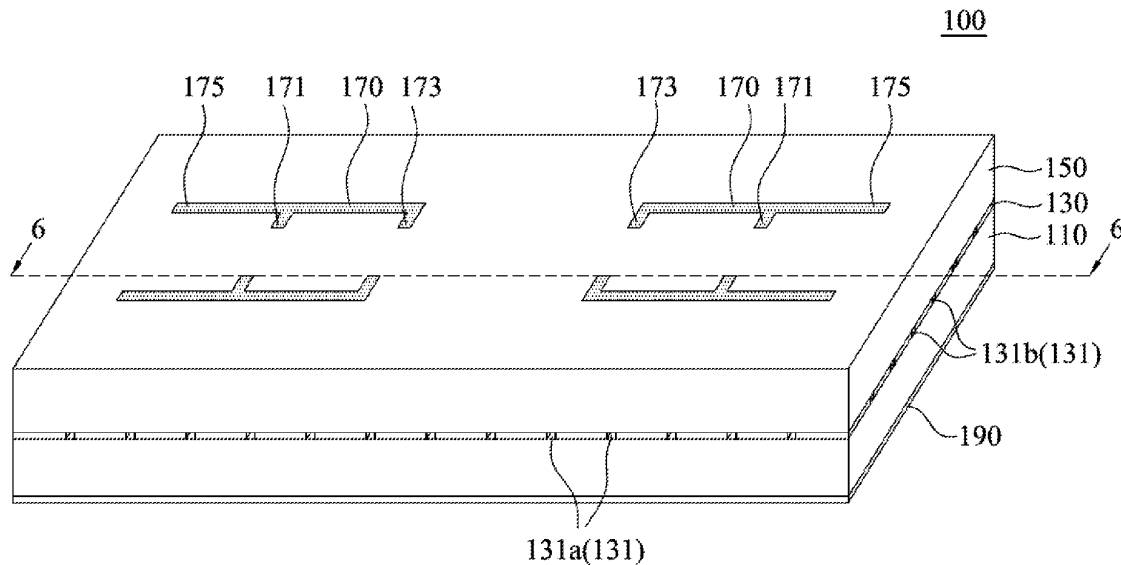
(21) Appl. No.: **17/806,733**

An antenna device includes a first insulation layer, a defected metal layer, a second insulation layer, and a plurality of radiators. The defected metal layer is disposed on the first insulation layer, and the defected metal layer has a plurality of recess features which are arranged with uniform pitches. The second insulation layer is disposed on the first insulation layer and the defected metal layer. The radiators are disposed on the second insulation layer, and each radiator has a feeding portion and a grounding portion.

(22) Filed: **Jun. 13, 2022**

(30) **Foreign Application Priority Data**

Nov. 15, 2021 (CN) 202111348648.4





US 20230155296A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0155296 A1**

(43) **Pub. Date: May 18, 2023**

(54) **ANTENNA MODULE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 13/16 (2006.01)
H01Q 21/06 (2006.01)

(72) Inventors: **Chien-Yi Wu,** Taipei City (TW);
Chao-Hsu Wu, Taipei City (TW);
Cheng-Hsiung Wu, Taipei City (TW);
Chia-Hung Chen, Taipei City (TW);
Shih-Keng Huang, Taipei City (TW);
Hau Yuen Tan, Taipei City (TW);
Sheng-Chin Hsu, Taipei City (TW);
Tse-Hsuan Wang, Taipei City (TW);
Hao-Hsiang Yang, Taipei City (TW)

(52) **U.S. Cl.**
CPC **H01Q 13/16** (2013.01); **H01Q 21/064**
(2013.01)

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

(57) **ABSTRACT**

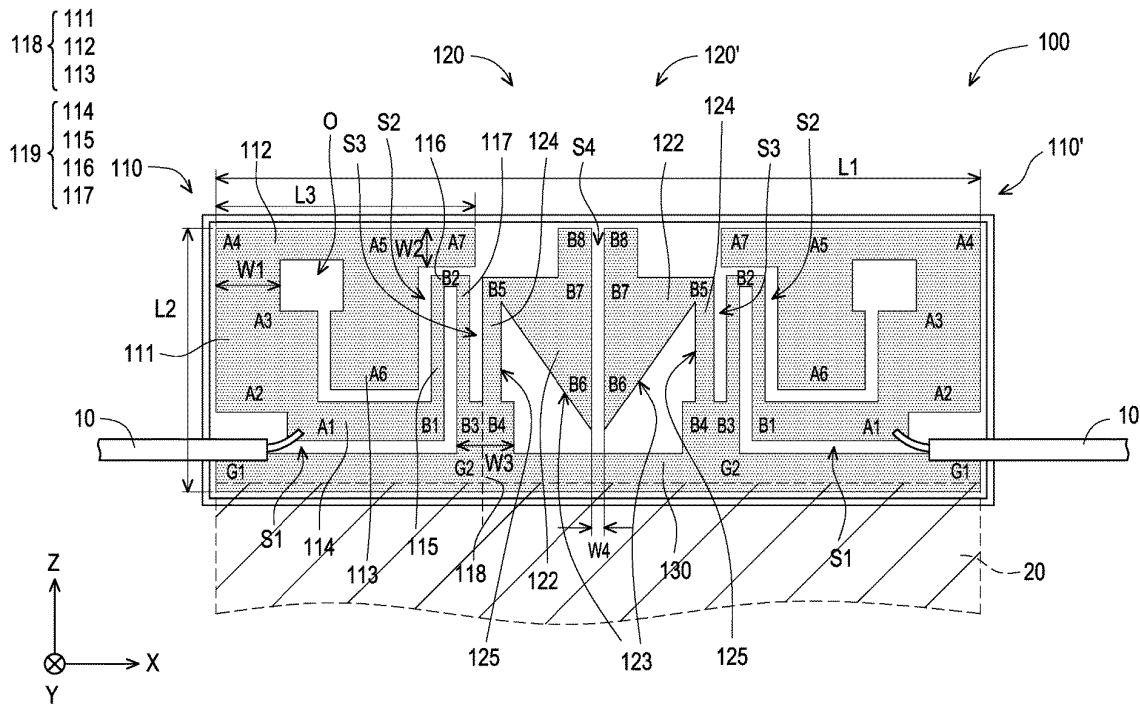
An antenna module includes two antenna units, two isolation members, and a grounding member. Each antenna unit consists of two feeding ends, two first radiators, and two second radiators. The isolating members are disposed between the first and second portions of each antenna unit. The grounding member is disposed beside the two antenna units and the two isolation members. A first slot is formed among each first radiator, the second radiator, and the grounding member. The two second radiators are connected to the third radiator. A third slot is formed between the second radiator and the second portion. The two antenna units are symmetric to the fourth slot in a mirrored manner, and the two first portions have widths gradually changing along an extending direction of the fourth position.

(21) Appl. No.: **17/965,339**

(22) Filed: **Oct. 13, 2022**

(30) **Foreign Application Priority Data**

Nov. 16, 2021 (TW) 110142544





US 20230155301A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0155301 A1**

(43) **Pub. Date: May 18, 2023**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/12 (2006.01)
H01Q 1/22 (2006.01)
G01K 1/024 (2006.01)
H01Q 21/00 (2006.01)

(72) Inventors: **Chien-Yi Wu,** Taipei City (TW);
Wu-Hua Chen, Taipei City (TW);
I-Shu Lee, Taipei City (TW);
Hung-Ming Yu, Taipei City (TW);
Chao-Hsu Wu, Taipei City (TW);
Yung-Yi Lee, Taipei City (TW);
Man-Jung Tsao, Taipei City (TW);
Chi-Min Tang, Taipei City (TW);
Shao-Chi Wang, Taipei City (TW)

(52) **U.S. Cl.**
CPC *H01Q 21/12* (2013.01); *H01Q 1/2291*
(2013.01); *G01K 1/024* (2013.01); *H01Q*
21/0006 (2013.01)

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

(57) **ABSTRACT**

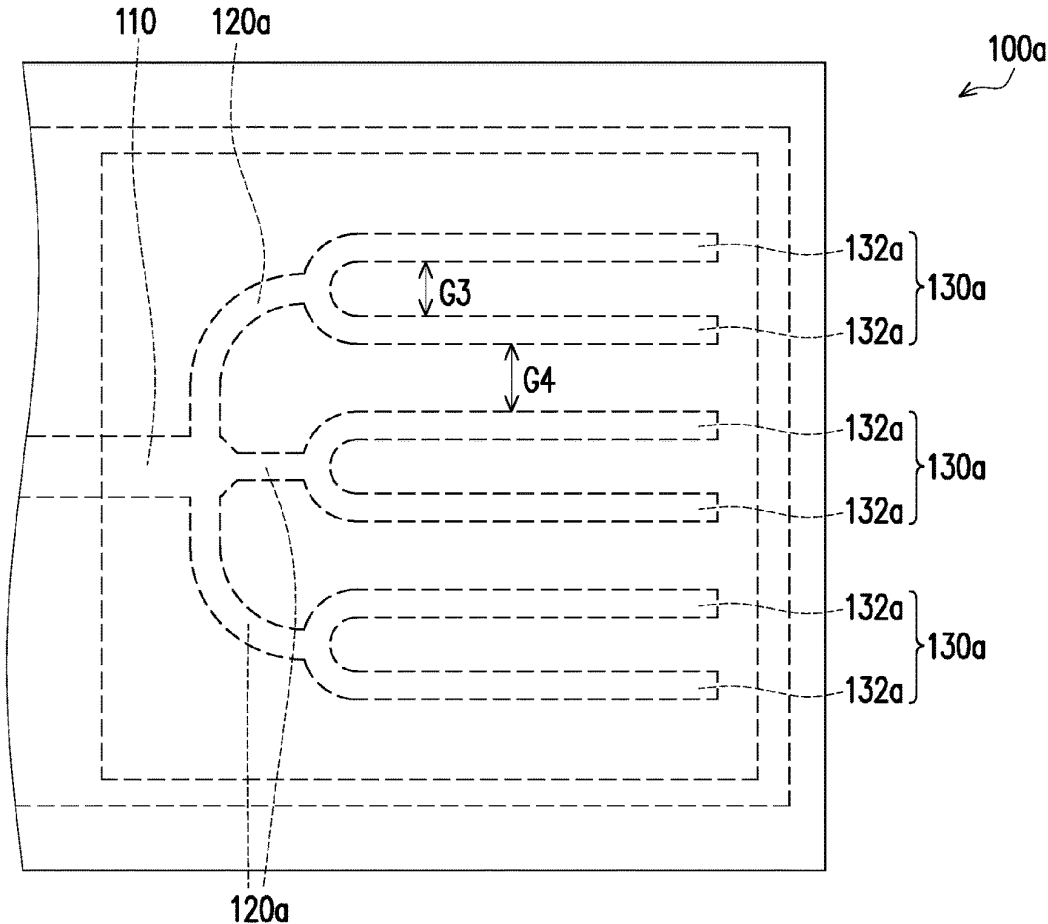
(21) Appl. No.: **17/940,917**

An antenna module includes a feeding end, multiple first forked radiators, and multiple connecting parts. The first forked radiators are disposed side by side. The connecting parts respectively extend from the feeding end to the first forked radiators. The feeding end, the first forked radiators, and the connecting parts are located on a same plane. The antenna module resonates at a frequency band, and a path length from the feeding end to an end of each of the forked radiators through the corresponding connecting part is $\frac{1}{4}$ wavelength of the frequency band.

(22) Filed: **Sep. 8, 2022**

(30) **Foreign Application Priority Data**

Nov. 16, 2021 (TW) 110142548





US 20230155302A1

(19) **United States**

(12) **Patent Application Publication**

Yu et al.

(10) **Pub. No.: US 2023/0155302 A1**

(43) **Pub. Date: May 18, 2023**

(54) **ANTENNA AND ELECTRONIC DEVICE**

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

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

CPC **H01Q 21/205** (2013.01); **H01Q 1/246**
(2013.01); **H01Q 15/14** (2013.01)

(72) Inventors: **Min Yu**, Chengdu (CN); **Michael Kadichevitz**,
Hod Hasharon (IL); **Yi Chen**, Leuven (BE)

(57) **ABSTRACT**

(21) Appl. No.: **17/989,244**

An antenna and an electronic device are provided. The antenna includes: a radiating element pair, including a first radiating element and a second radiating element that are arranged in an annular array, where the first radiating element and the second radiating element are symmetrically arranged with respect to a symmetry line, the symmetry line passes through a center point of the annular array, and the first radiating element or the second radiating element is in an arc shape centered on the center point, or extends in a tangent direction of an arc shape centered on the center point; and a feed structure, including a first feed part and a second feed part, where the first feed part is coupled to the first radiating element, and the second feed part is coupled to the second radiating element.

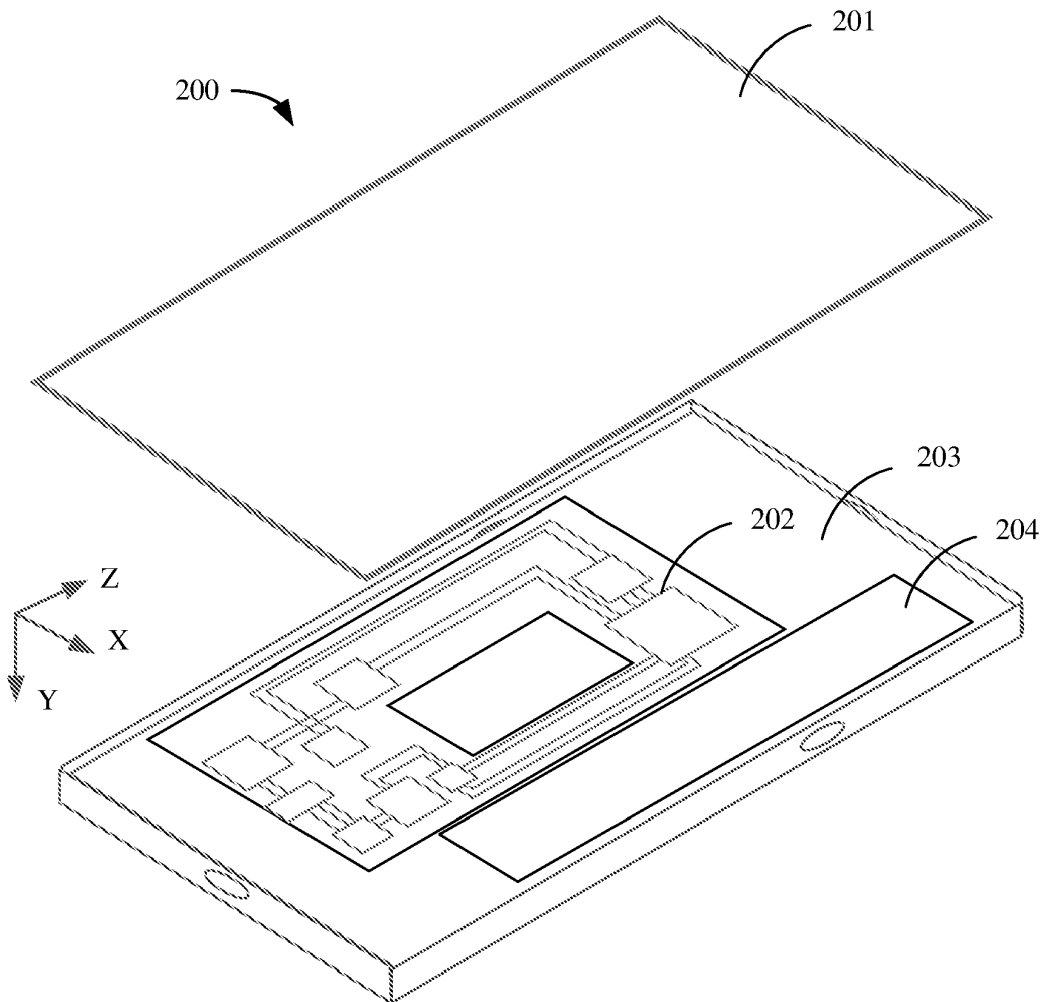
(22) Filed: **Nov. 17, 2022**

(30) **Foreign Application Priority Data**

Nov. 18, 2021 (CN) 202111368703.6
Feb. 21, 2022 (CN) 202210158355.8

Publication Classification

(51) **Int. Cl.**
H01Q 21/20 (2006.01)
H01Q 1/24 (2006.01)
H01Q 15/14 (2006.01)





US 20230155610A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0155610 A1**

(43) **Pub. Date: May 18, 2023**

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

H01Q 21/08 (2006.01)

H01Q 5/50 (2006.01)

H05K 7/14 (2006.01)

H05K 1/02 (2006.01)

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

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

CPC *H04B 1/0064* (2013.01); *H01Q 1/243*
(2013.01); *H01Q 21/08* (2013.01); *H01Q 5/50*
(2015.01); *H05K 7/1427* (2013.01); *H05K*
1/0243 (2013.01); *H05K 1/0277* (2013.01);
H05K 2201/10098 (2013.01)

(72) Inventors: **Yoondo LEE**, Suwon-si (KR); **Sigwan KIM**, Suwon-si (KR); **Hyelee SONG**, Suwon-si (KR); **Dongryul SHIN**, Suwon-si (KR); **Dongmin SHIN**, Suwon-si (KR); **Yoonjae LEE**, Suwon-si (KR); **Handug LEE**, Suwon-si (KR); **Woosik CHO**, Suwon-si (KR); **Weonjai CHOI**, Suwon-si (KR); **Taewook HAM**, Suwon-si (KR); **Kyunggu KIM**, Suwon-si (KR); **Hongpyo BAE**, Suwon-si (KR); **Jinwoo JUNG**, Suwon-si (KR); **Youngjun CHO**, Suwon-si (KR)

(57) **ABSTRACT**

In embodiments, an electronic device may include a housing having an inner space, a printed circuit board (PCB) disposed in the inner space of the housing, a first antenna structure disposed at a position spaced apart from the PCB, and transmitting and/or receiving a radio signal in a first frequency band, at least one second antenna structure disposed at a position spaced apart from the PCB, and transmitting and/or receiving a radio signal in a second frequency band different from the first frequency band, and a flexible substrate electrically connecting the PCB and the first antenna structure. The flexible substrate may include a first connecting portion electrically connected to the PCB, an interconnecting portion extended from the first connecting portion to the first antenna structure, at least one branch portion branched from at least a part of the interconnecting portion, and extended to the at least one second antenna structure, at least one first conductive path disposed in the interconnecting portion, and electrically connecting the first connecting portion and the first antenna structure, and at least one second conductive path disposed in the interconnecting portion and the at least one branch portion, and electrically connecting the first connecting portion and the at least one second antenna structure.

(21) Appl. No.: **16/976,907**

(22) PCT Filed: **Jul. 31, 2020**

(86) PCT No.: **PCT/KR2020/010158**

§ 371 (c)(1),

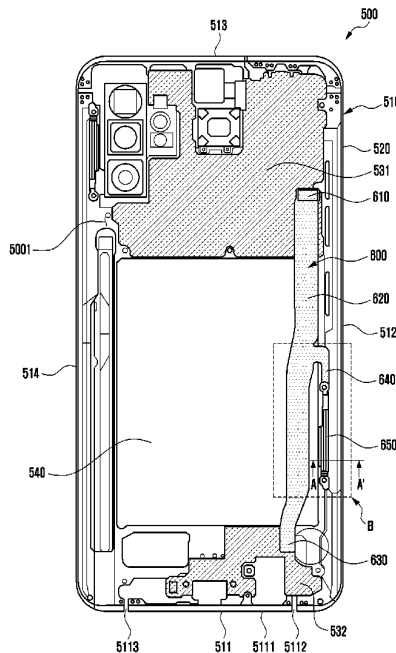
(2) Date: **Aug. 31, 2020**

(30) **Foreign Application Priority Data**

Aug. 6, 2019 (KR) 10-2019-0095741

Publication Classification

(51) **Int. Cl.**
H04B 1/00 (2006.01)
H01Q 1/24 (2006.01)





US 20230163446A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0163446 A1**

(43) **Pub. Date: May 25, 2023**

(54) **ANTENNA STACK STRUCTURE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventors: **Byung Jin CHOI**, Incheon (KR); **Han Sub RYU**, Gyeongsangbuk-do (KR); **Jae Hyun LEE**, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01); *H01Q 9/0407* (2013.01)

(21) Appl. No.: **18/098,800**

(57) **ABSTRACT**

(22) Filed: **Jan. 19, 2023**

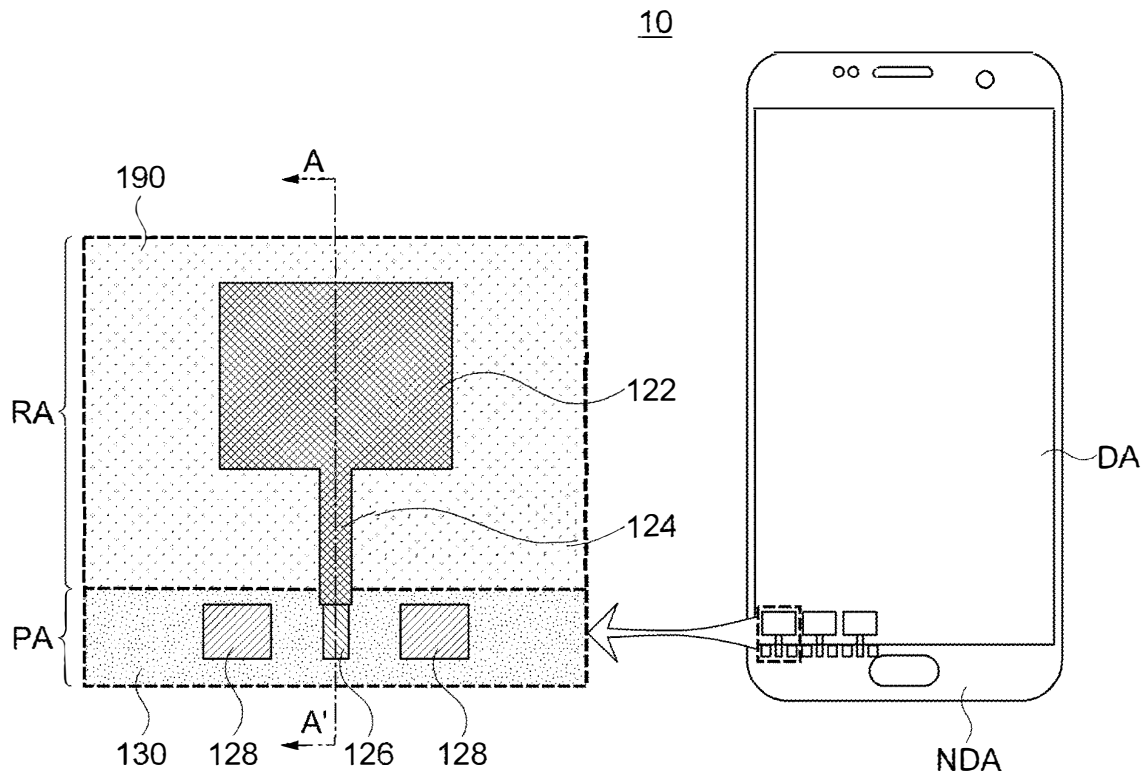
Related U.S. Application Data

An antenna stack structure according to an embodiment includes an antenna substrate layer, an antenna unit disposed on one surface of the antenna substrate layer and including a radiator and an antenna pad, and a pad ground and an insulating layer disposed at the same level on an opposite surface of the antenna substrate layer facing the one surface. The antenna pad is superimposed over the pad ground in a thickness direction. Radiation properties can be improved utilizing the antenna pad.

(63) Continuation of application No. PCT/KR2021/009257, filed on Jul. 19, 2021.

Foreign Application Priority Data

Jul. 24, 2020 (KR) 10-2020-0092579





US 20230163455A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0163455 A1**

(43) **Pub. Date: May 25, 2023**

(54) **MOBILE DEVICE FOR REDUCING SPECIFIC ABSORPTION RATE**

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

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

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

(57) **ABSTRACT**

(21) Appl. No.: **17/700,062**

(22) Filed: **Mar. 21, 2022**

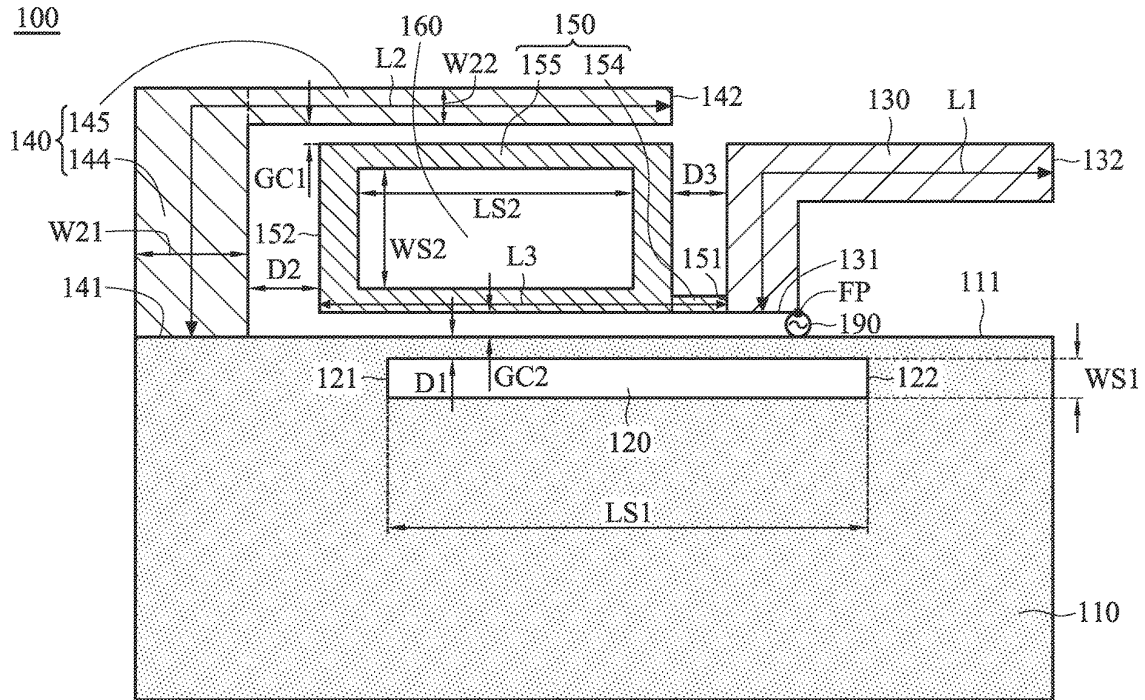
(30) **Foreign Application Priority Data**

Nov. 24, 2021 (TW) 110143659

Publication Classification

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)

A mobile device for reducing SAR (Specific Absorption Rate) includes a ground element, a first radiation element, a second radiation element, and a third radiation element. The ground element has a slot. The first radiation element is coupled to a feeding point. The second radiation element is coupled to the ground element. The third radiation element is coupled to the feeding point and has a hollow portion. The third radiation element is substantially surrounded by the ground element, the first radiation element, and the second radiation element. An antenna structure is formed by the ground element, the first radiation element, the second radiation element, and the third radiation element.





US 20230163466A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0163466 A1**
 Yu et al. (43) **Pub. Date: May 25, 2023**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/371 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/50 (2006.01)

(72) Inventors: **Dong Yu**, Shanghai (CN); **Kexin Liu**,
 Shanghai (CN); **Yuan Zhou**, Shanghai
 (CN); **Hanyang Wang**, Reading (GB);
Lijun Ying, Shanghai (CN); **Pengfei**
Wu, Shanghai (CN); **Chien-Ming Lee**,
 Shenzhen (CN); **Meng Hou**, Shanghai
 (CN)

(52) **U.S. Cl.**
 CPC *H01Q 5/371* (2015.01); *H01Q 1/48*
 (2013.01); *H01Q 1/50* (2013.01)

(57) **ABSTRACT**

This application provides an antenna unit and an electronic device. A signal at a C-mode port and a signal at a D-mode port of a same loop antenna in any antenna unit are respectively excited by using two feeds, and the antenna unit is electrically symmetrically disposed, so that the signal at the C-mode port is self-cancelled at the D-mode port, and the signal at the D-mode port is self-cancelled at the C-mode port, to implement signal isolation between the two ports and interference self-cancel, and the signal at the C-mode port and the signal at the D-mode port can be complementary to each other in different radiation directions, to implement two antennas with high isolation and a low envelope correlation coefficient ECC based on the same loop antenna.

(21) Appl. No.: **17/920,570**

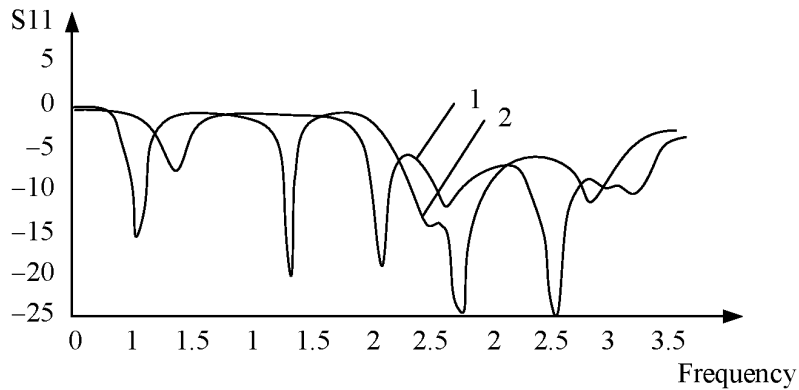
(22) PCT Filed: **Mar. 25, 2021**

(86) PCT No.: **PCT/CN2021/082974**

§ 371 (e)(1),
 (2) Date: **Oct. 21, 2022**

(30) **Foreign Application Priority Data**

Apr. 22, 2020 (CN) 202010323918.5





(19) **United States**

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

(10) **Pub. No.: US 2023/0163469 A1**

(43) **Pub. Date: May 25, 2023**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

Publication Classification

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

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

(72) Inventors: **Himchan YUN**, Suwon-si (KR);
Museok BANG, Suwon-si (KR);
Dongyeon KIM, Suwon-si (KR);
Haeyeon KIM, Suwon-si (KR);
Nakchung CHOI, Suwon-si (KR);
Soonho HWANG, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 9/0407** (2013.01); **H01Q 15/24** (2013.01)

(73) Assignee: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)

(57) **ABSTRACT**

(21) Appl. No.: **18/099,740**

An electronic device includes at least one processor, a first antenna comprises a first conductive patch disposed on a first layer, a first transmission line disposed on the first layer and electrically connected to one point of the first conductive patch, a ground disposed on a second layer and a dielectric disposed on a third layer between the first layer and the second layer, the first conductive patch has a shape of a rectangle in which a first corner portion of the rectangle and a second corner portion of the rectangle are removed, and the at least one processor transmits and/or receives at least one of a first RF signal having a first polarization characteristic and a second RF signal having a second polarization characteristic.

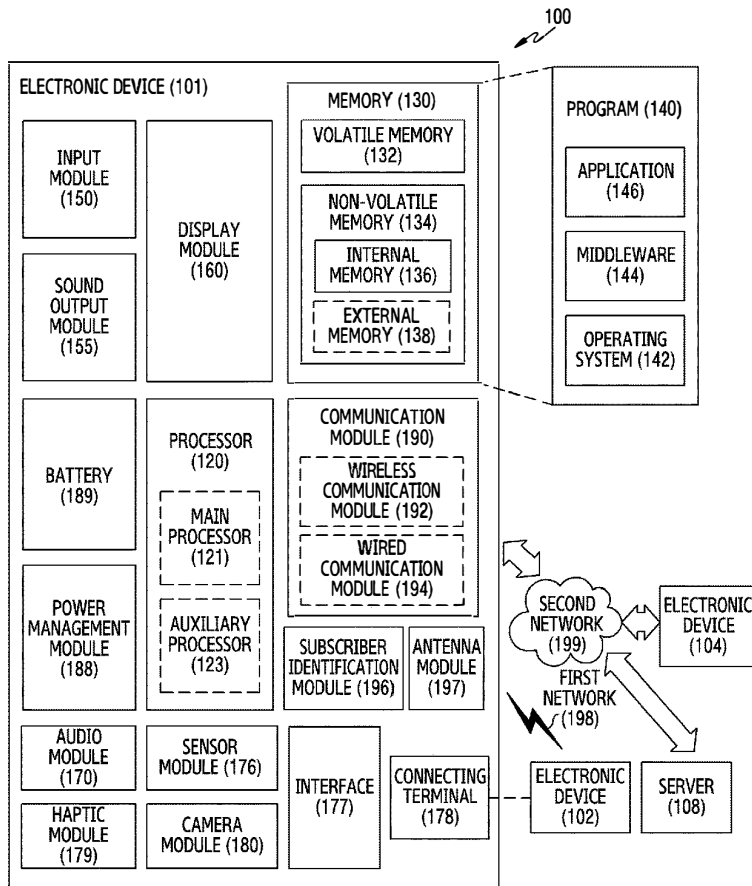
(22) Filed: **Jan. 20, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR21/09490, filed on Jul. 22, 2021.

(30) **Foreign Application Priority Data**

Jul. 22, 2020 (KR) 10-2020-0091136





(19) **United States**

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

(10) **Pub. No.: US 2023/0163475 A1**

(43) **Pub. Date: May 25, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/28 (2006.01)
H01Q 1/42 (2006.01)

(72) Inventors: **Namjun CHO**, Suwon-si (KR);
Hyoseok NA, Suwon-si (KR);
Junghwan SON, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 9/285** (2013.01); **H01Q 1/422** (2013.01)

(21) Appl. No.: **18/054,312**

(57) **ABSTRACT**

(22) Filed: **Nov. 10, 2022**

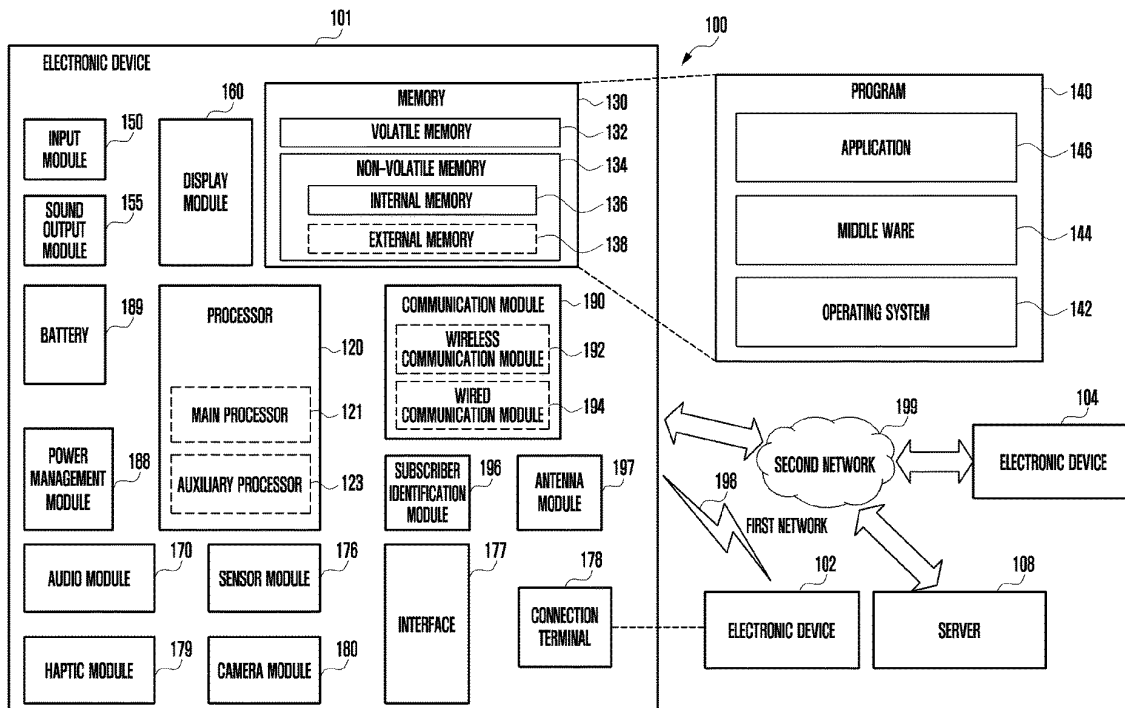
According to various embodiment, an electronic device may include: a housing, a first substrate disposed in an inner space of the housing and including a first surface facing a first direction, a second surface facing a direction opposite to the first surface, and a first recess area at least partially corresponding to the first surface, a second substrate at least partially disposed in the first recess area of the first substrate, a third substrate at least partially disposed on one surface of the second substrate and including multiple antenna elements comprising at least one antenna, and a wireless communication circuit disposed on the second surface of the first substrate and electrically connected to the second substrate. The second substrate may include at least one matching circuit electrically connected to the wireless communication circuit corresponding to each of the multiple elements.

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/095136, filed on Oct. 19, 2022.

Foreign Application Priority Data

Nov. 22, 2021 (KR) 10-2021-0161047
Jan. 5, 2022 (KR) 10-2022-0001626





US 20230163478A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0163478 A1**

(43) **Pub. Date: May 25, 2023**

(54) **ANTENNA AND MANUFACTURING METHOD THEREOF**

(52) **U.S. Cl.**
CPC **H01Q 13/106** (2013.01); **H01Q 1/422** (2013.01)

(71) Applicant: **BOE TECHNOLOGY GROUP CO., LTD.**, Beijing (CN)

(72) Inventors: **Qianhong WU**, Beijing (CN); **Dongdong ZHANG**, Beijing (CN); **Hai YU**, Beijing (CN); **Yafei ZHANG**, Beijing (CN); **Feng QU**, Beijing (CN)

(57) **ABSTRACT**

An antenna includes: a dielectric layer; a reference electrode layer on a first surface of the dielectric layer and with a slot therein; radiation structure on a second surface of the dielectric layer. The radiation structure includes a plurality of radiation parts spaced apart from each other, each of which includes radiation elements spaced apart from each other. The plurality of radiation parts in each radiation structure include first radiation part and a second radiation part; and a first microstrip line and a second microstrip line are on the second surface. The first microstrip line is configured to feed power to the radiation elements in the first radiation part, and the second microstrip line is configured to feed power to the radiation elements in the second radiation part. The first microstrip line has a feed direction different from that of the second microstrip line.

(21) Appl. No.: **17/638,953**

(22) PCT Filed: **Mar. 15, 2021**

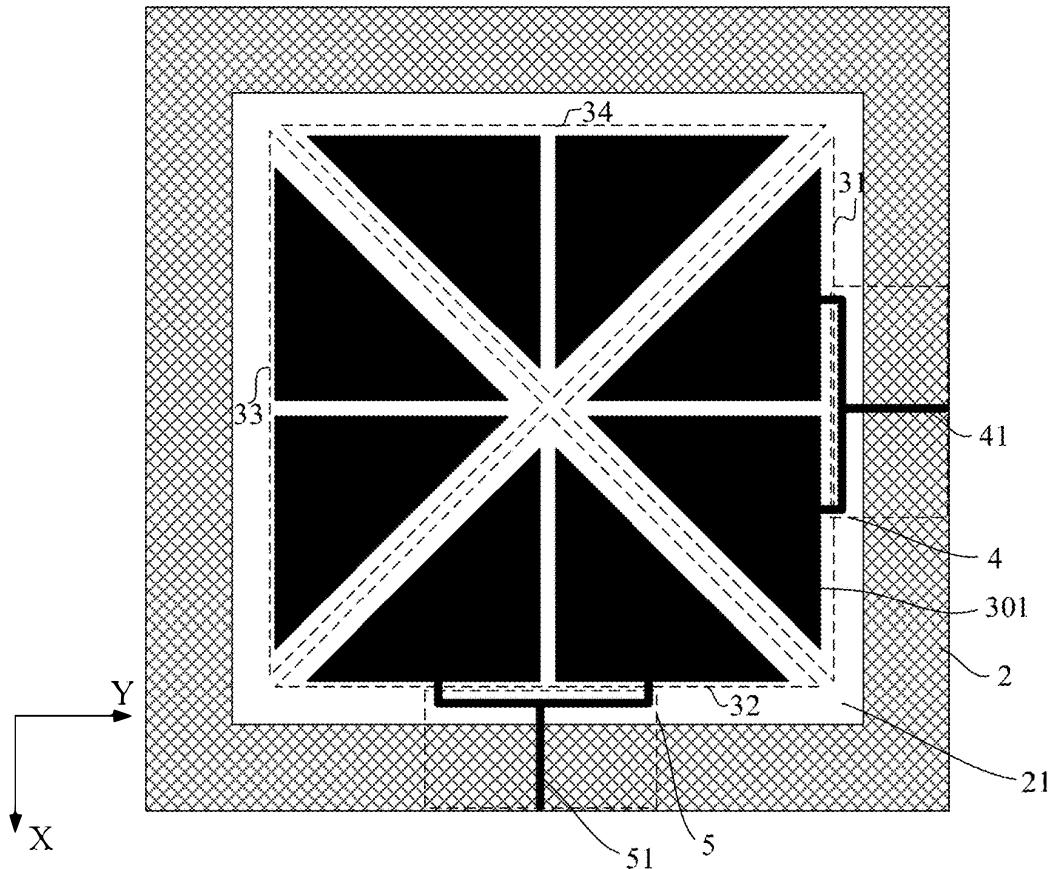
(86) PCT No.: **PCT/CN2021/080751**

§ 371 (c)(1),
(2) Date: **Feb. 28, 2022**

Publication Classification

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/42 (2006.01)

10





US 20230163487A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0163487 A1**

(43) **Pub. Date: May 25, 2023**

(54) **SLOT ANTENNAS WITH BRIDGE PORTIONS**

(52) **U.S. Cl.**
CPC *H01Q 21/064* (2013.01); *H01Q 13/106* (2013.01); *H01Q 21/0043* (2013.01)

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

(72) Inventors: **Chin-Hung Ma**, Taipei (TW); **Pai Cheng Huang**, Taipei (TW); **Po Chao Chen**, Taipei (TW)

(57) **ABSTRACT**

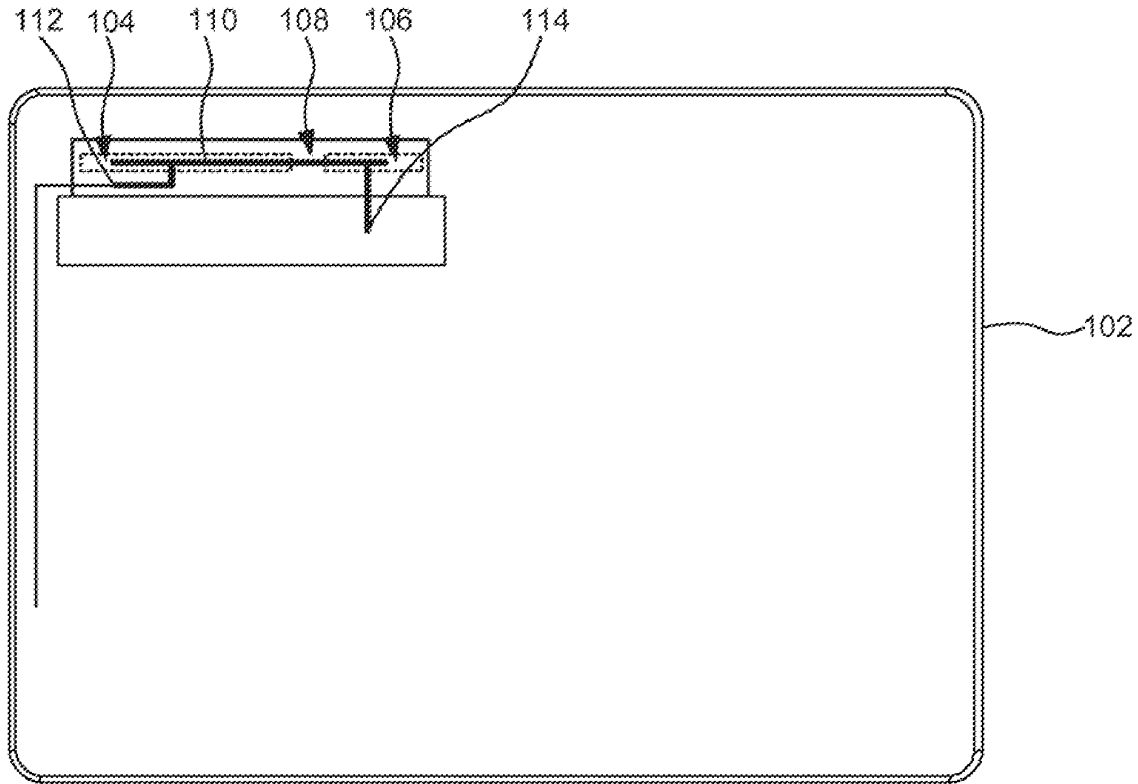
(21) Appl. No.: **17/535,600**

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

Publication Classification

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 13/10 (2006.01)
H01Q 21/00 (2006.01)

In an example, an electronic device includes a conductive housing. The conductive housing may include a first slot, a second slot, and a bridge portion to separate the first slot and the second slot. Further, the electronic device may include an antenna layout disposed across the first slot, the second slot, and the bridge portion. Furthermore, the electronic device may include an antenna feed coupled to the antenna layout in the first slot and an antenna ground coupled to the antenna layout in the second slot.



100



US 20230170604A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0170604 A1**

(43) **Pub. Date: Jun. 1, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

H01Q 21/08 (2006.01)

H01Q 9/04 (2006.01)

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

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

CPC *H01Q 1/243* (2013.01); *H01Q 1/42* (2013.01); *H01Q 21/08* (2013.01); *H01Q 9/0407* (2013.01); *H01Q 1/48* (2013.01)

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

(57)

ABSTRACT

(21) Appl. No.: **17/988,498**

(22) Filed: **Nov. 16, 2022**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/017008, filed on Nov. 2, 2022.

(30) **Foreign Application Priority Data**

Nov. 30, 2021 (KR) 10-2021-01685380
Dec. 22, 2021 (KR) 10-2021-0185092

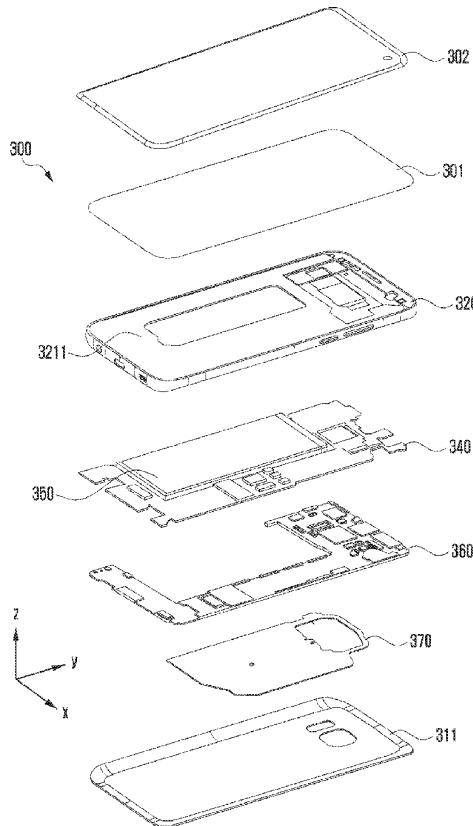
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/42 (2006.01)

According to various embodiments, an electronic device includes: a housing including a lateral member including a conductive member including an inner surface and an outer surface facing the inner surface, an antenna structure disposed in an inner space of the housing and including a substrate, and a plurality of antenna elements disposed at a first interval at the substrate, a plurality of through-holes penetrating the inner surface to at least a part of the outer surface and corresponding to the plurality of antenna elements, and a wireless communication circuit disposed in the inner space and configured to transmit or receive a radio signal in a specified frequency band through the antenna structure, wherein first opening portions of the plurality of through-holes formed in the inner surface are disposed at the first interval, and second opening portions of the plurality of through-holes formed in the outer surface are disposed at a second interval greater than the first interval.





US 20230170609A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0170609 A1**

(43) **Pub. Date: Jun. 1, 2023**

(54) **ELECTRONIC DEVICE**

Publication Classification

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

(72) Inventors: **Hanyang Wang**, Reading (GB); **Meng Hou**,
Shanghai (CN); **Dong Yu**, Shanghai (CN); **Pengfei Wu**,
Shanghai (CN); **Xiaowei Zhang**, Shenzhen (CN);
Chuanbo Shi, Shanghai (CN)

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/24 (2006.01)
H01Q 5/307 (2006.01)
H01Q 21/00 (2006.01)

(52) **U.S. Cl.**
CPC *H01Q 1/52* (2013.01); *H01Q 1/48*
(2013.01); *H01Q 1/243* (2013.01); *H01Q*
5/307 (2015.01); *H01Q 21/00* (2013.01)

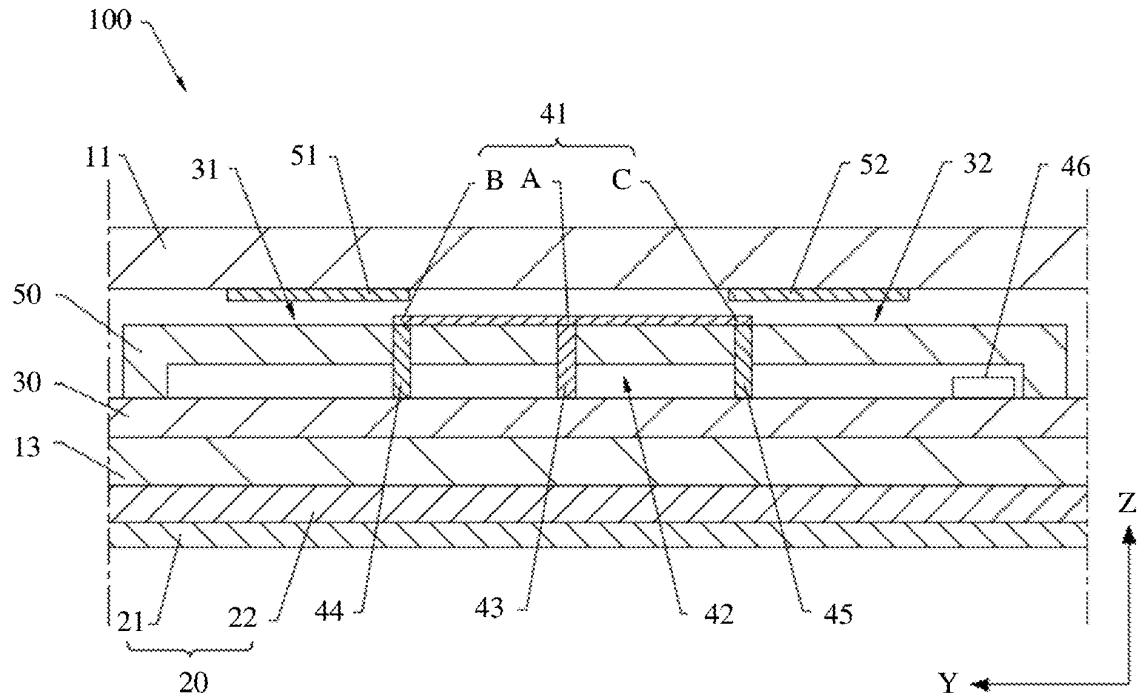
(21) Appl. No.: **17/921,273**

(22) PCT Filed: **Apr. 23, 2021**

(86) PCT No.: **PCT/CN2021/089245**
§ 371 (c)(1),
(2) Date: **Oct. 25, 2022**

(57) **ABSTRACT**
The electronic device includes a composite antenna including a slot antenna and a wire antenna. A first strip-shaped conductor of the slot antenna includes a first ground part, a second ground part, and a feeding part. The first ground part and the second ground part are respectively two ends of the first strip-shaped conductor. The feeding part is located between the first ground part and the second ground part. A second strip-shaped conductor of the wire antenna includes a first end and a second end. The first end of the second strip-shaped conductor is electrically connected to the first ground part. The second end of the second strip-shaped conductor is an open end.

(30) **Foreign Application Priority Data**
Apr. 27, 2020 (CN) 202010346611.7





US 20230170618A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0170618 A1**

(43) **Pub. Date: Jun. 1, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/48 (2006.01)
H01Q 5/328 (2006.01)

(72) Inventors: **Kyoungmok KIM**, Suwon-si (KR);
Sungjun LEE, Suwon-si (KR);
Sanggon SHIN, Suwon-si (KR); **Oleg FEYGENSON**, Suwon-si (KR);
Chaep YOO, Suwon-si (KR); **Soonho HWANG**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 9/0442* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/328* (2015.01)

(57) **ABSTRACT**

An electronic device may include a housing including a first side surface, a first conductive portion disposed between at least a first segmenting portion and a second segmenting portion formed in the first side surface, and including a first feeding point, a printed circuit board disposed inside the housing and including a ground, a first electronic component disposed adjacent to the first conductive portion, a first conductive connection member electrically connected to the first electronic component, a first wireless communication circuit electrically connected to the first feeding point, a processor electrically connected to the first wireless communication circuit, and a matching circuit electrically connected to the first conductive connection member and the ground, and configured to electrically connect or disconnect the first conductive connection member and the ground under control of the processor. The radiation performance of the antenna can be improved by adjusting the resonance frequency of the antenna through the control of the matching circuit. Other various embodiments are possible.

(21) Appl. No.: **18/086,070**

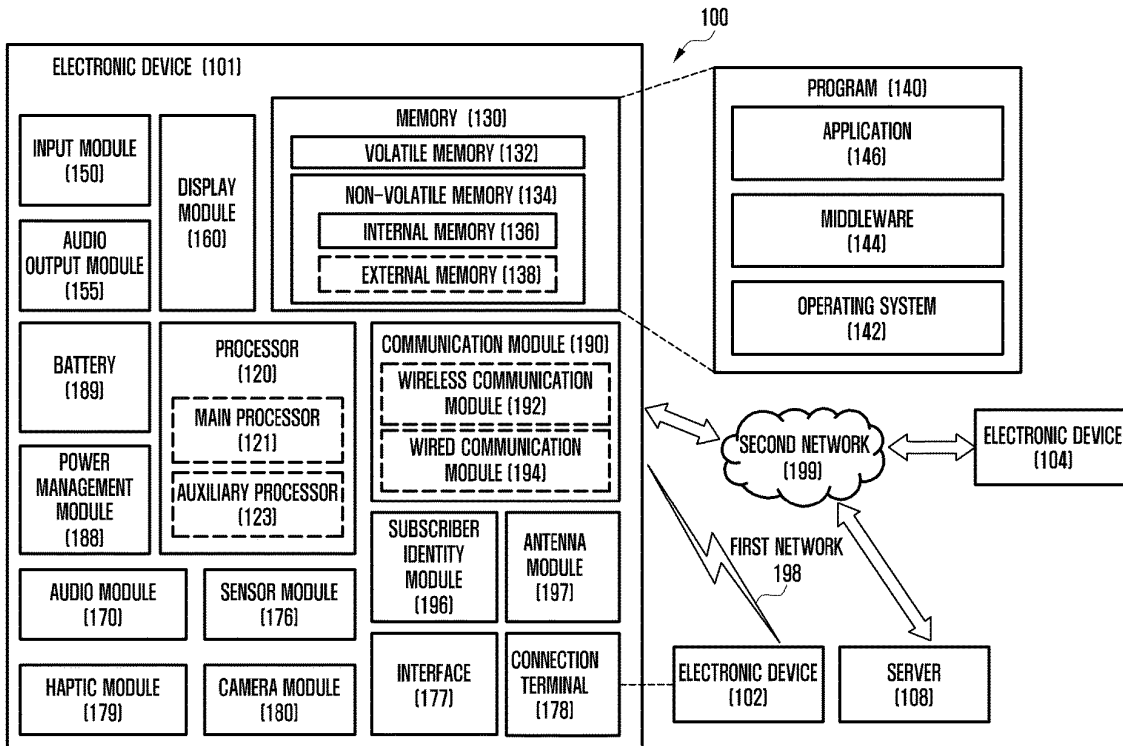
(22) Filed: **Dec. 21, 2022**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2022/018403, filed on Nov. 21, 2022.

(30) **Foreign Application Priority Data**

Nov. 29, 2021 (KR) 10-2021-0167271
Jan. 26, 2022 (KR) 10-2022-0011766





US 20230170626A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0170626 A1**

(43) **Pub. Date: Jun. 1, 2023**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 1/24 (2006.01)
H01Q 21/00 (2006.01)

(72) Inventors: **Jong Min KIM**, Gyeonggi-do (KR);
Young Su LEE, Gyeonggi-do (KR);
Yoon Ho HUH, Seoul (KR)

(52) **U.S. Cl.**
CPC *H01Q 21/061* (2013.01); *H01Q 1/243*
(2013.01); *H01Q 21/0006* (2013.01)

(21) Appl. No.: **18/096,649**

(57) **ABSTRACT**

(22) Filed: **Jan. 13, 2023**

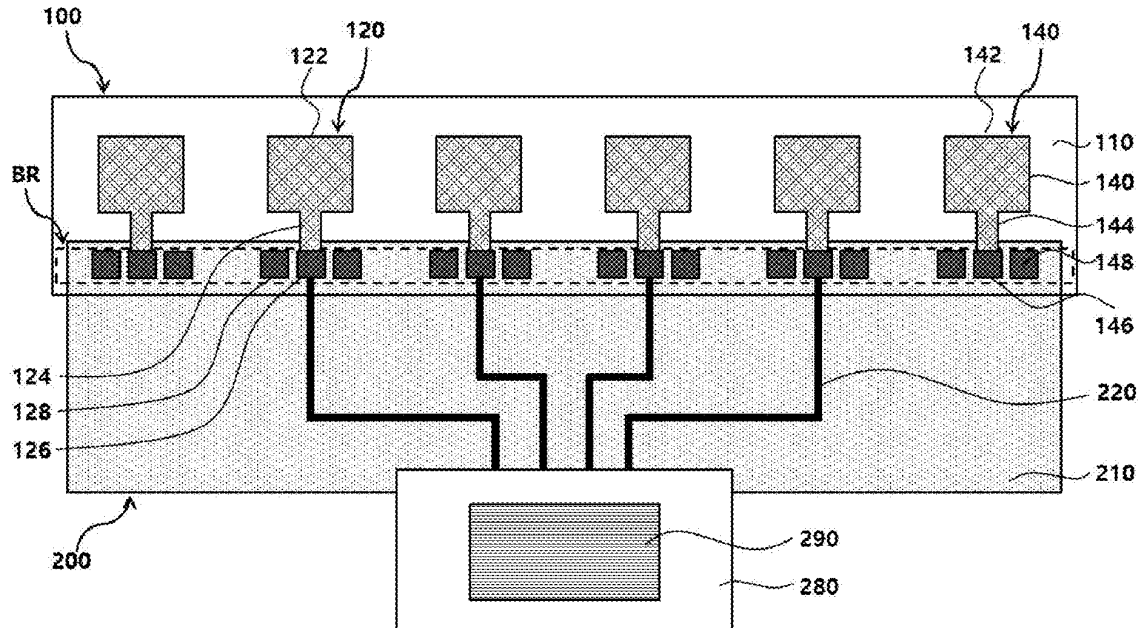
Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/
008532, filed on Jul. 6, 2021.

Foreign Application Priority Data

Jul. 17, 2020 (KR) 10-2020-0089101

An antenna package according to an embodiment includes an antenna device and a flexible circuit board. The antenna device includes a dielectric layer, a first antenna unit arranged on the dielectric layer and a second antenna unit arranged on the dielectric layer to be physically and electrically separated from the first antenna unit. The printed circuit board is coupled to the antenna device to be electrically connected to the first antenna unit, and electrically separated from the second antenna unit.





US 20230170628A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0170628 A1**

(43) **Pub. Date: Jun. 1, 2023**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 21/24 (2006.01)
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventors: **Dabin CHOI**, Suwon-si (KR); **Dongsik SHIN**, Suwon-si (KR); **Jonghwa KIM**, Suwon-si (KR); **Jihye KIM**, Suwon-si (KR); **Haegweon PARK**, Suwon-si (KR); **Seunghwan YOON**, Suwon-si (KR); **Jongwook ZEONG**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC *H01Q 21/24* (2013.01); *H01Q 1/243* (2013.01); *H01Q 9/0414* (2013.01); *H01Q 9/045* (2013.01)

(21) Appl. No.: **18/075,864**

(22) Filed: **Dec. 6, 2022**

Related U.S. Application Data

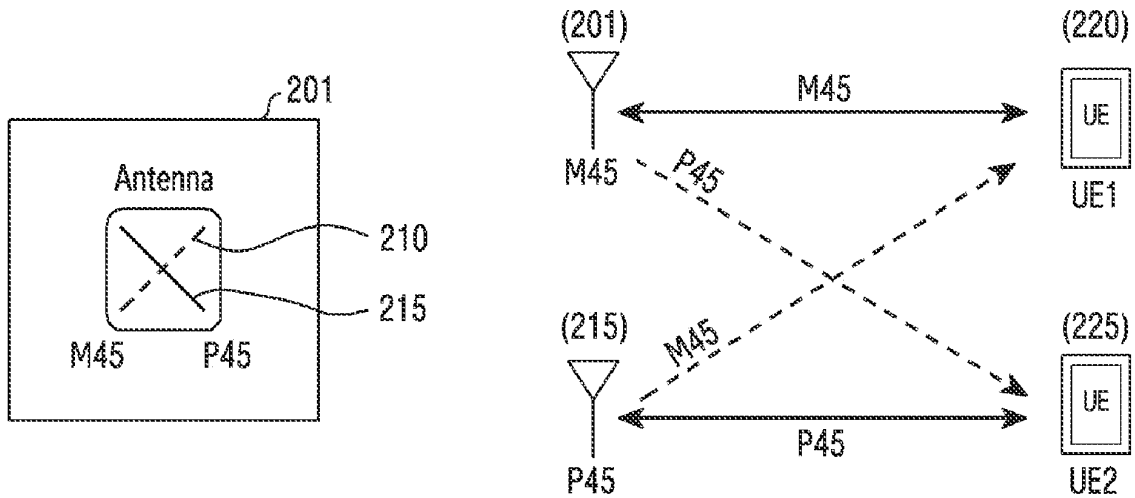
(63) Continuation of application No. PCT/KR2021/007174, filed on Jun. 8, 2021.

Foreign Application Priority Data

(30) Jun. 8, 2020 (KR) 10-2020-0069330

(57) **ABSTRACT**

The disclosure relates to a 5th generation (5G) or pre-5G communication system for supporting higher data transfer rates than 4th generation (4G) communication systems, such as long term evolution (LTE). An antenna device is provided. The antenna device includes a first feeding line for a first polarization, and an antenna. The antenna includes a radiation face and at least one corresponding face on which the first polarization is formed. An angle formed by the at least one corresponding face and a direction of the first polarization may be smaller than an angle formed by the at least one corresponding face and a direction of a polarization perpendicular to the first polarization.





US 20230170955A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0170955 A1**

(43) **Pub. Date: Jun. 1, 2023**

(54) **ELECTRONIC DEVICE AND METHOD FOR OPERATING ANTENNA**

H04B 1/44 (2006.01)

H04B 17/10 (2006.01)

H04B 7/0404 (2006.01)

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

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

CPC *H04B 7/0608* (2013.01); *H04M 1/0214*
(2013.01); *H04B 1/44* (2013.01); *H04B 17/102* (2015.01); *H04B 7/0404* (2013.01)

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

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a first antenna, a second antenna segmented from the first antenna, a switch selectively coupled to the first antenna and the second antenna, a front end module connected to the switch, and a radio frequency (RF) communication circuit, wherein the RF communication circuit controls to communicate using the first antenna, determines whether radiation power through the first antenna is equal to or greater than a predetermined value, and if the radiation power through the first antenna is greater than or equal to the predetermined value, checks the in-phase quadrature phase (IQ) value of the first antenna, determines whether the IQ value corresponds to a switching condition of the second antenna, and if the IQ value corresponds to the switching condition of the second antenna, may switch the first antenna to the second antenna.

(21) Appl. No.: **18/160,582**

(22) Filed: **Jan. 27, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2021/009804, filed on Jul. 28, 2021.

Foreign Application Priority Data

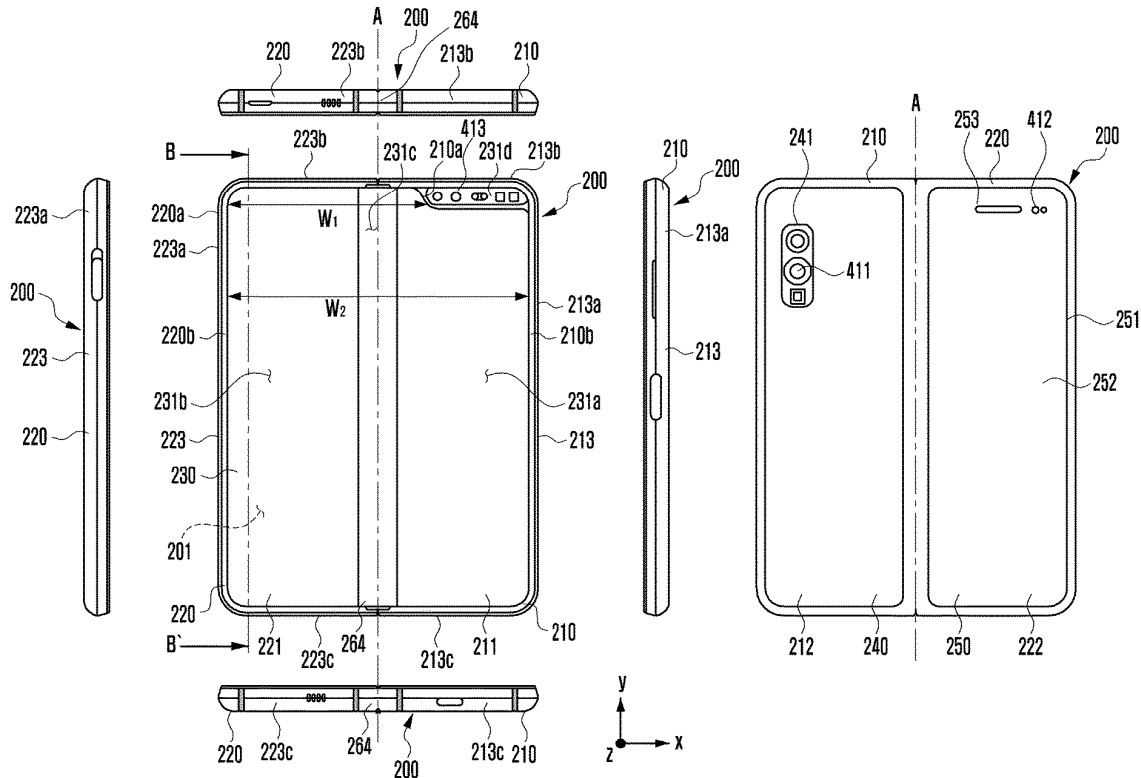
Jul. 31, 2020 (KR) 10-2020-0096328

Publication Classification

(51) **Int. Cl.**

H04B 7/06 (2006.01)

H04M 1/02 (2006.01)





US 20230176633A1

(19) **United States**

(12) **Patent Application Publication**
YAO

(10) **Pub. No.: US 2023/0176633 A1**

(43) **Pub. Date: Jun. 8, 2023**

(54) **ELECTRONIC DEVICE**

Publication Classification

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

(51) **Int. Cl.**
G06F 1/20 (2006.01)
G06F 1/16 (2006.01)
H01Q 1/24 (2006.01)
H04R 9/02 (2006.01)

(72) Inventor: **Chengwei YAO**, Dongguan (CN)

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

(52) **U.S. Cl.**
CPC *G06F 1/203* (2013.01); *G06F 1/1684* (2013.01); *H01Q 1/243* (2013.01); *G06F 1/1635* (2013.01); *H04R 9/022* (2013.01)

(21) Appl. No.: **18/098,682**

(57) **ABSTRACT**

(22) Filed: **Jan. 18, 2023**

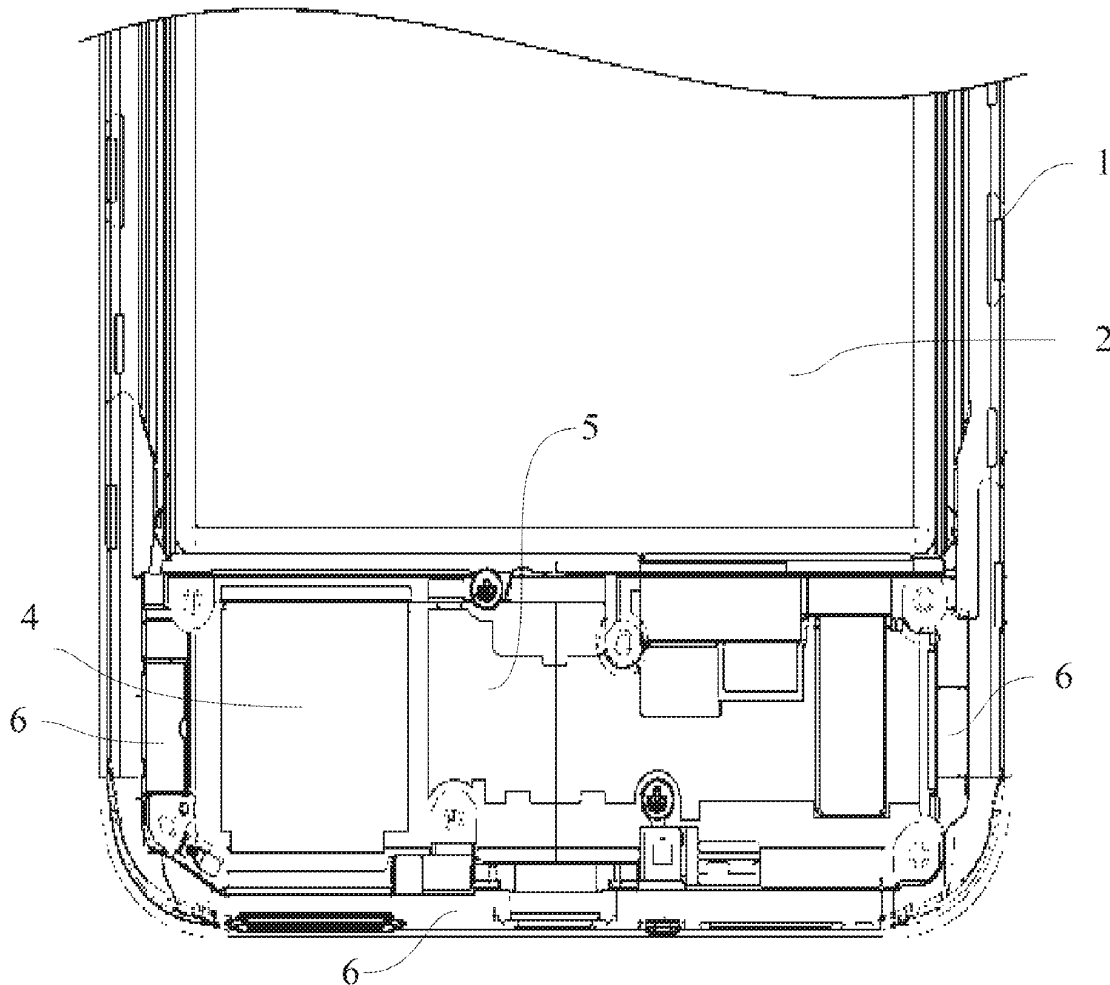
An electronic device is provided. The electronic device includes a housing, a battery, an antenna, a speaker module, and a heat sink. The battery, the antenna, the speaker module, and the heat sink are all disposed in a cavity formed by the housing. The battery and the speaker module are disposed adjacent to each other. A gap exists between the battery and the speaker module. The antenna is disposed on a periphery of a region where the battery and the speaker module are located. The heat sink is disposed on the speaker module and the battery, and an opening is disposed on the heat sink, where the opening is opposite to the gap.

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2021/108622, filed on Jul. 27, 2021.

Foreign Application Priority Data

(30) Jul. 28, 2020 (CN) 202010737350.1





US 20230178887A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0178887 A1**
CHIANG et al. (43) **Pub. Date: Jun. 8, 2023**

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

(52) **U.S. Cl.**
 CPC **H01Q 3/247** (2013.01);
H01Q 5/328 (2015.01)

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

(57) **ABSTRACT**

(72) Inventors: **Cheng-Wei CHIANG**, Hsinchu (TW);
Cheng-Rui ZHANG, Hsinchu (TW);
Ching-Wen CHEN, Hsinchu (TW)

An electronic device and an antenna structure thereof are provided. The antenna structure includes a first, a second and a third radiating element and a grounding element. The first radiating element includes a first and a second radiating portion, a feeding portion and a grounding portion. The grounding portion includes a first, a second, a third, a fourth and a fifth section. The first section is connected between the first radiating portion and the feeding portion. The grounding element is connected with the fourth section and the fifth section. The second radiating element is connected with the grounding element. The second radiating element includes a third radiating portion, and the third and the second radiating portion are coupled with each other. The third radiating element is connected with the feeding portion, and the third radiating element and the first section are coupled with each other.

(21) Appl. No.: **17/810,689**

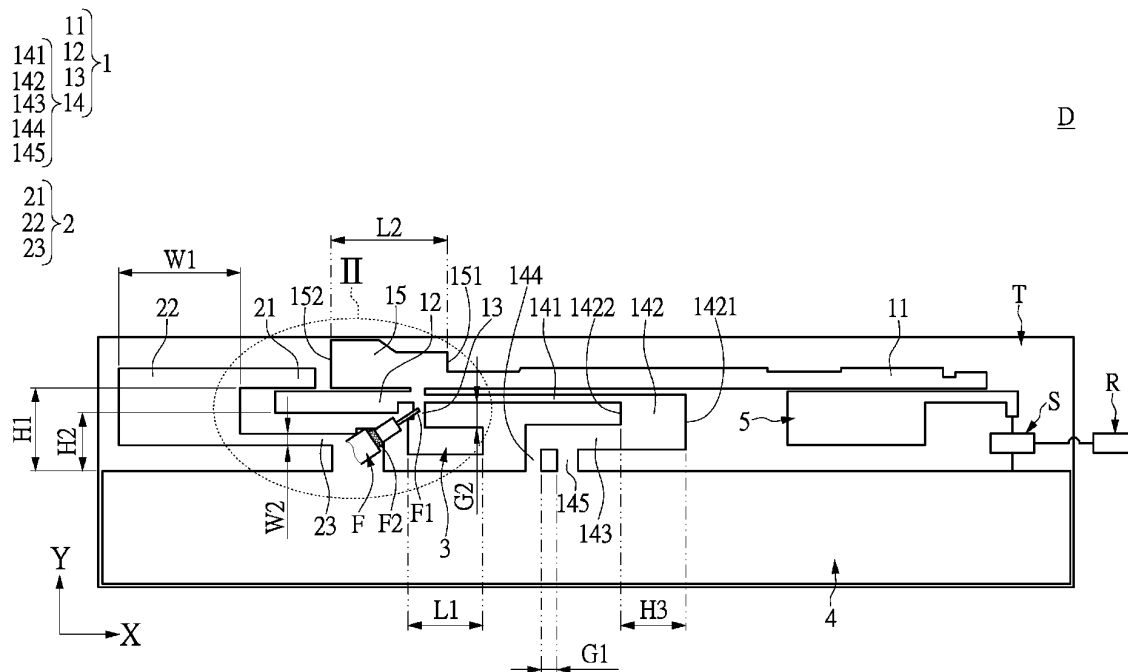
(22) Filed: **Jul. 5, 2022**

(30) **Foreign Application Priority Data**

Dec. 7, 2021 (TW) 110145605

Publication Classification

(51) **Int. Cl.**
H01Q 3/24 (2006.01)
H01Q 5/328 (2006.01)





US 20230186038A1

(19) **United States**

(12) **Patent Application Publication**
KAJINO

(10) **Pub. No.: US 2023/0186038 A1**

(43) **Pub. Date: Jun. 15, 2023**

(54) **ANTENNA DEVICE, AND FURNITURE WITH THE ANTENNA DEVICE**

(52) **U.S. Cl.**
CPC **G06K 7/10316** (2013.01); **H01Q 1/2216** (2013.01); **H01Q 7/00** (2013.01)

(71) Applicant: **System Japan Inc., TOKYO (JP)**

(72) Inventor: **Yoshiyuki KAJINO, Tokyo (JP)**

(73) Assignee: **System Japan Inc., TOKYO (JP)**

(21) Appl. No.: **17/769,018**

(22) PCT Filed: **Oct. 21, 2019**

(86) PCT No.: **PCT/JP2019/041259**

§ 371 (c)(1),

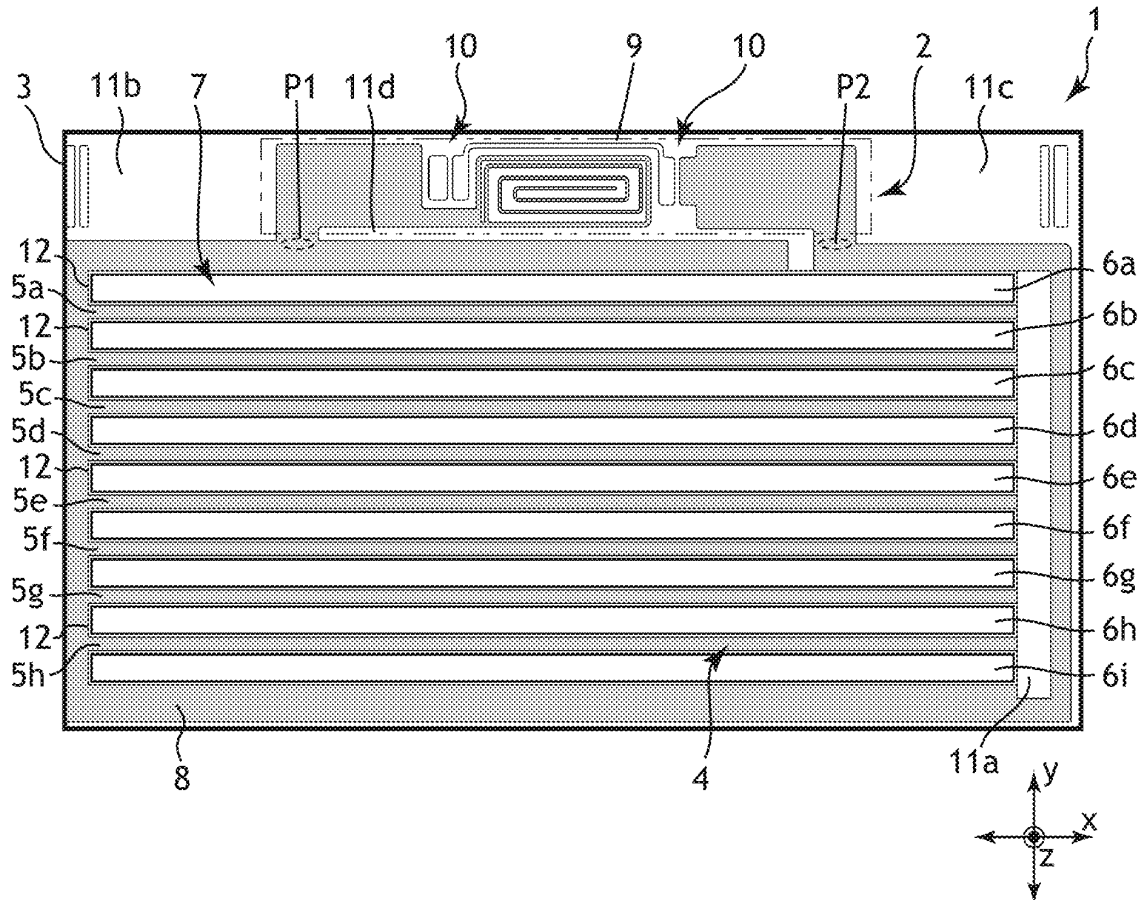
(2) Date: **Apr. 14, 2022**

Publication Classification

(51) **Int. Cl.**
G06K 7/10 (2006.01)
H01Q 1/22 (2006.01)
H01Q 7/00 (2006.01)

(57) **ABSTRACT**

An antenna device which includes an antenna structure constituted of a conductive material layer formed on a dielectric planar substrate, and configured to communicate with a radio frequency identification tag, wherein the antenna structure includes an active electrode group, a passive electrode group, and a loop type plane electrode which connects the active electrode group to feeding points, an electromagnetic field is produced between the active electrodes and the passive electrodes by electromagnetic induction, an electromagnetic field which is different from the electromagnetic field in phase is produced between the loop type plane electrode and the passive electrodes by an electromagnetic mutual interference, and electromagnetic field density on the dielectric planar substrate is raised while forming magnetic fields with different phases within the same electromagnetic field.





US 20230187849A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0187849 A1**
SONG et al. (43) **Pub. Date: Jun. 15, 2023**

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

G01S 5/06 (2006.01)
H01Q 21/08 (2006.01)
H01Q 9/04 (2006.01)

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

(52) **U.S. Cl.**
CPC *H01Q 25/002* (2013.01); *H01Q 1/243*
(2013.01); *G01S 5/06* (2013.01); *H01Q 21/08*
(2013.01); *H01Q 9/0407* (2013.01)

(72) Inventors: **Jaehoon SONG**, Suwon-si (KR);
Seunghan SEO, Suwon-si (KR);
Youngjin KANG, Suwon-si (KR);
Seokwon KIM, Suwon-si (KR);
Dongyeon KIM, Suwon-si (KR);
Dongil SON, Suwon-si (KR)

(57) **ABSTRACT**

(21) Appl. No.: **18/164,162**

An electronic device having antennas is provided. The electronic device includes a housing at least partially comprising a conductive part, an antenna module disposed in an inner space and comprising a substrate disposed in the inner space, an array antenna disposed on the substrate and supporting a first communication mode, and two or more antennas disposed on the substrate and supporting a second communication mode, a first wireless communication circuit disposed in the inner space and configured to transmit and/or receive a wireless signal of the first communication mode by means of the array antenna, a second wireless communication circuit disposed in the inner space and configured to transmit and/or receive a wireless signal of the second communication mode by means of the two or more antennas, and at least one processor electrically connected to the first wireless communication circuit and second wireless communication circuit.

(22) Filed: **Feb. 3, 2023**

Related U.S. Application Data

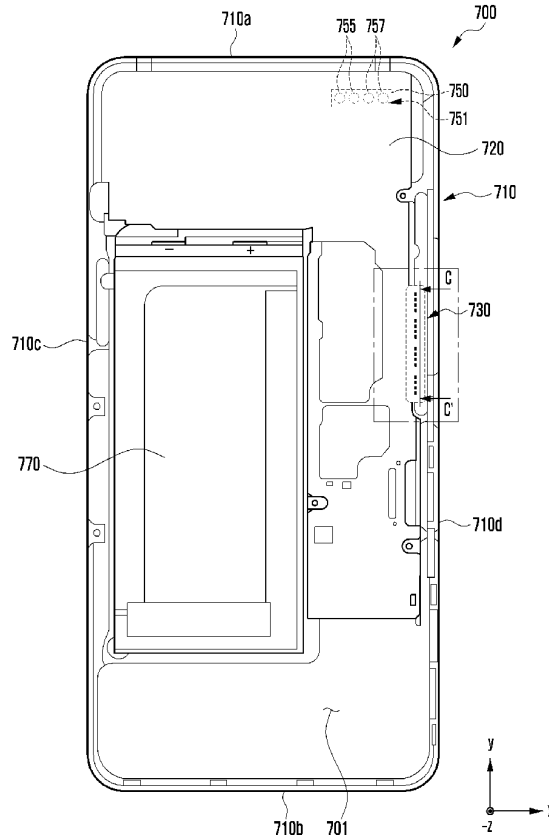
(63) Continuation of application No. PCT/KR2021/009708, filed on Jul. 27, 2021.

Foreign Application Priority Data

Aug. 6, 2020 (KR) 10-2020-0098801

Publication Classification

(51) **Int. Cl.**
H01Q 25/00 (2006.01)
H01Q 1/24 (2006.01)





(19) **United States**

(12) **Patent Application Publication**
Zhang

(10) **Pub. No.: US 2023/0188632 A1**

(43) **Pub. Date: Jun. 15, 2023**

(54) **MOBILE TERMINAL ASSEMBLY AND MOBILE TERMINAL**

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

(72) Inventor: **Yongliang Zhang**, Shenzhen (CN)

(73) Assignee: **ZTE Corporation**, Shenzhen, Guangdong (CN)

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(57) **ABSTRACT**

A mobile terminal assembly and a mobile terminal are disclosed. The mobile terminal assembly may include a housing, a card holder assembly and a first antenna module. The housing is provided with a card slot; the card holder assembly is located at the card slot and is configured to carry a memory; and the first antenna module is installed in the housing. The first antenna module is configured to be switched between a first position and a second position under the action of an external force. When the first antenna module is located at the first position, the card holder assembly is located in the housing, and the first antenna module is located between the card holder assembly and the card slot; and when the first antenna module is located at the second position, the holder assembly at least partially passes through the card slot to extend outside the housing.

