



US 20250096466A1

(19) **United States**

(12) **Patent Application Publication**
Deng

(10) **Pub. No.: US 2025/0096466 A1**

(43) **Pub. Date: Mar. 20, 2025**

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

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

(72) Inventor: **Shaogang Deng, Shenzhen (CN)**

(21) Appl. No.: **18/696,132**

(22) PCT Filed: **Aug. 26, 2022**

(86) PCT No.: **PCT/CN2022/115221**

§ 371 (c)(1),

(2) Date: **Mar. 27, 2024**

(30) **Foreign Application Priority Data**

Sep. 29, 2021 (CN) 202111156219.7

Publication Classification

(51) **Int. Cl.**

H01Q 5/371 (2015.01)

H01Q 9/24 (2006.01)

H01Q 9/30 (2006.01)

H01Q 13/10 (2006.01)

H01Q 21/28 (2006.01)

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

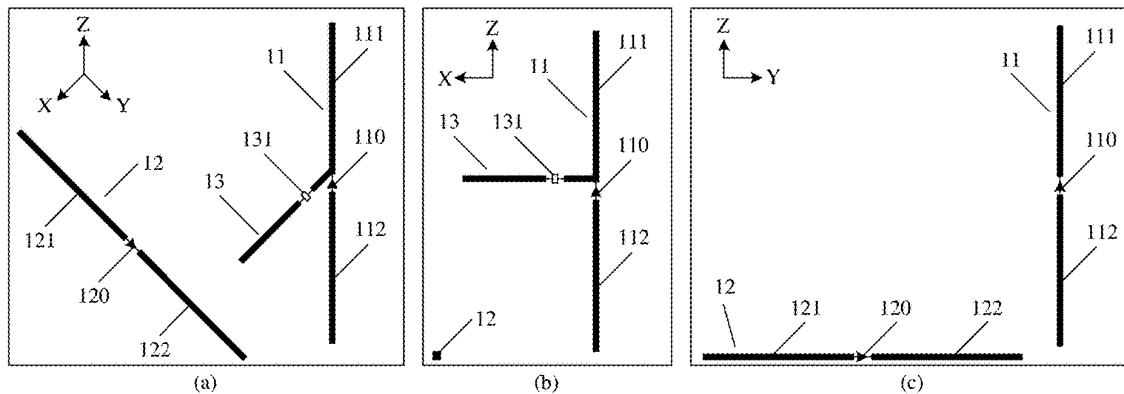
CPC **H01Q 5/371** (2015.01); **H01Q 9/24**

(2013.01); **H01Q 9/30** (2013.01); **H01Q 13/10**

(2013.01); **H01Q 21/28** (2013.01)

(57) **ABSTRACT**

An antenna system includes a first antenna, a second antenna, and a tuning stub, where the first antenna and the second antenna have a same first operating frequency band or similar first operating frequency bands. The tuning stub is electrically connected to the first antenna, and the tuning stub is configured to adjust an equivalent current path of the first antenna, so that a connection line between a projection point of a maximum equivalent current point of the first antenna and a projection point of a maximum equivalent current point of the second antenna on a first plane tends to be more perpendicular to a projection of the equivalent current path of the first antenna or of the second antenna on the first plane; or the equivalent current path of the first antenna and of the second antenna tend to be more perpendicular to each other.

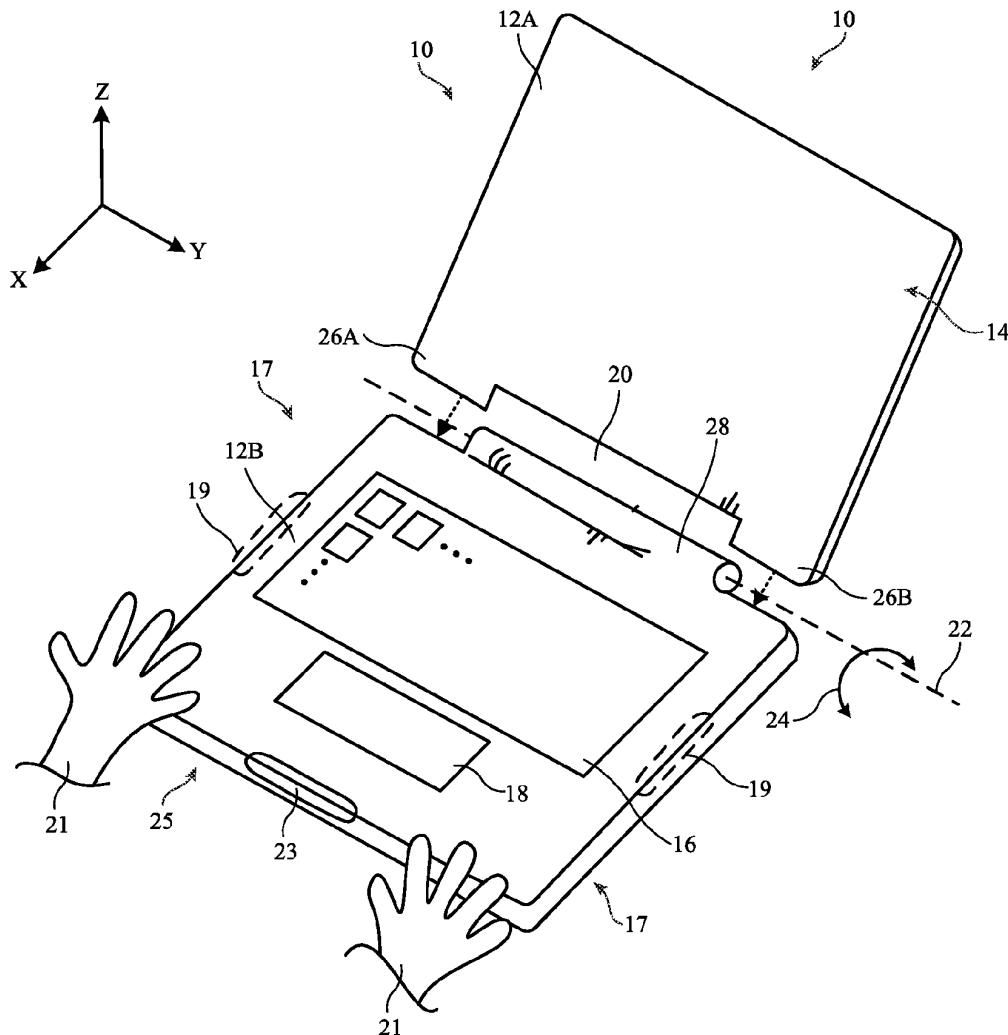




US 20250103109A1

(19) **United States**(12) **Patent Application Publication**
Williams et al.(10) **Pub. No.: US 2025/0103109 A1**(43) **Pub. Date: Mar. 27, 2025**(54) **ELECTRONIC DEVICE HAVING FINGER
RECESS ANTENNA****Publication Classification**(51) **Int. Cl.**
G06F 1/16 (2006.01)(52) **U.S. Cl.**
CPC **G06F 1/1681** (2013.01)(57) **ABSTRACT**

An electronic device such as a laptop computer may have an upper housing and a lower housing. The upper housing may be coupled to the lower housing by a hinge. The upper housing may be rotatable relative to the lower housing between an open position and a closed position. The lower housing may have an upper metal wall, a lower metal wall, and a metal sidewall that couples the lower metal wall to the upper metal wall. The lower metal housing may have a finger scoop in the metal sidewall. The finger scoop may have a surface that is oriented at a non-parallel and non-perpendicular angle to a lateral surface of the upper housing when the upper housing is in the closed position. The device may have an antenna with a radiating slot in the surface of the finger scoop.

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Michael J Williams**, Campbell, CA (US); **Nikolaos Chiotellis**, San Jose, CA (US); **Joel D Barrera**, Cedar Park, TX (US); **Jerzy S Guterman**, Sunnyvale, CA (US); **Trevor J Edmonds**, San Francisco, CA (US); **Marc Soriano Baliarda**, San Jose, CA (US); **Mahmoud R Amini**, Redwood City, CA (US); **Soroush Kamrava**, Mountain View, CA (US)(21) Appl. No.: **18/476,220**(22) Filed: **Sep. 27, 2023**



US 20250105489A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105489 A1**

(43) **Pub. Date: Mar. 27, 2025**

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

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/50 (2006.01)

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

(52) **U.S. Cl.**
CPC **H01Q 1/22** (2013.01); **H01Q 1/48** (2013.01); **H01Q 1/50** (2013.01)

(72) Inventors: **WON HEE LEE**, Jeollabuk-do (KR);
KI HUN SUNG, Jeollabuk-do (KR);
SUNG JOON HONG, Jeollabuk-do (KR)

(57) **ABSTRACT**

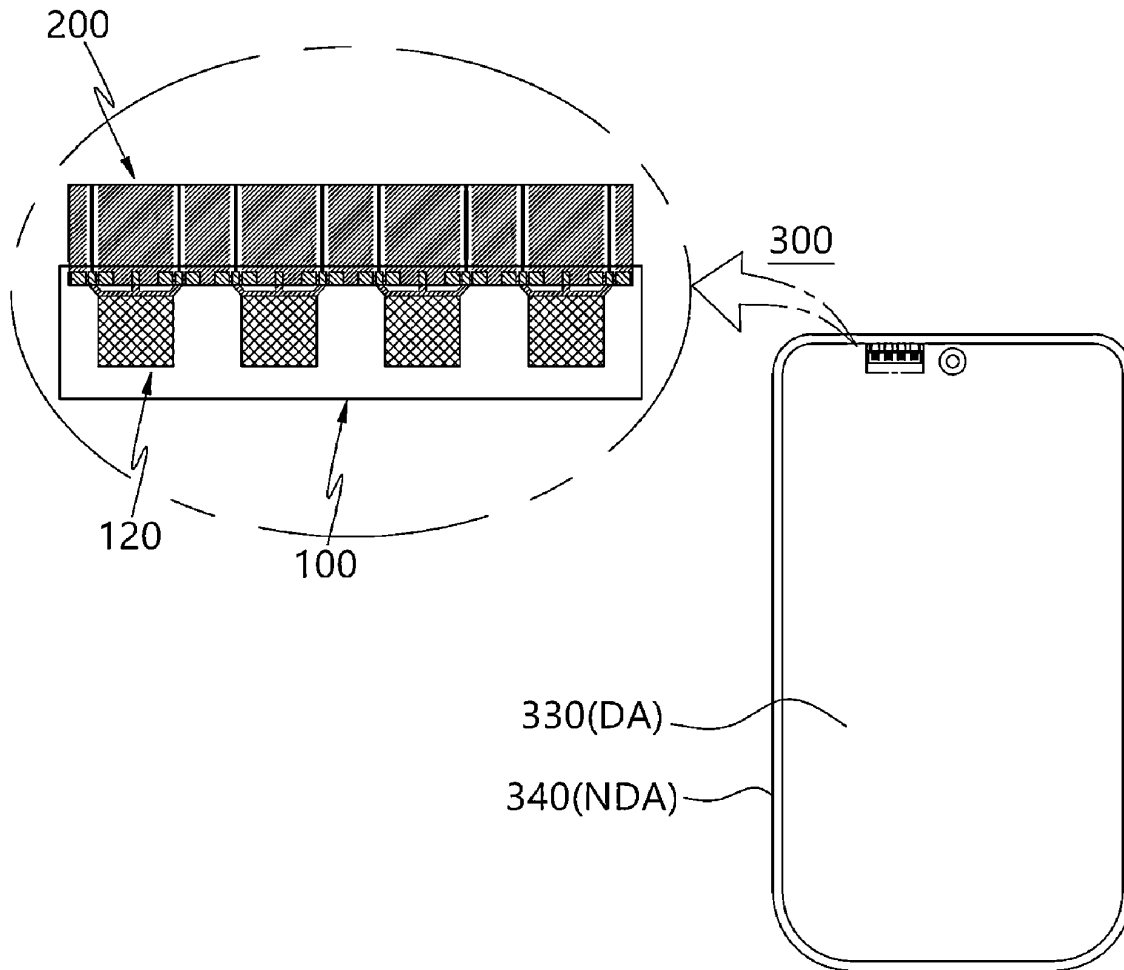
(21) Appl. No.: **18/889,850**

(22) Filed: **Sep. 19, 2024**

(30) **Foreign Application Priority Data**

Sep. 22, 2023 (KR) 10-2023-0127276

An antenna device includes a radiator, a transmission line and a relay pattern. The transmission line is connected to the radiator and includes a first transmission line and a second transmission line that face each other. The relay pattern is disposed between the first transmission line and the second transmission line to be connected to the radiator.

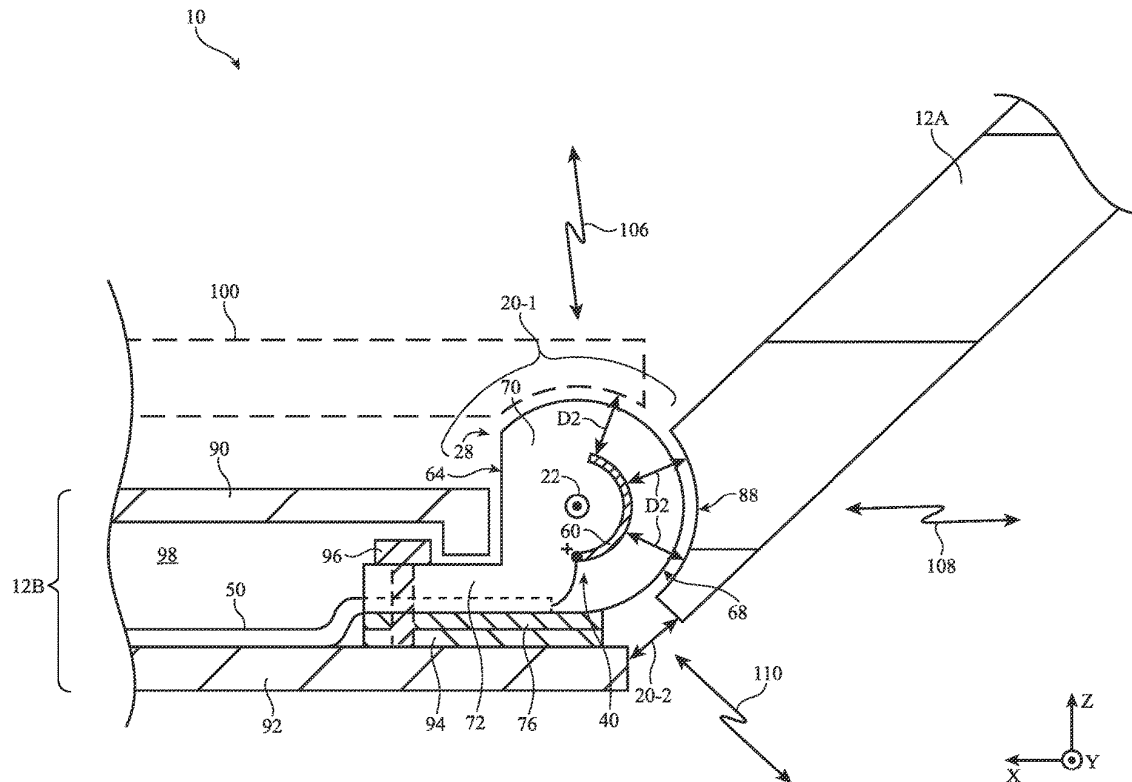




US 20250105490A1

(19) **United States**(12) **Patent Application Publication**
Chiotellis et al.(10) **Pub. No.: US 2025/0105490 A1**(43) **Pub. Date: Mar. 27, 2025**(54) **ELECTRONIC DEVICE HAVING CLUTCH
BARREL ANTENNA ARM**(52) **U.S. Cl.**
CPC **H01Q 1/2266** (2013.01); **H01Q 1/38**
(2013.01); **H01Q 9/0421** (2013.01)(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Nikolaos Chiotellis**, San Jose, CA
(US); **Michael J. Williams**, Campbell,
CA (US); **Joel D. Barrera**, Cedar Park,
TX (US); **Marc Soriano Baliarda**, San
Jose, CA (US); **Ayoub Yari Boroujeni**,
Redwood City, CA (US); **Trevor J.**
Edmonds, San Francisco, CA (US);
Jerzy S. Guterman, Sunnyvale, CA
(US)(57) **ABSTRACT**

An electronic device such as a laptop computer may have an upper housing and a lower housing. The lower housing may have a clutch barrel coupled to the upper housing by a hinge. The upper housing may be rotatable relative to the lower housing between an open position and a closed position. The upper housing may have a curved metal surface facing the clutch barrel. The device may have an antenna with a radiating arm on a curved interior surface of a substrate in the clutch barrel. The radiating arm may extend parallel to the curved metal surface. The radiating arm may remain separated from the curved metal surface across its lateral area as the upper housing is rotated from the open position to the closed position. This may ensure that the antenna is provided with a uniform capacitive load from the upper housing at all upper housing positions.

(21) Appl. No.: **18/476,035**(22) Filed: **Sep. 27, 2023****Publication Classification**(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/38 (2006.01)
H01Q 9/04 (2006.01)



US 20250105492A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105492 A1**

(43) **Pub. Date: Mar. 27, 2025**

(54) **ELECTRONIC ASSEMBLY AND
ELECTRONIC DEVICE**

Publication Classification

(71) Applicant: **Honor Device Co., Ltd.**, Shenzhen
(CN)

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

(72) Inventors: **Kangle XUE**, Shenzhen (CN); **Xijian
DI**, Shenzhen (CN); **Shouliang LI**,
Shenzhen (CN); **Zhenrui TANG**,
Shenzhen (CN)

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

(73) Assignee: **Honor Device Co., Ltd.**, Shenzhen
(CN)

(57) **ABSTRACT**

(21) Appl. No.: **18/730,710**

This application provides an electronic assembly and an electronic device. At least two antennas are formed on a metal frame of the electronic assembly, a circuit board and an electronic component are located on one side of the metal frame, and there is a gap between the metal frame and each of the circuit board and the electronic component. An orthographic projection of the electronic component on the metal frame covers a first antenna, a slit between the first antenna and a second antenna, and a part of the second antenna. One end of a first extension member is connected to one end of the first antenna which is close to the second antenna, the other end of the first extension member is electrically connected to a first feed point on the circuit board. The second antenna is electrically connected to a second feed point on the circuit board.

(22) PCT Filed: **Aug. 17, 2023**

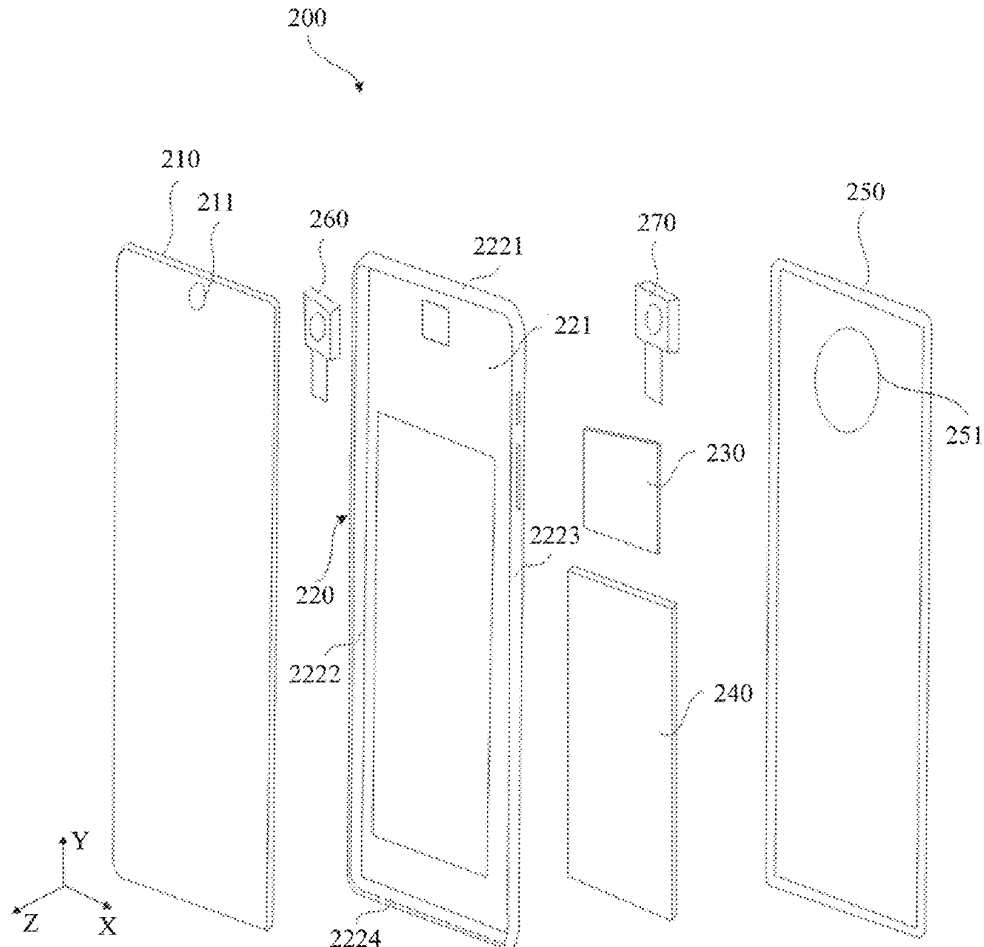
(86) PCT No.: **PCT/CN2023/113606**

§ 371 (c)(1),

(2) Date: **Jul. 19, 2024**

(30) **Foreign Application Priority Data**

Sep. 7, 2022 (CN) 202211090616.3

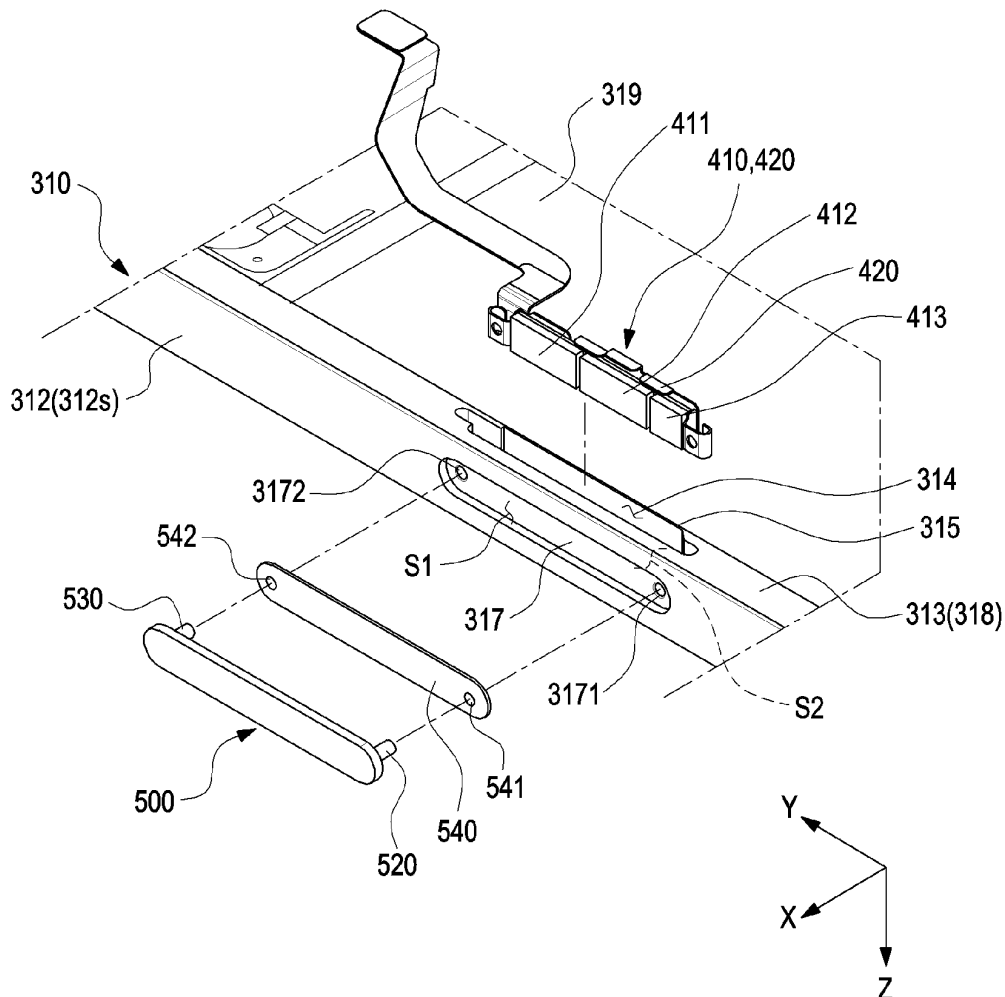


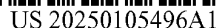


US 20250105493A1

(19) **United States**(12) **Patent Application Publication**
ROH et al.(10) **Pub. No.: US 2025/0105493 A1**(43) **Pub. Date: Mar. 27, 2025**(54) **ELECTRONIC DEVICE INCLUDING
ANTENNA MODULE****Publication Classification**(71) Applicant: **Samsung Electronics Co., Ltd.**,
Suwon-si (KR)(72) Inventors: **Hyunyoung ROH**, Suwon-si (KR);
Jeong PARK, Suwon-si (KR)(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)
H01Q 9/16 (2006.01)(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 9/0407**
(2013.01); **H01Q 9/16** (2013.01)(21) Appl. No.: **18/896,063**(22) Filed: **Sep. 25, 2024****Related U.S. Application Data**(63) Continuation of application No. PCT/KR2024/
013920, filed on Sep. 12, 2024.(30) **Foreign Application Priority Data**Sep. 25, 2023 (KR) 10-2023-0128288
Nov. 22, 2023 (KR) 10-2023-0163584(57) **ABSTRACT**

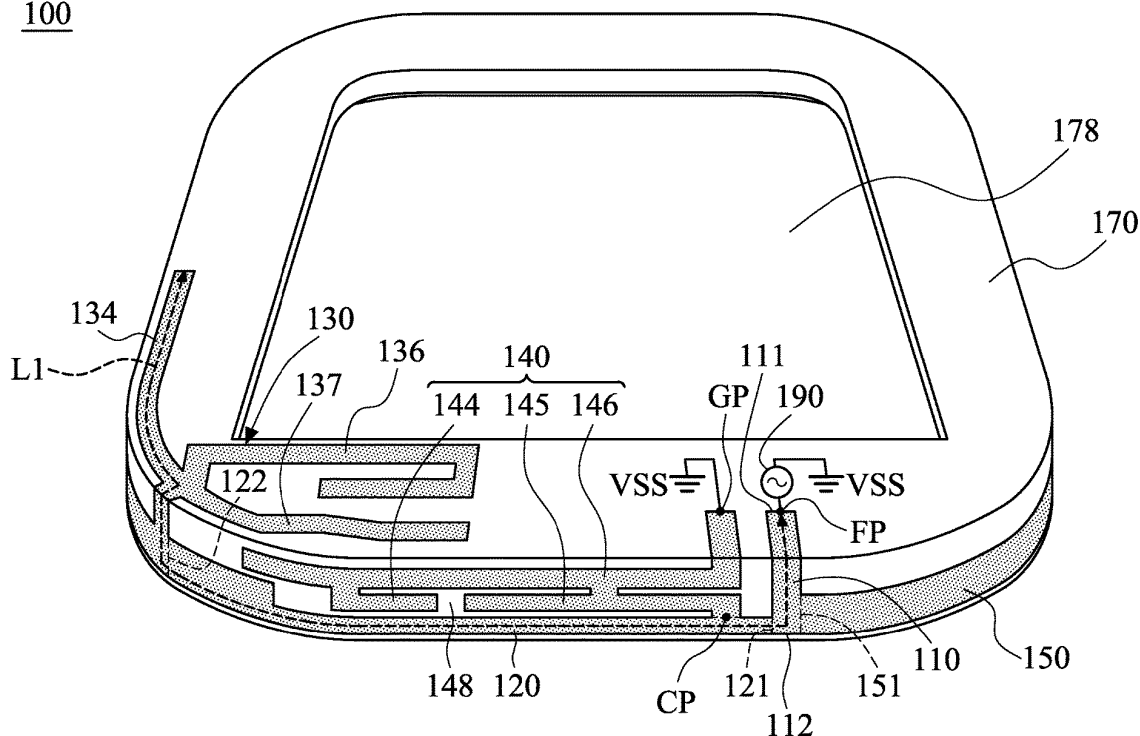
The disclosure relates to an electronic device. An electronic device according to an embodiment of the disclosure may include: a housing including a side wall, wherein the side wall includes a recess recessed from an outer surface of the side wall; a non-conductive cap disposed in the recess and including a protruding portion passing through the recess; an antenna module disposed opposite to the cap with respect to the recess and including at least one antenna element disposed to face the recess; and a bracket disposed inside the housing such that the antenna module is mounted thereon and including a coupling hole through which the protruding portion is inserted.





(43) **Pub. Date:** **Mar. 27, 2025**

A wearable device includes a feeding radiation element, a connection radiation element, a bifurcate radiation element, a shorting radiation element, an extension radiation element, and a carrier element. The feeding radiation element has a feeding point. The connection radiation element is coupled to the feeding radiation element. The bifurcate radiation element is coupled to the connection radiation element. The connection radiation element is also coupled through the shorting radiation element to a grounding point. The extension radiation element is coupled to the feeding radiation element. The feeding radiation element, the connection radiation element, the bifurcate radiation element, the shorting radiation element, and the extension radiation element are disposed on the carrier element. An antenna structure is formed by the feeding radiation element, the connection radiation element, the bifurcate radiation element, the shorting radiation element, and the extension radiation element.





US 20250105500A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105500 A1**

(43) **Pub. Date: Mar. 27, 2025**

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

(71) Applicant: **Wistron NeWeb Corporation**, Hsinchu
(TW)

(72) Inventors: **Tzu-Kuan SUN**, Hsinchu (TW);
Hong-Jun JIAN, Hsinchu (TW);
Hsiang-Chao LIU, Hsinchu (TW)

(21) Appl. No.: **18/507,188**

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

(30) **Foreign Application Priority Data**

Sep. 23, 2023 (TW) 112136424

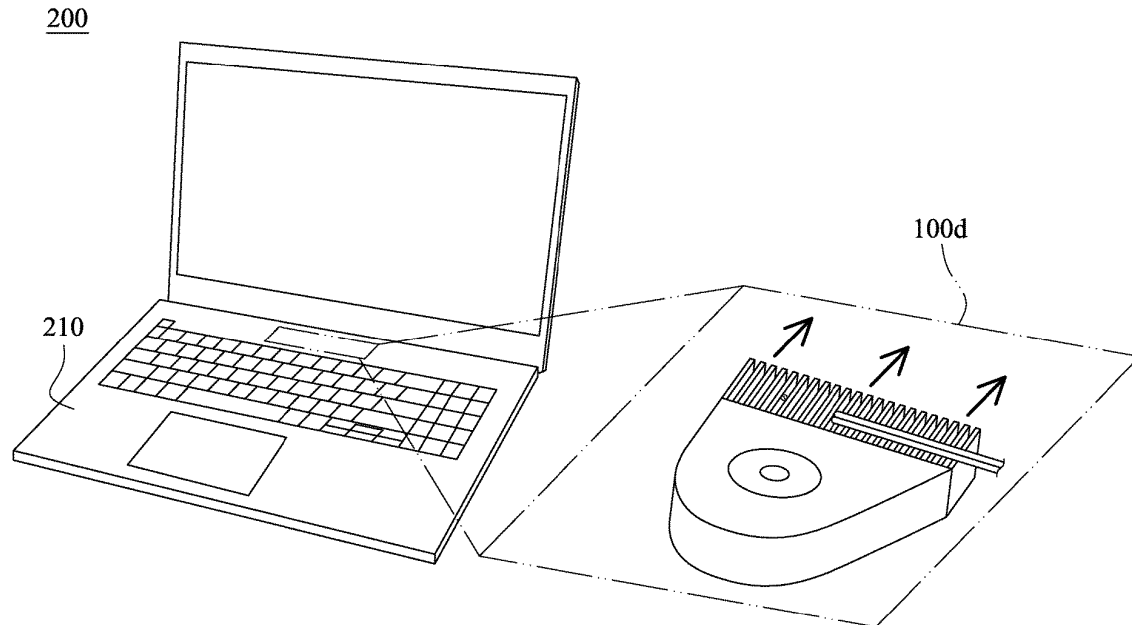
Publication Classification

(51) **Int. Cl.**
H01Q 1/44 (2006.01)
H05K 7/20 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/44** (2013.01); **H05K 7/20336**
(2013.01); **H05K 7/2039** (2013.01)

(57) **ABSTRACT**

An antenna structure includes a heatsink and a feeding source. The heatsink includes a plurality of cooling fins and a metal connecting portion. The cooling fins are spaced apart from each other and have a same fin length. The metal connecting portion is connected to one end of each of the cooling fins. The feeding source is disposed on one side of the cooling fins and is signally connected to the heatsink by one of a direct feed type and a coupled feed type.





US 20250105506A1

(19) **United States**

(12) **Patent Application Publication**
TOYAO

(10) **Pub. No.: US 2025/0105506 A1**

(43) **Pub. Date: Mar. 27, 2025**

(54) **MULTI-RESONANT ANTENNA**

Publication Classification

(71) Applicant: **JAPAN AVIATION ELECTRONICS
INDUSTRY, LIMITED**, Tokyo (JP)

(51) **Int. Cl.**
H01Q 5/10 (2015.01)
H01Q 5/35 (2015.01)

(72) Inventor: **Hiroshi TOYAO**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **H01Q 5/10** (2015.01); **H01Q 5/35**
(2015.01)

(73) Assignee: **JAPAN AVIATION ELECTRONICS
INDUSTRY, LIMITED**, Tokyo (JP)

(21) Appl. No.: **18/820,746**

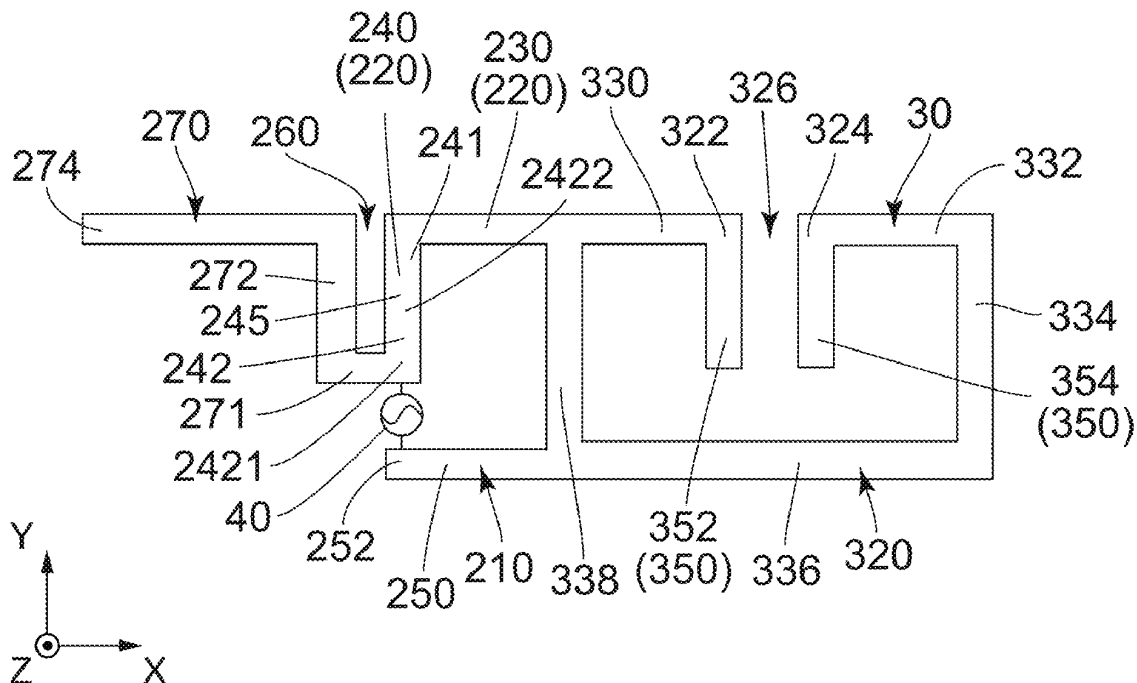
(22) Filed: **Aug. 30, 2024**

(30) **Foreign Application Priority Data**

Sep. 21, 2023 (JP) 2023-156342

(57) **ABSTRACT**

A multi-resonant antenna comprises a main antenna and an additional radiation element. The main antenna comprises a main portion and a feeding portion. The main portion forms a split ring. The feeding portion extends outward of the main antenna from the main portion. The additional radiation element extends outward of the main antenna directly from the feeding portion.





US 20250105510A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105510 A1**

(43) **Pub. Date: Mar. 27, 2025**

(54) **ANTENNA AND ELECTRONIC DEVICE**

Publication Classification

(71) Applicant: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen, Guangdong (CN)

(51) **Int. Cl.**
H01Q 5/328 (2015.01)
H01Q 3/26 (2006.01)
H01Q 13/08 (2006.01)

(72) Inventors: **Xiuyin Zhang**, Guangzhou (CN); **Di Pang**, Guangzhou (CN); **Huafeng Su**, Guangzhou (CN); **Huiliang Xu**, Shenzhen (CN)

(52) **U.S. Cl.**
CPC **H01Q 5/328** (2015.01); **H01Q 3/2611** (2013.01); **H01Q 13/08** (2013.01)

(73) Assignee: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen, Guangdong (CN)

(57) **ABSTRACT**

(21) Appl. No.: **18/722,569**

(22) PCT Filed: **Dec. 12, 2022**

(86) PCT No.: **PCT/CN2022/138413**

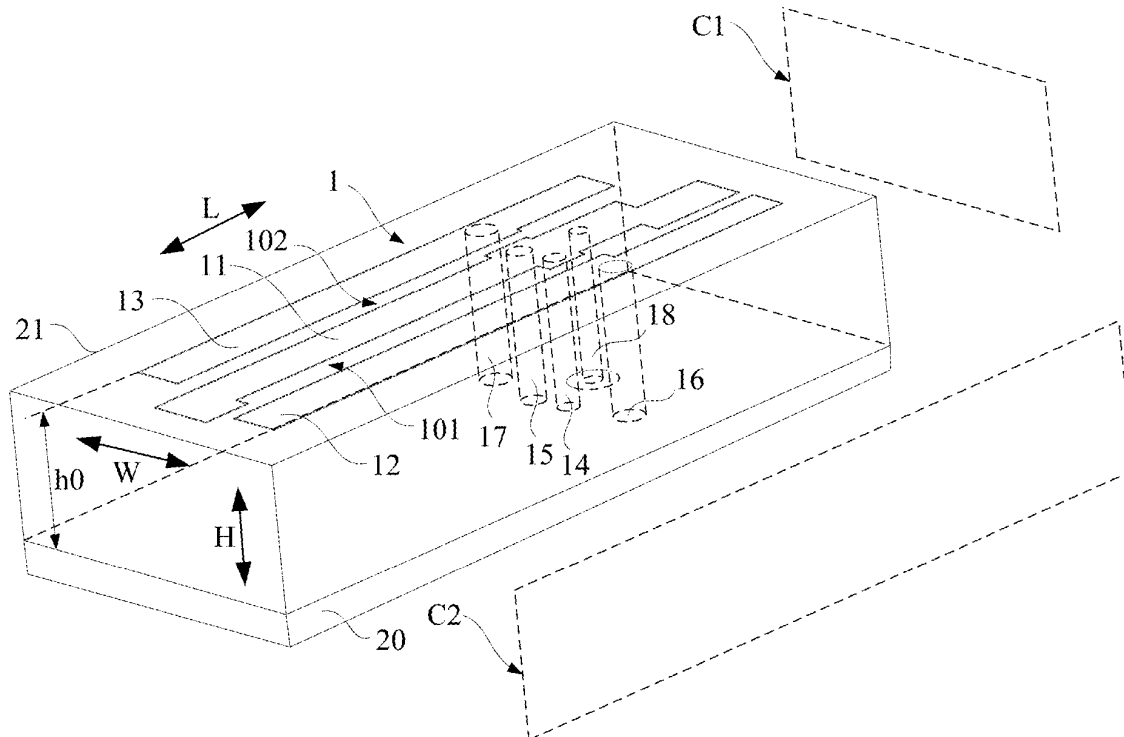
§ 371 (c)(1),

(2) Date: **Jun. 20, 2024**

An antenna comprises a feeding element and a plurality of radiators including a first radiator, a second radiator, and a third radiator spaced from each other side by side in a first direction on a same plane. One end of the feeding element is connected to a feeding connection point of the first radiator, and the other end is connected to a feeding point. The antenna further includes a first ground element, a second ground element, a third ground element, and a fourth ground element that are spaced from each other in the first direction. A first gap is formed between the second radiator and the first radiator, and a second gap is formed between the third radiator and the first radiator.

(30) **Foreign Application Priority Data**

Jan. 17, 2022 (CN) 202210050320.2





US 20250105512A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105512 A1**

(43) **Pub. Date: Mar. 27, 2025**

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

Publication Classification

(71) Applicant: **Wistron NeWeb Corporation**, Hsinchu
(TW)

(51) **Int. Cl.**
H01Q 5/328 (2015.01)
H01Q 5/48 (2015.01)
H01Q 9/04 (2006.01)

(72) Inventors: **Jia-Le ZHU**, Hsinchu (TW);
Ching-Wen CHEN, Hsinchu (TW);
Cheng-Wei CHIANG, Hsinchu (TW);
Wen-Pin HO, Hsinchu (TW)

(52) **U.S. Cl.**
CPC **H01Q 5/328** (2015.01); **H01Q 5/48**
(2015.01); **H01Q 9/0407** (2013.01)

(57) **ABSTRACT**

An antenna structure and an electronic device are provided. The antenna structure includes a feeding source, a main radiation portion, a metal portion, and a grounding portion. The main radiation portion is signally connected to the feeding source. There is a first gap between the metal portion and the main radiation portion. There is a second gap between the grounding portion and the metal portion, and there is a third gap between the grounding portion and the main radiation portion. The main radiation portion couples with the metal portion via the first gap, and the grounding portion couples with the metal portion via the second gap.

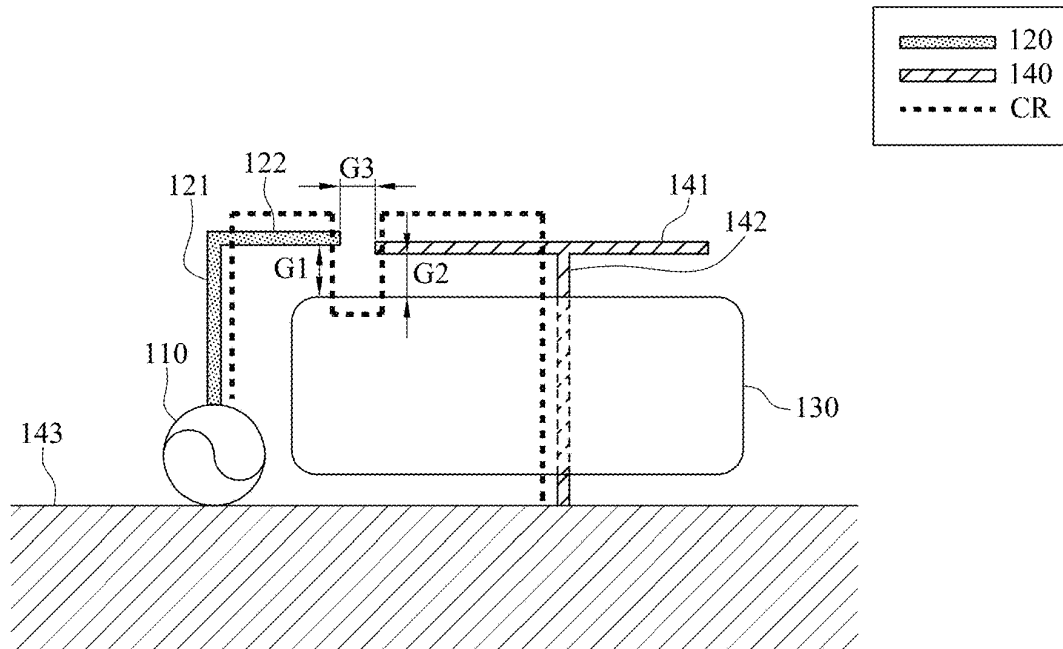
(21) Appl. No.: **18/888,198**

(22) Filed: **Sep. 18, 2024**

(30) **Foreign Application Priority Data**

Sep. 22, 2023 (TW) 112136237

100





US 20250105514A1

(19) **United States**

(12) **Patent Application Publication**
IINO

(10) **Pub. No.: US 2025/0105514 A1**

(43) **Pub. Date: Mar. 27, 2025**

(54) **HALF-WAVELENGTH ANTENNA DEVICE
AND LOW-PROFILE ANTENNA DEVICE
USING SAME**

H01Q 9/40 (2006.01)

H01Q 19/26 (2006.01)

H01Q 21/30 (2006.01)

(71) Applicant: **HARADA INDUSTRY CO., LTD.**,
Tokyo (JP)

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

CPC *H01Q 5/378* (2015.01); *H01Q 9/32*
(2013.01); *H01Q 9/40* (2013.01); *H01Q 19/26*
(2013.01); *H01Q 21/30* (2013.01)

(72) Inventor: **Shinji IINO**, Shinagawa-ku, Tokyo (JP)

(21) Appl. No.: **18/709,435**

(22) PCT Filed: **Nov. 9, 2022**

(57)

ABSTRACT

(86) PCT No.: **PCT/JP2022/041638**

§ 371 (c)(1),

(2) Date: **Dec. 5, 2024**

(30) **Foreign Application Priority Data**

Nov. 16, 2021 (JP) 2021-186311

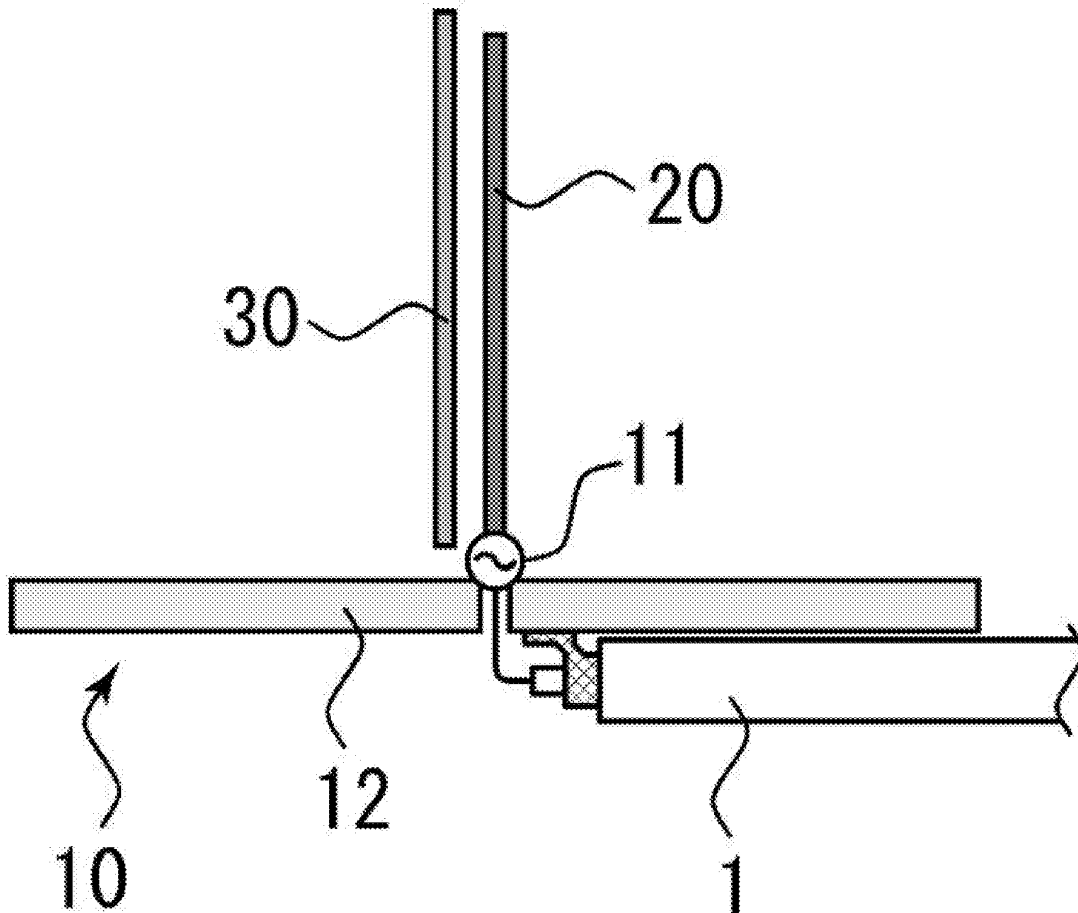
Publication Classification

(51) **Int. Cl.**

H01Q 5/378 (2015.01)

H01Q 9/32 (2006.01)

To provide a small-sized half-wavelength antenna device capable of adjusting directivity. A half-wavelength antenna device for a vehicle includes: a conductive plate **10**; a half-wavelength element **20**; and a parasitic element **30**. The conductive plate **10** has a feeding part **11** and a ground **12**. The half-wavelength element **20** is vertically installed on the conductive plate **10** so as to be connected to the feeding part **11** but insulated from the ground **12**. The parasitic element **30** is disposed in proximity and parallel to the half-wave-length element **20** so as to be electromagnetically coupled thereto but insulated from the ground **12**.





US 20250105515A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105515 A1**

(43) **Pub. Date: Mar. 27, 2025**

(54) **ANTENNA AND DISPLAY DEVICE**

Publication Classification

(71) Applicant: **TDK CORPORATION**, Tokyo (JP)

(51) **Int. Cl.**
H01Q 5/378 (2015.01)
H01Q 1/38 (2006.01)
H01Q 13/08 (2006.01)

(72) Inventors: **Kenichi TEZUKA**, Tokyo (JP); **Mei FUKAYA**, Tokyo (JP)

(73) Assignee: **TDK CORPORATION**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **H01Q 5/378** (2015.01); **H01Q 1/38** (2013.01); **H01Q 13/08** (2013.01)

(21) Appl. No.: **18/724,918**

(22) PCT Filed: **Dec. 27, 2022**

(86) PCT No.: **PCT/JP2022/048366**

§ 371 (c)(1),

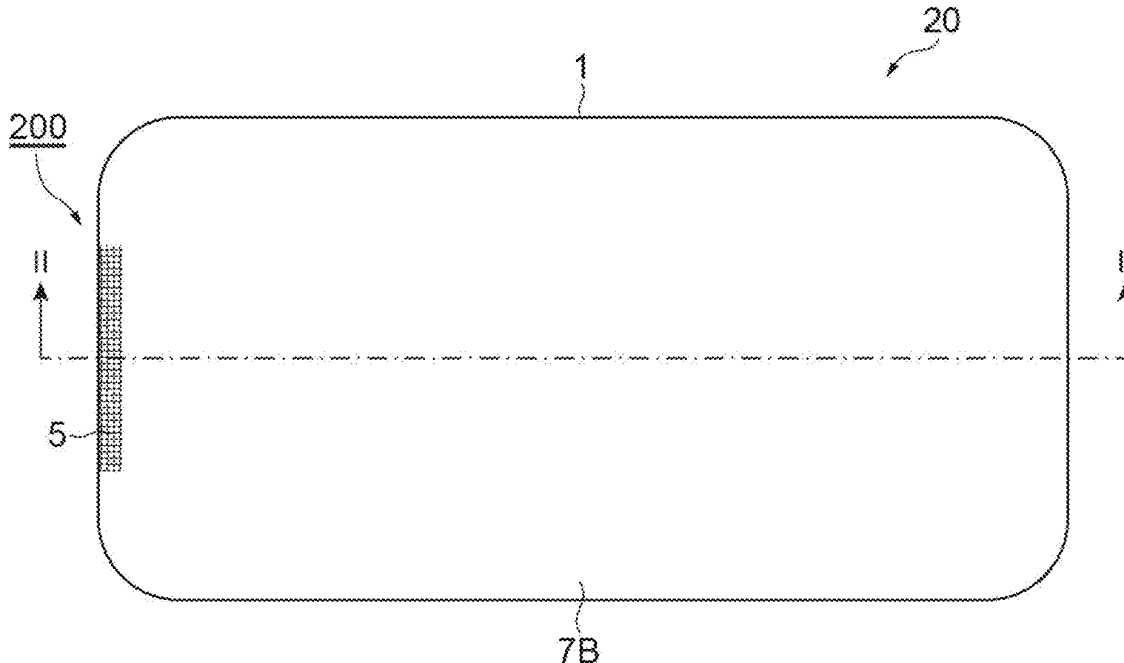
(2) Date: **Jun. 27, 2024**

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Dec. 28, 2021 (JP) 2021-214184

An antenna includes a radiation conductor having a circular shape, a feed line configured to feed power to the radiation conductor, and a terminal connected to the feed line, in which impedance of the feed line is greater than impedance of a feed point of the terminal, and a line length of the feed line is longer than a radius of the radiation conductor.





US 20250105517A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0105517 A1**

(43) **Pub. Date: Mar. 27, 2025**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

Publication Classification

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

(51) **Int. Cl.**
H01Q 5/50 (2015.01)
H01Q 1/50 (2006.01)

(72) Inventors: **Sanghoon CHOI**, Suwon-si (KR);
Youngjung Kim, Suwon-si (KR);
Jonghoon Kim, Suwon-si (KR);
Dongjun Oh, Suwon-si (KR);
Himchan Yun, Suwon-si (KR);
Youngsung Lee, Suwon-si (KR); **Aro Cheon**, Suwon-si (KR)

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

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

(57) **ABSTRACT**

(21) Appl. No.: **18/903,650**

(22) Filed: **Oct. 1, 2024**

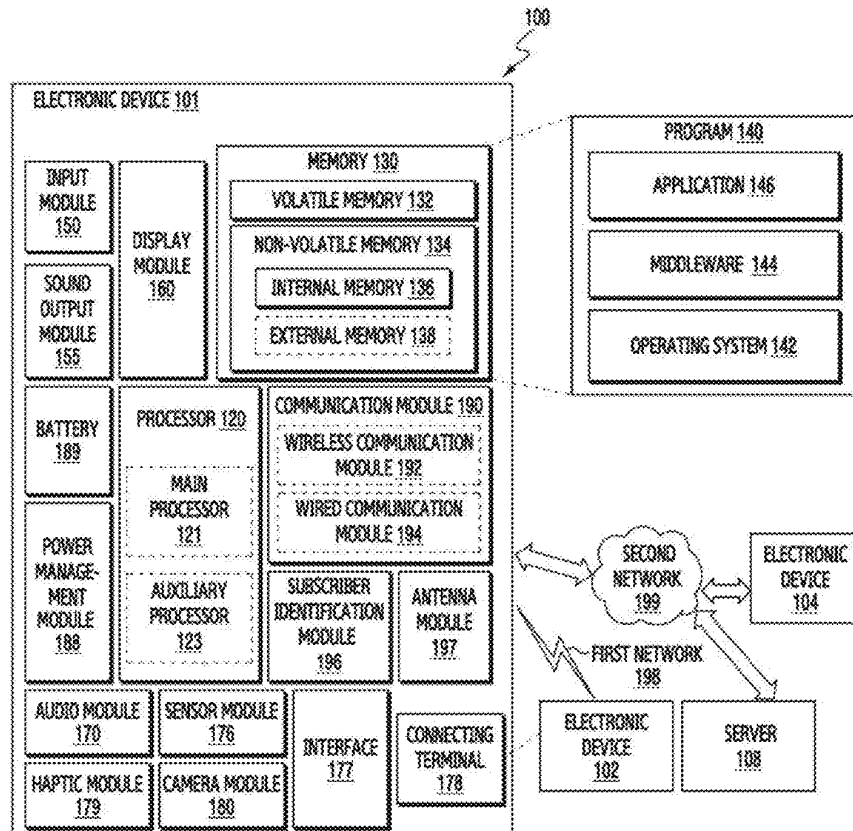
Related U.S. Application Data

(63) Continuation of application No. PCT/KR2024/013356, filed on Sep. 4, 2024.

An electronic device includes: a conductive portion; a printed circuit board having a first ground path, a second ground path, and a feed path; and a wireless communication circuit on the printed circuit board. The conductive portion includes a feed point, a first ground point, and a second ground point. The first ground point is connected to a ground of the electronic device through the first ground path. The second ground point is connected to the ground through the second ground path. The feed point is electrically connected to the wireless communication circuit through the feed path. The printed circuit board includes a conductive pattern connected between the feed path and the first ground path. The wireless communication circuit is configured to supply a signal, through the feed path, to the conductive portion and the conductive pattern. The signal is radiated through the conductive portion and the conductive pattern.

(30) **Foreign Application Priority Data**

Sep. 21, 2023 (KR) 10-2023-0126641
Nov. 2, 2023 (KR) 10-2023-0150359





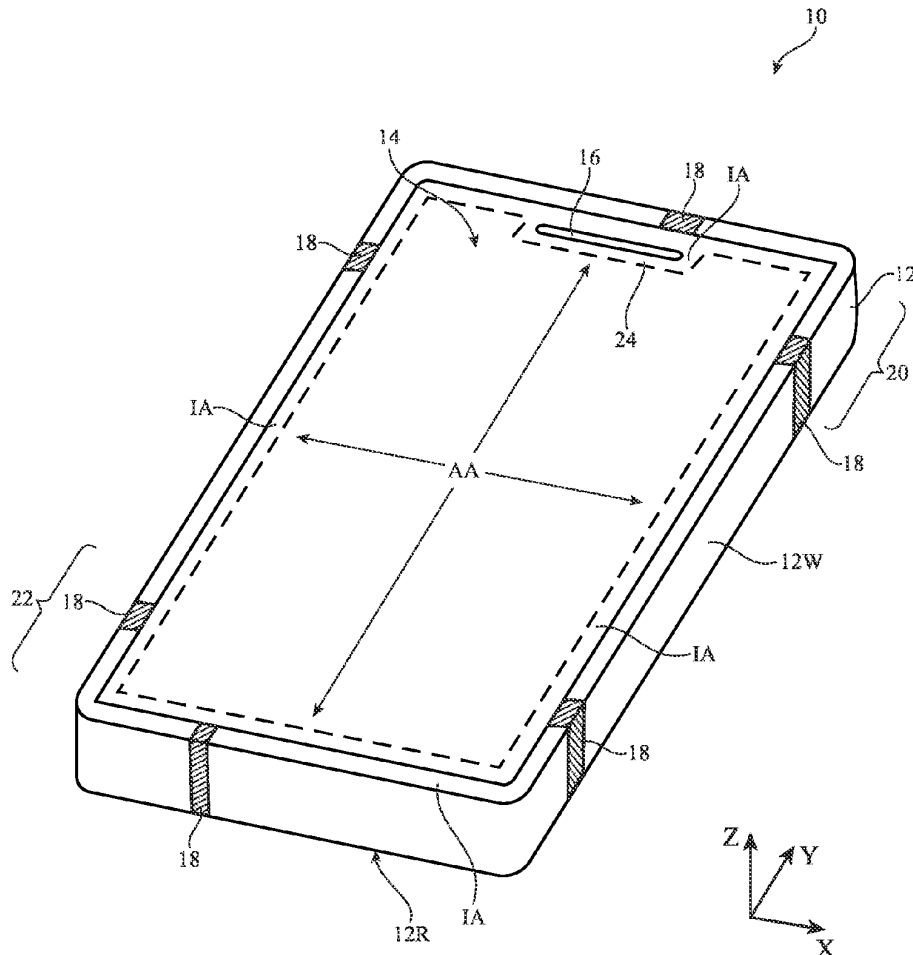
US 20250112354A1

(19) **United States**(12) **Patent Application Publication**
Amjadi et al.(10) **Pub. No.: US 2025/0112354 A1**(43) **Pub. Date: Apr. 3, 2025**(54) **ELECTRONIC DEVICE HAVING SUPPORT
PLATE ANTENNA**(52) **U.S. Cl.**CPC **H01Q 1/22** (2013.01); **H01Q 1/42**
(2013.01); **H01Q 13/10** (2013.01)(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Seyed Mohammad Amjadi**, Santa
Clara, CA (US); **Yiren Wang**,
Cupertino, CA (US); **Sidharath Jain**,
Redwood City, CA (US); **Victor C Lee**,
Santa Clara, CA (US); **Mattia**
Pascolini, San Francisco, CA (US);
Alden T Rush, San Diego, CA (US);
Yuan Tao, Santa Clara, CA (US); **Hao**
Xu, Cupertino, CA (US); **Carlo Di**
Nallo, Belmont, CA (US)

(57)

ABSTRACT

An electronic device may be provided with peripheral conductive housing structures and a rear housing wall. The electronic device may have a display mounted to the peripheral conductive housing structures opposite the rear housing wall. The rear housing wall may have a dielectric cover layer and a conductive support plate that extends along the dielectric cover layer. The electronic device may have an antenna that radiates through the dielectric cover layer. The antenna may have a slot antenna resonating element that includes a first slot between the support plate and the peripheral structures and may include a second slot extending from the first slot into the support plate. A conductive interconnect may couple the support plate to the peripheral conductive housing structures at an end of the first slot. The antenna may be fed at a feed protrusion that extends into the second slot.

(21) Appl. No.: **18/477,872**(22) Filed: **Sep. 29, 2023****Publication Classification**(51) **Int. Cl.****H01Q 1/22** (2006.01)**H01Q 1/42** (2006.01)**H01Q 13/10** (2006.01)



US 20250118893A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0118893 A1**

(43) **Pub. Date: Apr. 10, 2025**

(54) **ELECTRONIC DEVICE COMPRISING ANTENNA**

Publication Classification

(51) **Int. Cl.**
H01Q 3/02 (2006.01)
G06F 1/16 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 3/02** (2013.01); **H01Q 1/243** (2013.01); **G06F 1/1641** (2013.01)

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

(72) Inventors: **Pilwon SEO**, Suwon-si (KR); **Seonguk PARK**, Suwon-si (KR); **Seokwoo LEE**, Suwon-si (KR); **Junhee HAN**, Suwon-si (KR); **Jiyoung KIM**, Suwon-si (KR); **Jeongseob KIM**, Suwon-si (KR)

(21) Appl. No.: **18/982,370**

(22) Filed: **Dec. 16, 2024**

Related U.S. Application Data

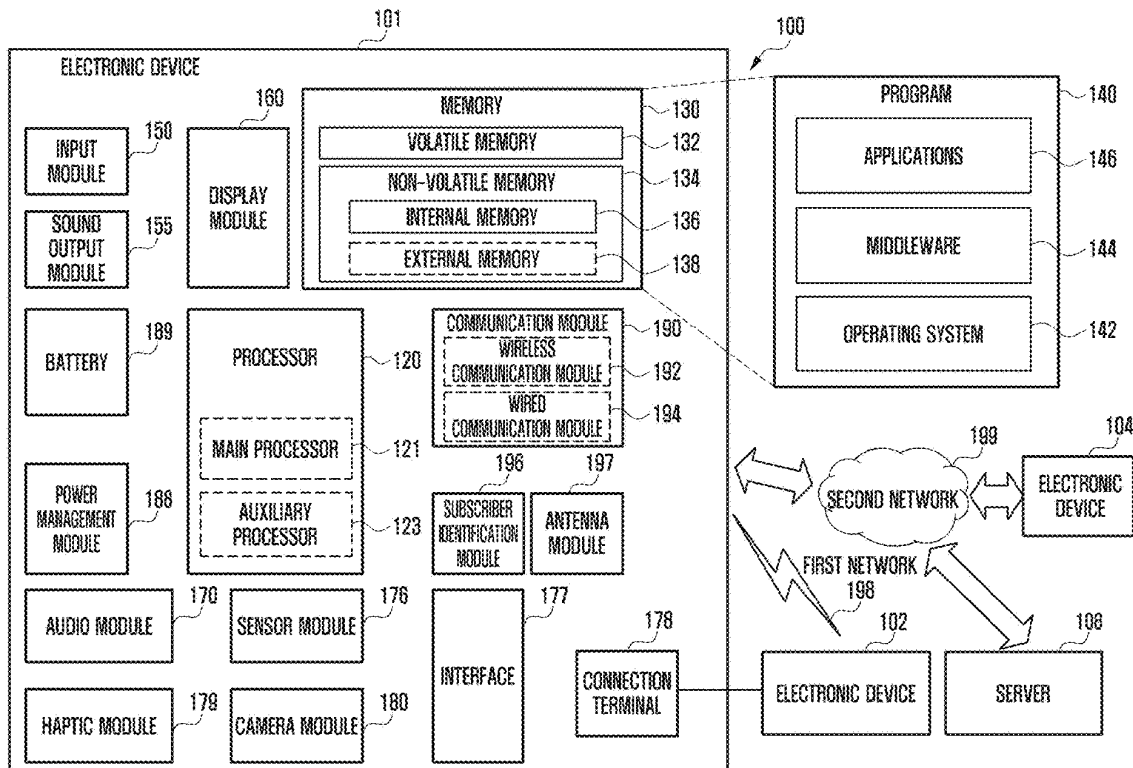
(63) Continuation of application No. PCT/KR2023/008548, filed on Jun. 20, 2023.

(30) **Foreign Application Priority Data**

Jun. 20, 2022 (KR) 10-2022-0075140
Aug. 4, 2022 (KR) 10-2022-0097440

(57) **ABSTRACT**

An electronic is provided. The electronic device includes a first housing, a second housing rotatably connected to the first housing, a display disposed on the front surface of the electronic device and having a partial area configured to be deformed by a rotation of the second housing relative to the first housing, a first antenna module disposed on one of the first housing and the second housing so that a communication signal is radiated in a direction identical to a direction in which the display faces the outside of the electronic device, and a radiation part included in the other or the first housing and the second housing and including an internal space that faces the first antenna module in a state in which the electronic device is folded so that the first housing and the second housing face each other, wherein the first antenna module transmits or receives the communication signal in a designated frequency band through the radiation part.

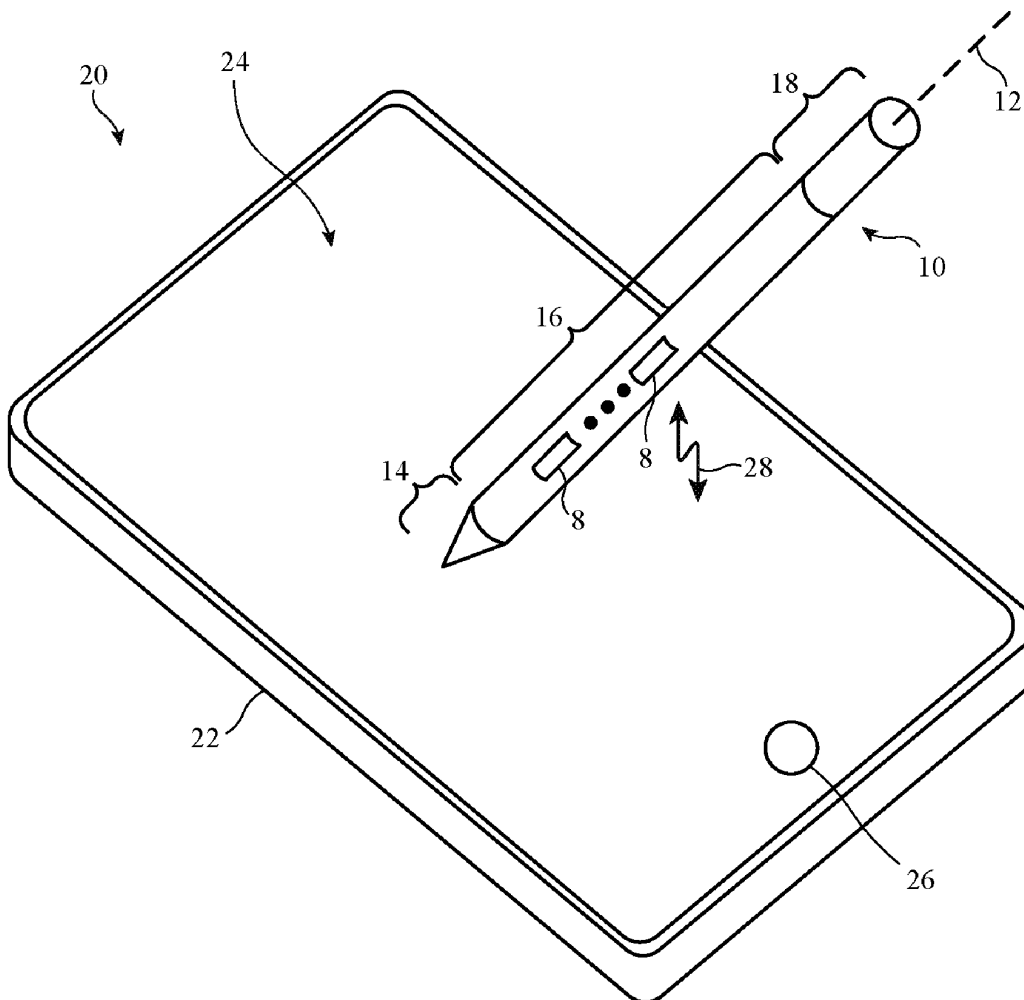




US 20250123697A1

(19) **United States**(12) **Patent Application Publication**
Leung et al.(10) **Pub. No.: US 2025/0123697 A1**(43) **Pub. Date: Apr. 17, 2025**(54) **STYLUS ANTENNA**(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Brandon Y Leung**, San Jose, CA (US);
Zhe Zhang, Santa Clara, CA (US);
Caleb J Flori, Cupertino, CA (US); **Lu Zhang**, Shanghai (CN); **Stephen J Marrone**, San Francisco, CA (US);
Harish Rajagopalan, San Jose, CA (US); **Colin J Abraham**, Mountain View, CA (US); **Kevin Bui**, San Jose, CA (US); **Stephanie Chou**, San Francisco, CA (US)(21) Appl. No.: **18/487,471**(22) Filed: **Oct. 16, 2023****Publication Classification**(51) **Int. Cl.**
G06F 3/0354 (2013.01)
H01Q 1/22 (2006.01)(52) **U.S. Cl.**CPC **G06F 3/03545** (2013.01); **H01Q 1/22** (2013.01)(57) **ABSTRACT**

A computer stylus may have a shaft with a metal tube and a cap slidable between open and closed positions. A connector port may be exposed in the open position and hidden in the closed position. An antenna element may be formed from conductive traces on a printed circuit board in the shaft and aligned with a window in the metal tube. The cap may include a metal hook extending from a conductive wall into the shaft. The hook may overlap the antenna element in the closed position. The shaft may include a dielectric bumper in an opening of the hook. The hook and wall may slide relative to the shaft along the dielectric bumper. The cap may include a metal sleeve around the port. The cap may include a conductive bumper on the wall. The conductive bumper may contact the sleeve when the cap is in the closed position.





US 20250124249A1

(19) **United States**

(12) **Patent Application Publication**
ARAO

(10) **Pub. No.: US 2025/0124249 A1**

(43) **Pub. Date: Apr. 17, 2025**

(54) **ANTENNA PATTERN AND RFID INLAY**

Publication Classification

(71) Applicant: **SATO HOLDINGS KABUSHIKI**
KAISHA, Tokyo (JP)

(51) **Int. Cl.**
G06K 19/077 (2006.01)
H01Q 1/22 (2006.01)

(72) Inventor: **Yuichi ARAO**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **G06K 19/07786** (2013.01); **H01Q 1/2225**
(2013.01)

(73) Assignee: **SATO HOLDINGS KABUSHIKI**
KAISHA, Tokyo (JP)

(57) **ABSTRACT**

(21) Appl. No.: **18/834,909**

An aspect of the present invention is an antenna pattern used in a UHF-band RFID inlay. The antenna pattern includes a first element and a second element. The first element is formed to include a loop portion and an emission portion. The loop portion includes a pair of electric power supply portions. The emission portion is connected to the loop portion, and extends line-symmetrically from the loop portion. The emission portion operates as a dipole antenna to emit a radio wave whose half wavelength is a first length. The second element is formed apart from the first element. The second element operates as a dipole antenna by electromagnetic coupling with the first element to emit a radio wave whose half wavelength is a second length. The second length is different from the first length.

(22) PCT Filed: **Nov. 29, 2022**

(86) PCT No.: **PCT/JP2022/043862**

§ 371 (c)(1),

(2) Date: **Jul. 31, 2024**

(30) **Foreign Application Priority Data**

Feb. 8, 2022 (JP) 2022-018039



US 20250125516A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0125516 A1**

(43) **Pub. Date: Apr. 17, 2025**

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

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

(72) Inventors: **DE-SHAO YAO, HSINCHU (TW);
CHIH-FENG TAI, HSINCHU (TW)**

(21) Appl. No.: **18/650,543**

(22) Filed: **Apr. 30, 2024**

(30) **Foreign Application Priority Data**

Oct. 11, 2023 (TW) 112138655

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/48 (2006.01)
H01Q 5/307 (2015.01)

H01Q 13/10 (2006.01)

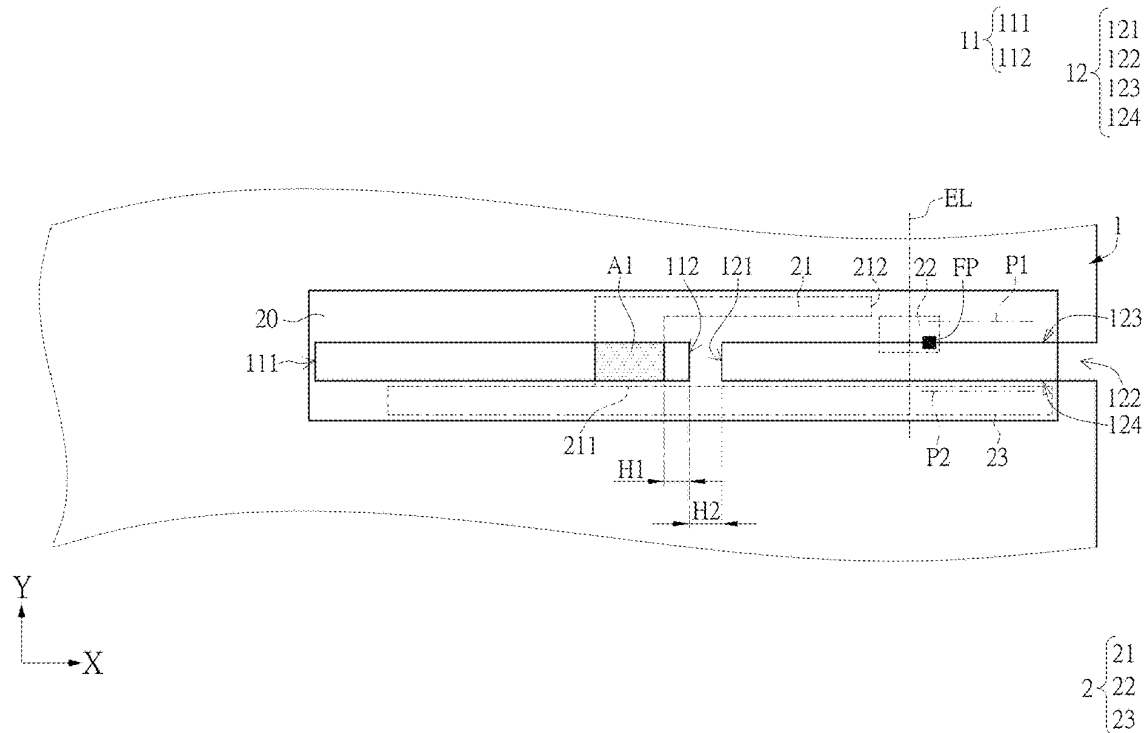
H01Q 21/06 (2006.01)

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

CPC **H01Q 1/2266** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/307** (2015.01); **H01Q**
13/10 (2013.01); **H01Q 21/06** (2013.01)

(57) **ABSTRACT**

An electronic device includes a housing and an antenna structure. The housing includes a first slot and a second slot. The first slot and the second slot extend along a same direction. The first slot has a first closed end and a second closed end. The second slot has a third closed end and an open end. The antenna structure is disposed in the housing. The antenna structure includes a grounding element, a first radiating element, and a second radiating element. The first radiating element has a first end and a second end, the first end is connected to the grounding element, and the second end is located between the third closed end and the open end. An orthogonal projection of the first radiating element that is projected onto the housing overlaps with and crosses on the first slot.





US 20250125538A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0125538 A1**

(43) **Pub. Date: Apr. 17, 2025**

(54) **ELECTRONIC DEVICE INCLUDING ANTENNA**

Publication Classification

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

(72) Inventors: **Jaehoon JO**, Suwon-si (KR); **Hojung NAM**, Suwon-si (KR); **Sungkoo PARK**, Suwon-si (KR); **Kyungjae LEE**, Suwon-si (KR); **Kookjoo LEE**, Suwon-si (KR); **Soonho HWANG**, Suwon-si (KR)

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

(21) Appl. No.: **18/986,127**

(22) Filed: **Dec. 18, 2024**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2024/015429, filed on Oct. 11, 2024.

Foreign Application Priority Data

Oct. 12, 2023 (KR) 10-2023-0135975
Jan. 23, 2024 (KR) 10-2024-0010353

(51) **Int. Cl.**

H01Q 21/06 (2006.01)

H01Q 1/24 (2006.01)

H01Q 1/42 (2006.01)

H05K 1/14 (2006.01)

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

CPC **H01Q 21/064** (2013.01); **H01Q 1/241**

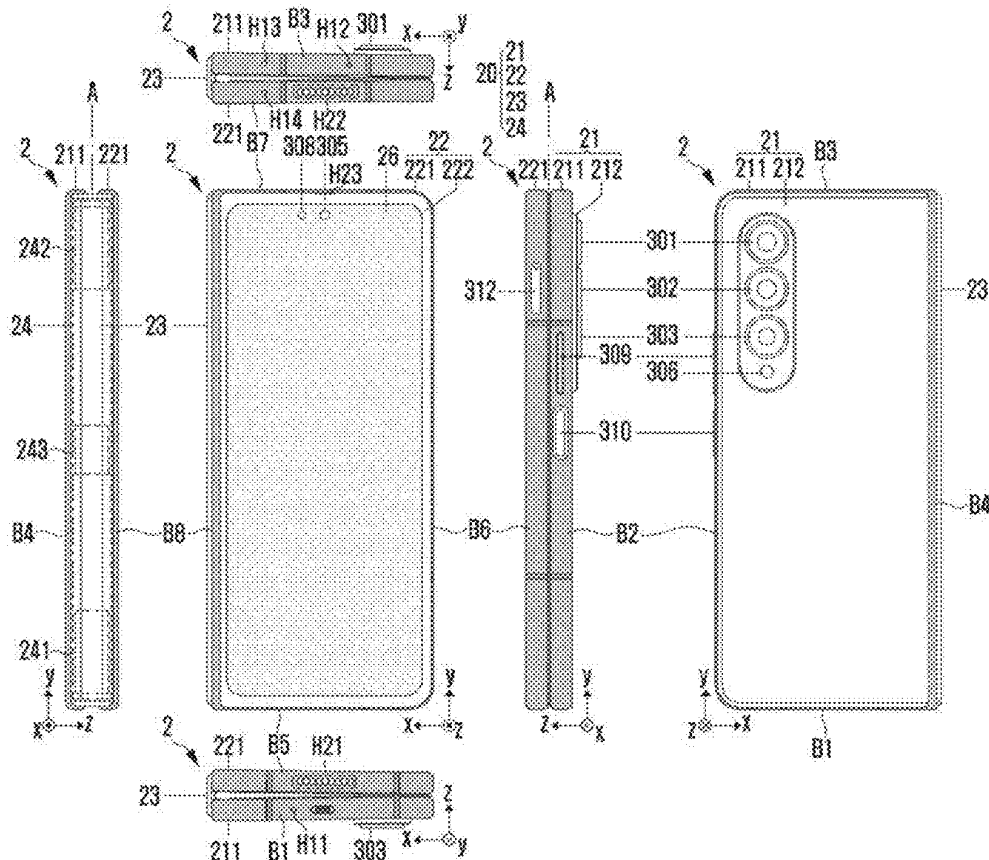
(2013.01); **H01Q 1/42** (2013.01); **H05K 1/147**

(2013.01)

(57)

ABSTRACT

A foldable electronic device includes a first housing including a first rear cover and a first bracket, a second housing including a second rear cover and a second bracket, a hinge module rotatably interconnecting the first housing and the second housing, a hinge cover coupled to the hinge module, and a wireless communication circuit. A first slot is formed in a conductive area of the first bracket. In a direction orthogonal to the first rear cover, at least a portion of the first slot overlaps the hinge cover in an unfolded state of the foldable electronic device. The wireless communication circuit is configured to transmit, receive, or transmit and receive a signal of a predetermined frequency band through the first slot formed in the conductive area of the first bracket.





US 20250132486A1

(19) **United States**

(12) **Patent Application Publication**
PUDENZ

(10) **Pub. No.: US 2025/0132486 A1**

(43) **Pub. Date: Apr. 24, 2025**

(54) **ANTENNA ARRANGEMENT FOR
RECEIVING AND TRANSMITTING
ELECTROMAGNETIC WAVES OF
DIFFERENT POLARIZATION**

(52) **U.S. Cl.**
CPC **H01Q 1/2208** (2013.01); **H01Q 9/0428**
(2013.01); **H01Q 21/24** (2013.01)

(71) Applicant: **SICK AG**, Waldkirch (DE)

(72) Inventor: **Florian PUDENZ**, Hamburg (DE)

(21) Appl. No.: **18/904,524**

(22) Filed: **Oct. 2, 2024**

(30) **Foreign Application Priority Data**

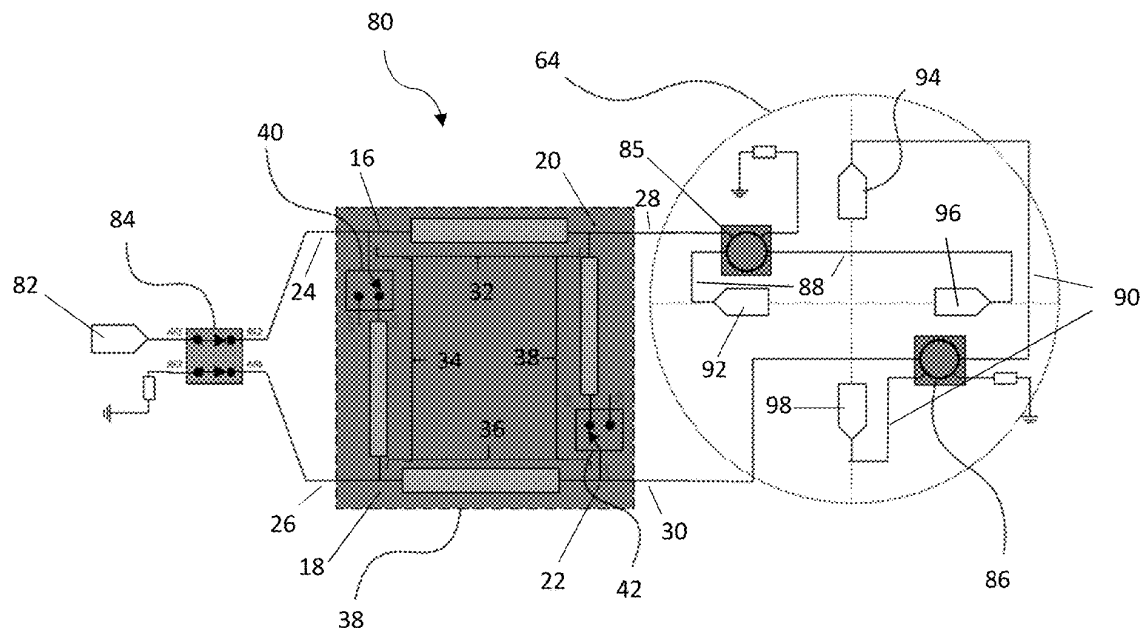
Oct. 18, 2023 (EP) 23204364.6

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 9/04 (2006.01)
H01Q 21/24 (2006.01)

(57) **ABSTRACT**

An antenna arrangement for receiving and transmitting electromagnetic waves of different polarization includes an antenna that has at least two feed points arranged spaced apart. The antenna arrangement includes a signal input for a high-frequency input signal and a coupler circuit coupled to the signal input. The coupler circuit includes a first coupler input connected to a first node; a second coupler input connected to a second node; a first coupler output connected to a third node; and a second coupler output connected to a fourth node. The first and third node are electrically coupled to one another via a first line, the second and fourth node are electrically coupled to one another via a third line, a first switching apparatus can electrically couple the first and second node via a second line and a second switching apparatus can electrically couple the third and fourth node via a fourth line.

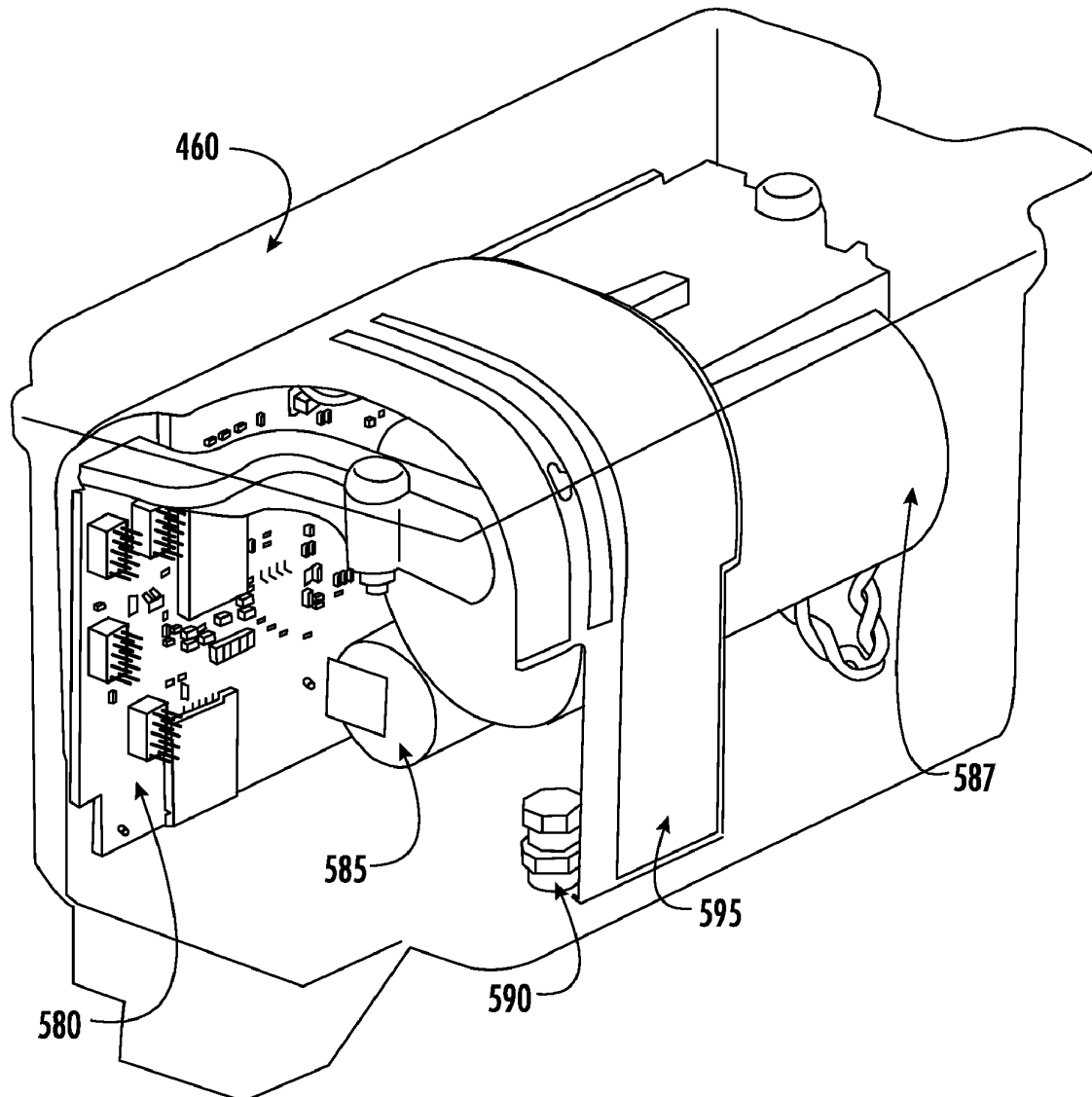




US 20250132487A1

(19) **United States**(12) **Patent Application Publication**
Khan(10) **Pub. No.: US 2025/0132487 A1**(43) **Pub. Date: Apr. 24, 2025**(54) **MULTI-BAND CONFORMAL SLOT**
ANTENNAS AND RELATED DEVICES(52) **U.S. Cl.**
CPC **H01Q 1/2233** (2013.01); **G01D 4/002**
(2013.01); **H01Q 13/10** (2013.01)(71) Applicant: **Sensus Spectrum, LLC**, Morrisville,
NC (US)(72) Inventor: **Zafarullah Khan**, Kenner, LA (US)(57) **ABSTRACT**(21) Appl. No.: **18/492,207**(22) Filed: **Oct. 23, 2023****Publication Classification**(51) **Int. Cl.**
H01Q 1/22 (2006.01)
G01D 4/00 (2006.01)
H01Q 13/10 (2006.01)

A multi-band conformal slot antenna is provided. The multi-band conformal slot antenna includes an antenna ground plane including two or more radiating slots of substantially equal length therein. The antenna ground plane has a length L and a width W of the antenna ground plane. The antenna ground plane includes a flexible material that bends into a form factor that allows the multi-band conformal slot antenna to be positioned in an enclosure that has a length less than the length L of the antenna ground plane.





US 20250132488A1

(19) **United States**(12) **Patent Application Publication**
CHANG et al.(10) **Pub. No.: US 2025/0132488 A1**(43) **Pub. Date: Apr. 24, 2025**(54) **ELECTRONIC DEVICE AND ANTENNA
STRUCTURE**(52) **U.S. Cl.**CPC **H01Q 1/2266** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 5/307** (2015.01)(71) Applicant: **WISTRON NEWEB
CORPORATION, HSINCHU (TW)**(72) Inventors: **CHIA-HAO CHANG, HSINCHU**
(TW); **CHUNG-CHE LIEN,**
HSINCHU (TW); TING-HAN SHIH,
HSINCHU (TW); TZU-KUAN SUN,
HSINCHU (TW)

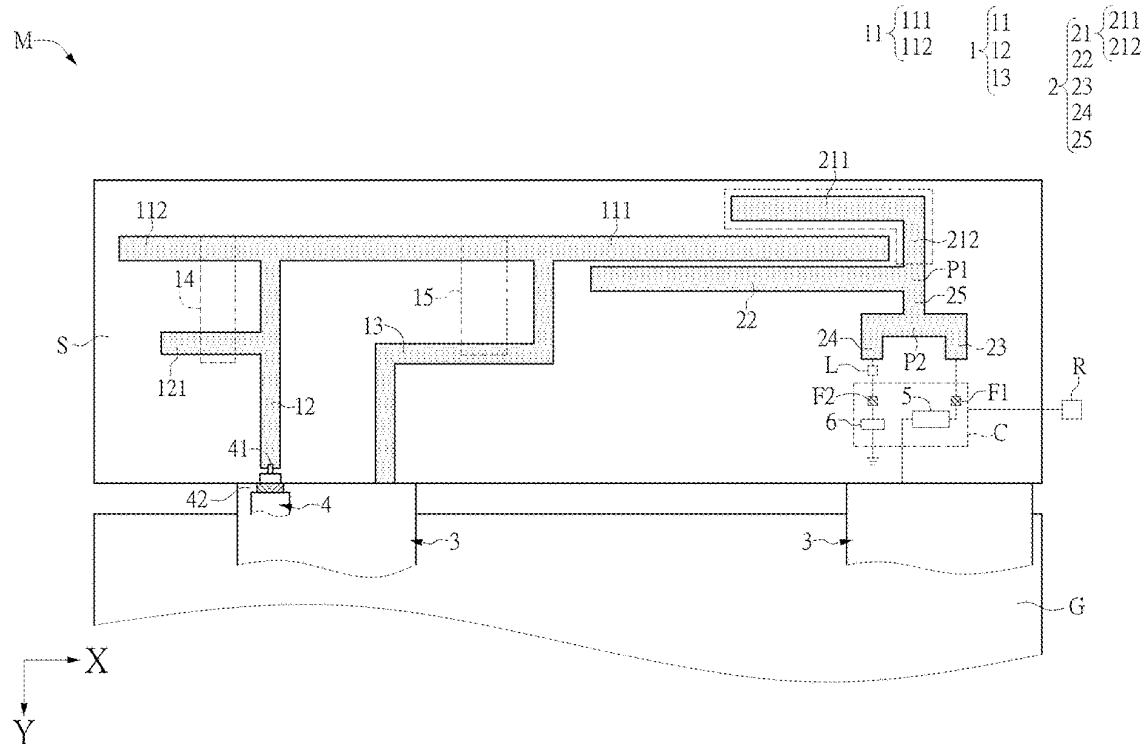
(57)

ABSTRACT

An electronic device and an antenna structure are provided. The electronic device includes a housing and an antenna structure which includes a first radiating element with a first radiating part, a feed part, and a grounding part, a second radiating element with five branches, a grounding element connected to the grounding part, a feed element connected to the feed part, a switching circuit electrically connected to the third branch, and a proximity sensing circuit electrically connected to the fourth branch. The first branch and the second branch intersect at a first branching point, the third branch and the fourth branch intersect at a second branching point. The fifth branch is connected between the first branching point and the second branching point. The first radiating part extends between the first branch and the second branch so the first radiating part and the second radiating element couple with each other.

(21) Appl. No.: **18/916,886**(22) Filed: **Oct. 16, 2024**(30) **Foreign Application Priority Data**

Oct. 19, 2023 (TW) 112139871

Publication Classification(51) **Int. Cl.****H01Q 1/22** (2006.01)**H01Q 1/48** (2006.01)**H01Q 5/307** (2015.01)



US 20250132505A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0132505 A1**

(43) **Pub. Date: Apr. 24, 2025**

(54) **WIDEBAND DUAL-POLARIZED ANTENNA
ELEMENT AND INTERLEAVED ANTENNA
ARRAY**

(71) Applicant: **QUALCOMM Incorporated**, San
Diego, CA (US)

(72) Inventors: **Prasidh RAMABADRAN**, Bangalore
(IN); **Sunil KUMAR**, Bangalore (IN);
Madhav VENKATESWARAN,
Hyderabad (IN)

(21) Appl. No.: **18/490,283**

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

Publication Classification

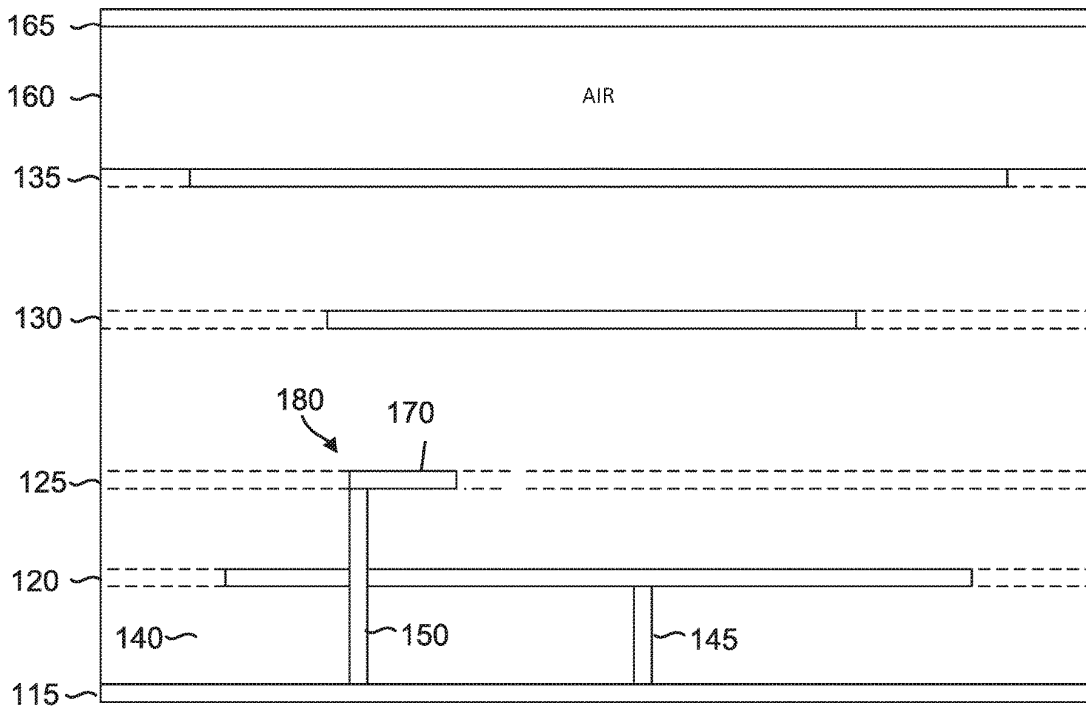
(51) **Int. Cl.**
H01Q 21/06 (2006.01)
H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 21/065** (2013.01); **H01Q 9/0407**
(2013.01)

(57) **ABSTRACT**

A multi-band antenna element is provided with a stacked pair of a first low-band patch antenna element and a second low-band patch antenna element and also a high-band patch antenna element for operation across both a low band and a high band. An L-shaped probe in the multi-band antenna is configured to parasitically excite the high-band patch antenna element. A linear slot in the second low-band patch antenna element is configured to resonant in the high band.

100





US 20250132506A1

(19) **United States**

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

(10) **Pub. No.: US 2025/0132506 A1**

(43) **Pub. Date: Apr. 24, 2025**

(54) **ANTENNA DEVICE**

Publication Classification

(71) Applicant: **YOKOWO CO., LTD.**, Tokyo (JP)

(51) **Int. Cl.**
H01Q 21/24 (2006.01)
H01Q 9/16 (2006.01)

(72) Inventors: **Takeshi SAMPO**, Tomioka-shi (JP);
Takayuki SONE, Tomioka-shi (JP)

(52) **U.S. Cl.**
CPC **H01Q 21/24** (2013.01); **H01Q 9/16**
(2013.01)

(73) Assignee: **YOKOWO CO., LTD.**, Tokyo (JP)

(21) Appl. No.: **18/973,112**

(22) Filed: **Dec. 9, 2024**

(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation of application No. 18/512,703, filed on Nov. 17, 2023, now Pat. No. 12,206,178, which is a continuation of application No. 18/092,950, filed on Jan. 4, 2023, now Pat. No. 11,862,859, which is a continuation of application No. 17/163,691, filed on Feb. 1, 2021, now Pat. No. 11,581,659, which is a continuation of application No. PCT/JP2019/029899, filed on Jul. 30, 2019.

Foreign Application Priority Data

(30) Jul. 31, 2018 (JP) 2018-143828

An antenna device includes: a pair of first elements that are arranged on a first plane; and a pair of second elements that are arranged on a second plane parallel to the first plane such that a polarized wave direction of the pair of second elements is orthogonal to that of the pair of first elements. Each element of the pair of first elements and the pair of second elements includes a portion that acts as a self-similarity antenna or an antenna that acts based on similar operating principle to the self-similarity antenna. In one embodiment, each element of the pair of first elements and the pair of second elements includes two arms that extend in a direction away from each other from a proximal end portion to which a feed point is connectable.

