



US 20160028150A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0028150 A1**

(43) **Pub. Date: Jan. 28, 2016**

(54) **ELECTRONIC DEVICE**

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

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

CPC **H01Q 1/243** (2013.01); **H01Q 1/48** (2013.01); **H01Q 5/10** (2015.01)

(72) Inventors: **Ming-Yu Chou**, New Taipei City (TW);
Ching-Chi Lin, New Taipei City (TW);
Kun-Sheng Chang, New Taipei City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **14/501,047**

(22) Filed: **Sep. 30, 2014**

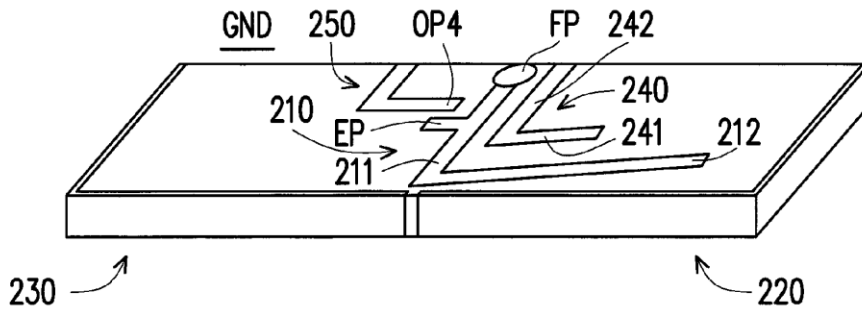
(30) **Foreign Application Priority Data**

Jul. 22, 2014 (TW) 103125085

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/10 (2006.01)
H01Q 1/48 (2006.01)

An electronic device having a radiation part and a metallic frame is provided. The radiation part is L-shaped, and includes a feeding branch and an open branch. The metallic frame includes a first metallic part and a second metallic part. The first metallic part is L-shaped, wherein a first side of the first metallic part is near the open branch of the radiation part, and a first gap exists therebetween. The second metallic part is L-shaped, wherein an open terminal of a first side of the second metallic part is aligned with an open terminal of the first side of the first metallic part, and a second gap exists therebetween. The radiation part and the metallic frame forms an antenna to transceive a plurality of radio frequency signals.





US 20160028157A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0028157 A1**

(43) **Pub. Date: Jan. 28, 2016**

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

Publication Classification

(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)
(72) Inventors: **Jong Suk KIM**, Gyeonggi-do (KR); **Jin Kyu BANG**, Gyeonggi-do (KR); **Kyung Bae KO**, Gyeonggi-do (KR); **Dong Hwan KIM**, Gyeonggi-do (KR)

(51) **Int. Cl.**
H01Q 5/35 (2006.01)
H01Q 5/371 (2006.01)
H01Q 5/335 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 5/35** (2015.01); **H01Q 5/335** (2015.01); **H01Q 5/371** (2015.01)

(73) Assignee: **Samsung Electronics Co., Ltd.**

(57) **ABSTRACT**

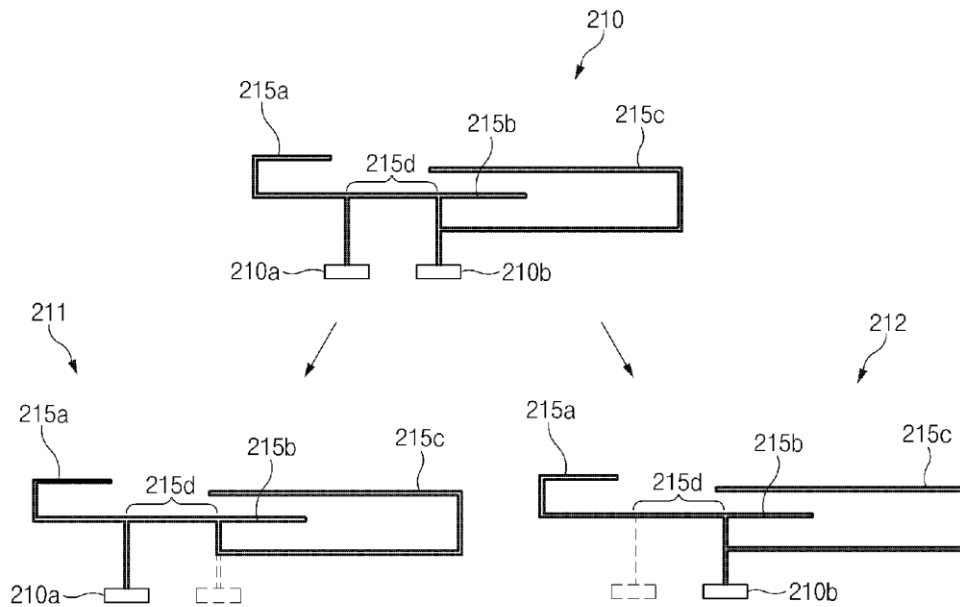
A multi-band antenna is provided. The multi-band antenna includes a plurality of radiator patterns that are configured to operate according to different frequency bands, a plurality of feeding units that are respectively connected to different contact points of the antenna radiator for connecting feeding units of the plurality of feeding units to at least one radiator pattern included in the plurality of radiator patterns, and a switching unit configured to switch between feeding units of the plurality of feeding units for connecting at least one radiator pattern included in the plurality of radiator patterns to the switched feeding unit.

(21) Appl. No.: **14/808,667**

(22) Filed: **Jul. 24, 2015**

(30) **Foreign Application Priority Data**

Jul. 24, 2014 (KR) 10-2014-0094171





US 20160029507A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0029507 A1**

(43) **Pub. Date: Jan. 28, 2016**

(54) **ELECTRONIC APPARATUS**

Publication Classification

(71) Applicant: **Kabushiki Kaisha Toshiba**, Tokyo (JP)

(51) **Int. Cl.**
H05K 7/14 (2006.01)
H05K 1/18 (2006.01)
H05K 5/00 (2006.01)

(72) Inventors: **Ippei Kashiwagi**, Ome Tokyo (JP);
Shuichi Sekine, Hachioji Tokyo (JP)

(52) **U.S. Cl.**
CPC **H05K 7/1427** (2013.01); **H05K 5/0017**
(2013.01); **H05K 5/0086** (2013.01); **H05K**
1/181 (2013.01); **H05K 2201/10098** (2013.01)

(21) Appl. No.: **14/660,680**

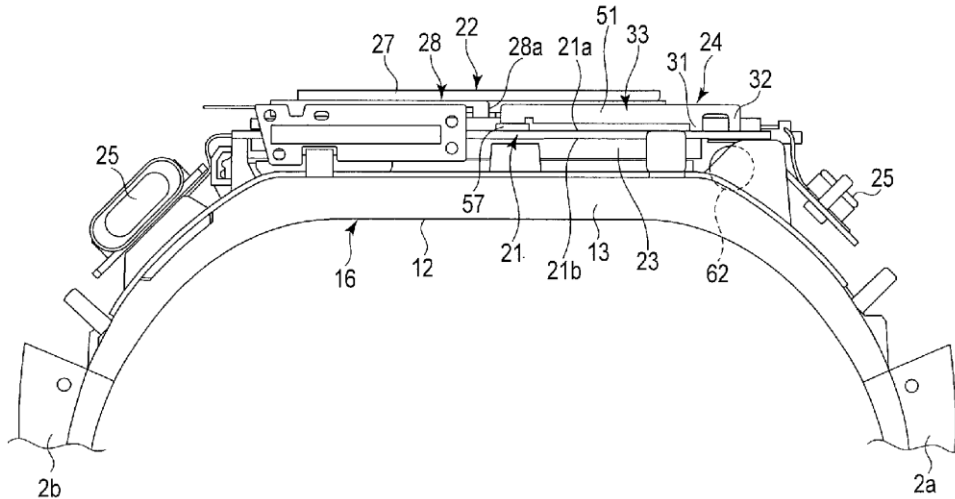
(57) **ABSTRACT**

(22) Filed: **Mar. 17, 2015**

According to one embodiment, an electronic apparatus includes a housing, a circuit board in the housing, and an antenna. The housing includes a wearable surface to contact with a body part of a person. The antenna includes a feed portion and an element portion, the element portion having a shape of a plate raised with respect to the wearable surface, and extending from a distal end of the feeding portion along an end portion of the circuit board.

Related U.S. Application Data

(60) Provisional application No. 62/029,846, filed on Jul. 28, 2014.





US 20160036120A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0036120 A1**

(43) **Pub. Date: Feb. 4, 2016**

(54) **ANTENNA FOR DEVICE HAVING CONDUCTING CASING**

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

(71) Applicant: **Suunto Oy**, Vantaa (FI)

(57) **ABSTRACT**

(72) Inventors: **Mikko Sepänniitty**, Vantaa (FI); **Heikki Puuri**, Vantaa (FI); **Ville Mattila**, Vantaa (FI); **Panu Perko**, Vantaa (FI); **Pertti Nissinen**, Vantaa (FI)

The invention concerns an electronic device for personal use and a coupled antenna apparatus for such a device, comprising a top cover and a housing with an opposing back cover configured to form a closed space between said top and back cover that is adapted to receive electronic circuitry and a display unit. A bezel made of a conductive material is forming a rim on top of said housing and is interfacing with the top cover. According to the invention, an elongate strip of a conductive material deposited on a first side of an elongate antenna feed element and is forming a first radiating element and a second elongate strip of a conductive material deposited on a second side of the antenna feed element is forming a second radiating element, whereby the first and second radiating elements are positioned in proximity against the bezel at at least one inner wall portion of the bezel that extends in a direction between the first and second radiating elements and the display unit. The first and second radiating elements are functionally coupled to said bezel to form an antenna system of said electronic device.

(21) Appl. No.: **14/882,487**

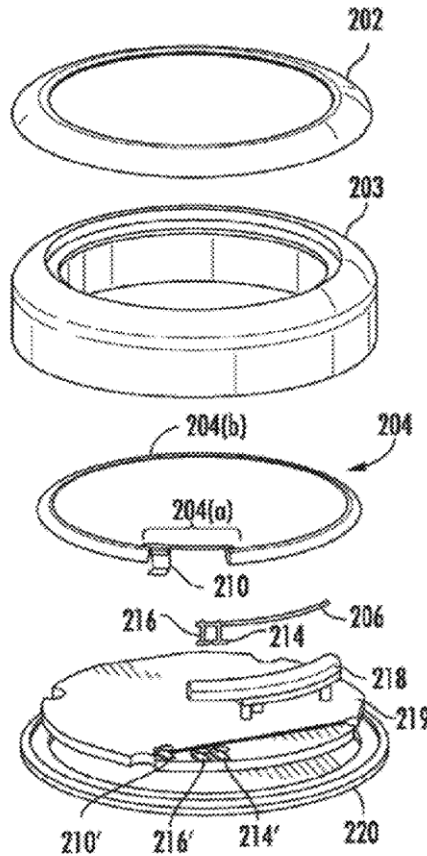
(22) Filed: **Oct. 14, 2015**

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/195,670, filed on Mar. 3, 2014, which is a continuation-in-part of application No. 13/794,468, filed on Mar. 11, 2013.

Publication Classification

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





US 20160036127A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0036127 A1**

(43) **Pub. Date: Feb. 4, 2016**

(54) **RECONFIGURABLE MULTI-MODE ACTIVE ANTENNA SYSTEM**

Publication Classification

(71) Applicant: **ETHERTRONICS, INC.**, San Diego, CA (US)

(51) **Int. Cl.**
H01Q 5/364 (2006.01)
H01Q 5/335 (2006.01)

(72) Inventors: **Laurent DESCLOS**, San Diego, CA (US); **Chun-Su YOON**, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC **H01Q 5/364** (2015.01); **H01Q 5/335** (2015.01)

(73) Assignee: **ETHERTRONICS, INC.**, San Diego, CA (US)

(57) **ABSTRACT**

(21) Appl. No.: **14/781,889**

(22) PCT Filed: **Mar. 19, 2014**

(86) PCT No.: **PCT/US2014/031151**

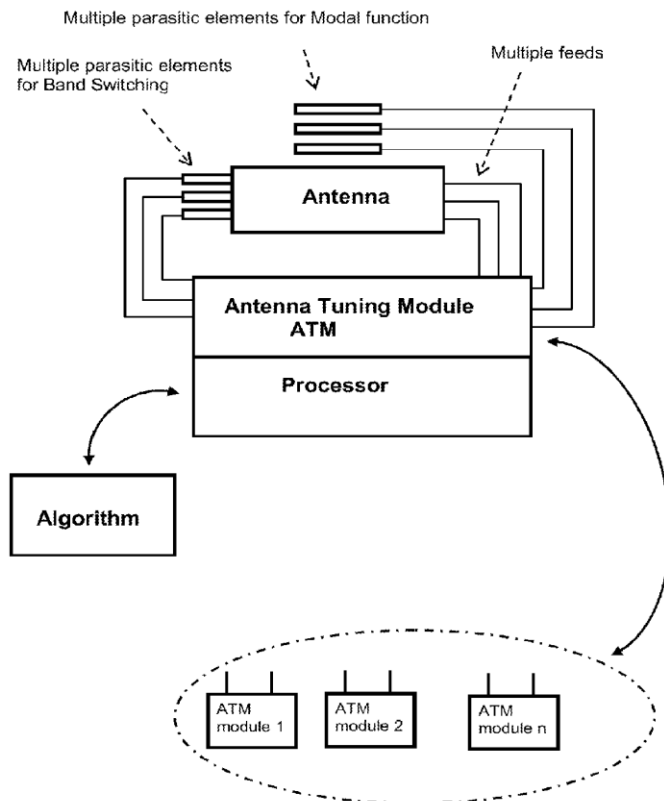
§ 371 (c)(1),

(2) Date: **Oct. 1, 2015**

Related U.S. Application Data

(60) Provisional application No. 61/806,939, filed on Apr. 1, 2013.

A reconfigurable antenna system is described which combines active and passive components used to impedance match, alter the frequency response, and change the radiation pattern of an antenna. Re-use of components such as switches and tunable capacitors make the circuit topologies more space and cost effective, while reducing complexity of the control signaling required. Antenna structures with single and multiple feed and/or ground connections are described and active circuit topologies are shown for these configurations. A processor and algorithm can reside with the antenna circuitry, or the algorithm to control antenna optimization can be implemented in a processor in the host device.





US 20160036129A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0036129 A1**

(43) **Pub. Date: Feb. 4, 2016**

(54) **PLANAR INVERTED-F ANTENNA**

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

CPC . **H01Q 9/045** (2013.01); **H01Q 1/48** (2013.01)

(71) Applicant: **FOXCONN INTERCONNECT TECHNOLOGY LIMITED**, Grand Cayman (KY)

(57)

ABSTRACT

(72) Inventors: **TZU-YAO HWANG**, New Taipei (TW); **LUNG-SHENG TAI**, New Taipei (TW)

A planar inverted-F antenna includes an antenna body including a grounding portion, a first and a second radiating arm extending in a lengthwise direction substantially, a coaxial cable and a metal foil attached the grounding portion. The first radiating arm and the second radiating arm extend in opposite directions from a joint point thereof, the joint point and the grounding portion connect with each other by a connecting portion. A first slot is defined between the first radiating arm and the grounding arm, a second slot is defined between the second radiating arm and the grounding portion. A coaxial cable includes a core soldered to the joint point and a shielding layer soldered to the grounding portion. The metal foil covers a most portion of the grounding portion, thereby exposes a first end of the grounding portion near to the first radiating arm to an exterior.

(21) Appl. No.: **14/810,725**

(22) Filed: **Jul. 28, 2015**

(30) **Foreign Application Priority Data**

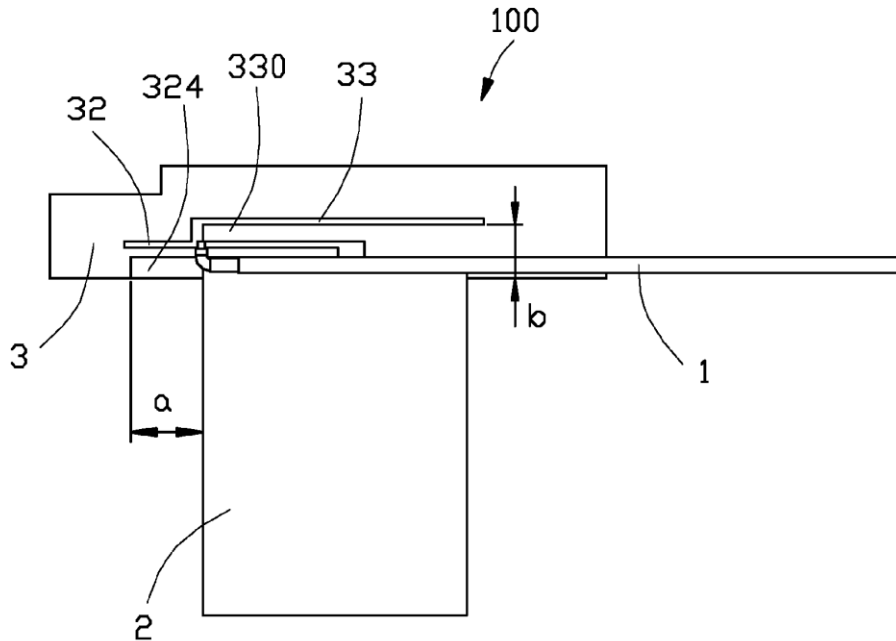
Jul. 30, 2014 (TW) 103213468

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 1/48 (2006.01)





US 20160043459A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0043459 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **SPRING ANTENNA STRUCTURE**

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

CPC . **H01Q 1/20** (2013.01); **H01Q 1/36** (2013.01);
H01Q 1/48 (2013.01)

(71) Applicant: **AUDEN TECHNO CORP.**, TAOYUAN COUNTY (TW)

(72) Inventors: **SHIH-CHI LAI**, MIAOLI COUNTY (TW); **YING-HWEI LI**, MIAOLI COUNTY (TW); **WEI-SHUAI LIN**, TAOYUAN COUNTY (TW)

(57)

ABSTRACT

A spring antenna structure integrally formed by bending a metallic sheet includes a supporting portion, a grounding radiating portion, and an antenna radiating portion. Two opposite ends of the supporting portion are respectively connected to the grounding and antenna radiating portion. The grounding and antenna radiating portion are formed by bending the supporting portion in a rotating direction. A first angle (θ_1) is defined between the grounding radiating portion and the supporting portion, and a second angle (θ_2) is defined between the antenna radiating portion and the supporting portion. $0^\circ < \theta_1 < 90^\circ$ and $0^\circ < \theta_2 < \theta_1 + 90^\circ$. When the spring antenna structure is pressed and deformed by an external force, the spring antenna structure generates a returning force for returning to the original shape.

(21) Appl. No.: **14/456,030**

(22) Filed: **Aug. 11, 2014**

Publication Classification

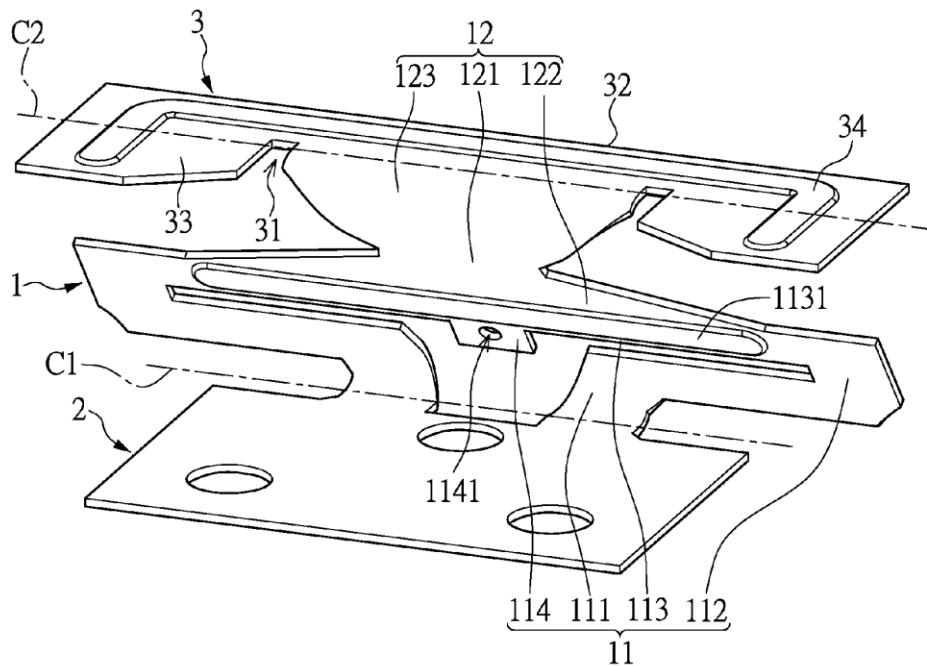
(51) **Int. Cl.**

H01Q 1/20 (2006.01)

H01Q 1/48 (2006.01)

H01Q 1/36 (2006.01)

100





US 20160043463A1

(19) **United States**

(12) **Patent Application Publication**
NAKAGAWA

(10) **Pub. No.: US 2016/0043463 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **WIRELESS COMMUNICATION DEVICE**

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

(72) Inventor: **Masashi NAKAGAWA**, Tokyo (JP)

(21) Appl. No.: **14/812,450**

(22) Filed: **Jul. 29, 2015**

(30) **Foreign Application Priority Data**

Aug. 6, 2014 (JP) 2014-160517

Publication Classification

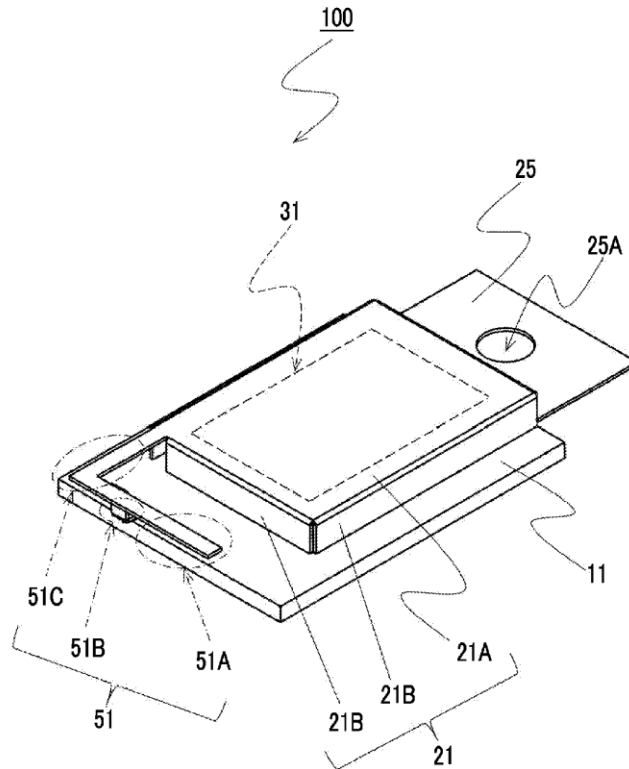
(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 9/04 (2006.01)

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

CPC ... **H01Q 1/38** (2013.01); **H01Q 9/04** (2013.01)

(57) **ABSTRACT**

A wireless communication device includes a circuit board having a pattern formed on a surface thereof, a wireless communication main body configured to perform wireless communication, a shield cover configured to cover and shield the wireless communication main body arranged on the one surface of the circuit board, and an antenna connected to the wireless communication main body, in which the shield cover and the antenna include one metal plate, an attachment portion for attachment to a product, the antenna is an inverted F-antenna including an antenna main body, a feed portion, and a short-circuit portion, the short-circuit portion provided on one end side of the antenna and a top plate portion of the shield cover facing the wireless communication main body are connected by a short-circuit plate portion, and the feed portion is connected to a feed land formed on the surface of the circuit board.





US 20160043467A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0043467 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **ANTENNA WITH MULTIPLE COUPLED REGIONS**

continuation of application No. 12/894,052, filed on Sep. 29, 2010, now Pat. No. 8,077,116, which is a continuation of application No. 11/841,207, filed on Aug. 20, 2007, now Pat. No. 7,830,320.

(71) Applicant: **ETHERTRONICS, INC.**, San Diego, CA (US)

Publication Classification

(72) Inventors: **Laurent Desclos**, San Diego, CA (US); **Chew Chwee Heng**, Singapore (SG); **Sebastian Rowson**, San Diego, CA (US); **Jeffrey Shamblin**, San Diego, CA (US)

(51) **Int. Cl.**
H01Q 5/328 (2006.01)
H01Q 5/385 (2006.01)

(73) Assignee: **ETHERTRONICS, INC.**, San Diego, CA (US)

(52) **U.S. Cl.**
CPC **H01Q 5/328** (2015.01); **H01Q 5/385** (2015.01)

(21) Appl. No.: **14/885,981**

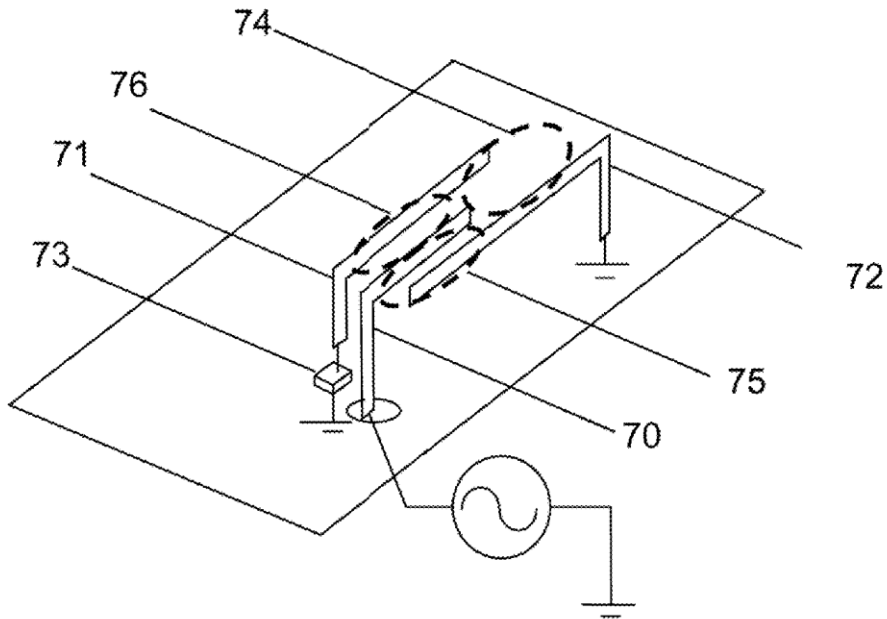
(57) **ABSTRACT**

(22) Filed: **Oct. 16, 2015**

A device includes a plurality of antennas, including one or more active antennas, the antennas being configured in one of a plurality of possible configurations to achieve operation in WAN, LTE, WiFi, or WiMax bands, or a combination thereof. In some embodiments, a passive antenna is utilized with lumped loading to fix the antenna tuning state. A primary and auxiliary radiator can be included in the device and configured for WAN/LTE bands, while additional antennas can be incorporated for WiFi and WiMax bands. Various antenna configurations incorporate the antenna having multiple coupled regions.

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/767,854, filed on Feb. 14, 2013, now Pat. No. 9,190,733, which is a continuation of application No. 12/536,419, filed on Aug. 5, 2009, now abandoned, which is a continuation-in-part of application No. 13/289,901, filed on Nov. 4, 2011, now Pat. No. 8,717,241, which is a





US 20160043468A1

(19) **United States**

(12) **Patent Application Publication**
ONAKA

(10) **Pub. No.: US 2016/0043468 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **ANTENNA DEVICE**

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

CPC **H01Q 5/328** (2015.01); **H03H 7/40** (2013.01)

(71) Applicant: **Murata Manufacturing Co., Ltd.**,
Nagaokakyo-shi (JP)

(72) Inventor: **Kengo ONAKA**, Nagaokakyo-shi (JP)

(57)

ABSTRACT

(21) Appl. No.: **14/887,411**

(22) Filed: **Oct. 20, 2015**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2014/055350,
filed on Mar. 4, 2014.

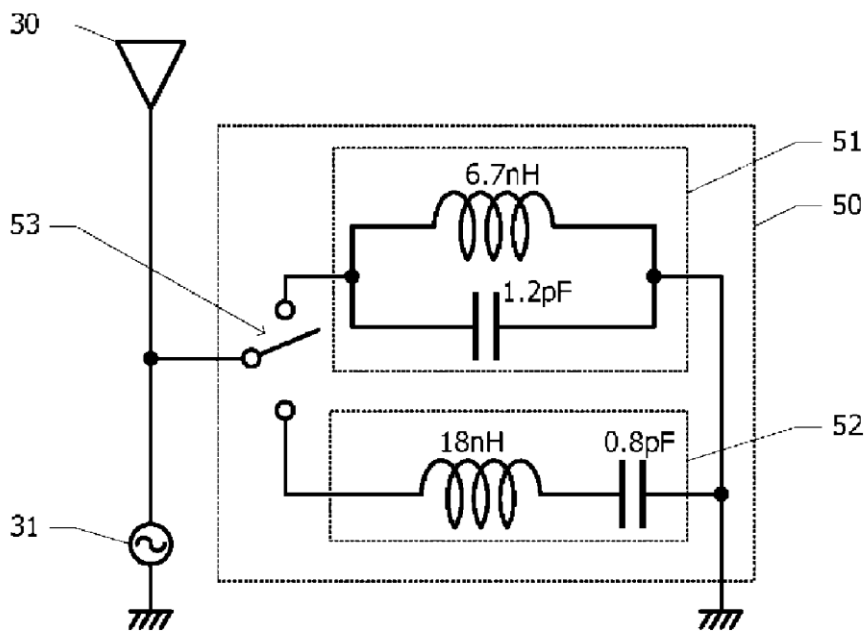
(30) **Foreign Application Priority Data**

May 10, 2013 (JP) 2013-100156

Publication Classification

(51) **Int. Cl.**
H01Q 5/328 (2006.01)
H03H 7/40 (2006.01)

A variable resonant circuit is inserted between a feeding point of a radiating element and a ground conductor. When the variable resonant circuit is not inserted, an input impedance of the radiating element is lower than about 50Ω and capacitive in a first low frequency band, lower than about 50Ω and inductive in a second low frequency band, and close to about 50Ω in a high frequency band. When the variable resonant circuit exhibits a first resonance characteristic, the variable resonant circuit is inductive in the first low frequency band, and its impedance in the high frequency band is higher than that in the first low frequency band. When the variable resonant circuit exhibits a second resonance characteristic, the variable resonant circuit is capacitive in the second low frequency band, and its impedance in the high frequency band is higher than that in the second low frequency band.





US 20160043470A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0043470 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **ANTENNA DEVICE**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 21/24 (2006.01)
H01Q 3/24 (2006.01)

(72) Inventors: **Seung-Tae KO**, Bucheon-si (KR);
Yoon-Geon KIM, Busan (KR);
Kwang-Hyun BAEK, Anseong-si (KR);
Won-Bin HONG, Seoul (KR)

(52) **U.S. Cl.**
CPC *H01Q 9/045* (2013.01); *H01Q 3/24*
(2013.01); *H01Q 21/24* (2013.01)

(21) Appl. No.: **14/819,005**

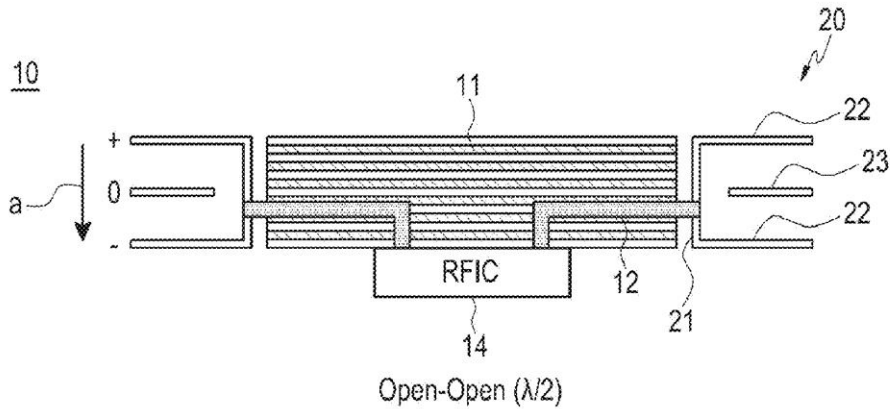
(57) **ABSTRACT**

(22) Filed: **Aug. 5, 2015**

According to various embodiments, an antenna device may include: a board unit; a power feeding unit provided in the board unit; and radiation units connected to the power feeding unit to be fed with a power feeding signal. The radiation units may be provided to face each other within a width of the board unit along a periphery of the board unit. The device as described above may be implemented more variously according to embodiments.

(30) **Foreign Application Priority Data**

Aug. 5, 2014 (KR) 10-2014-0100691





US 20160043477A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0043477 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **MULTIMODE ANTENNA STRUCTURE**

Publication Classification

(71) Applicant: **Skycross, Inc.**, San Jose, CA (US)

(51) **Int. Cl.**
H01Q 21/28 (2006.01)

(72) Inventors: **Mark T. Montgomery**, Melbourne Beach, FL (US); **Mark W. Kishler**, Rockledge, FL (US); **Li Chen**, Melbourne, FL (US)

H01Q 1/48 (2006.01)

(52) **U.S. Cl.**
CPC . **H01Q 21/28** (2013.01); **H01Q 1/48** (2013.01)

(21) Appl. No.: **14/918,895**

(57) **ABSTRACT**

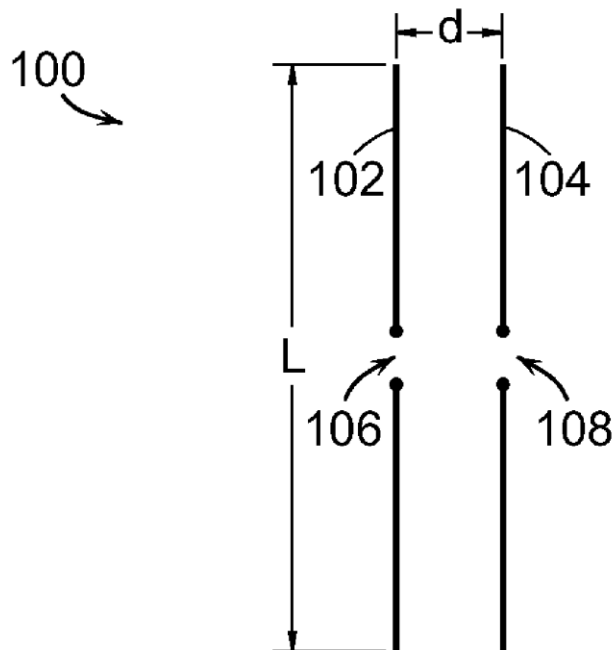
(22) Filed: **Oct. 21, 2015**

A multimode antenna structure is provided for transmitting and receiving electromagnetic signals in a communication device. The antenna structure includes a plurality of antenna ports for coupling to the circuitry; a plurality of antenna elements, each operatively coupled to a different one of the antenna ports; and a plurality of connecting elements. The connecting elements each electrically connect neighboring antenna elements such that the antenna elements and the connecting elements are arranged about the periphery of the antenna structure and form a single radiating structure. Electrical currents on one antenna element flow to connected neighboring antenna elements and generally bypass the antenna ports coupled to the neighboring antenna elements such that an antenna mode excited by one antenna port is generally electrically isolated from a mode excited by another antenna port at a given desired signal frequency range, and the antenna structure generates diverse antenna patterns.

Related U.S. Application Data

(63) Continuation of application No. 14/450,365, filed on Aug. 4, 2014, now Pat. No. 9,190,726, which is a continuation of application No. 12/727,531, filed on Mar. 19, 2010, now Pat. No. 8,866,691, which is a continuation-in-part of application No. 12/099,320, filed on Apr. 8, 2008, now Pat. No. 7,688,273, which is a continuation-in-part of application No. 11/769,565, filed on Jun. 27, 2007, now Pat. No. 7,688,275.

(60) Provisional application No. 61/161,669, filed on Mar. 19, 2009, provisional application No. 60/925,394, filed on Apr. 20, 2007, provisional application No. 60/916,655, filed on May 8, 2007.





US 20160044818A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0044818 A1**

(43) **Pub. Date: Feb. 11, 2016**

(54) **SYSTEMS AND METHODS FOR GROUNDING OF AN ANTENNA CABLE IN AN INFORMATION HANDLING SYSTEM**

(52) **U.S. Cl.**
CPC **H05K 7/1405** (2013.01)

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

(72) Inventors: **Benny Bologna**, Austin, TX (US);
Andrew Thomas Sultenfuss, Leander, TX (US);
Sinem Koçkan, Austin, TX (US);
Jason Morrison, Cedar Park, TX (US)

(57) **ABSTRACT**

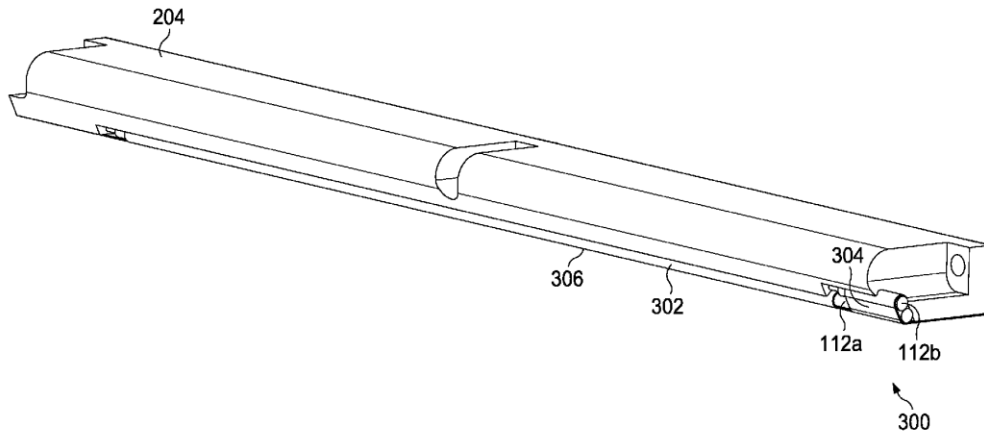
An information handling system may include a first member, a second member hingedly coupled to the first member via a hinge, a coaxial cable, and a grounding jacket. The coaxial cable may have a ground sheath and a signal wire internal to the ground sheath, wherein an axis of the signal wire is substantially parallel to a rotational axis of the hinge and wherein the coaxial cable comprises an exposed portion in which the ground sheath is exposed externally to the coaxial cable. The grounding jacket may be mechanically coupled to the first member and the second member, wherein the grounding jacket may be configured to mechanically support the coaxial cable and electrically couple to an electrically conductive portion of at least one of the first member and the second member and to the ground sheath at the exposed portion in order to create an electrically conductive path between the ground sheath and the electrically conductive portion via the grounding jacket.

(21) Appl. No.: **14/454,397**

(22) Filed: **Aug. 7, 2014**

Publication Classification

(51) **Int. Cl.**
H05K 7/14 (2006.01)





US 20160049719A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0049719 A1**

(43) **Pub. Date: Feb. 18, 2016**

(54) **WIRELESS COMMUNICATION DEVICE**

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

CPC . **H01Q 1/24** (2013.01); **H01Q 5/10** (2015.01);
H01Q 13/106 (2013.01)

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

(72) Inventors: **Kuan-Hsueh Tseng**, Hsinchu (TW);
Chung-Hsuan Chen, Hsinchu (TW)

(57) **ABSTRACT**

(21) Appl. No.: **14/700,168**

(22) Filed: **Apr. 30, 2015**

A wireless communication device includes a metal frame, a mechanical part on which a ground is formed for providing grounding, and at least one antenna, wherein each one of the at least one antenna includes a radiator, a feed terminal electrically connected to the radiator, disposed adjacent to the metal frame and for feeding a radio-frequency signal, a first ground terminal disposed at a first side of the feed terminal for electrically connecting the metal frame with the ground of the mechanical part, and a second ground terminal disposed at a second side of the feed terminal for electrically connecting the metal frame with the ground of the mechanical part, wherein an area enclosed by the metal frame, the mechanical part and the first and second ground terminals forms a first slot.

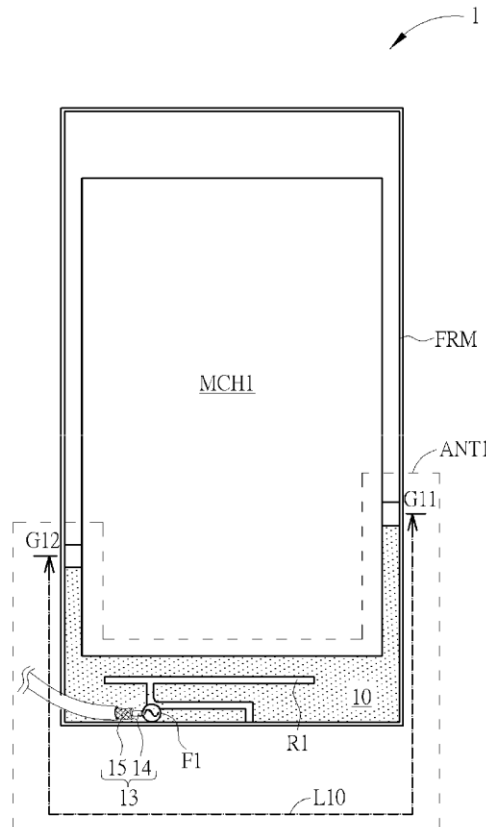
(30) **Foreign Application Priority Data**

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Publication Classification

(51) **Int. Cl.**

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H01Q 13/10 (2006.01)
H01Q 5/10 (2006.01)





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(19) **United States**

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HWANG et al.

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(43) **Pub. Date: Feb. 18, 2016**

(54) **ANTENNA OF ELECTRONIC DEVICE**

(30) **Foreign Application Priority Data**

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Aug. 18, 2014 (KR) 10-2014-0106730

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Publication Classification

(51) **Int. Cl.**
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H01Q 1/48 (2006.01)
(52) **U.S. Cl.**
CPC . *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01)

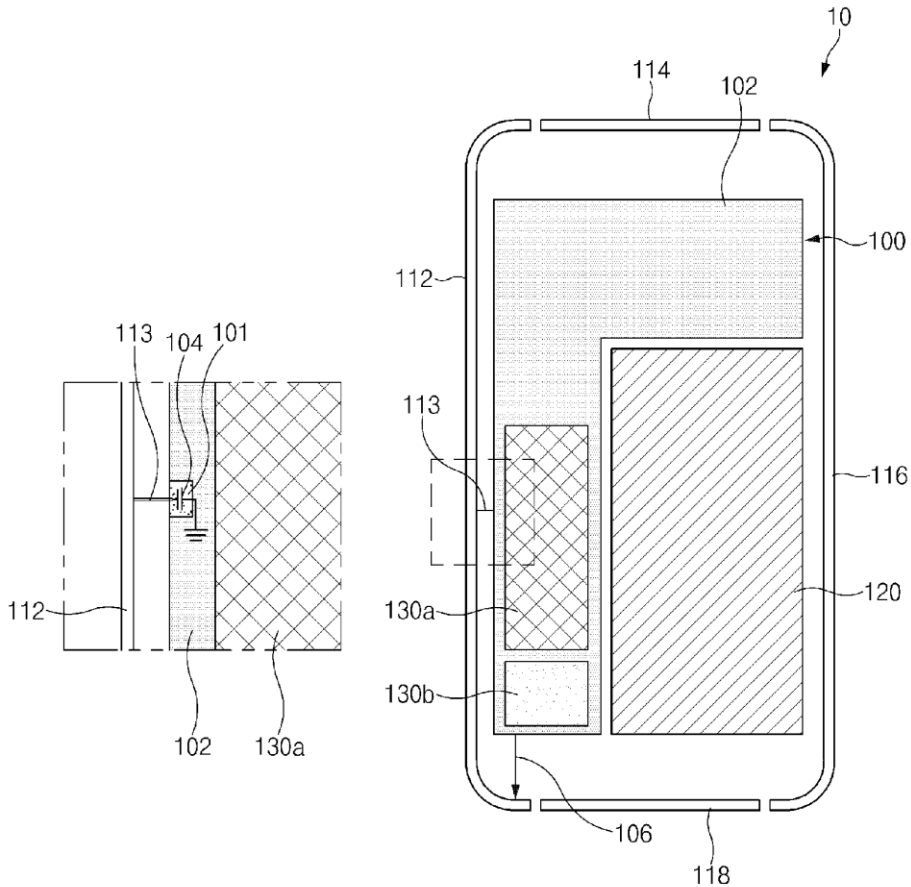
(57) **ABSTRACT**

(73) Assignee: **Samsung Electronics Co., Ltd.**

An antenna of an electronic device is provided, which includes a radiator including at least part of a metal housing of the electronic device; a capacitor connected to the radiator; a feeding part connected to the radiator; and a ground part connected to the capacitor.

(21) Appl. No.: **14/829,305**

(22) Filed: **Aug. 18, 2015**





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(19) **United States**

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

(10) **Pub. No.: US 2016/0049721 A1**

(43) **Pub. Date: Feb. 18, 2016**

(54) **ELECTRONIC APPARATUS**

(71) Applicant: **Seiko Epson Corporation**, Tokyo (JP)

(72) Inventors: **Tadashi AIZAWA**, Matsumoto-shi (JP);
Masayuki Ikeda, Nagano-shi (JP)

(21) Appl. No.: **14/822,674**

(22) Filed: **Aug. 10, 2015**

(30) **Foreign Application Priority Data**

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Publication Classification

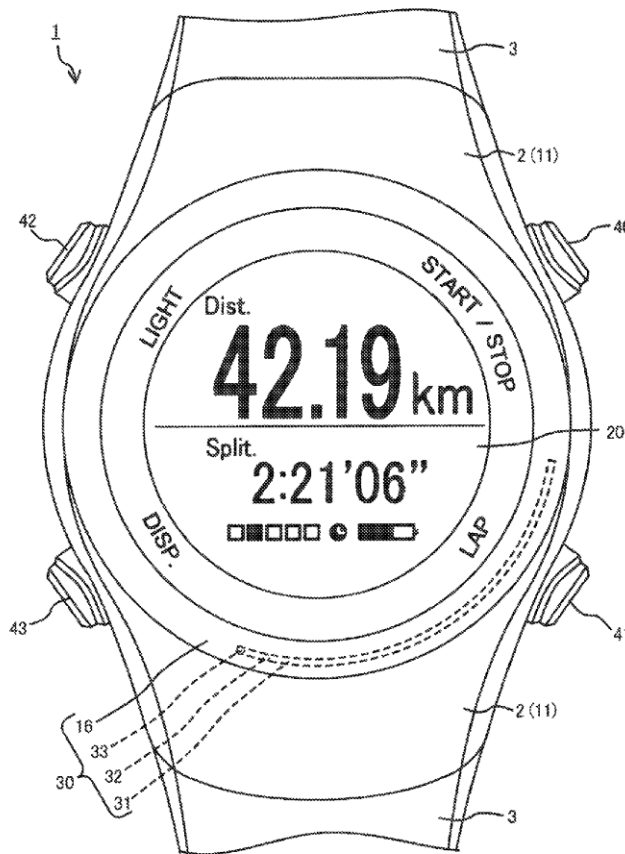
(51) **Int. Cl.**
H01Q 1/27 (2006.01)
G04G 21/04 (2006.01)
H01Q 1/24 (2006.01)

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

CPC **H01Q 1/273** (2013.01); **H01Q 1/241**
(2013.01); **G04G 21/04** (2013.01)

(57) **ABSTRACT**

An electronic apparatus includes a display; and an antenna including a first element without power feeding that is a structural component made of metal and is disposed on the display or above a display surface of the display in a display direction, a second element which is disposed below the first element and is connected to a power supply, and a GND plate that is disposed below the second element, wherein the first element and the second element are electromagnetically coupled.





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KIM et al.

(10) **Pub. No.: US 2016/0049734 A1**

(43) **Pub. Date: Feb. 18, 2016**

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

Publication Classification

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

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Gyu Sub KIM**, Seoul (KR); **Yeon Woo KIM**, Seoul (KR); **Se Hyun PARK**, Suwon-si (KR); **Jae Bong CHUN**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC **H01Q 13/10** (2013.01); **H01Q 1/243** (2013.01)

(21) Appl. No.: **14/820,107**

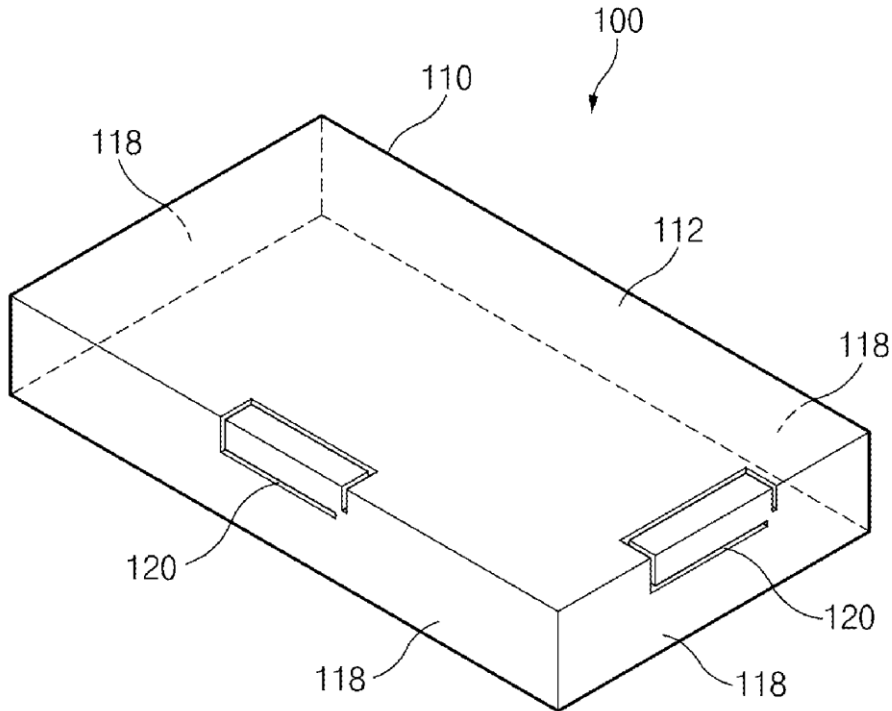
(57) **ABSTRACT**

(22) Filed: **Aug. 6, 2015**

An antenna device is provided. The antenna device includes a base plate of a conductive material, at least one slit disposed in at least one area of the base plate and having a form in which a portion of a closed curve is open, and a feeding part configured to supply current to an inner area surrounded by the slit.

(30) **Foreign Application Priority Data**

Aug. 14, 2014 (KR) 10-2014-0106058





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(19) **United States**

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

(10) **Pub. No.: US 2016/0049736 A1**

(43) **Pub. Date: Feb. 18, 2016**

(54) **ANTENNA APPARATUS AND THE MIMO COMMUNICATION DEVICE USING THE SAME**

Publication Classification

(71) Applicant: **ACCTON TECHNOLOGY CORPORATION**, Hsinchu City (TW)

(51) **Int. Cl.**
H01Q 21/30 (2006.01)
H01Q 21/06 (2006.01)

(72) Inventors: **I-Ru LIU**, Hsinchu City (TW);
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(52) **U.S. Cl.**
CPC *H01Q 21/30* (2013.01); *H01Q 21/065* (2013.01)

(73) Assignee: **ACCTON TECHNOLOGY CORPORATION**, Hsinchu City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **14/819,139**

The present invention discloses an antenna apparatus. The antenna apparatus includes a first antenna array and a second antenna array. The first antenna array includes multiple first radiating elements for transmitting radio signals of a first frequency. The second antenna array includes multiple second radiating elements for transmitting radio signals of a second frequency, wherein the first and second radiating elements are arranged in a staggered manner; wherein each of the first radiating elements is disposed between two of the second radiating elements; and wherein each of the second radiating elements is disposed between two of the first radiating elements.

(22) Filed: **Aug. 5, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/038,623, filed on Aug. 18, 2014.

