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(19) **United States**

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

(10) **Pub. No.: US 2023/0013109 A1**

(43) **Pub. Date: Jan. 19, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

(52) **U.S. Cl.**  
CPC ..... **H01Q 13/18** (2013.01); **H01Q 1/241** (2013.01); **H01Q 1/526** (2013.01)

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

(72) Inventors: **Jaewoong JEON**, Suwon-si (KR);  
**Yonghyun YOON**, Suwon-si (KR)

(57) **ABSTRACT**

(21) Appl. No.: **17/879,609**

(22) Filed: **Aug. 2, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2022/008282, filed on Jun. 13, 2022.

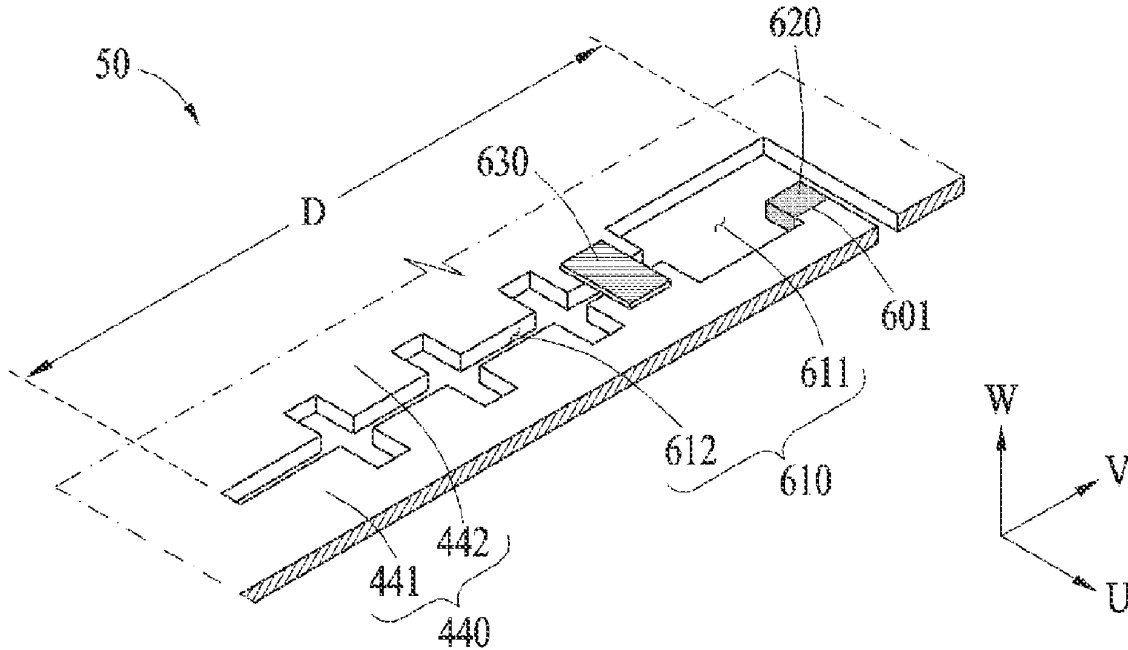
**Foreign Application Priority Data**

(30) Jul. 12, 2021 (KR) ..... 10-2021-0090857

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 13/18** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 1/52** (2006.01)

According to an example embodiment, an electronic device includes: a housing including a front surface, a rear surface opposite to the front surface, and a side surface surrounding at least a portion of an internal space between the front surface and the rear surface, the side surface comprising a conductive material; a wireless communication circuit disposed in the internal space, and an antenna structure including an antenna electrically connected to the wireless communication circuit. The antenna structure includes, an antenna slit formed in an area of the side surface comprising the conductive material and having a longitudinal direction, a feeder configured to apply a current to the antenna slit, and a conductive member comprising a conductive material connected to the side surface to cover at least a portion of the antenna slit.





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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0014260 A1**  
**KIM et al.** (43) **Pub. Date: Jan. 19, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA INCLUDING COUPLING-FEEDING STRUCTURE**

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/24** (2013.01); **H01Q 5/307** (2015.01); **H01Q 21/06** (2013.01)

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

(57) **ABSTRACT**

(72) Inventors: **Jaehyung KIM**, Suwon-si (KR); **Hakjin KIM**, Suwon-si (KR)

According to various embodiments, an electronic device includes: a housing; a first conductive member comprising a conductive material corresponding to a portion of the housing; a second conductive member comprising a conductive material arranged inside the housing; a printed circuit board arranged inside the housing; a wireless communication circuit arranged on the printed circuit board; and a conductive connection member comprising a conductive material electrically connected to the wireless communication circuit. The conductive connection member includes an elastic portion and at least one of a first surface, a second surface, a third surface, and a fourth surface. The elastic portion of the conductive connection member is in contact with the first conductive member, and the at least one of the first surface, the second surface, the third surface, and the fourth surface of the conductive connection member is spaced apart, by a gap, from a portion of the second conductive member. The wireless communication circuit may be configured to: receive a signal in a first frequency band by directly feeding power to the first conductive member via the conductive connection member, and receive a signal in a second frequency band higher than the first frequency band by coupling-feeding power to the second conductive member via the conductive connection member.

(21) Appl. No.: **17/946,681**

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

**Related U.S. Application Data**

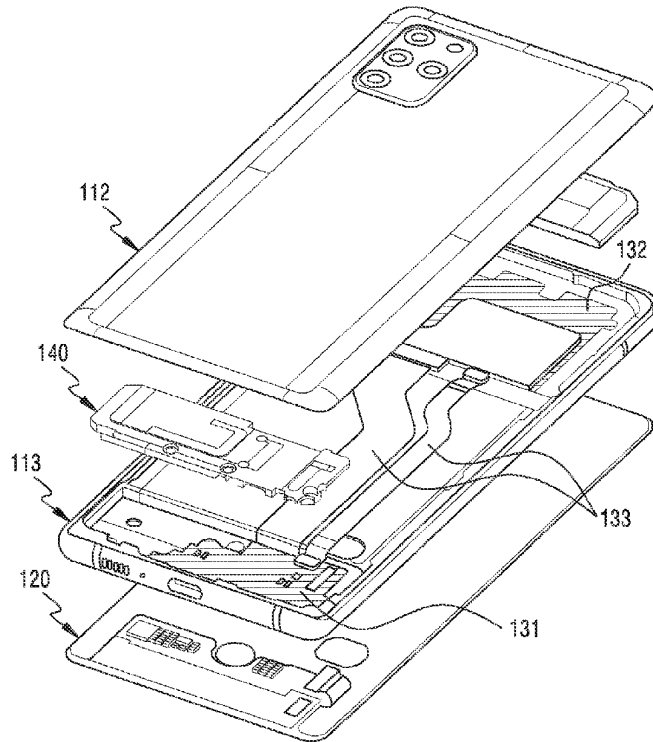
(63) Continuation of application No. PCT/KR2021/003172, filed on Mar. 15, 2021.

**Foreign Application Priority Data**

Mar. 17, 2020 (KR) ..... 10-2020-0032875

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 5/307** (2006.01)  
**H01Q 21/06** (2006.01)



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US 20230018781A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0018781 A1**

(43) **Pub. Date: Jan. 19, 2023**

(54) **INFORMATION HANDLING SYSTEM  
DOCKING STATION GLASS HOUSING  
HAVING AN INTEGRATED ANTENNA**

*H01Q 9/28* (2006.01)  
*H01Q 9/04* (2006.01)

(52) **U.S. Cl.**  
CPC ..... *G06F 1/1632* (2013.01); *H01Q 1/2275*  
(2013.01); *H01Q 9/285* (2013.01); *H01Q*  
*9/0407* (2013.01)

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

(72) Inventors: **Duck-Soo Choi**, Georgetown, TX (US);  
**Peng Lip Goh**, Singapore (SG);  
**Deeder M. Aurongzeb**, Austin, TX  
(US)

(57) **ABSTRACT**

A portable information handling system or docking station glass ceramic housing integrates antenna conductive wires in a first glass ceramic piece and a director conductive wire in a second glass ceramic piece coupled to the first ceramic glass piece, such as with optically-clear adhesive. A conductive contact interfaces the antenna conductive wire by exposure at the glass ceramic housing interior where pogo pins of a printed circuit board assembly bias against the conductive contacts to communicate the radio signals. The director conductive wire provides a parasitic element for directional control of the wireless signal. Ground conductive wires may integrate in the exterior side of the second glass ceramic piece and interface with the radio to provide a dipole antenna.

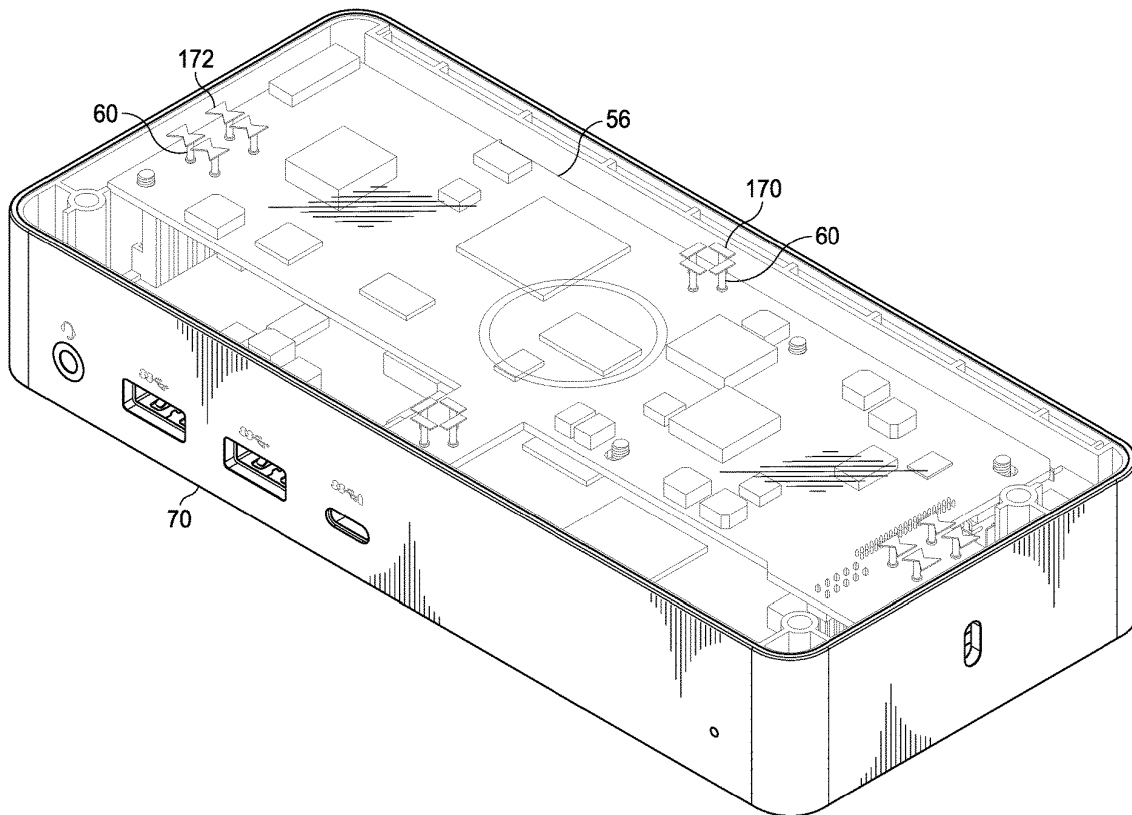
(73) Assignee: **Dell Products L.P.**, Round Rock, TX  
(US)

(21) Appl. No.: **17/376,649**

(22) Filed: **Jul. 15, 2021**

**Publication Classification**

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





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(19) **United States**

(12) **Patent Application Publication**  
**YONG**

(10) **Pub. No.: US 2023/0019425 A1**

(43) **Pub. Date: Jan. 19, 2023**

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

**Publication Classification**

(71) Applicant: **Guangdong Oppo Mobile Telecommunications Corp., Ltd., Dongguan (CN)**

(51) **Int. Cl.**  
**H01Q 9/04** (2006.01)  
**H01Q 5/335** (2006.01)

(72) Inventor: **Zhengdong YONG, Dongguan (CN)**

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/0414** (2013.01); **H01Q 5/335** (2015.01)

(73) Assignee: **Guangdong Oppo Mobile Telecommunications Corp., Ltd., Dongguan (CN)**

(57) **ABSTRACT**

(21) Appl. No.: **17/947,788**

An antenna device and an electronic device are provided. The antenna apparatus includes a dielectric substrate, a grounding metal layer, a radiation patch, a first feeding structure, a first deflection patch, and a radio frequency chip. The grounding metal layer, the dielectric substrate, and the radiation patch are stacked. The first feeding structure has a first end connected to the radiation patch, and a second end electrically connected to the radio frequency chip. The radio frequency chip is configured to feed a first excitation signal to the first feeding structure to excite the radiation patch to radiate beam. The first deflection patch is fixed on a side of dielectric substrate away from the grounding metal layer, the first deflection patch is located at a side of the radiation patch, and is configured to be in an amorphous state or in a crystalline state when the antenna device works.

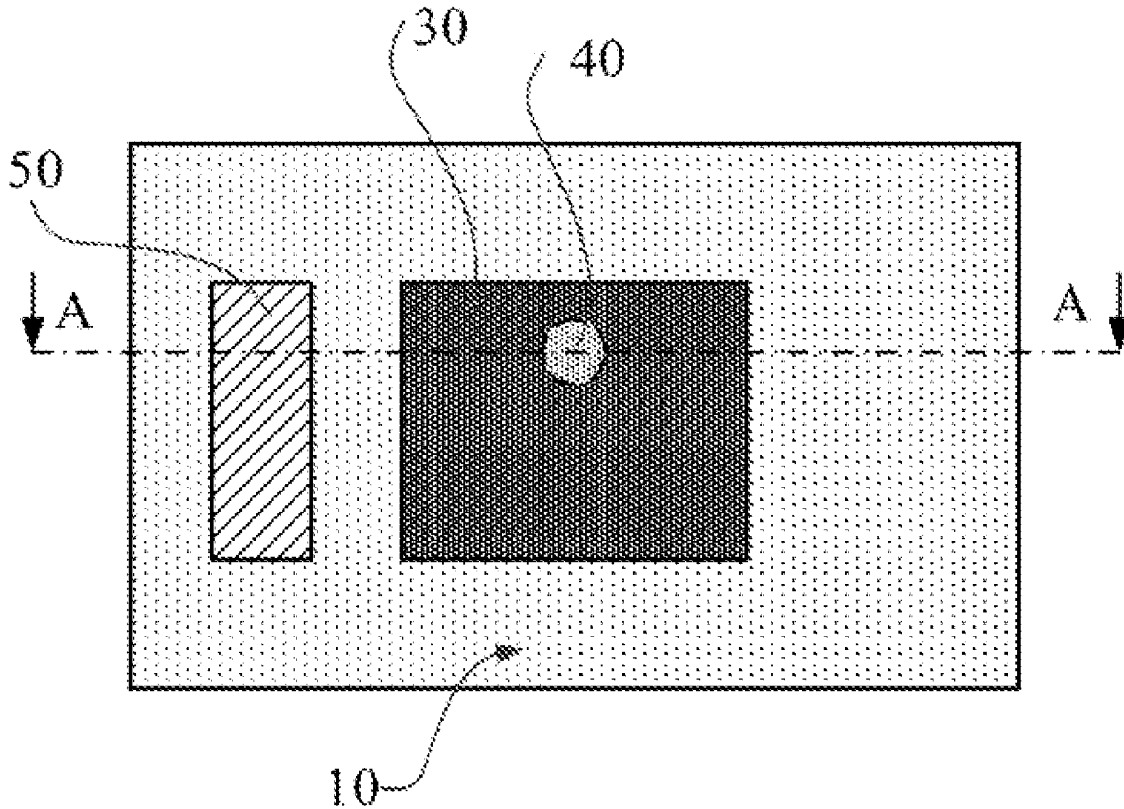
(22) Filed: **Sep. 19, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/CN2021/074780, filed on Feb. 2, 2021.

(30) **Foreign Application Priority Data**

Mar. 19, 2020 (CN) ..... 202010195147.6





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(19) **United States**

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

(10) **Pub. No.: US 2023/0021496 A1**

(43) **Pub. Date: Jan. 26, 2023**

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

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

(72) Inventors: **Taiwan CHOI**, Suwon-si (KR);  
**Dokyun KIM**, Suwon-si (KR);  
**Jongdo KIM**, Suwon-si (KR);  
**Hyoseok NA**, Suwon-si (KR);  
**Kwangseok AHN**, Suwon-si (KR);  
**Wongi HWANG**, Suwon-si (KR)

(21) Appl. No.: **17/866,101**

(22) Filed: **Jul. 15, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2022/009182, filed on Jun. 28, 2022.

**Foreign Application Priority Data**

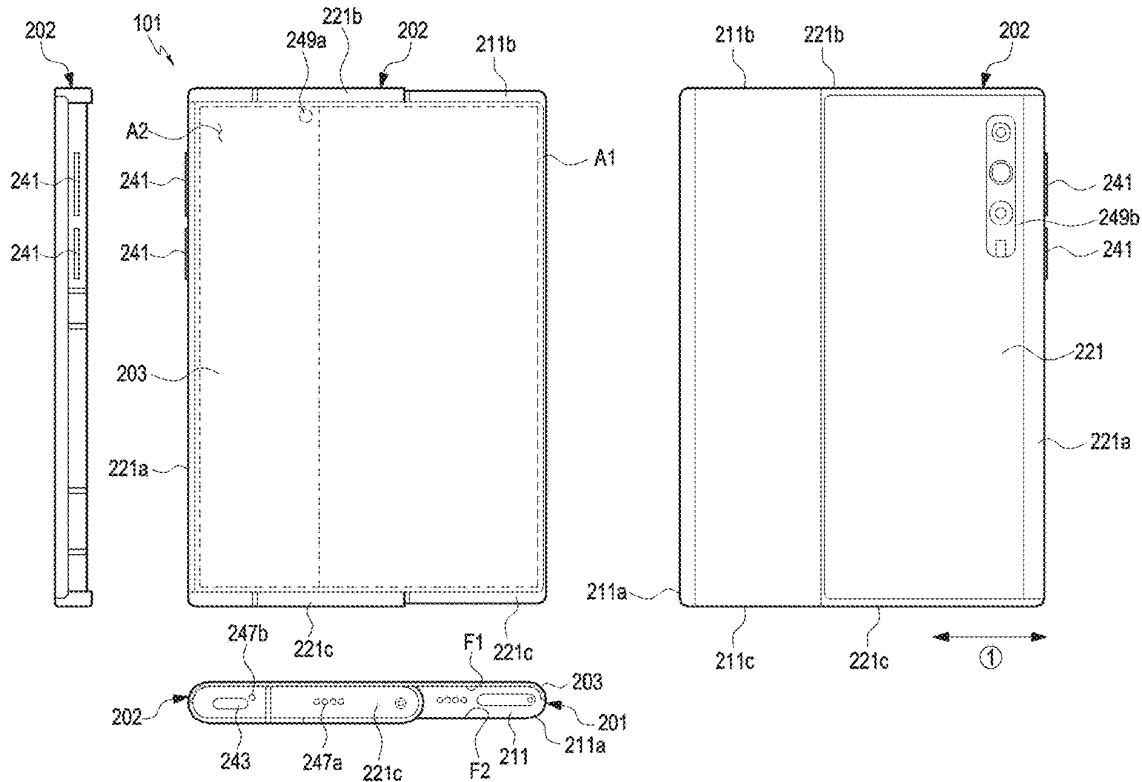
Jul. 20, 2021 (KR) ..... 10-2021-0094997

**Publication Classification**

(51) **Int. Cl.**  
**H04M 1/02** (2006.01)  
**H01Q 1/24** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H04M 1/0237** (2013.01); **H04M 1/0268** (2013.01); **H01Q 1/243** (2013.01)

(57) **ABSTRACT**

An electronic device according to various embodiments of the disclosure may include: a first housing including a first conductive portion, a first non-conductive portion, and a first segmented portion extending from the first conductive portion, a second housing configured to accommodate at least a portion of the first housing and to guide a slide movement of the first housing, the second housing including a second conductive portion, and a flexible display including a first area connected to the first housing and a second area extending from the first area and configured to be bendable or rollable, wherein, from a slide-in state to a slide-out state of the first housing with respect to the second housing, the first conductive portion and the second conductive portion may be spaced apart from each other, and in the slide-in state of the first housing with respect to the second housing, at least a portion of the first non-conductive portion may overlap the second conductive portion.





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(19) **United States**

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

(10) **Pub. No.: US 2023/0022305 A1**

(43) **Pub. Date: Jan. 26, 2023**

(54) **ANTENNA AND ELECTRONIC DEVICE**

*H01Q 9/28* (2006.01)

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

*H01P 5/10* (2006.01)

*H01Q 1/22* (2006.01)

(72) Inventors: **Chen Zhang**, Xi'an (CN); **Xiaofeng Li**,  
Xi'an (CN); **Hanyang Wang**, Reading  
(GB)

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

CPC ..... *H01Q 13/106* (2013.01); *H01Q 21/29*

(2013.01); *H01Q 9/285* (2013.01); *H01P 5/10*

(2013.01); *H01Q 1/2291* (2013.01)

(21) Appl. No.: **17/788,883**

(57) **ABSTRACT**

(22) PCT Filed: **Oct. 30, 2020**

An antenna includes a radiator and a balun structure. The radiator includes a first branch for a first current to flow through and a second branch for a second current to flow through. The first branch and the second branch are arranged on two opposite sides of the balun structure. A direction of the first current is at least partially opposite to that of the second current. The first branch is spaced from the balun structure by a first slot. The second branch is spaced from the balun structure by a second slot. The first slot is configured to form a first horizontally-radiated electric field by the first current and a current on the balun structure. The second slot is configured to form a second horizontally-radiated electric field by the second current and the current on the balun structure.

(86) PCT No.: **PCT/CN2020/125436**

§ 371 (c)(1),

(2) Date: **Jun. 24, 2022**

(30) **Foreign Application Priority Data**

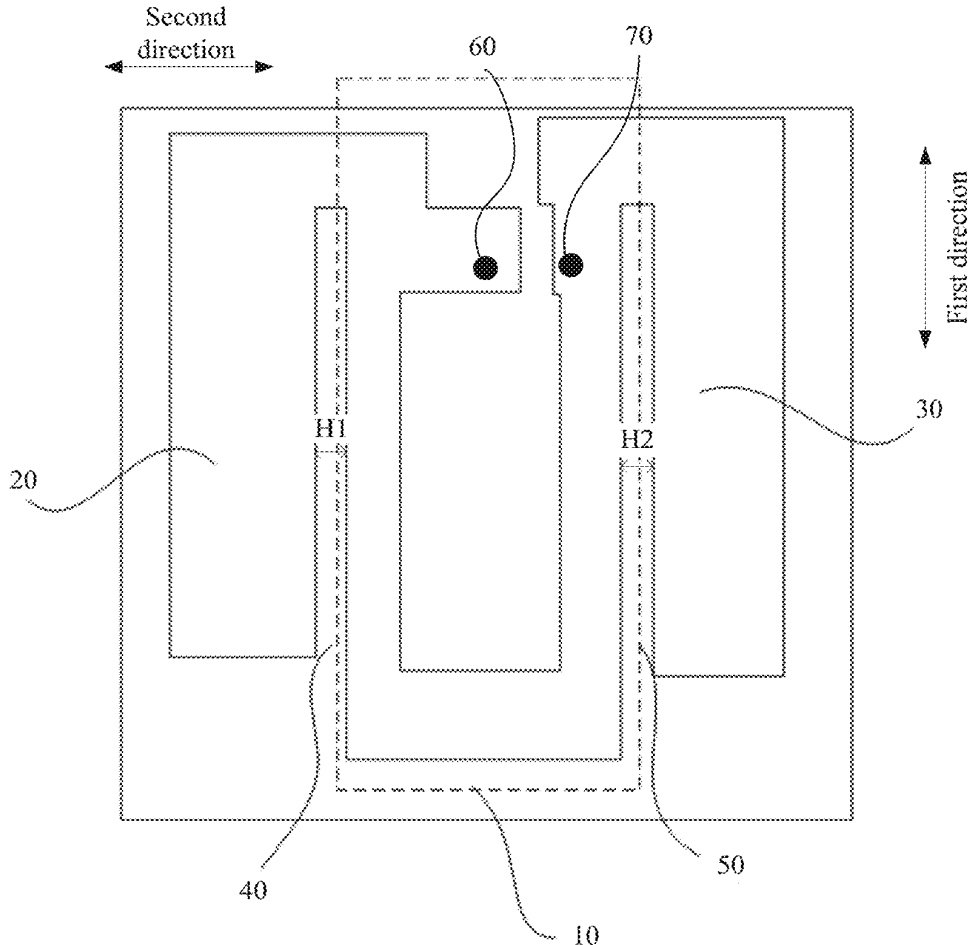
Dec. 27, 2019 (CN) ..... 201911378073.3

**Publication Classification**

(51) **Int. Cl.**

*H01Q 13/10* (2006.01)

*H01Q 21/29* (2006.01)





(19) **United States**

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

(10) **Pub. No.: US 2023/0028988 A1**

(43) **Pub. Date: Jan. 26, 2023**

(54) **ANTENNA STRUCTURE**

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

(72) Inventors: **Jian-De LI**, Hsinchu (TW); **Cheng-Da YANG**, Hsinchu (TW)

(21) Appl. No.: **17/404,023**

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

(30) **Foreign Application Priority Data**

Jul. 23, 2021 (TW) ..... 110127094

**Publication Classification**

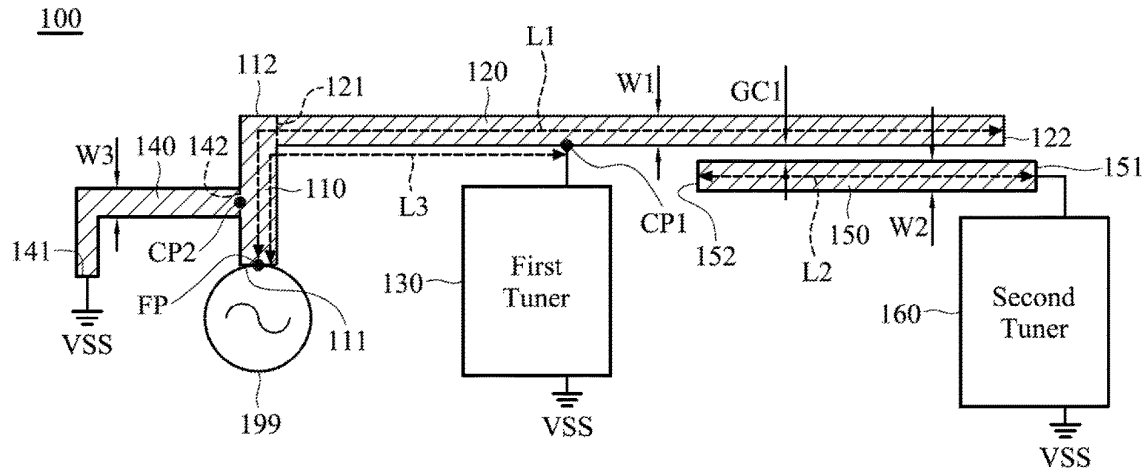
(51) **Int. Cl.**  
**H01Q 5/328** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 1/38** (2006.01)

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

CPC ..... **H01Q 5/328** (2015.01); **H01Q 1/24** (2013.01); **H01Q 1/38** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a feeding radiation element, a first radiation element, a second radiation element, a shorting element, a first tuner, and a second tuner. The feeding radiation element has a feeding point. The first radiation element is coupled to the feeding radiation element. The first radiation element is coupled through the first tuner to a ground voltage. The feeding radiation element is coupled through the shorting element to the ground voltage. The second radiation element is adjacent to the first radiation element, and is separated from the first radiation element. The second radiation element is coupled through the second tuner to the ground voltage. The feeding radiation element is disposed between the first tuner and the shorting element.





(19) **United States**

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

(10) **Pub. No.: US 2023/0029513 A1**

(43) **Pub. Date: Feb. 2, 2023**

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

*H01Q 1/36* (2006.01)

*H01Q 1/44* (2006.01)

*H01Q 1/50* (2006.01)

*H01Q 5/10* (2006.01)

(71) Applicant: **HONOR DEVICE CO., LTD.**,  
Shenzhen, Guangdong (CN)

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

CPC ..... *H01Q 5/335* (2015.01); *H01Q 1/243* (2013.01); *H01Q 1/245* (2013.01); *H01Q 1/36* (2013.01); *H01Q 1/44* (2013.01); *H01Q 1/50* (2013.01); *H01Q 5/10* (2015.01); *H01Q 5/28* (2015.01)

(72) Inventors: **Xiaotao CAI**, Shenzhen (CN); **Dawei ZHOU**, Shenzhen (CN); **Yuanpeng LI**, Shenzhen (CN); **Tiezhu LIANG**, Shenzhen (CN)

(21) Appl. No.: **17/786,788**

(57) **ABSTRACT**

(22) PCT Filed: **Dec. 11, 2020**

The present invention provides an antenna structure, including a frame body, a first feed-in part, and a first connection part, where the frame body is at least partially made of a metal material, the frame body includes a first part and a second part, the second part is connected to one end of the first part, a length of the second part is greater than a length of the first part, a first slot is provided in the first part, a second slot is provided in the second part, a part of the frame body between the first slot and the second slot forms a first radiation part, the first feed-in part is disposed on the first radiation part and located on the first part of the frame body. The antenna structure can effectively improve low band radiation performance.

(86) PCT No.: **PCT/CN2020/135927**

§ 371 (c)(1),

(2) Date: **Jun. 17, 2022**

(30) **Foreign Application Priority Data**

Jan. 17, 2020 (CN) ..... 202010054712.7

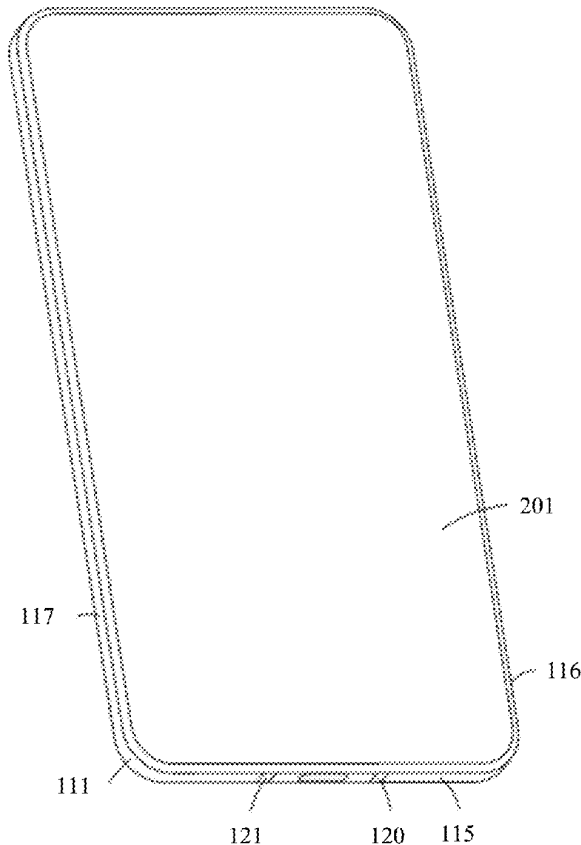
**Publication Classification**

(51) **Int. Cl.**

*H01Q 5/335* (2006.01)

*H01Q 1/24* (2006.01)

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(19) **United States**

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

(10) **Pub. No.: US 2023/0032455 A1**

(43) **Pub. Date: Feb. 2, 2023**

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

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 1/22* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 1/38* (2006.01)  
*H01Q 1/48* (2006.01)

(72) Inventors: **Seung Hyun SHIN**, Seoul (KR); **Yun Seok OH**, Gyeonggi-do (KR); **Won Hee LEE**, Incheon (KR)

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/2283* (2013.01); *H01Q 1/243* (2013.01); *H01Q 1/38* (2013.01); *H01Q 1/2266* (2013.01); *H01Q 1/48* (2013.01); *G06F 3/041* (2013.01)

(21) Appl. No.: **17/954,811**

(22) Filed: **Sep. 28, 2022**

(57) **ABSTRACT**

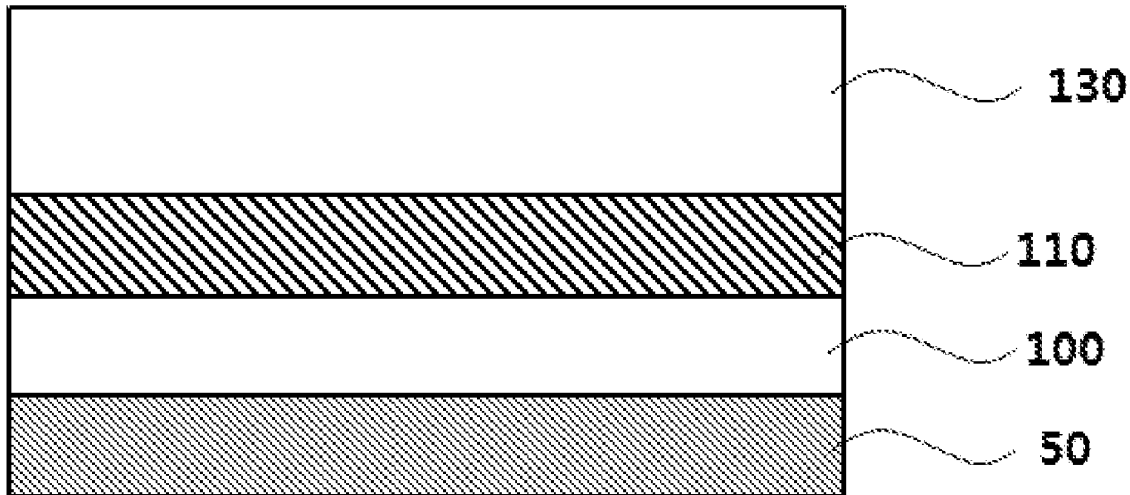
**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2021/003828, filed on Mar. 29, 2021.

An antenna stack structure according to an embodiment includes a lower dielectric layer, an antenna electrode layer formed on the lower dielectric layer, and an upper dielectric layer disposed on the antenna electrode layer. A dielectric constant of the upper dielectric layer is 1 or more and less than 7, and a thickness of the upper dielectric layer is in a range from 100 μm to 1,300 μm. A frequency and a band width are finely controlled using the upper dielectric layer while suppressing excessive gain reduction and frequency shift.

**Foreign Application Priority Data**

(30) Mar. 31, 2020 (KR) ..... 10-2020-0038807





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(19) **United States**

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

(10) **Pub. No.: US 2023/0033007 A1**

(43) **Pub. Date: Feb. 2, 2023**

(54) **PATCH ANTENNA**

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

(71) Applicant: **QuantumZ Inc.**, Kaohsiung City (TW)

CPC ..... **H01Q 19/005** (2013.01); **H01Q 9/0414**  
(2013.01); **H01Q 13/10** (2013.01)

(72) Inventors: **Chih-Yang LOU**, Kaohsiung City (TW); **Meng-Hua TSAI**, Kaohsiung City (TW); **Wei-Ting LEE**, Kaohsiung City (TW); **Sin-Siang WANG**, Kaohsiung City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **17/689,952**

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

(30) **Foreign Application Priority Data**

Jul. 27, 2021 (TW) ..... 110127564

A patch antenna includes a dielectric substrate formed by a high dielectric coefficient material covered with a soft material. The dielectric substrate has a first surface, an opposite second surface, and surrounding side surfaces there between. The patch antenna further includes a radiating metal arm formed on at least the first surface with a thin metal layer in a specific shape, a grounding metal plate disposed on the second surface, and a parasitic metal arm extending from the grounding metal plate towards the first surface via at least one of the side surfaces. The parasitic metal arm is approximate but not connected to the radiating metal arm. The radiation metal arm further includes an enclosed slot, together with the parasitic metal arm, improve the working bandwidth and high directivity of the antenna.

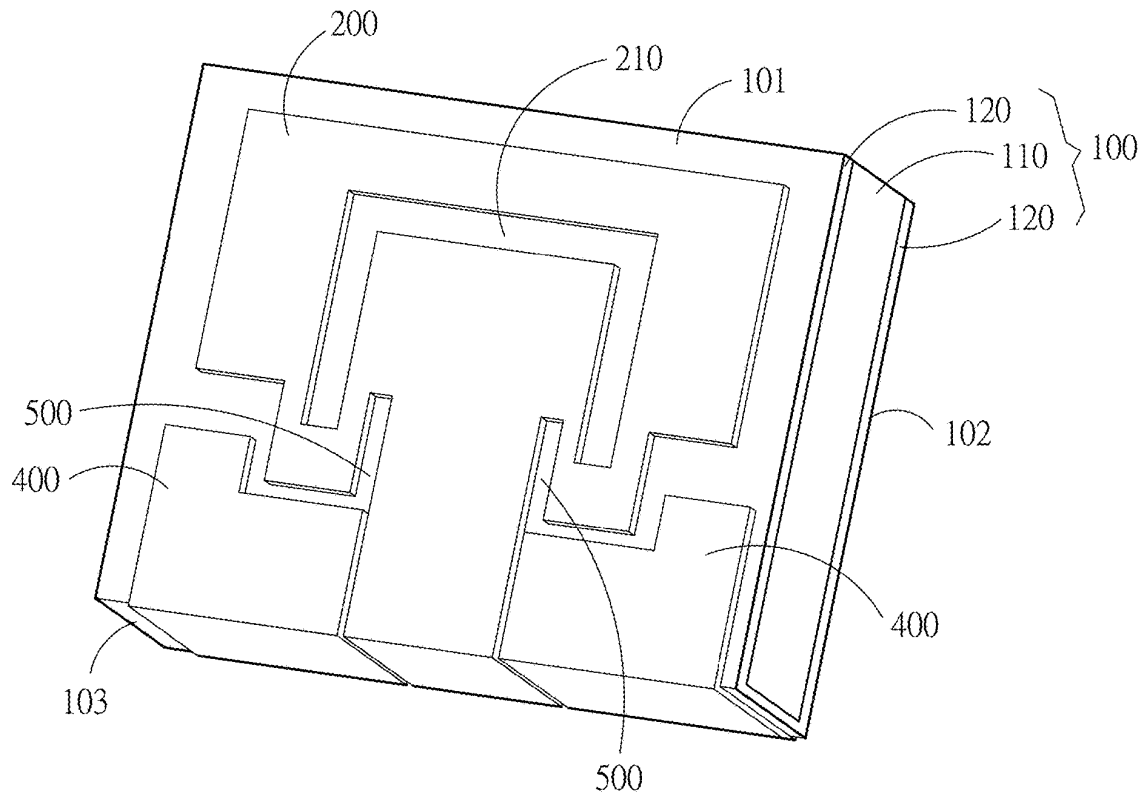
**Publication Classification**

(51) **Int. Cl.**

**H01Q 19/00** (2006.01)

**H01Q 9/04** (2006.01)

**H01Q 13/10** (2006.01)





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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2023/0033219 A1**

**Wu et al.**

(43) **Pub. Date: Feb. 2, 2023**

(54) **ELECTRONIC DEVICE**

(30) **Foreign Application Priority Data**

(71) Applicant: **PEGATRON CORPORATION**, Taipei City (TW)

Jul. 29, 2021 (TW) ..... 110127964

**Publication Classification**

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

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

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/2291** (2013.01)

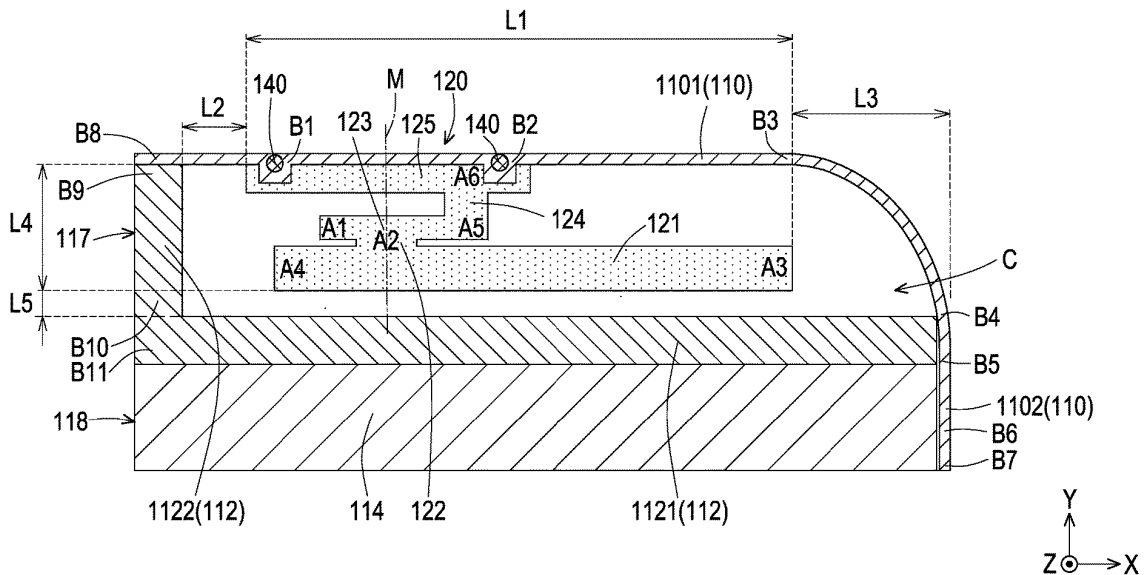
(57) **ABSTRACT**

An electronic device, including a metal back cover, a front cover, a metal wall, and at least one antenna radiator, is provided. The front cover covers the metal back cover and includes a frame area. The metal wall is disposed between the metal back cover and the front cover, and forms a metal cavity corresponding to the frame area together with the metal back cover. Each of the at least one antenna radiator is disposed in the metal cavity, is connected to a first side wall of the metal back cover, and is spaced apart from the metal wall by a distance.

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

(21) Appl. No.: **17/746,863**

(22) Filed: **May 17, 2022**





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(19) **United States**

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

(10) **Pub. No.: US 2023/0035028 A1**

(43) **Pub. Date: Feb. 2, 2023**

(54) **ANTENNA SYSTEM**

**Publication Classification**

(71) Applicant: **SHANGHAI CHUANGGONG  
TELECOM TECHNOLOGY CO.,  
LTD.**, Shanghai (CN)

(51) **Int. Cl.**  
*H01Q 13/18* (2006.01)  
*H01P 1/207* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 1/48* (2006.01)  
*H01Q 1/52* (2006.01)

(72) Inventors: **Zhongjie QIN**, Shanghai (CN);  
**Zhichao ZHANG**, Shanghai (CN)

(52) **U.S. Cl.**  
CPC ..... *H01Q 13/18* (2013.01); *H01P 1/207*  
(2013.01); *H01Q 1/242* (2013.01); *H01Q 1/48*  
(2013.01); *H01Q 1/52* (2013.01)

(21) Appl. No.: **17/785,365**

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

(57) **ABSTRACT**

(86) PCT No.: **PCT/CN2020/142399**

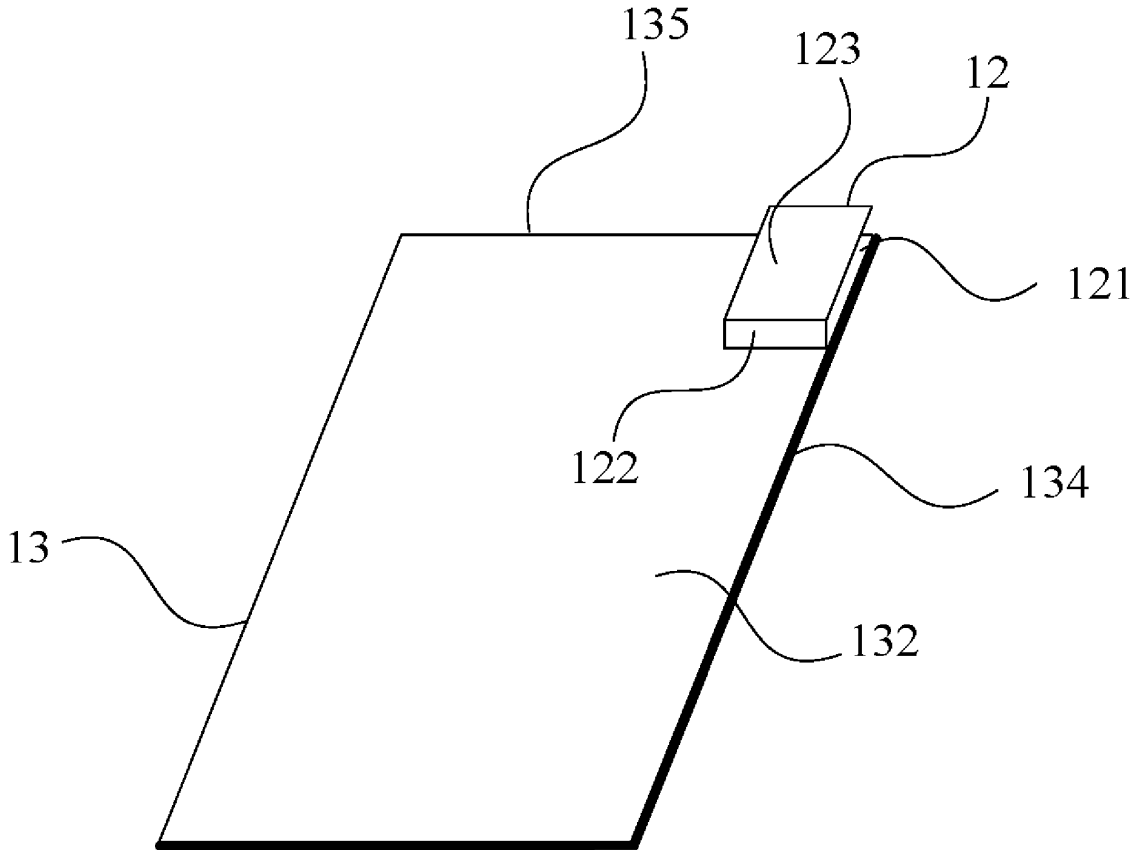
§ 371 (c)(1),

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

An antenna system according to an embodiment of the present disclosure includes an antenna unit and a metal cavity corresponding to the antenna unit. The metal cavity is grounded and provided with an opening connected with the outside. By introducing the metal cavity, an embodiment of the present invention solves the problem of multi-band mutual coupling caused by a common ground current by using the cavity filter structure with a small size.

(30) **Foreign Application Priority Data**

Jun. 5, 2020 (CN) ..... 202010507913.8





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(19) **United States**

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

(10) **Pub. No.: US 2023/0035171 A1**

(43) **Pub. Date: Feb. 2, 2023**

(54) **ANTENNA STRUCTURE**

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 5/307* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 5/10* (2006.01)

(72) Inventors: **Hee Jun PARK**, Gyeonggi-do (KR);  
**Young Ju KIM**, Gyeonggi-do (KR);  
**Won Hee LEE**, Gyeonggi-do (KR);  
**Sung Jin HAN**, Incheon (KR)

(52) **U.S. Cl.**  
CPC ..... *H01Q 5/307* (2015.01); *H01Q 1/24* (2013.01); *H01Q 5/10* (2015.01)

(57) **ABSTRACT**

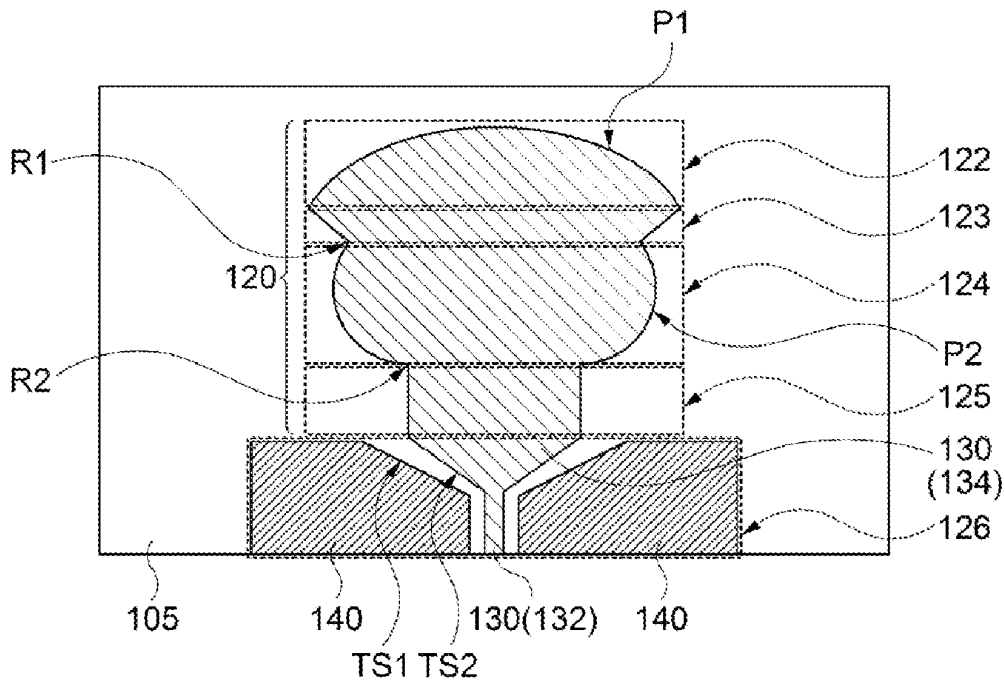
An antenna structure according to an embodiment of the present disclosure includes a transmission line, and a radiator connected to the transmission line, the radiator having a linear perimeter region and a plurality of curved perimeter regions separated by the linear perimeter region, wherein an outermost portion of the radiator from the transmission line in a planar view has any one of the curved peripheral regions. A broadband antenna structure covering low frequency and high frequency bands is provided.

(21) Appl. No.: **17/873,254**

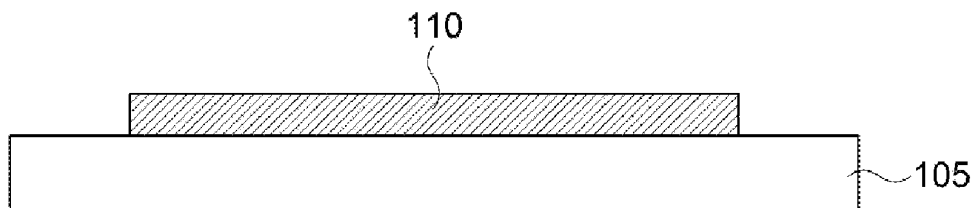
(22) Filed: **Jul. 26, 2022**

(30) **Foreign Application Priority Data**

Jul. 27, 2021 (KR) ..... 10-2021-0098712



**FIG. 2**





US 20230038634A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0038634 A1**

(43) **Pub. Date: Feb. 9, 2023**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA AND METHOD FOR MANUFACTURING THE SAME**

**Publication Classification**

(51) **Int. Cl.**  
*H04M 1/02* (2006.01)  
*H01Q 1/24* (2006.01)  
(52) **U.S. Cl.**  
CPC ..... *H04M 1/026* (2013.01); *H01Q 1/243* (2013.01)

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

(72) Inventors: **Hyungjin KIM**, Gyeonggi-do (KR);  
**Jiho KIM**, Gyeonggi-do (KR);  
**Seongyong AN**, Gyeonggi-do (KR);  
**Kyihyun JANG**, Gyeonggi-do (KR);  
**Yoonjung KIM**, Gyeonggi-do (KR);  
**Kyungmoon SEOL**, Gyeonggi-do (KR);  
**Bumjin CHO**, Gyeonggi-do (KR)

(57) **ABSTRACT**

An electronic device may include a housing including a front plate, a rear plate, and a side member surrounding a space formed by the front plate and the rear plate, a support member disposed in the space, at least one electronic component disposed in the space, a first non-conductive member disposed on at least a portion of the support member and on the side member, a conductive pattern at least partially disposed between the side member and the first non-conductive member, and a second non-conductive member disposed between the side member and a portion of the conductive pattern and a portion of the first non-conductive member, at least a portion of the conductive pattern may be spaced apart from the at least one electronic component by a predetermined distance, and a first inclined surface may be formed on a portion of the first non-conductive member.

(21) Appl. No.: **17/883,810**

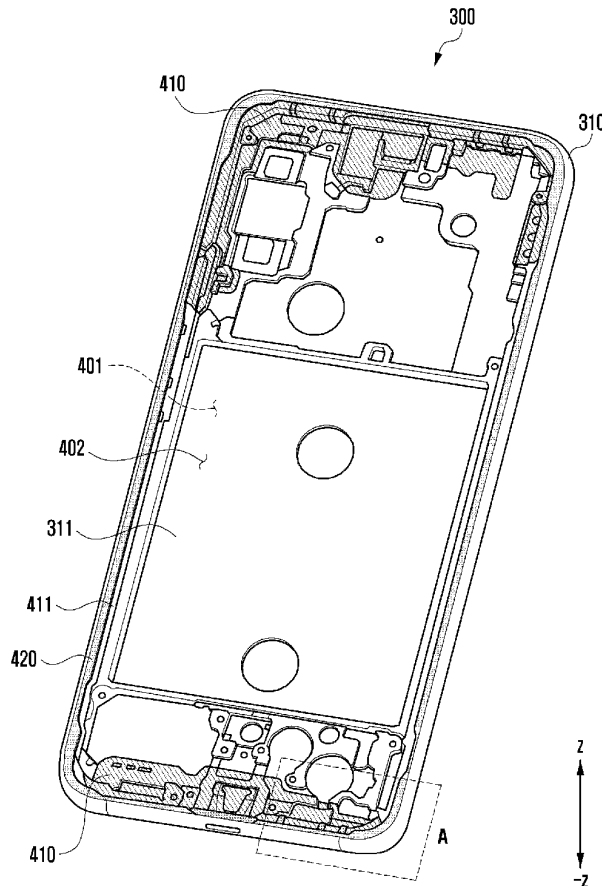
(22) Filed: **Aug. 9, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2022/011729, filed on Aug. 8, 2022.

(30) **Foreign Application Priority Data**

Aug. 9, 2021 (KR) ..... 10-2021-0104348





US 20230039277A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0039277 A1**

(43) **Pub. Date: Feb. 9, 2023**

(54) **ANTENNA DEVICE**

**Publication Classification**

(71) Applicant: **DENSO CORPORATION**, Kariya-city (JP)

(51) **Int. Cl.**  
**H01Q 13/08** (2006.01)  
**H01Q 5/328** (2006.01)

(72) Inventors: **Yuuji KAKUYA**, Nisshin-city (JP);  
**Masakazu IKEDA**, Nisshin-city (JP);  
**Kenichirou SANJI**, Kariya-city (JP);  
**Tomokazu MIYASHITA**, Kariya-city (JP);  
**Ryozou FUJII**, Kariya-city (JP);  
**Masashi URABE**, Kariya-city (JP);  
**Hiroimichi NAITOH**, Kariya-city (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 13/08** (2013.01); **H01Q 5/328** (2015.01)

(57) **ABSTRACT**

An antenna device includes a ground plate which is a flat plate-shaped conductor member, an opposing conductive plate which is a flat plate-shaped conductor member installed at a predetermined distance from the ground plate and is electrically connected to a power supply line, and a plurality of short-circuit pins for electrically connecting the opposing conductive plate and the ground plate. One end of a plurality of short-circuit pins extends to a conductive plate plane, which is a plane including the opposing conductive plate, and the other end of the plurality of short-circuit pins extends to the ground plate plane, which is a plane including the ground plate. One or more of the plurality of short-circuit pins connect the opposing conductive plate and the ground plate.

(21) Appl. No.: **17/972,133**

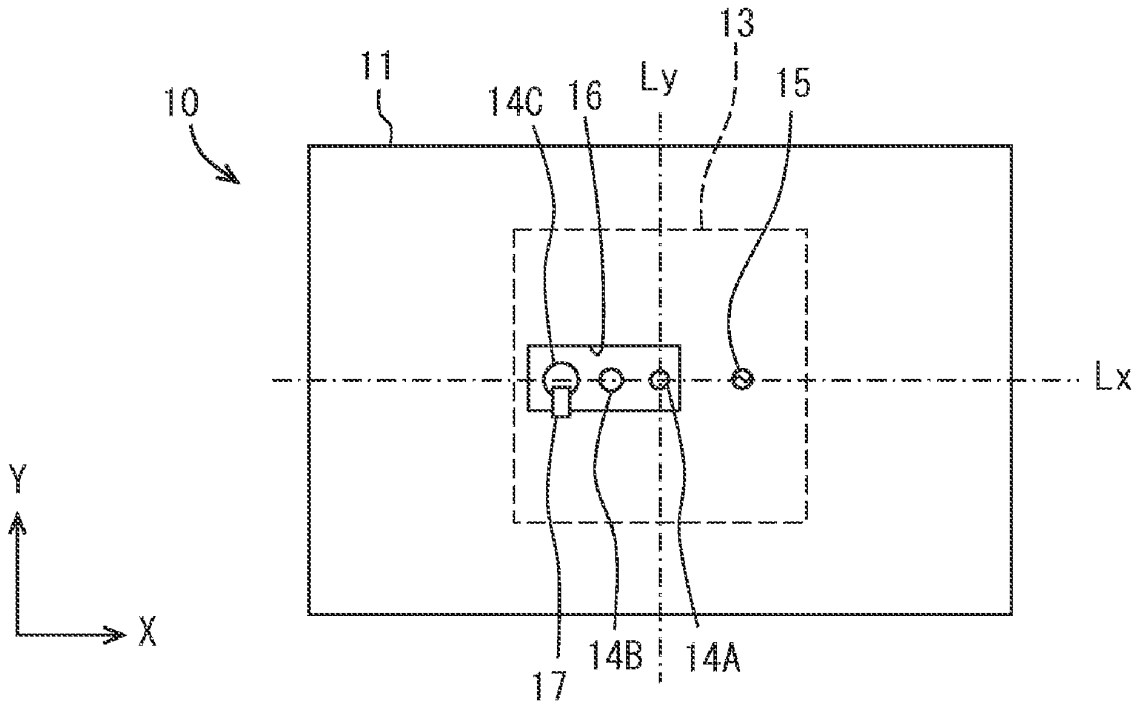
(22) Filed: **Oct. 24, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2021/021496, filed on Jun. 7, 2021.

(30) **Foreign Application Priority Data**

Jun. 17, 2020 (JP) ..... 2020-104775





US 20230040028A1

(19) **United States**  
 (12) **Patent Application Publication** (10) **Pub. No.: US 2023/0040028 A1**  
**Chang** (43) **Pub. Date: Feb. 9, 2023**

(54) **MOBILE DEVICE**

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 5/335* (2006.01)  
*H01Q 1/22* (2006.01)

(72) Inventor: **Chia-Lin Chang**, Taipei City (TW)

(52) **U.S. Cl.**  
CPC ..... *H01Q 5/335* (2015.01);  
*H01Q 1/2266* (2013.01)

(21) Appl. No.: **17/878,105**

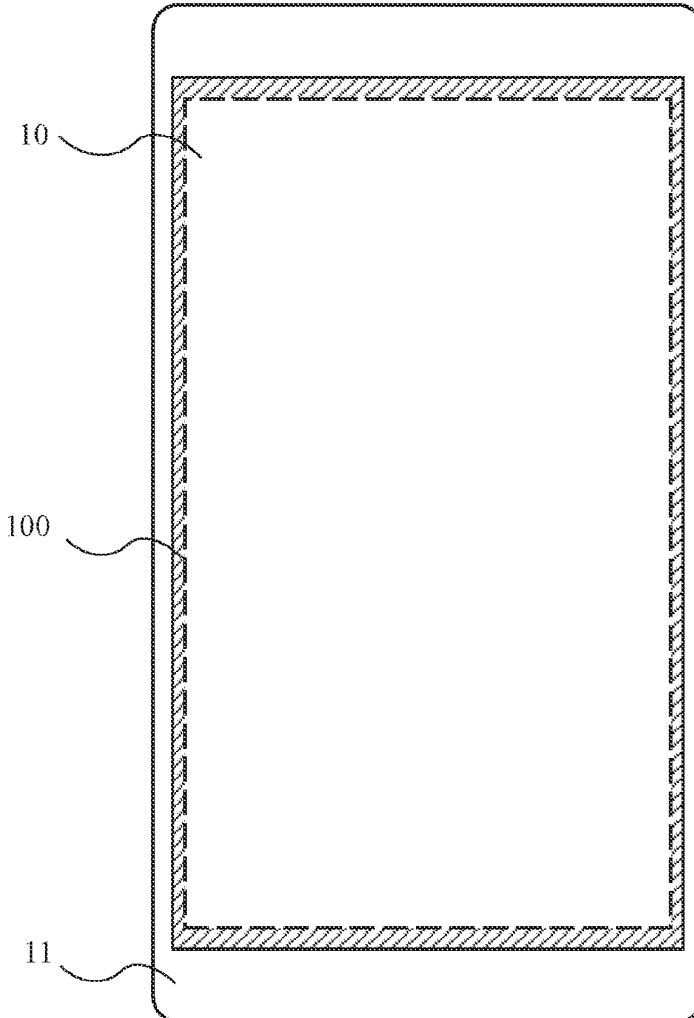
(22) Filed: **Aug. 1, 2022**

(30) **Foreign Application Priority Data**

Aug. 3, 2021 (CN) ..... 202110888619.0

(57) **ABSTRACT**

A mobile device comprises a touch screen and a frame antenna. The touch screen have a first sensing module. The frame antenna is disposed around the periphery of the touch screen, and the frame antenna further has at least one second sensing module, wherein the first sensing module and the at least one second sensing module form at least one mutual-capacitive sensing loop to sense whether an object approaches or touches the touch screen and the frame antenna.







US 20230042513A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0042513 A1**

(43) **Pub. Date: Feb. 9, 2023**

(54) **ELECTRONIC DEVICE**

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 1/24* (2006.01)  
*H01Q 5/307* (2006.01)  
*H01Q 5/25* (2006.01)

(72) Inventors: **Xiaochao DUAN**, Beijing (CN);  
**Wanbo XIE**, Beijing (CN); **Xiaolei JIANG**, Beijing (CN); **Weihui ZHU**, Beijing (CN); **Xiaodong SHANG**, Beijing (CN); **Yong LIU**, Beijing (CN); **Xuwan CUI**, Beijing (CN); **Zonglin XUE**, Beijing (CN)

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/243* (2013.01); *H01Q 5/307* (2015.01); *H01Q 5/25* (2015.01)

(57) **ABSTRACT**

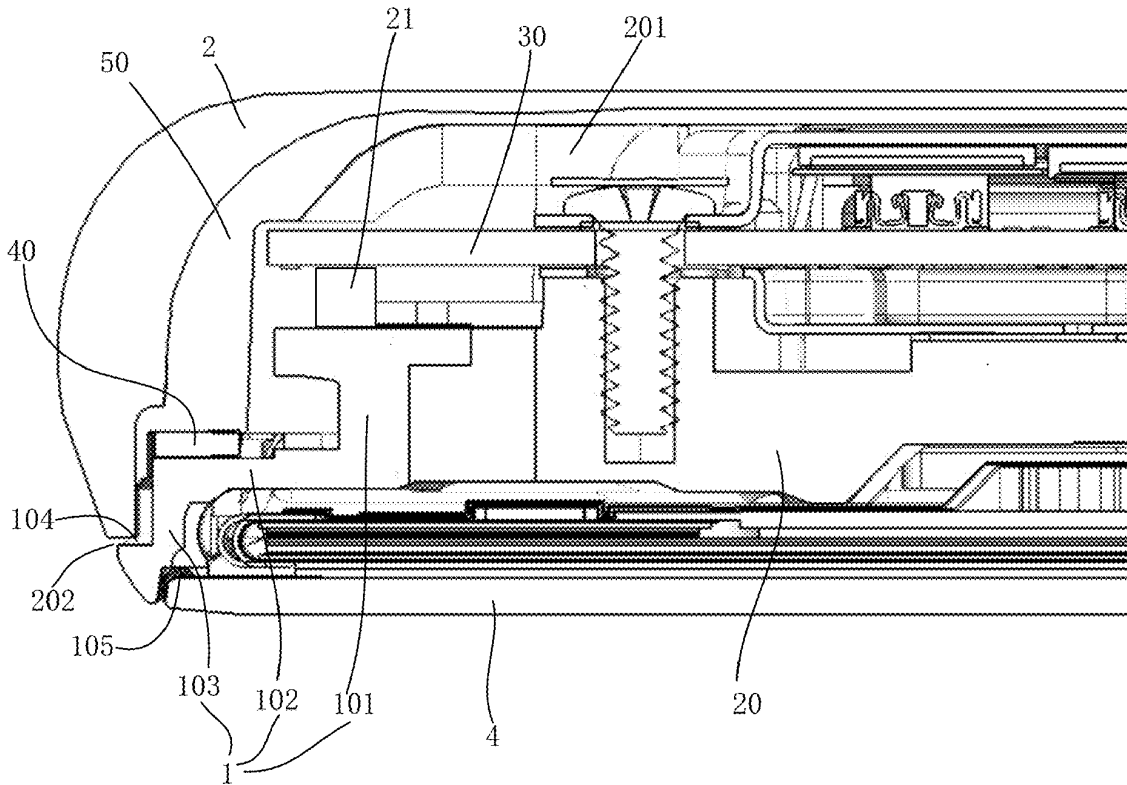
(21) Appl. No.: **17/681,752**

An electronic device includes: a housing having an accommodation cavity, a circuit board being arranged in the accommodation cavity; a screen holder coupled to the housing and comprising at least one antenna radiator electrically coupled to the circuit board to receive and/or transmit signals; and a screen with an edge arranged on the screen holder.

(22) Filed: **Feb. 26, 2022**

(30) **Foreign Application Priority Data**

Aug. 5, 2021 (CN) ..... 202110898513.9





US 20230043277A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0043277 A1**

(43) **Pub. Date: Feb. 9, 2023**

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

*H01Q 3/36* (2006.01)

*H04M 1/02* (2006.01)

*H01Q 9/16* (2006.01)

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

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

CPC ..... *H01Q 1/243* (2013.01); *H01Q 9/0407*

(2013.01); *H01Q 3/36* (2013.01); *H04M 1/026*

(2013.01); *H04M 1/0216* (2013.01); *H01Q*

*9/16* (2013.01)

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

(57)

**ABSTRACT**

(21) Appl. No.: **17/966,156**

(22) Filed: **Oct. 14, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2021/004298, filed on Apr. 6, 2021.

(30) **Foreign Application Priority Data**

Apr. 14, 2020 (KR) ..... 10-2020-0045397

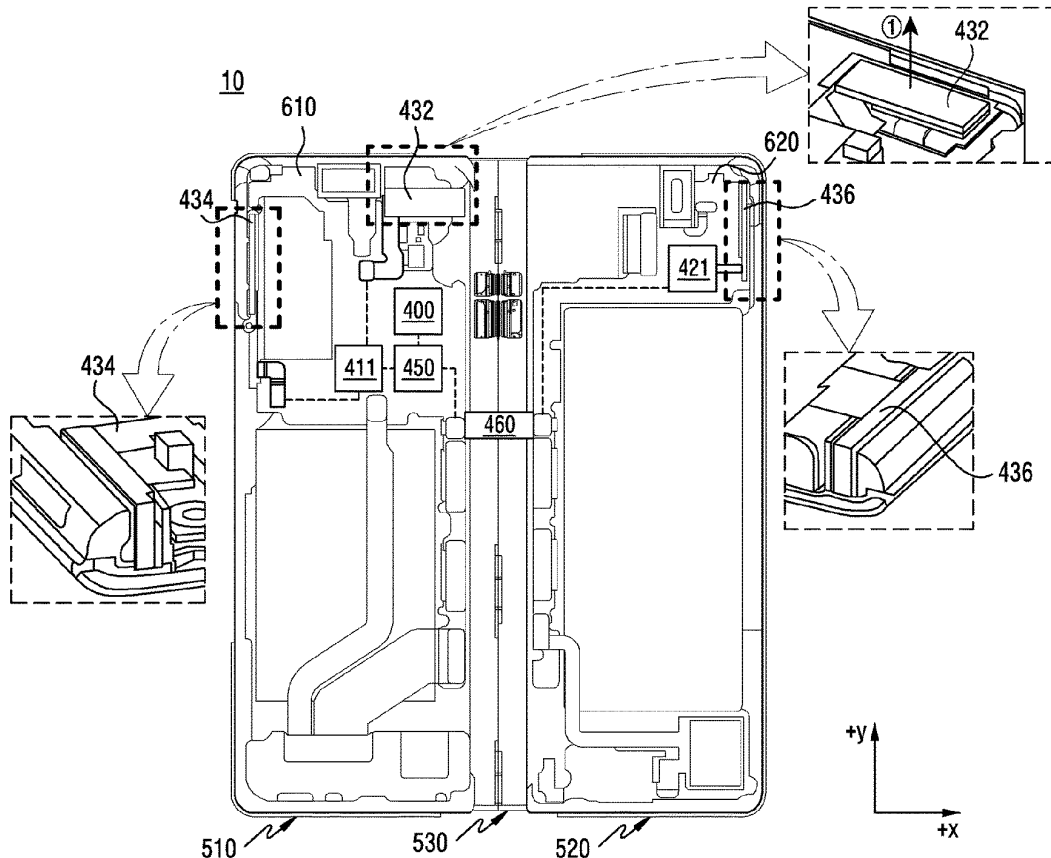
**Publication Classification**

(51) **Int. Cl.**

*H01Q 1/24* (2006.01)

*H01Q 9/04* (2006.01)

An electronic device is provided. The electronic device includes a first part, a second part, a connection part disposed and coupled to the first part and the second part such that the first part and the second part are rotatable, a first antenna module disposed in the first part and includes an antenna array, a second antenna module disposed in the second part and includes an antenna array, a processor disposed in the first part, an IFIC disposed in the first part and electrically connected to the first antenna module and the processor, a second IFIC disposed in the second part and electrically connected to the second antenna module and the processor and an FPCB disposed over the first part, the connection part, and the second part, and is configured to transfer a digital signal or a baseband I/Q signal between the processor and the second IFIC.





US 20230047210A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0047210 A1**

(43) **Pub. Date: Feb. 16, 2023**

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

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

(72) Inventors: **Daehee PARK**, Gyeonggi-do (KR);  
**Jungmin PARK**, Gyeonggi-do (KR);  
**Janghoon HAN**, Gyeonggi-do (KR)

(21) Appl. No.: **17/892,826**

(22) Filed: **Aug. 22, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2021/  
018255, filed on Dec. 3, 2021.

**Foreign Application Priority Data**

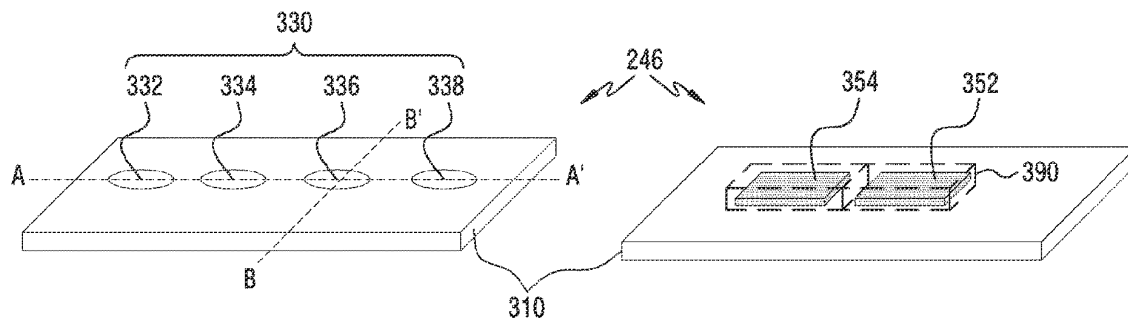
Dec. 3, 2020 (KR) ..... 10-2020-0167764

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 21/08** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 9/04** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H01Q 21/08** (2013.01); **H01Q 1/243**  
(2013.01); **H01Q 9/045** (2013.01)

(57) **ABSTRACT**

Disclosed is an electronic device including an antenna module comprising a first array antenna disposed on a first surface, a radio frequency integrated circuit (RFIC) disposed on a second surface which is parallel to the first surface, and a connector, a wireless communication circuit electrically connected with the antenna module through the connector, and a flexible printed circuit board (FPCB) electrically connected with the antenna module through the connector, the FPCB comprising a second array antenna, wherein the wireless communication circuit is configured to transmit and receive a first signal via the first array antenna, and to transmit and receive a second signal which is distinct from the first signal via the second array antenna





US 20230048914A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0048914 A1**

(43) **Pub. Date: Feb. 16, 2023**

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

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 21/06* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 1/36* (2006.01)  
*H01Q 1/50* (2006.01)  
*H01Q 1/52* (2006.01)

(72) Inventors: **Pengfei Wu**, Shanghai (CN); **Hanyang Wang**, Reading (GB); **Dong Yu**,  
Shanghai (CN); **Chien-Ming Lee**,  
Shenzhen (CN)

(52) **U.S. Cl.**  
CPC ..... *H01Q 21/064* (2013.01); *H01Q 1/244*  
(2013.01); *H01Q 1/36* (2013.01); *H01Q 1/50*  
(2013.01); *H01Q 1/521* (2013.01)

(21) Appl. No.: **17/759,203**

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

(57) **ABSTRACT**

(86) PCT No.: **PCT/CN2021/073326**

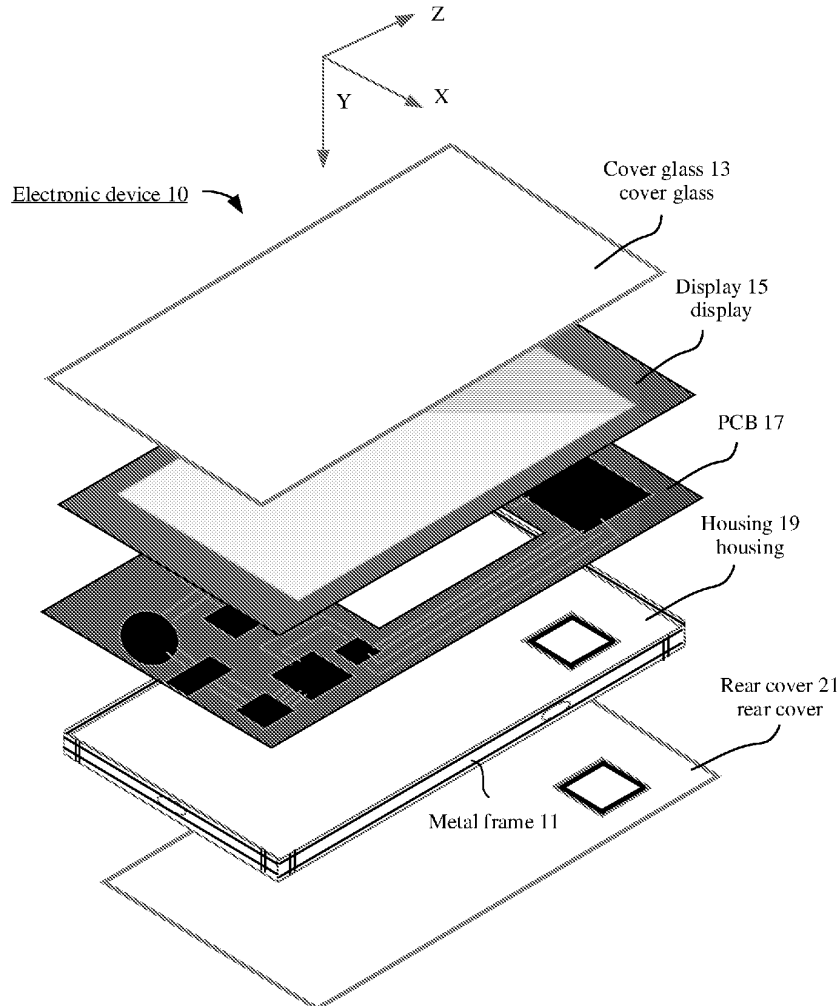
§ 371 (c)(1),

(2) Date: **Jul. 21, 2022**

An antenna design solution is provided. A metal frame and a PCB ground layer of an electronic device are used to form a slot. Through symmetric feeding and anti-symmetric feeding, the slot can be excited to generate two slot antenna patterns: a CM slot antenna pattern and a DM slot antenna pattern. In addition, the two slot antenna patterns share a same slot antenna radiator.

(30) **Foreign Application Priority Data**

Jan. 22, 2020 (CN) ..... 202010075833.X





US 20230049386A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0049386 A1**

(43) **Pub. Date: Feb. 16, 2023**

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

**Publication Classification**

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

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

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

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

(21) Appl. No.: **17/974,801**

(22) Filed: **Oct. 27, 2022**

(57) **ABSTRACT**

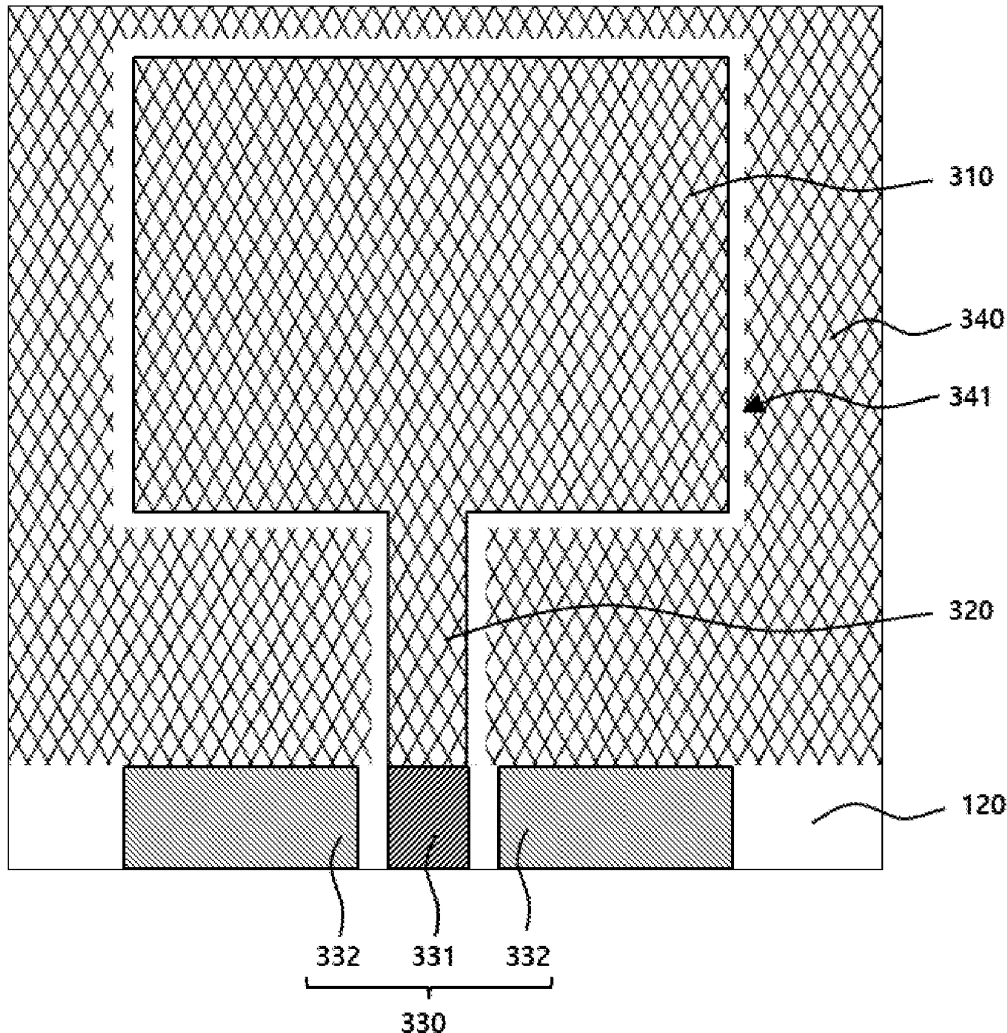
**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2021/  
004489, filed on Apr. 9, 2021.

**Foreign Application Priority Data**

Apr. 29, 2020 (KR) ..... 10-2020-0052674

An antenna laminate according to an embodiment may include a display panel which includes an electrode structure, a dielectric layer disposed on the display panel, an antenna conductive layer disposed on the dielectric layer, and a lower ground layer disposed on a lower side of the display panel and having a lower resistance than the display panel.





(19) **United States**

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

(10) **Pub. No.: US 2023/0051681 A1**

(43) **Pub. Date: Feb. 16, 2023**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 5/314* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 1/38* (2006.01)  
*H04B 7/0413* (2006.01)

(72) Inventors: **Kyihyun JANG**, Suwon-si (KR); **Jiho KIM**, Suwon-si (KR); **Seongyong AN**, Suwon-si (KR); **Moohyun ROH**, Suwon-si (KR); **Gyubok PARK**, Suwon-si (KR); **Kyungmoon SEOL**, Suwon-si (KR); **Jaewon CHOE**, Suwon-si (KR)

(52) **U.S. Cl.**  
CPC ..... *H01Q 5/314* (2015.01); *H01Q 1/243* (2013.01); *H01Q 1/38* (2013.01); *H04B 7/0413* (2013.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **17/971,165**

An electronic device includes: a side member forming sides of the electronic device, the side member including a first conductive portion, a second conductive portion, a first non-conductive portion, and a slit; a printed circuit board including the ground; and a wireless communication circuit, wherein the first conductive portion includes a first electrical path and a second electrical path, the second conductive portion includes a third electrical path and a fourth electrical path, a capacitor is arranged along the third electrical path, and the wireless communication circuit may feed, to the first conductive portion via the first electrical path, an RF signal of a first frequency band and may feed, to the second conductive portion via the third electrical path, an RF signal of a second frequency band which at least partially overlaps the first frequency band.

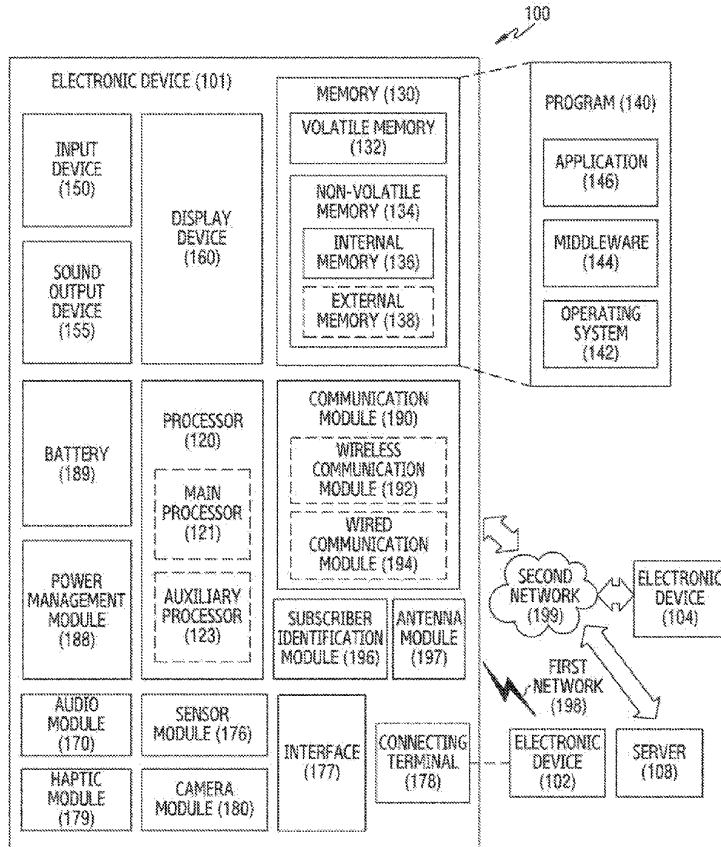
(22) Filed: **Oct. 21, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2021/005098, filed on Apr. 22, 2021.

(30) **Foreign Application Priority Data**

Apr. 22, 2020 (KR) ..... 10-2020-0048891





US 20230051826A1

(19) **United States**

(12) **Patent Application Publication**  
HU

(10) **Pub. No.: US 2023/0051826 A1**

(43) **Pub. Date: Feb. 16, 2023**

(54) **DUAL-FREQUENCY AND  
DUAL-POLARIZATION ANTENNA ARRAY  
AND ELECTRONIC DEVICE**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 21/24* (2006.01)  
*H01Q 5/307* (2006.01)

(71) Applicants: **HONG FU JIN PRECISION  
INDUSTRY (WuHan) CO., LTD.**,  
Wuhan (CN); **HON HAI PRECISION  
INDUSTRY CO., LTD.**, New Taipei  
(TW)

(52) **U.S. Cl.**  
CPC ..... *H01Q 21/24* (2013.01); *H01Q 5/307*  
(2015.01)

(72) Inventor: **HSIN-NAN HU**, New Taipei (TW)

(57) **ABSTRACT**

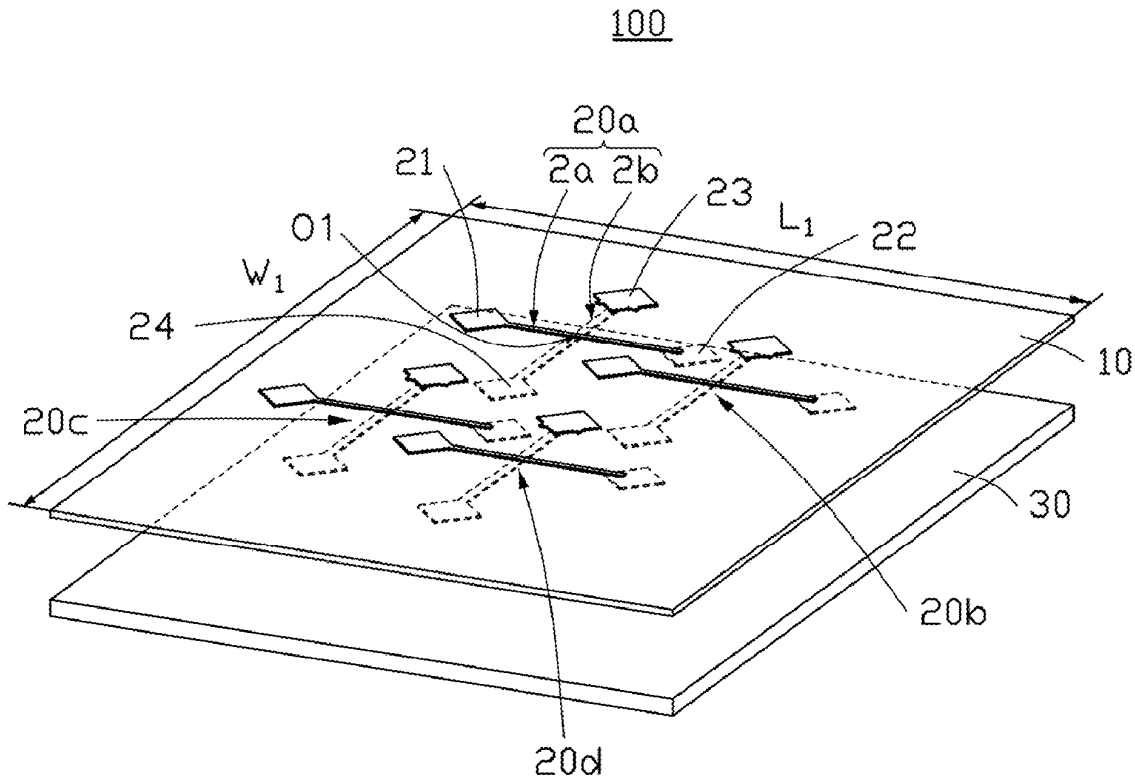
A dual-frequency and dual-polarization antenna array for simultaneously transmitting and receiving dual-frequency signals comprises: a first substrate, an array of dual-frequency and dual-polarization antennas, each antenna in the array comprising a first polarization antenna and a second polarization antenna. The first and second polarization antennas are laid out orthogonally in the first substrate, a horizontal distance between adjacent antennas being equal to a wavelength of frequency band of each antenna, the horizontal distance between adjacent antennas is smaller than a vertical distance between adjacent antennas. An electronic device comprising the dual-frequency and dual-polarization antenna array is also provided.

(21) Appl. No.: **17/871,027**

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

(30) **Foreign Application Priority Data**

Jul. 29, 2021 (CN) ..... 202110866620.3





US 20230051848A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0051848 A1**

(43) **Pub. Date: Feb. 16, 2023**

(54) **MIMO ANTENNA SYSTEM AND ELECTRONIC DEVICE USING THE SAME**

**Publication Classification**

(71) Applicant: **Alpha Networks Inc.**, Hsinchu City (TW)

(51) **Int. Cl.**  
*H01Q 1/38* (2006.01)  
*H01Q 21/30* (2006.01)  
*H01Q 1/24* (2006.01)

(72) Inventors: **De-Chang SU**, Hsinchu City (TW);  
**Chih Jen CHENG**, Hsinchu City (TW)

(52) **U.S. Cl.**  
CPC ..... *H01Q 1/38* (2013.01); *H01Q 21/30* (2013.01); *H01Q 1/241* (2013.01)

(73) Assignee: **Alpha Networks Inc.**, Hsinchu City (TW)

(57) **ABSTRACT**

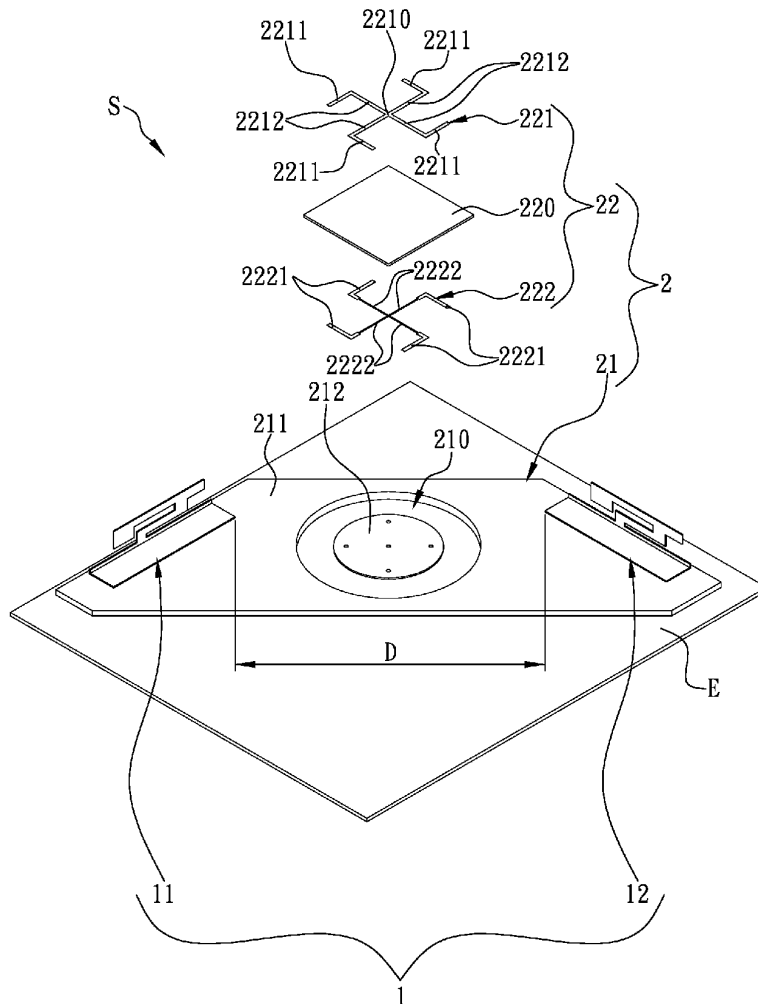
A multi-input multi-output antenna system capable of being disposed in an electronic device and the electronic device including the antenna system have a low-frequency antenna assembly and a high-frequency antenna assembly. The low-frequency antenna assembly includes multiple low-frequency antennas that are spaced apart from each other by a distance. The high-frequency antenna assembly includes multiple high-frequency antennas that are spaced apart from each other by a distance. One of the high-frequency antennas is structured as a low-profile dish antenna and is located between the low-frequency antennas, so that the antenna system has smaller volume and height, and better isolation and radiation patterns.

(21) Appl. No.: **17/839,442**

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

(30) **Foreign Application Priority Data**

Aug. 2, 2021 (TW) ..... 110128337







US 20230052259A1

(19) **United States**

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

(10) **Pub. No.: US 2023/0052259 A1**

(43) **Pub. Date: Feb. 16, 2023**

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

**Publication Classification**

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

(51) **Int. Cl.**  
*H01Q 5/35* (2006.01)  
*H01Q 9/04* (2006.01)  
*H01Q 1/24* (2006.01)  
(52) **U.S. Cl.**  
CPC ..... *H01Q 5/35* (2015.01); *H01Q 9/0407* (2013.01); *H01Q 1/241* (2013.01)

(72) Inventors: **Byung Jin CHOI**, Incheon (KR); **Na Yeon KIM**, Seoul (KR); **Young Ju KIM**, Gyeonggi-do (KR); **Won Bin HONG**, Seoul (KR)

(57) **ABSTRACT**

An antenna package according to an embodiment includes an antenna unit including a radiator, a transmission line extending from the radiator and an antenna ground pad disposed around the transmission line, and a circuit board electrically connected to the antenna unit. The circuit board includes a core layer, a circuit wiring layer disposed on one surface of the core layer, the circuit wiring layer including a signal transmission wiring electrically connected to the transmission line of the antenna unit and a first ground pattern bonded to the antenna ground pad, and a ground layer disposed on an opposite surface facing the one surface of the core layer. The ground layer does not overlap a portion of the antenna ground pad except for a region bonded to the first ground pattern in a planar view.

(21) Appl. No.: **17/977,205**

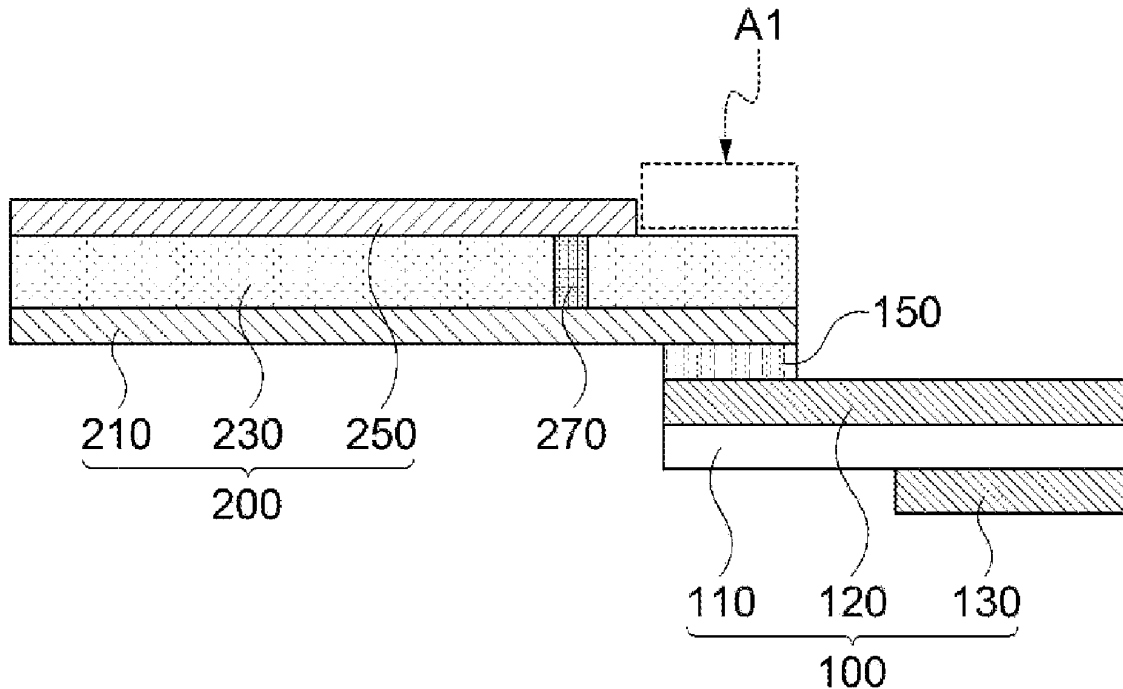
(22) Filed: **Oct. 31, 2022**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/KR2021/005422, filed on Apr. 29, 2021.

**Foreign Application Priority Data**

(30) Apr. 29, 2020 (KR) ..... 10-2020-0052083





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(54) **MULTI-FEED ANTENNA WITH A SHARED RADIATOR**

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(57) **ABSTRACT**

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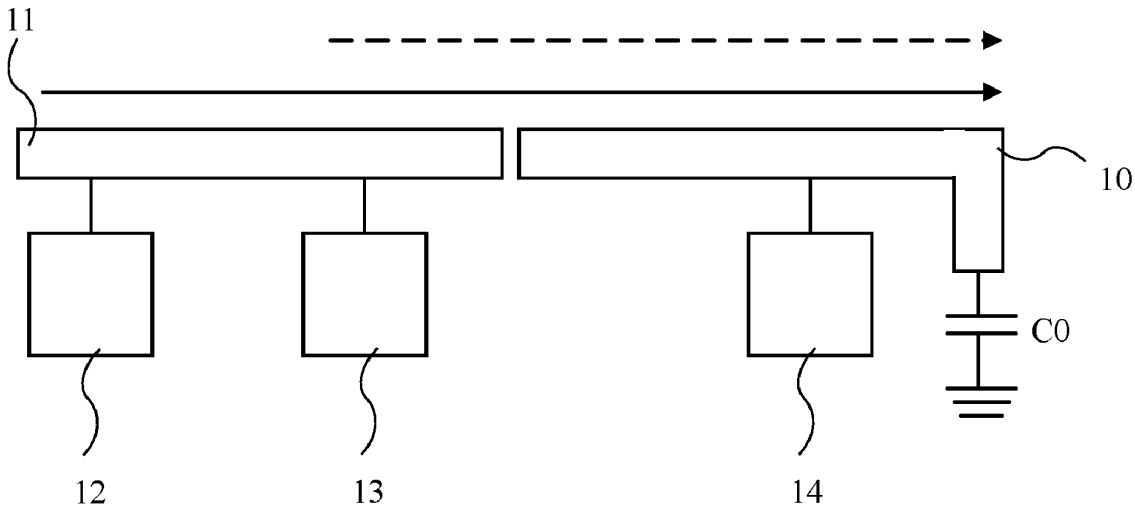
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A multi-feed antenna with a shared radiator comprises a ground capacitor, a first antenna module, a second antenna module, a first feed-in module, a second feed-in module and at least one sensing module. The first antenna module is grounded through the ground capacitor. The second antenna module is coupled with the first antenna module. The first feed-in module and the second feed-in module are connected with the second antenna module, and the first feed-in module and the second feed-in module are used to receive or send radio frequency signals through the first antenna module and the second antenna module. The at least one sensing module is connected with the first antenna module or the second antenna module, and the at least one sensing module is used to sense a capacitance value of a parasitic capacitance of the first antenna module or the second antenna module.





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(54) **MULTI-BAND ANTENNA AND ELECTRONIC DEVICE INCLUDING THE SAME**

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(57) **ABSTRACT**

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An antenna includes a first radiating layer including a first radiation patch, a slit formed in the first radiation patch, and a first feed point provided in the first radiation patch, a second radiating layer including a second radiation patch provided below the first radiation patch and a second feed point provided in the second radiation patch, a feeding layer including a coupling patch provided below the second radiation patch and at least one ground point provided in the coupling patch, a ground layer provided below the coupling patch, a feed line provided between the second radiation patch and the ground layer and including a third feed point, a signal via connecting the first feed point, the second feed point, and the third feed point, and a ground via connecting the at least one ground point and the ground layer.

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