



US 20120133562A1

(19) **United States**

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

(10) **Pub. No.: US 2012/0133562 A1**

(43) **Pub. Date: May 31, 2012**

(54) **INTERNAL ANTENNA JOINED TO
TERMINAL HOUSING**

Publication Classification

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

(52) **U.S. Cl.** **343/702**

(57) **ABSTRACT**

An internal antenna for attaching to a terminal housing is disclosed. The antenna includes: a perpendicular structure formed in a perpendicular direction to a substrate and positioned in contact with an inner wall of a housing; a first conductive member electrically connected to a power feed and joined to the perpendicular structure to extend in a perpendicular direction to the substrate; and a second conductive member electrically connected to a ground, joined to the perpendicular structure, and separated by a particular distance from the first conductive member to extend in a perpendicular direction to the substrate. The first conductive member is joined to the inner wall of the housing to extend in a first direction orthogonal to the perpendicular direction, and the second conductive member is joined to the inner wall of the housing to extend in the first direction at a particular distance from the first conductive member.

(75) Inventors: **Byong-Nam KIM**, Kyeonggi-do (KR); **Jong-Ho JUNG**, Gyeonggi-do (KR)

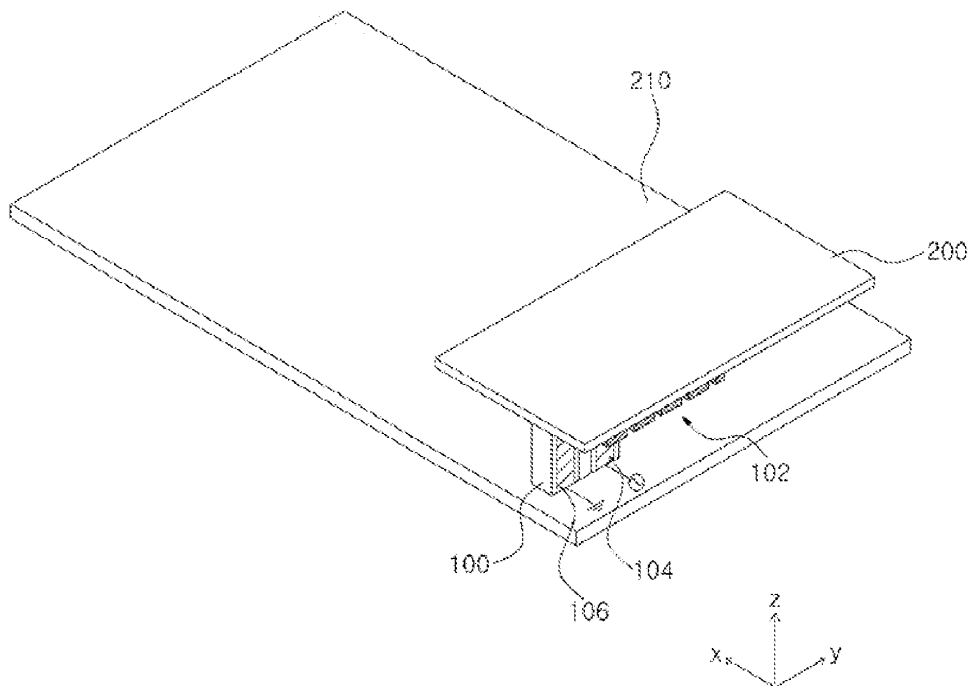
(73) Assignee: **ACE TECHNOLOGIES CORPORATION**, Incheon-si (KR)

(21) Appl. No.: **13/305,548**

(22) Filed: **Nov. 28, 2011**

(30) **Foreign Application Priority Data**

Nov. 29, 2010 (KR) 10-2010-0119668



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US 20120133565A1

(19) **United States**

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

(10) **Pub. No.: US 2012/0133565 A1**

(43) **Pub. Date: May 31, 2012**

(54) **CABLE ANTENNA APPARATUS AND SYSTEM**

Publication Classification

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

(52) **U.S. Cl.** **343/791**

(57) **ABSTRACT**

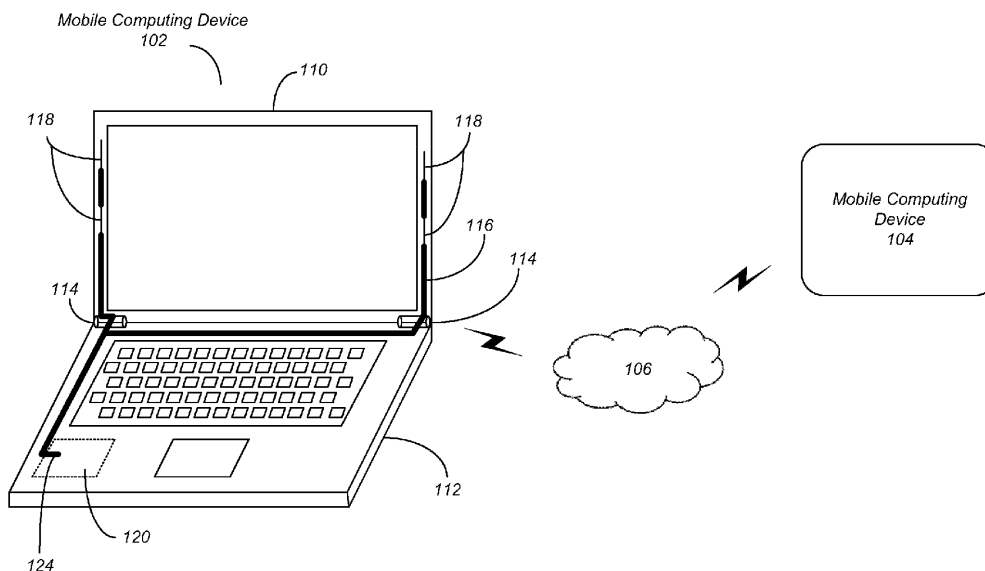
Embodiments of an apparatus and system are described for a coaxial antenna. An apparatus may comprise, for example, an integrated circuit and a coaxial cable coupled to the integrated circuit and arranged to operate as an antenna, the coaxial cable comprising an inner conductor layer and at least one insulator layer, wherein one or more portions of the inner conductor layer are exposed to allow the exposed inner conductor layer to operate as a radiating element for the antenna. Other embodiments are described and claimed.

(76) Inventors: **Anand S. Konanur**, San Jose, CA (US); **Ulun Karacaoglu**, San Diego, CA (US); **Songnan Yang**, San Jose, CA (US); **Xintian E. Lin**, Palo Alto, CA (US)

(21) Appl. No.: **12/957,208**

(22) Filed: **Nov. 30, 2010**

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US 20120133597A1

(19) **United States**

(12) **Patent Application Publication**
CHEN

(10) **Pub. No.: US 2012/0133597 A1**

(43) **Pub. Date: May 31, 2012**

(54) **ANTENNA STRUCTURE**

Publication Classification

(75) Inventor: **Chih-Jung CHEN**, TAIPEI CITY
(TW)

(51) **Int. Cl.**
G06F 3/041 (2006.01)
C30B 33/08 (2006.01)
H01Q 1/22 (2006.01)

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

(52) **U.S. Cl.** **345/173; 343/720; 216/23**

(21) Appl. No.: **13/028,226**

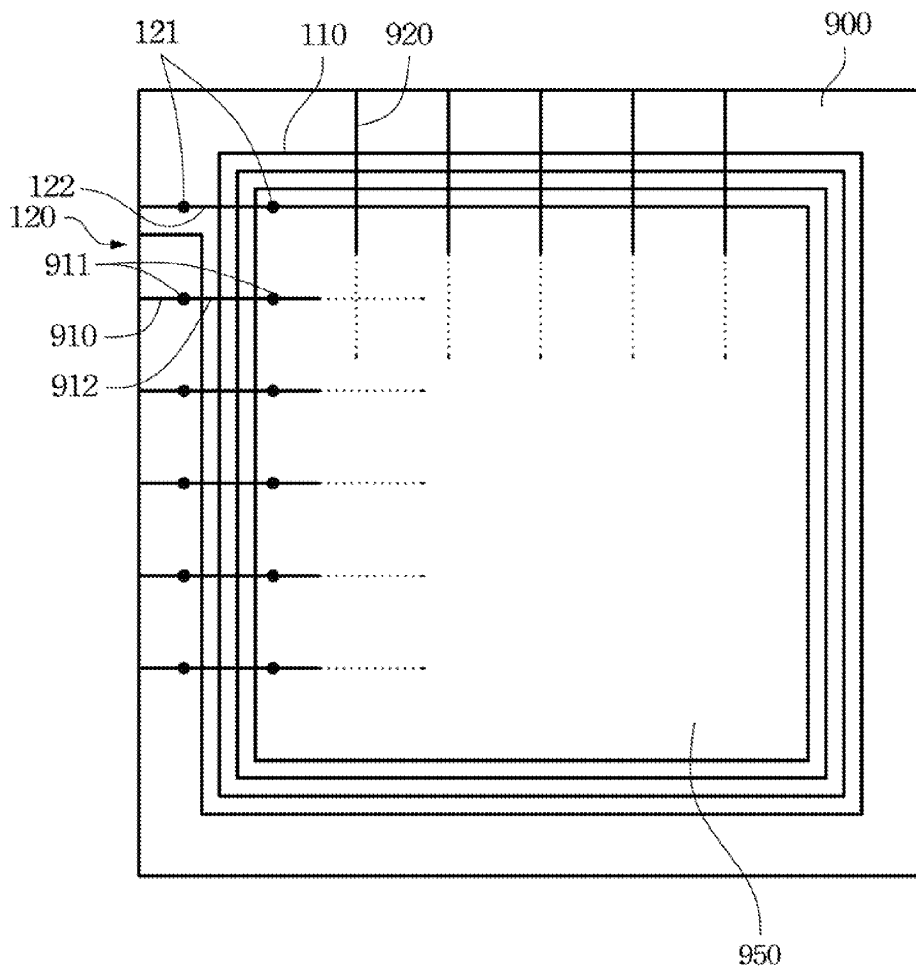
(57) **ABSTRACT**

(22) Filed: **Feb. 16, 2011**

(30) **Foreign Application Priority Data**

Nov. 30, 2010 (TW) 099141509

An antenna structure includes a coil unit formed by etching a conductive film in a non-display area of a display and a set of electrodes for transmitting signals connected to terminals of the coil unit. The antenna structure can be a near field communication antenna or a radio frequency identification antenna to transmit and receive signals with the coil unit formed in the non-display area of the display to save the occupation space in a portable communication device. Therefore, the antenna structure can effectively reduce the size of the portable communication device.



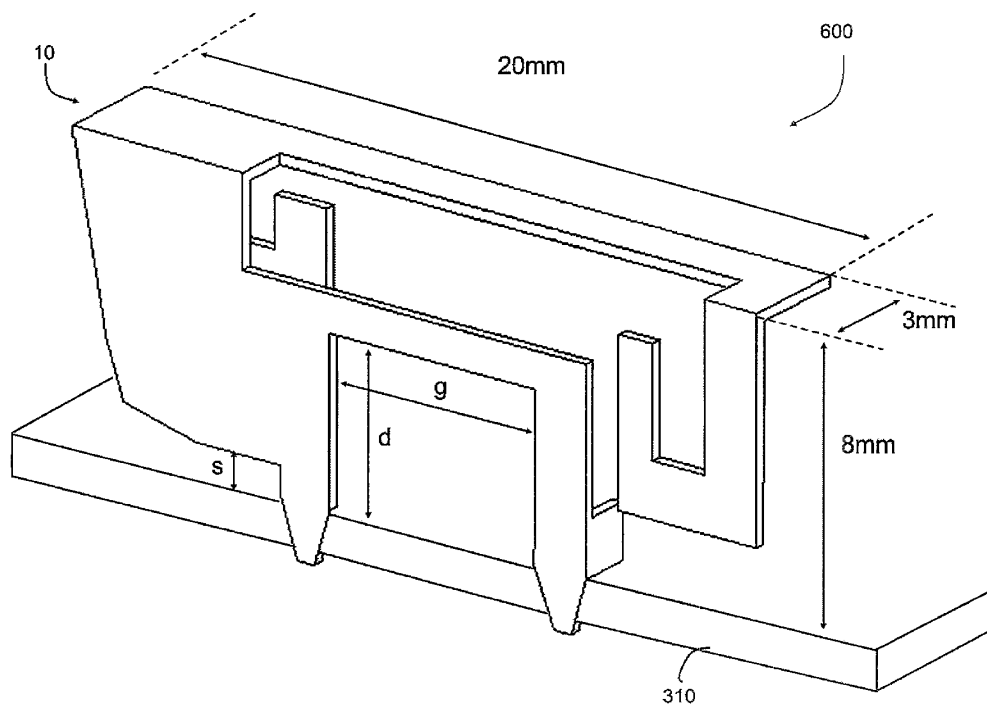
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US 20120139792A1

(19) **United States**(12) **Patent Application Publication**
PAN et al.(10) **Pub. No.: US 2012/0139792 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **DUAL-BAND ANTENNA AND
COMMUNICATION DEVICE USING THE
SAME**(52) **U.S. CL. 343/700 MS**(75) Inventors: **Bo PAN**, Irvine, CA (US);
Ching-Wei LING, Xinhua
Township (TW)(73) Assignee: **REALTEK SEMICONDUCTOR
CORP.**, Hsinchu (TW)(21) Appl. No.: **12/957,702**(22) Filed: **Dec. 1, 2010****Publication Classification**(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/00 (2006.01)(57) **ABSTRACT**

A dual-band antenna is disclosed, comprising a radiating body, a shorting element, and a feeding element. The radiating body comprises a plurality of radiating portions located in a first, a second, a third, and a fourth planes, respectively. The shorting element and the feeding element both extend from the radiating body and are located in the first plane. The radiating portions located in the first, the second, and the third planes transmit and/or receive signals in a first frequency band. The radiating portions located in the first, the second, and the fourth planes transmit and/or receive signals in a second frequency band. A first angle between the first and the second planes, a second angle between the second and the third planes, and a third angle between the second and the fourth planes range between 80 degrees to 100 degrees.



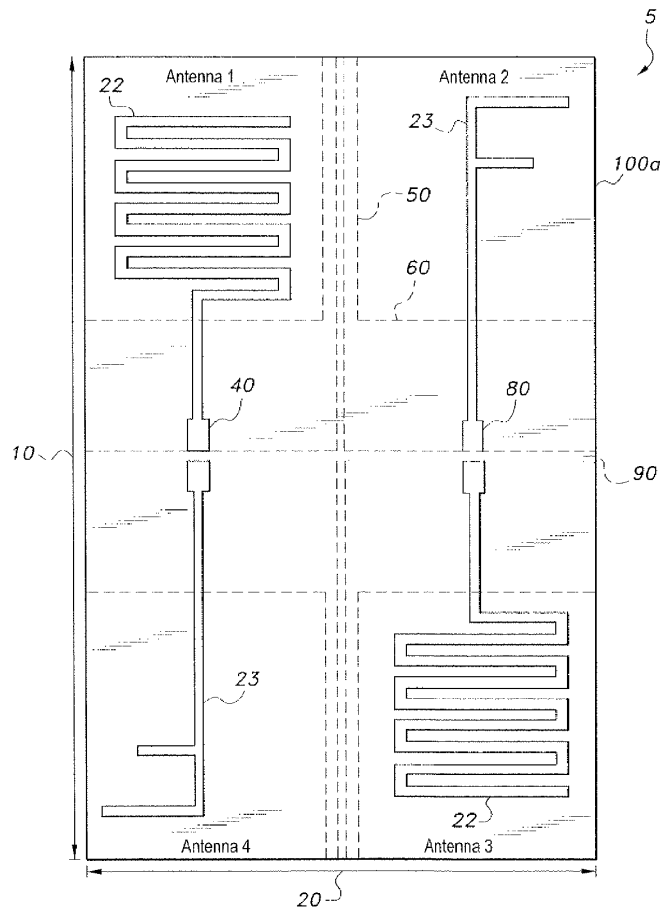
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US 20120139793A1

(19) **United States**(12) **Patent Application Publication**
SHARAWI(10) **Pub. No.: US 2012/0139793 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **HIGH ISOLATION MULTIBAND MIMO**
ANTENNA SYSTEM(52) **U.S. CL. 343/700 MS**(75) **Inventor: MOHAMMAD S. SHARAWI,**
DHAHRAN (SA)(57) **ABSTRACT**(73) **Assignee: KING FAHD UNIVERSITY OF**
PETROLEUM AND MINERALS,
DHAHRAN (SA)

The high isolation multiband MIMO antenna system is a multi-band dual and quad antenna for multiple-input-multiple-output (MIMO) antenna systems. Element and ground plane geometries that can cover a wide range of frequency bands (780 MHz-5850 MHz) are based on the varying some simple geometrical lengths and widths of the elements and ground planes. The MIMO antenna systems can be used for next generation cellular and wireless MIMO communication systems. Several isolation enhancement schemes increase the isolation between adjacent antenna elements. Any combination of the isolation and MIMO antenna system geometries can be created to support different wireless system standards. The novel MIMO antenna systems are disposed within a dielectric substrate area of 50×100 mm².

(21) **Appl. No.: 12/958,330**(22) **Filed: Dec. 1, 2010****Publication Classification**(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 9/04 (2006.01)

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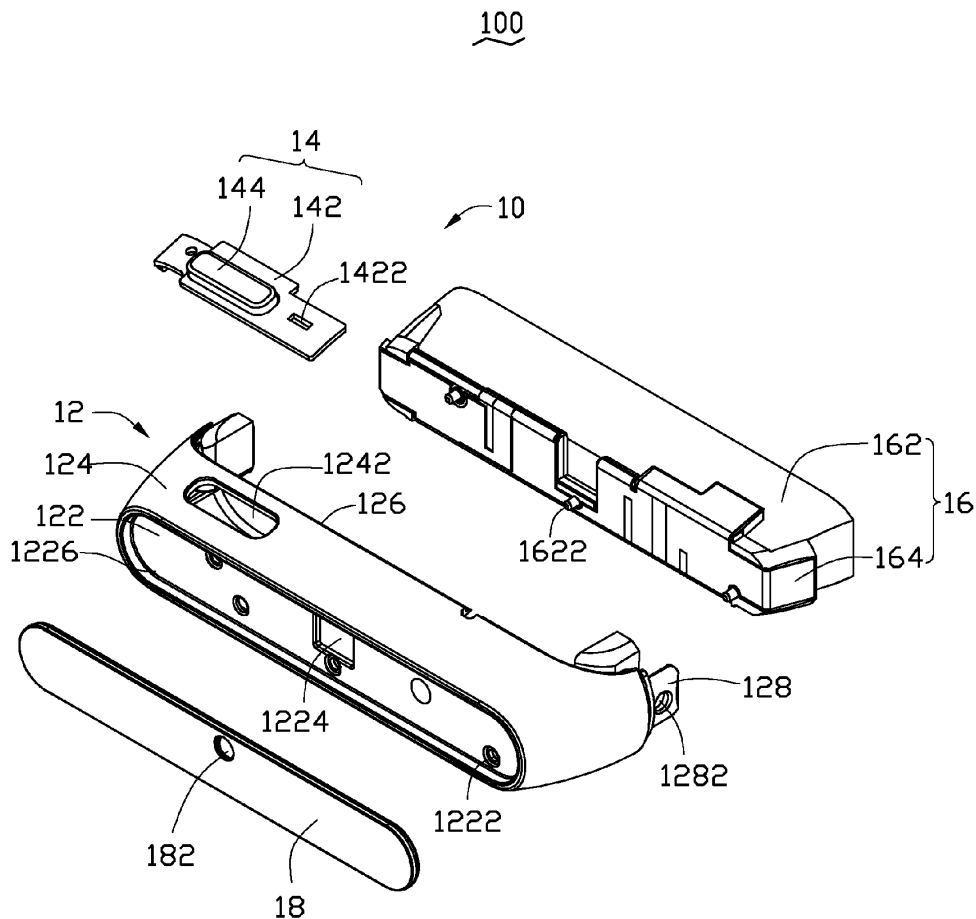
US 20120139798A1

(19) **United States**(12) **Patent Application Publication**
HSIUNG(10) **Pub. No.: US 2012/0139798 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **COVER ASSEMBLY AND ELECTRONIC
DEVICE USING THE SAME****Publication Classification**(75) Inventor: **MING-CHUN HSIUNG**, Shindian
(TW)(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/22 (2006.01)(73) Assignee: **FIH (HONG KONG) LIMITED**,
Kowloon (HK)(52) **U.S. Cl.** **343/702**(21) Appl. No.: **13/043,640**(57) **ABSTRACT**(22) Filed: **Mar. 9, 2011**

A cover assembly includes a cover body, an antenna, and a function key. The cover body includes an end wall and a peripheral wall cooperatively defining a receiving slot. The peripheral wall defines an assembly hole. The antenna is received in the receiving slot and fixed to the end wall. The function key includes a latching plate and a press portion positioned on the latching plate. The press portion extends from the assembly hole, and the latching plate is sandwiched between the antenna and the cover body.

(30) **Foreign Application Priority Data**

Dec. 1, 2010 (CN) 201010568588.2



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US 20120139800A1

(19) **United States**

(12) **Patent Application Publication**
Davies

(10) **Pub. No.: US 2012/0139800 A1**

(43) **Pub. Date: Jun. 7, 2012**

(54) **ANTENNA SYSTEM**

Publication Classification

(75) Inventor: **Stuart Davies**, Copenhagen (DK)

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

(73) Assignee: **Molex Incorporated**, Lisle, IL (US)

(52) **U.S. Cl.** **343/702**

(21) Appl. No.: **13/292,586**

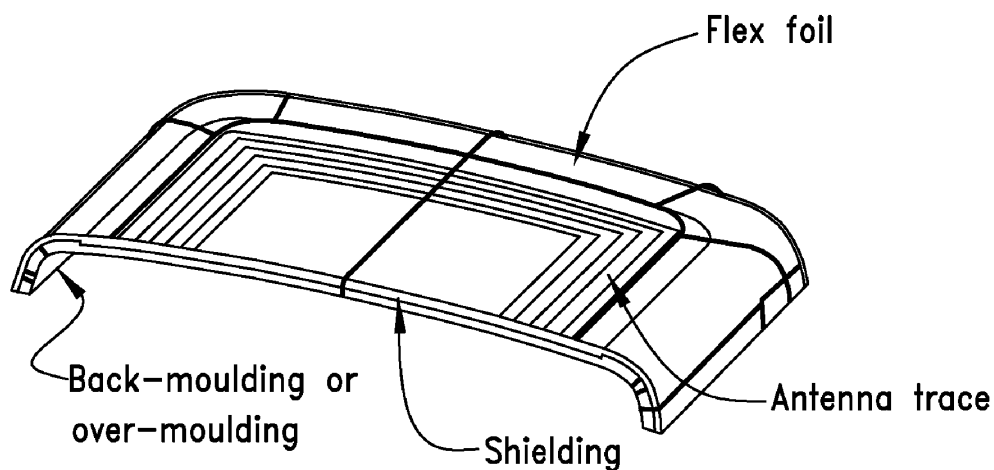
(57) **ABSTRACT**

(22) Filed: **Nov. 9, 2011**

Related U.S. Application Data

(60) Provisional application No. 61/411,646, filed on Nov. 9, 2010.

A housing includes a 3-D composite structure. The structure includes a flex foil. An antenna trace is provided on a first surface of the flex foil. A shield, which may be a sheet, is positioned on the antenna trace. A resin is molded to the first surface, the shield and the antenna trace. The resultant structure allows for a thin-walled design that can communicate efficiently via wireless signals.



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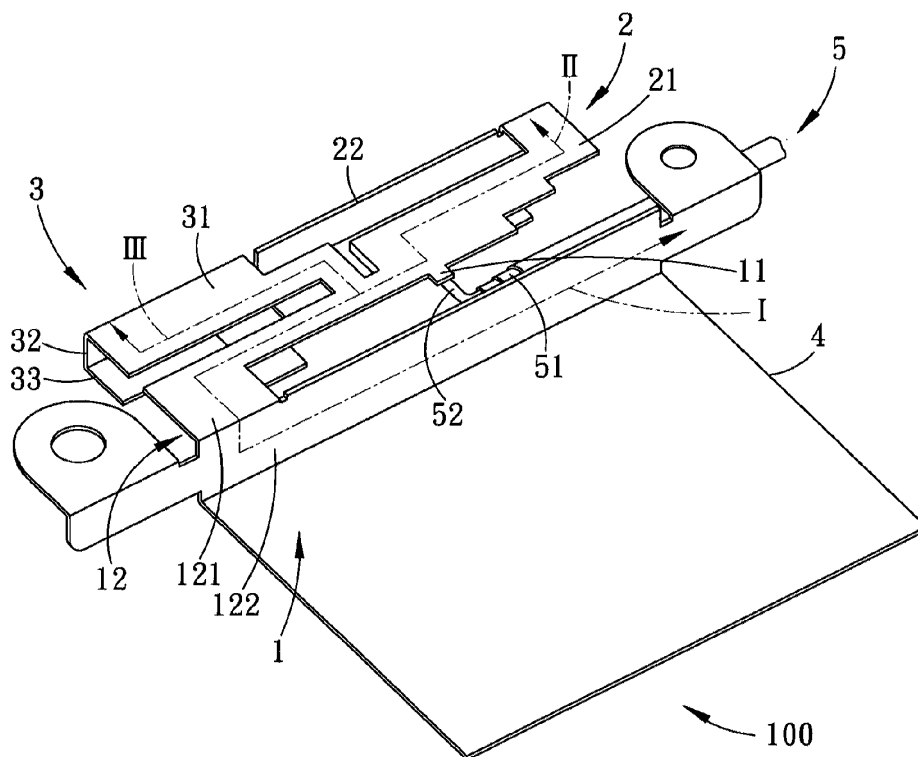


US 20120139802A1

(19) **United States**(12) **Patent Application Publication**
WANG et al.(10) **Pub. No.: US 2012/0139802 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **MULTI-BAND ANTENNA****Publication Classification**(75) Inventors: **Ying-Chih WANG**, Tao Yuan Shien
(TW); **Tsung-Ming KUO**, Tainan
City (TW); **Ling-Chen WEI**,
Tainan City (TW)(51) **Int. Cl.**
H01Q 21/30 (2006.01)(52) **U.S. Cl.** **343/728**(57) **ABSTRACT**(73) Assignee: **QUANTA COMPUTER INC.**, Tao
Yuan Hsien (TW)(21) Appl. No.: **13/066,504**(22) Filed: **Apr. 14, 2011**(30) **Foreign Application Priority Data**

Dec. 1, 2010 (TW) 099141699

A multi-band antenna includes a loop conductor, a first conductor arm, and a second conductor arm. The loop conductor is configured to resonate in a first frequency band and includes a feed-in end for feeding of signals and a main body that extends from the feed-in end, and that has a grounding point disposed adjacent to the feed-in end. The first conductor arm is configured to resonate in a second frequency band and extends from the feed-in end. The second conductor arm is configured to resonate in a third frequency band and extends from the feed-in end. At least one of the loop conductor, the first conductor arm, and the second conductor arm is bent so as to be disposed in different planes.



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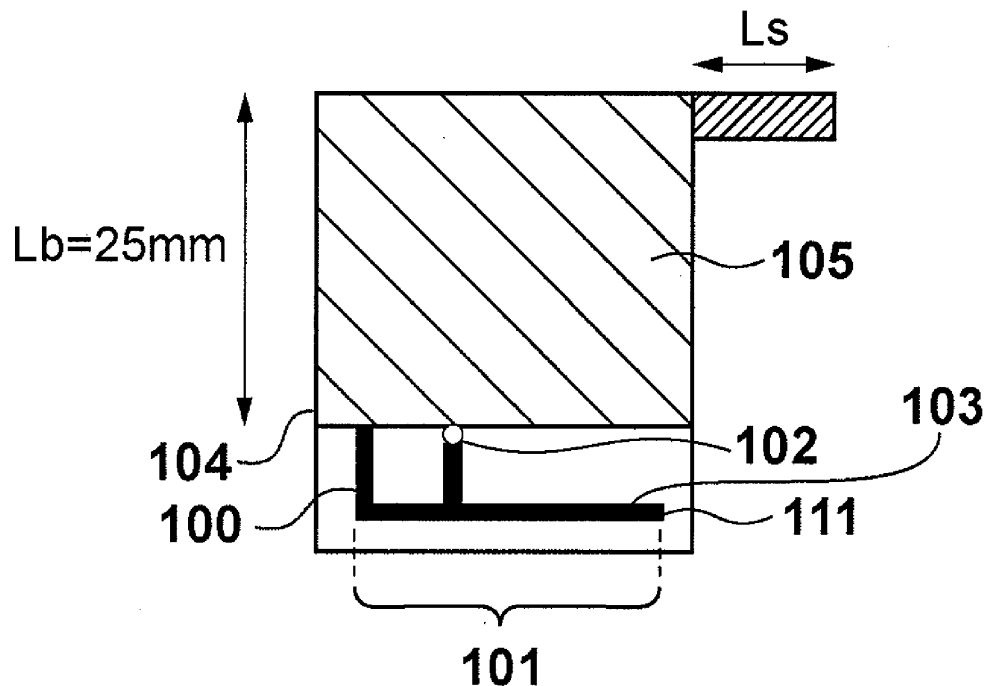
US 20120139803A1

(19) **United States**(12) **Patent Application Publication**
Saito(10) **Pub. No.: US 2012/0139803 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **ANTENNA, ADJUSTMENT METHOD
THEREOF, AND ELECTRONIC DEVICE IN
WHICH THE ANTENNA IS IMPLEMENTED****Publication Classification**(51) **Int. Cl.**
H01Q 9/04 (2006.01)(52) **U.S. Cl.** 343/745(57) **ABSTRACT**

An antenna used in wireless communication, comprises: a dielectric substrate; a ground conductor portion arranged upon the dielectric substrate; an antenna element including a radiating conductor portion arranged upon the dielectric substrate opposite to the ground conductor portion, a shorted conductor portion that connects the radiating conductor portion and the ground conductor portion, and a power supply unit adapted to supply a high-frequency current to the radiating conductor portion; and an open conductor portion connected at high frequencies to the ground conductor portion, wherein the open conductor portion is connected to the dielectric substrate so as to protrude by a predetermined length from the location of the ground conductor portion in a diagonal direction from the location where the ground conductor portion and the shorted conductor portion are connected.

(75) **Inventor:** **Katsuo Saito, Yokohama-shi (JP)**(73) **Assignee:** **CANON KABUSHIKI KAISHA,**
Tokyo (JP)(21) **Appl. No.: 13/309,981**(22) **Filed: Dec. 2, 2011**(30) **Foreign Application Priority Data**

Dec. 7, 2010 (JP) 2010-273018
Oct. 3, 2011 (JP) 2011-219566



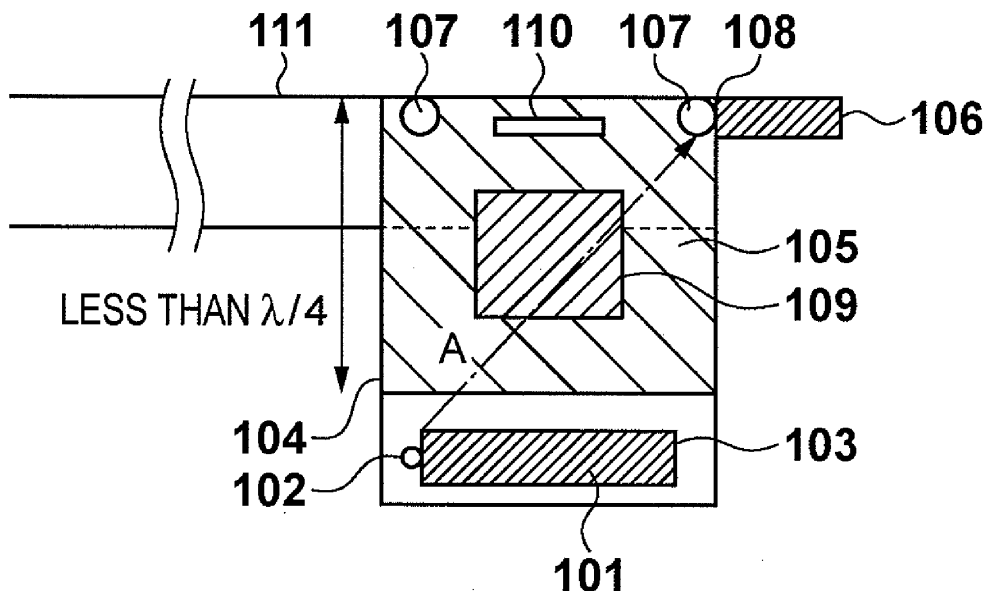
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US 20120139809A1

(19) **United States**(12) **Patent Application Publication**
Saito(10) **Pub. No.: US 2012/0139809 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **ANTENNA, ADJUSTMENT METHOD
THEREOF, AND ELECTRONIC DEVICE IN
WHICH THE ANTENNA IS MOUNTED****Publication Classification**(51) **Int. Cl.**
H01Q 1/48 (2006.01)(52) **U.S. Cl.** **343/848**(57) **ABSTRACT**(75) **Inventor:** **Katsuo Saito, Yokohama-shi (JP)**(73) **Assignee:** **CANON KABUSHIKI KAISHA,**
Tokyo (JP)(21) **Appl. No.:** **13/287,438**(22) **Filed:** **Nov. 2, 2011**(30) **Foreign Application Priority Data**Dec. 3, 2010 (JP) 2010-270793
Oct. 12, 2011 (JP) 2011-225300

An antenna used in wireless communication, provided with an antenna element and a GND portion on a dielectric board and mounted in an electronic device, includes an open conductor having a high-frequency connection to the GND portion at an end of the dielectric board in the opposing corner direction from a power supply point of the antenna element. The length of the GND portion in the vertical direction relative to the propagation direction of a high-frequency signal is less than $\frac{1}{4}$ the wavelength of the operating frequency of the antenna element.



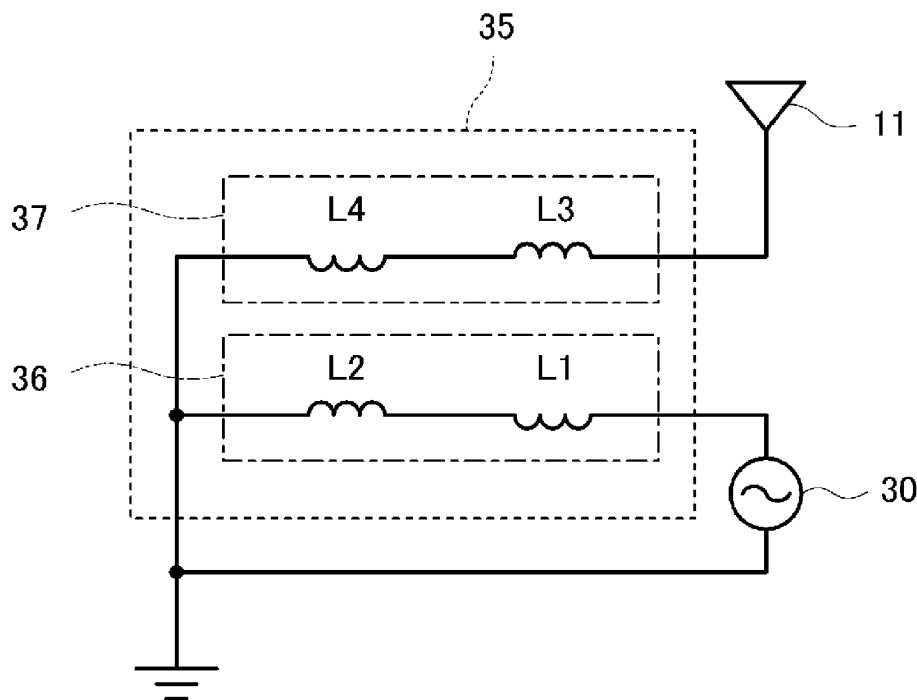
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US 20120139814A1

(19) **United States**(12) **Patent Application Publication**
ISHIZUKA et al.(10) **Pub. No.: US 2012/0139814 A1**(43) **Pub. Date: Jun. 7, 2012**(54) **FREQUENCY STABILIZATION CIRCUIT,
ANTENNA DEVICE, AND COMMUNICATION
TERMINAL DEVICE****Publication Classification**(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H03H 7/38 (2006.01)(75) Inventors: **Kenichi ISHIZUKA**,
Nagaokakyo-shi (JP); **Noboru**
KATO, Nagaokakyo-shi (JP)(52) **U.S. Cl.** **343/860; 333/32**(73) Assignee: **MURATA MANUFACTURING**
CO., LTD., Nagaokakyo-shi (JP)(57) **ABSTRACT**(21) Appl. No.: **13/369,364**(22) Filed: **Feb. 9, 2012****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2011/050883,
filed on Jan. 19, 2011.(30) **Foreign Application Priority Data**Aug. 11, 2010 (JP) 2010-180088
Sep. 17, 2010 (JP) 2010-209295
Jan. 19, 2011 (JP) 2011-008533

A frequency stabilization circuit includes four coiled conductors, the first coiled conductor and the second coiled conductor are connected in series to each other to define a first series circuit, the third coiled conductor and the fourth coiled conductor are connected in series to each other to define a second series circuit, the first series circuit is connected between an antenna port and a power feeding port, and the second series circuit is connected between the antenna port and the ground. The first coiled conductor and the second coiled conductor are wound so that a first closed magnetic circuit is provided, and the third coiled conductor and the fourth coiled conductor are wound so that a second closed magnetic circuit is provided.



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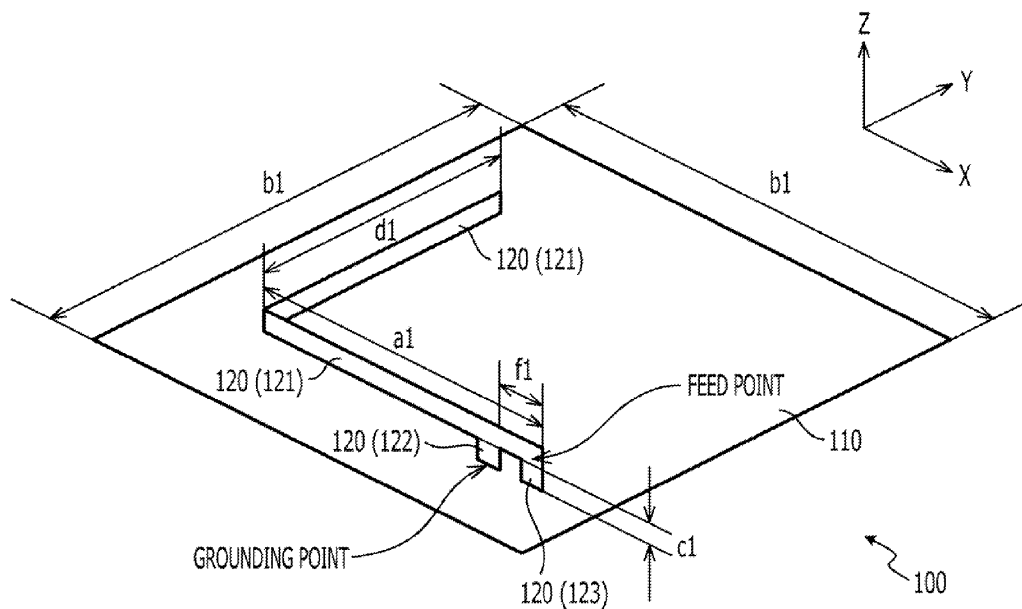
US 20120146854A1

(19) **United States**(12) **Patent Application Publication**
ISHIKAWA(10) **Pub. No.: US 2012/0146854 A1**(43) **Pub. Date: Jun. 14, 2012**(54) **ANTENNA DEVICE**(52) **U.S. CL. 343/700 MS**(75) **Inventor: Shohei ISHIKAWA, Kawasaki (JP)**(73) **Assignee: FUJITSU LIMITED,**
Kawasaki-shi (JP)(21) **Appl. No.: 13/185,141**(22) **Filed: Jul. 18, 2011**(30) **Foreign Application Priority Data**

Dec. 10, 2010 (JP) 2010-276320

Publication Classification(51) **Int. Cl.**
H01Q 9/04 (2006.01)(57) **ABSTRACT**

An antenna device includes a ground plate, a feed section insulated from the ground plate, two radiating conductors each coupled to a corresponding short-circuit section coupled to the feed section and the ground plate, extending in parallel to the ground plate, and spaced a predetermined distance apart from the ground plate; and a feeder circuit that supplies electric power to the radiating conductors, the two radiating conductors are disposed, on the ground plate, at positions symmetric about the midpoint of the ground plate, the feeder circuit supplies electric power in opposite phases to the two radiating conductors, and the two radiating conductors have bent portions of the same form.



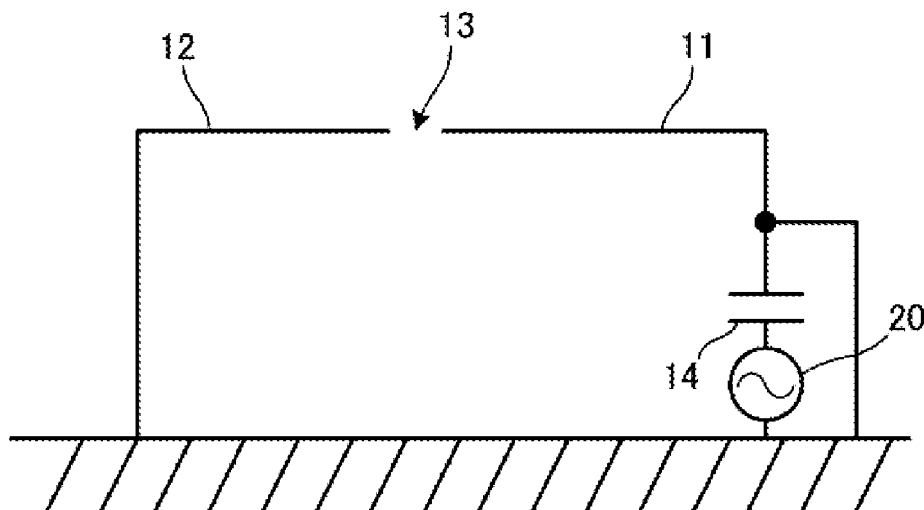
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US 20120146856A1

(19) **United States**(12) **Patent Application Publication**
TANAKA et al.(10) **Pub. No.: US 2012/0146856 A1**(43) **Pub. Date: Jun. 14, 2012**(54) **FLEXIBLE SUBSTRATE ANTENNA AND
ANTENNA DEVICE****Publication Classification**(75) Inventors: **Hiroya TANAKA**, Kyoto-fu (JP);
Yuichi KUSHIHI, Kyoto-fu (JP)(51) **Int. Cl.**
H01Q 9/04 (2006.01)(73) Assignee: **MURATA MANUFACTURING
CO., LTD.**, Kyoto-fu (JP)(52) **U.S. Cl. 343/700 MS**(21) Appl. No.: **13/402,791**(57) **ABSTRACT**(22) Filed: **Feb. 22, 2012****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2010/057208,
filed on Apr. 23, 2010.(30) **Foreign Application Priority Data**Aug. 27, 2009 (JP) 2009-196504
Aug. 27, 2009 (JP) 2009-196521

This disclosure provides a flexible substrate antenna and antenna device including a flexible substrate antenna. The flexible substrate antenna includes a first parasitic radiation electrode and a second parasitic radiation electrode provided on the flexible substrate, where a leading ends (open ends) of the first parasitic radiation electrode and the second parasitic radiation electrode face each other with a slit of a predetermined gap therebetween. Further, a capacitive feed electrode is formed on the flexible substrate at a position facing the first parasitic radiation electrode, and is configured to capacitively feed power to the first parasitic radiation electrode.



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US 20120146857A1

(19) **United States**

(12) **Patent Application Publication**
Wang

(10) **Pub. No.: US 2012/0146857 A1**

(43) **Pub. Date: Jun. 14, 2012**

(54) **ANTENNA MODULE, AND TOUCH MODULE
AND ELECTRONIC DEVICE USING THE
SAME**

(75) Inventor: **Cheng-Ke Wang**, Pingtung County
(TW)

(73) Assignee: **SMART APPROACH CO., LTD.**,
Hsinchu (TW)

(21) Appl. No.: **13/040,138**

(22) Filed: **Mar. 3, 2011**

(30) **Foreign Application Priority Data**

Dec. 10, 2010 (TW) 099143297

Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/36 (2006.01)

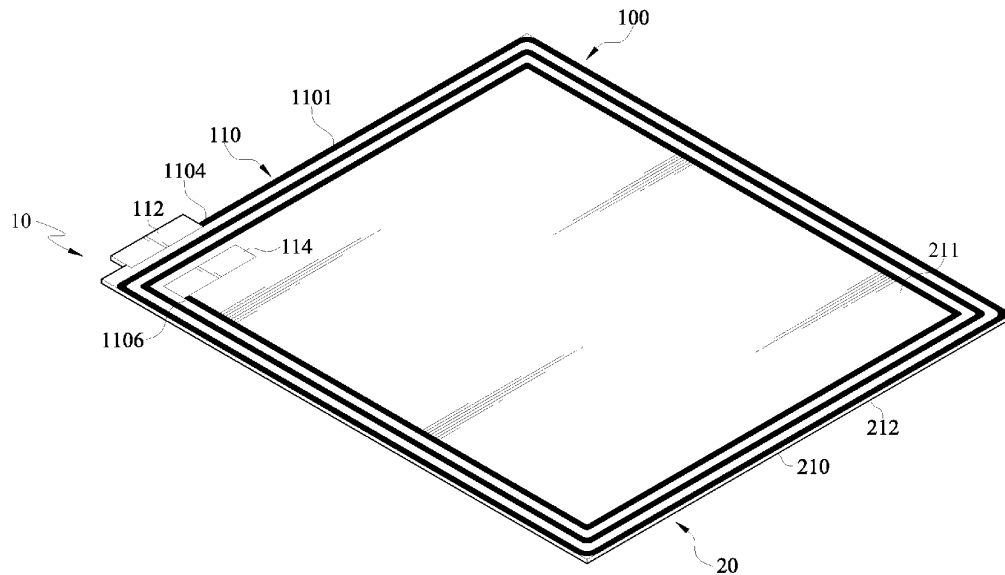
H01Q 1/22 (2006.01)

H01Q 7/00 (2006.01)

(52) **U.S. Cl. 343/702; 343/870; 343/895; 343/720**

(57) **ABSTRACT**

An antenna module, and a touch module and an electronic device using the same are presented. The antenna module includes a transparent substrate and an antenna circuit disposed on the transparent substrate. The antenna circuit includes a pair of electrodes and a coil assembly connected to the electrodes. The electronic device includes a mother board, a display panel, and an antenna module. The transparent substrate and the mother board are overlapped on opposite surfaces of the display panel, such that a circuit design space of the electronic device using the antenna module is reduced.



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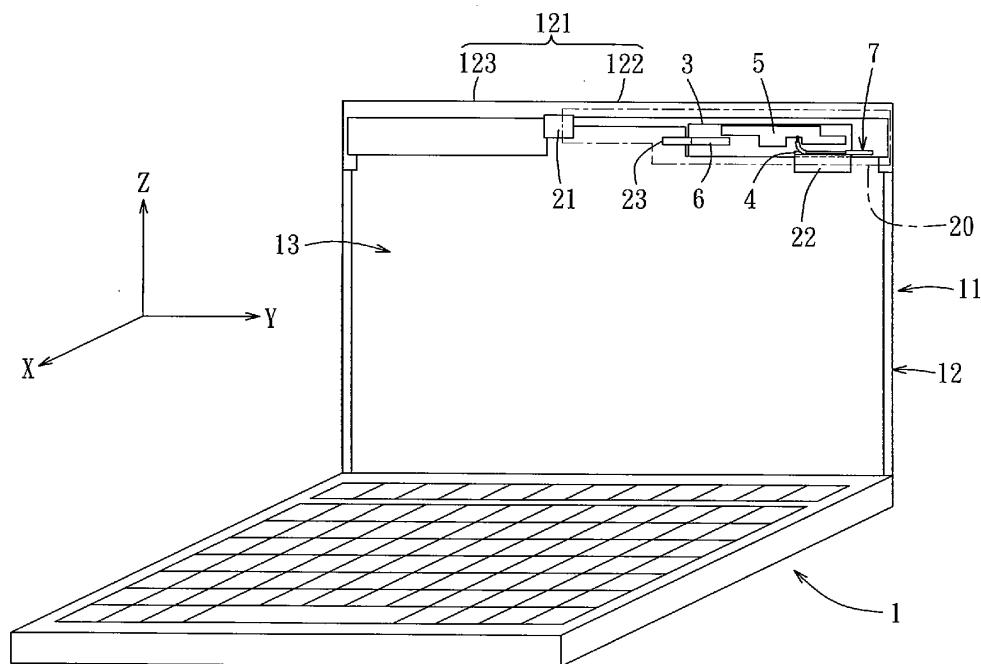
US 20120146858A1

(19) **United States**(12) **Patent Application Publication**
TSAI et al.(10) **Pub. No.: US 2012/0146858 A1**(43) **Pub. Date: Jun. 14, 2012**(54) **MULTI-BAND ANTENNA MODULE**(52) **U.S. CL. 343/702**(75) Inventors: **Tiao-Hsing TSAI**, New Taipei City (TW); **Chao-Hsu Wu**, Luzhu Township (TW); **Yuan-Chang Chao**, Dayuan Township (TW); **Tsung-Ming Kuo**, Tainan City (TW)(73) Assignee: **Quanta Computer Inc.**(21) Appl. No.: **13/099,992**(22) Filed: **May 3, 2011**(30) **Foreign Application Priority Data**

Dec. 13, 2010 (TW) 099143470

Publication Classification(51) **Int. Cl.**
H01Q 5/01 (2006.01)(57) **ABSTRACT**

A multi-band antenna module is disposed in a housing of an electronic device. The housing has a grounding plane disposed therein and includes a metal frame part having two ends electrically connected to opposite side edges of the grounding plane. The multi-band antenna module includes a conductor, a substrate, a grounding section, and a first radiator section. The conductor is to be coupled across the metal frame part and the grounding plane so as to cooperate with the grounding plane and a portion of the metal frame part to form a closed loop thereamong, in which the substrate is disposed. The first radiator section and the grounding section are disposed on the substrate, with the grounding section to be coupled electrically to the grounding plane. A portion of the first radiator section is disposed to cooperate with the closed loop to resonate in a first frequency band. Another portion of the first radiator section is disposed to cooperate with the grounding section to resonate in a second frequency band.



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(19) **United States**

(12) **Patent Application Publication**
Kwon

(10) **Pub. No.: US 2012/0146863 A1**

(43) **Pub. Date: Jun. 14, 2012**

(54) **ANTENNA APPARATUS FOR PORTABLE
TERMINAL**

Publication Classification

(75) Inventor: **Young-Mi Kwon**, Bucheon-si (KR)

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

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

(52) **U.S. Cl.** **343/720**

(21) Appl. No.: **13/298,125**

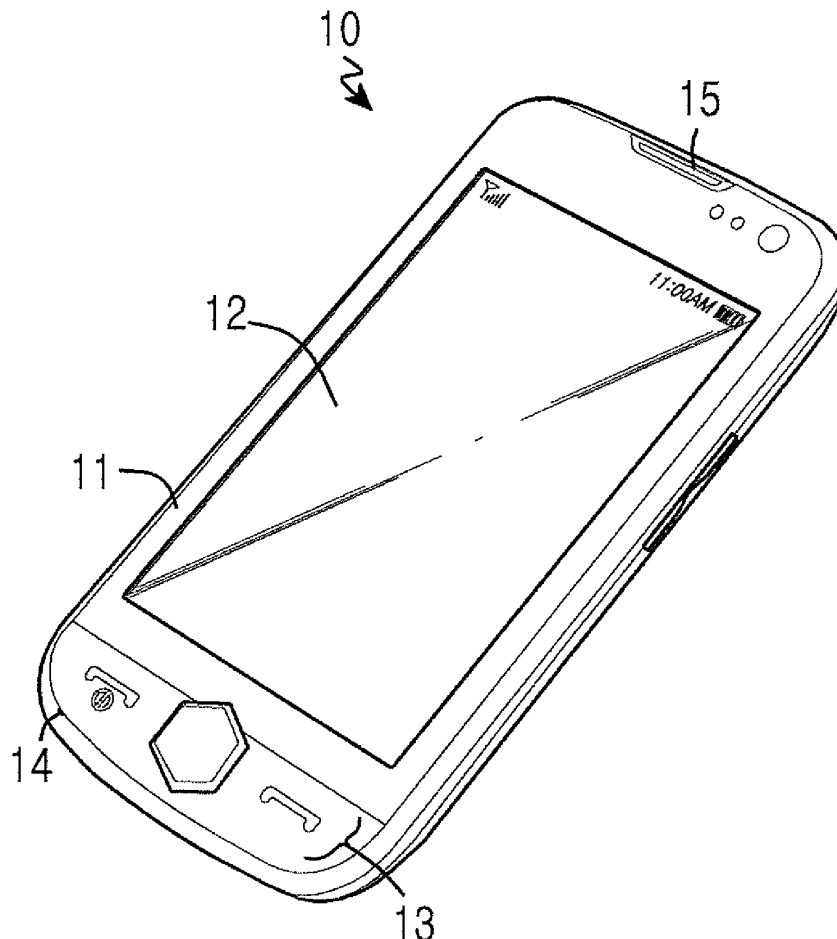
(57) **ABSTRACT**

(22) Filed: **Nov. 16, 2011**

An antenna apparatus for a portable terminal includes a main board and a display device. The main board has a ground for grounding and a feed terminal for feeding. The display device electrically communicates with the main board by the medium of a Flexible Printed Circuit Board (FPCB) and has an ElectroStatic Charge (ESD) prevention ground. If the display device is mounted above the main board, the ESD prevention ground of the display device comes in electric contact with the feed terminal of the main board, for emission.

(30) **Foreign Application Priority Data**

Dec. 8, 2010 (KR) 10-2010-0124717



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US 20120146864A1

(19) **United States**

(12) **Patent Application Publication**
KOGA

(10) **Pub. No.: US 2012/0146864 A1**

(43) **Pub. Date: Jun. 14, 2012**

(54) **ANTENNA**

Publication Classification

(75) Inventor: **Yohei KOGA**, Kawasaki (JP)

(51) **Int. Cl.**
H01Q 11/12 (2006.01)

(73) Assignee: **FUJITSU LIMITED**, Kawasaki (JP)

(52) **U.S. Cl.** **343/741**

(21) Appl. No.: **13/234,607**

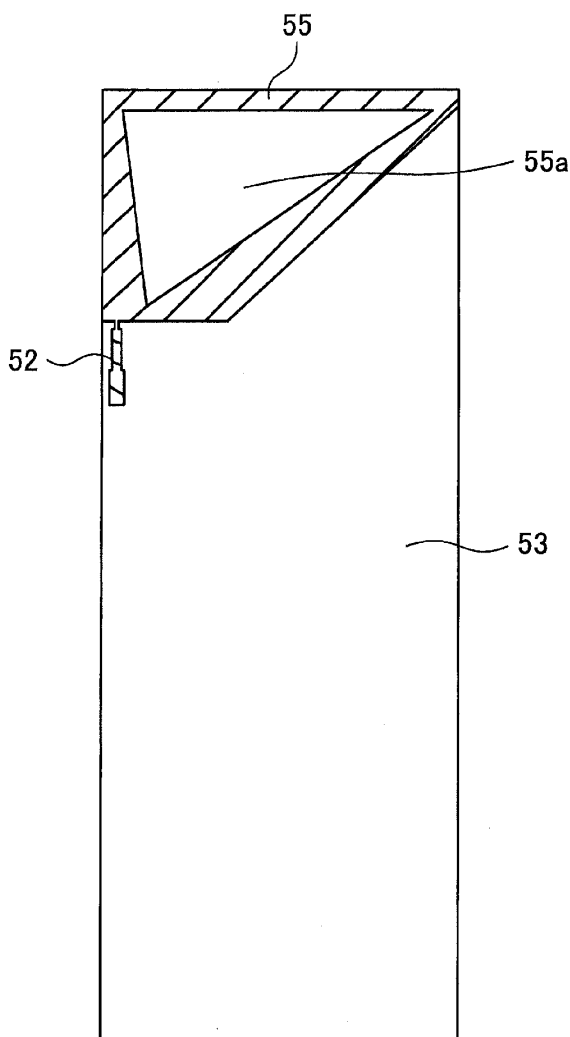
(57) **ABSTRACT**

(22) Filed: **Sep. 16, 2011**

A radiation section of an antenna includes a first connection portion and a second connection portion, and is in a loop form having a plate shape. A switch unit couples the second connection portion to the first connection portion e.g. according to a signal input from the outside. Further, the switch unit couples the second connection portion e.g. to ground formed on a reverse side of a substrate according to a signal input from the outside.

(30) **Foreign Application Priority Data**

Dec. 13, 2010 (JP) 2010-276736



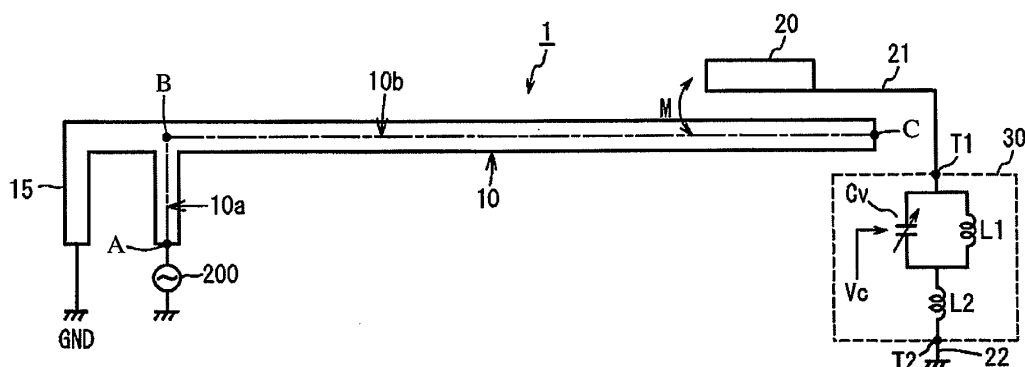
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US 20120146865A1

(19) **United States**(12) **Patent Application Publication**
Hayashi et al.(10) **Pub. No.: US 2012/0146865 A1**(43) **Pub. Date: Jun. 14, 2012**(54) **FREQUENCY-VARIABLE ANTENNA
CIRCUIT, ANTENNA DEVICE
CONSTITUTING IT, AND WIRELESS
COMMUNICATIONS APPARATUS
COMPRISING IT****Publication Classification**(51) **Int. Cl.**
H01Q 9/36 (2006.01)(52) **U.S. Cl.** **343/750**(75) **Inventors:** **Kenji Hayashi**, Tottori-shi (JP);
Hiroshi Okamoto, Tottori-shi (JP);
Hiroto Ideno, Tottori-shi (JP)(73) **Assignee:** **HITACHI METALS, LTD.**,
Minato-ku, Tokyo (JP)(21) **Appl. No.:** **13/391,954**(22) **PCT Filed:** **Nov. 15, 2010**(86) **PCT No.:** **PCT/JP2010/070302**§ 371 (c)(1),
(2), (4) Date:**Feb. 23, 2012**(30) **Foreign Application Priority Data**Nov. 13, 2009 (JP) 2009-260127
Aug. 6, 2010 (JP) 2010-177561(57) **ABSTRACT**

An antenna device comprising an antenna element disposed on a mounting board separate from a main circuit board, a coupling means disposed on the mounting board such that it is electromagnetically coupled to the antenna element, and a frequency-adjusting means disposed on the mounting board such that it is connected to the coupling means, the antenna element comprising first and second strip-shaped antenna elements integrally connected for sharing a feeding point, the second antenna element being shorter than the first antenna element; the coupling means being formed on a dielectric chip attached to the mounting board, and having a coupling electrode electromagnetically coupled to part of the first antenna element. The frequency-adjusting means comprises a parallel resonance circuit comprising a variable capacitance circuit and a first inductance element, and a second inductance element series-connected to the parallel resonance circuit.



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US 20120146874A1

(19) **United States**(12) **Patent Application Publication**

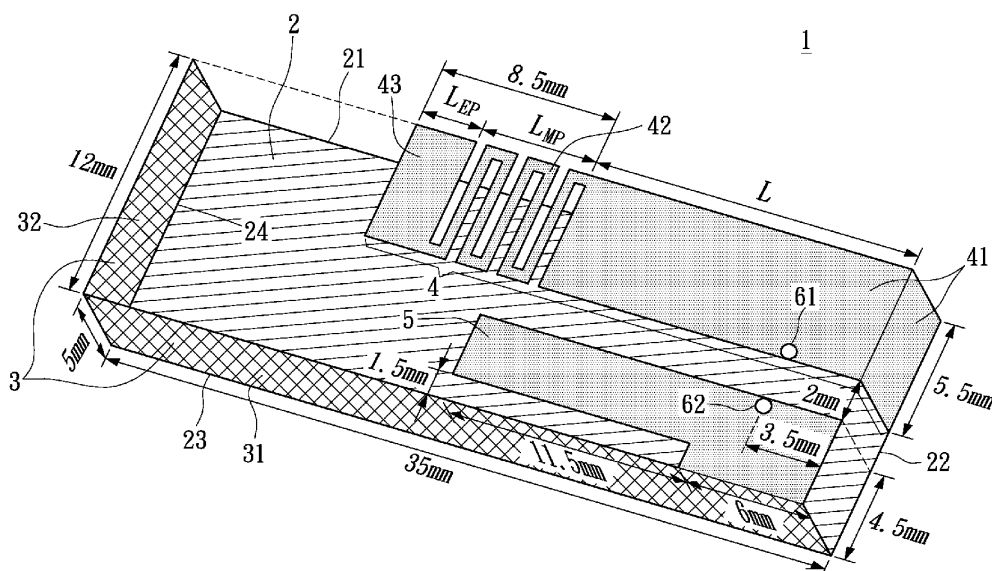
LEE et al.

(10) **Pub. No.: US 2012/0146874 A1**(43) **Pub. Date: Jun. 14, 2012**(54) **STAND-ALONE MULTI-BAND ANTENNA****Publication Classification**(75) Inventors: **Cheng-Tse LEE**, Jiaoxi Township (TW); **Saou-Wen Su**, Keelung City (TW)(51) **Int. Cl.**
H01Q 5/01 (2006.01)(52) **U.S. Cl.** **343/841**(57) **ABSTRACT**(73) Assignees: **LITE-ON TECHNOLOGY CORPORATION**, Taipei City (TW); **SILITEK ELECTRONIC (GUANGZHOU) CO., LTD.**, Guangzhou (CN)

A stand-alone multi-band antenna includes an antenna ground plate, a shielding metal wall, a first radiating unit, and a signal feed-in source. The first radiating unit connected to at least one side of the antenna ground plate and located above the antenna ground plate is an antenna structure generating the fringing-field. The first radiating unit provides a first operating band and a second operating band. The shielding metal wall is connected to a plurality of the adjacent sides of the antenna ground plate, and the height thereof is larger than or equal to that of the first radiating unit, therefore limiting the fringing-field of the first radiating unit within the stand-alone multi-band antenna. The signal feed-in source has a signal feed-in point and a ground point. The signal feed-in point is electrically connected to the first radiating unit, and the ground point is electrically connected to the shielding metal wall.

(21) Appl. No.: **13/049,284**(22) Filed: **Mar. 16, 2011**(30) **Foreign Application Priority Data**

Dec. 13, 2010 (CN) 201010623325.7



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US 20120146876A1

(19) **United States**

(12) **Patent Application Publication**
YANG

(10) **Pub. No.: US 2012/0146876 A1**

(43) **Pub. Date: Jun. 14, 2012**

(54) **SURFACE MOUNT DEVICE ANTENNA
MODULE**

Publication Classification

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 1/12 (2006.01)

(52) **U.S. Cl.** **343/848**

(57) **ABSTRACT**

(75) **Inventor:** **Tsai-Yi YANG**, Tainan City (TW)

(73) **Assignee:** **Cirotech Technology Corp.**

(21) **Appl. No.:** **13/316,416**

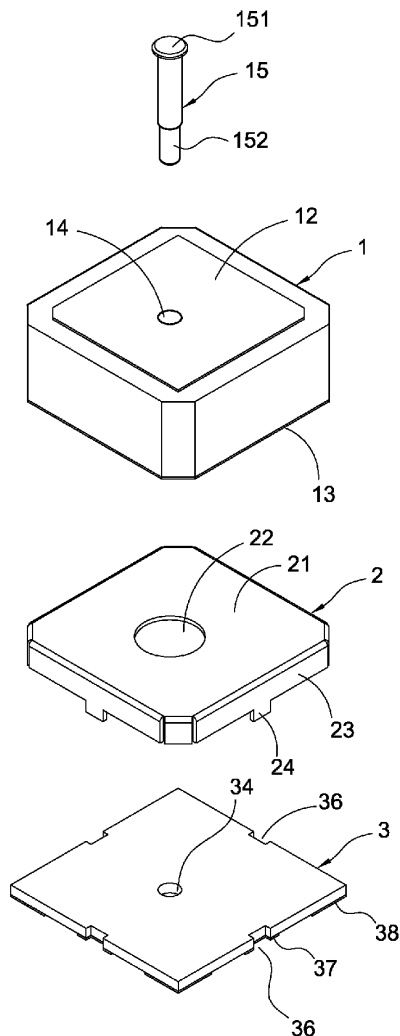
(22) **Filed:** **Dec. 9, 2011**

(30) **Foreign Application Priority Data**

Dec. 9, 2010 (TW) 099143120

Mar. 16, 2011 (TW) 100108918

A surface mount device antenna module includes an antenna unit, a connecting unit and a circuit board. The connecting unit is used to connect the antenna unit and the circuit board. The antenna unit has a signal feeder electrically connected with the circuit board which is under the antenna unit. The antenna module is able to be attached onto the main board of an electronic device by surface mount technology. The area of the main board covered by the antenna module can be decreased. And the dimensions of the main board and the electronic device can be consequently decreased.



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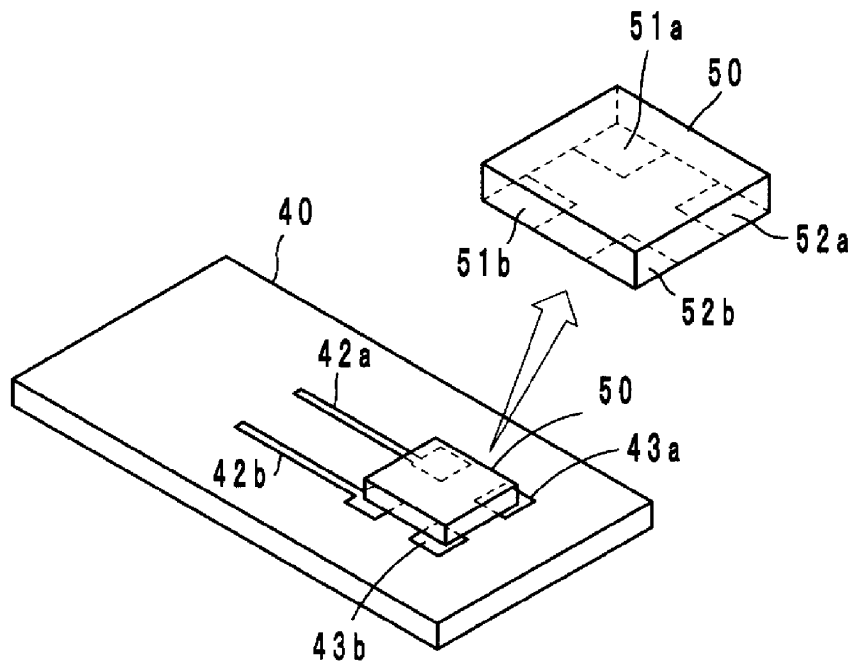
US 20120153029A1

(19) **United States**(12) **Patent Application Publication**
KATO(10) **Pub. No.: US 2012/0153029 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **ANTENNA, METHOD OF MANUFACTURING
THE ANTENNA, AND WIRELESS IC DEVICE**(75) Inventor: **Noboru KATO**, Nagaokakyo-shi
(JP)(73) Assignee: **MURATA MANUFACTURING
CO., LTD.**, Nagaokakyo-shi (JP)(21) Appl. No.: **13/406,599**(22) Filed: **Feb. 28, 2012****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2010/061344,
filed on Jul. 2, 2010.(30) **Foreign Application Priority Data**

Sep. 9, 2009 (JP) 2009-208564

Publication Classification(51) **Int. Cl.**
G06K 19/07 (2006.01)
H01Q 11/12 (2006.01)
H01P 11/00 (2006.01)(52) **U.S. Cl.** **235/492; 29/600; 343/741**(57) **ABSTRACT**

An antenna includes first and second radiation portions including one lead wire that is folded back into a loop shape to define a folded-back portion and that includes a first power feed portion at a first end and a second power feed portion at a second end. The lead wire portion extending toward the folded-back portion and the lead wire portion extending through the folded-back portion are close enough to each other near each of the first and second power feed portions in the first and second radiation portions, respectively, to be electromagnetically coupled to each other. The power feed portions of the antenna are coupled to a wireless IC chip. The power feed portions may be coupled to a feed circuit in a feed circuit board coupled to a wireless IC.



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US 20120154222A1

(19) **United States**(12) **Patent Application Publication****Oh et al.**(10) **Pub. No.: US 2012/0154222 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **MULTIBAND ANTENNA WITH GROUNDED ELEMENT****Publication Classification**

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
(52) **U.S. Cl.** 343/702; 343/700 MS

(57) **ABSTRACT**

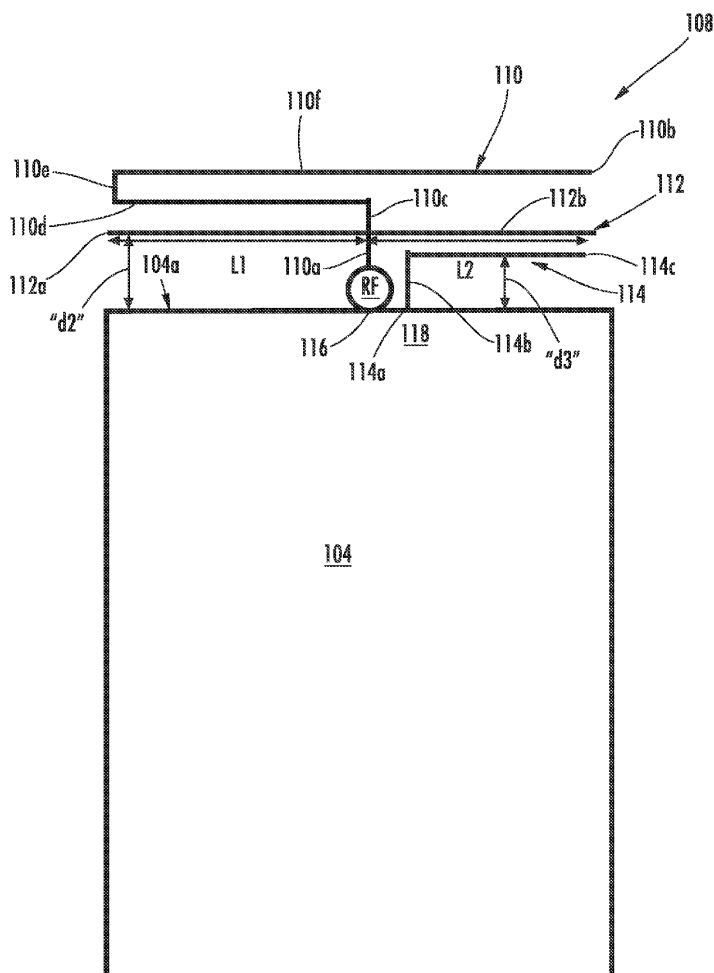
Various embodiments of an antenna structure for mobile devices are described. In one or more embodiments a multi-band antenna includes a grounded parasitic element. In some embodiments, a high band arm is provided, and is fed off-center, so that the resonating arms are not symmetrical in length. In some embodiments, a coupled ground resonator is included to add a differential resonating mode. A ground leg may be included to offer facilitate impedance and inductance matching. The combination of these structures creates four distinct resonance modes for the high band, which creases a wide effective bandwidth for the disclosed antenna. Other embodiments are described and claimed.

(75) **Inventors:** **Sung-Hoon Oh**, Cupertino, CA (US); **Thomas Liu**, Sunnyvale, CA (US); **Thorsten Hertel**, San Jose, CA (US)

(73) **Assignee:** **PALM, INC.**, SUNNYVALE, CA (US)

(21) **Appl. No.:** **12/971,444**

(22) **Filed:** **Dec. 17, 2010**



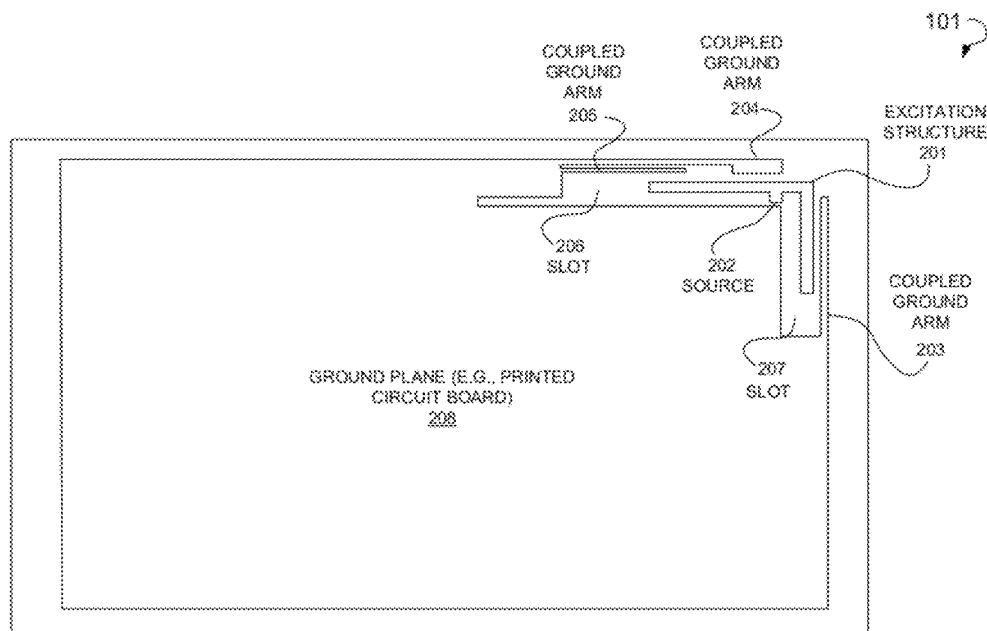
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US 20120154223A1

(19) **United States**(12) **Patent Application Publication****Oh et al.**(10) **Pub. No.: US 2012/0154223 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **SIGNAL GENERATION THROUGH USING A GROUNDING ARM AND EXCITATION STRUCTURE**(76) Inventors: **Sung-Hoon Oh**, Cupertino, CA (US); **Joselito dela Cruz Gavilan**, San Jose, CA (US)(21) Appl. No.: **12/975,335**(22) Filed: **Dec. 21, 2010****Publication Classification**(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)(52) **U.S. CL.** **343/702; 343/720; 343/767**(57) **ABSTRACT**

Disclosed is an apparatus and method to create multiple signals by utilizing the ground plane as part of the antenna. The apparatus comprises an excitation structure that includes a first segment and a second segment joined to form an angle, the first segment to generate a first signal and the second segment to generate a second signal. The apparatus also includes a ground plane that includes a slot with a perimeter, the excitation structure residing within the perimeter of the slot. Further, the apparatus also includes at least one ground arm coupled to the ground plane and formed from at least a portion of the perimeter of the slot, the at least one ground arm to generate a third signal from at least one of the first signal or the second signal.



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US 20120154225A1

(19) **United States**

(12) **Patent Application Publication**
KANAZAWA

(10) **Pub. No.: US 2012/0154225 A1**

(43) **Pub. Date: Jun. 21, 2012**

(54) **WIRELESS COMMUNICATION DEVICE**

Publication Classification

(75) Inventor: **Masaru KANAZAWA**, Kawasaki
(JP)

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

(52) **U.S. Cl.** **343/702**

(73) Assignee: **FUJITSU LIMITED**,
Kawasaki-shi (JP)

(57) **ABSTRACT**

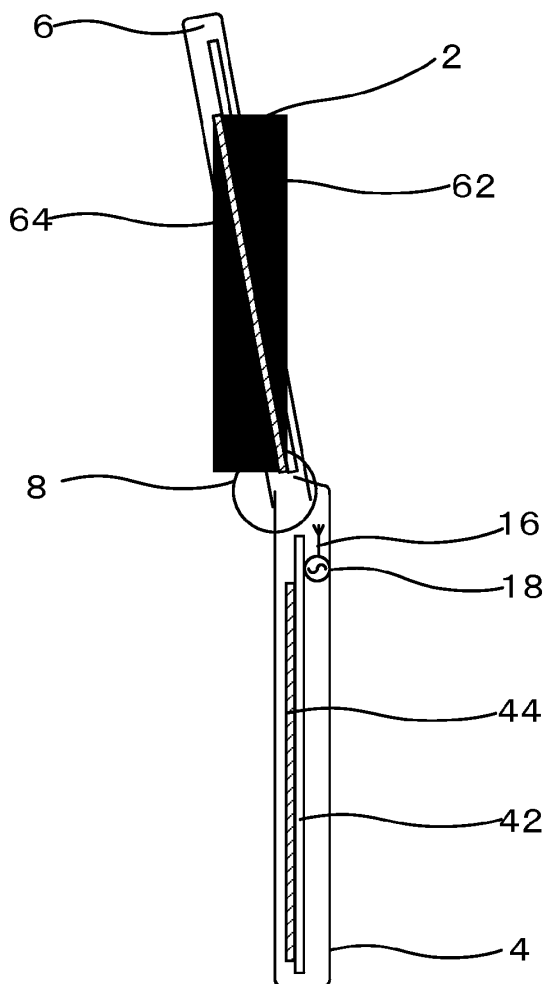
(21) Appl. No.: **13/299,491**

(22) Filed: **Nov. 18, 2011**

A wireless communication device includes: a first case having an antenna; and a second case connected to the first case, and having a first conductor at a position that is opposite to the antenna when the first case and the second case overlay each other, a second conductor at a position different from the position at which the first conductor is disposed, and a switch that switches an electrical connection state of the first conductor and the second conductor, wherein the switch switches the electrical connection state to disconnect state when the switch detects that the first case and the second case overlay each other.

(30) **Foreign Application Priority Data**

Dec. 21, 2010 (JP) 2010-285129



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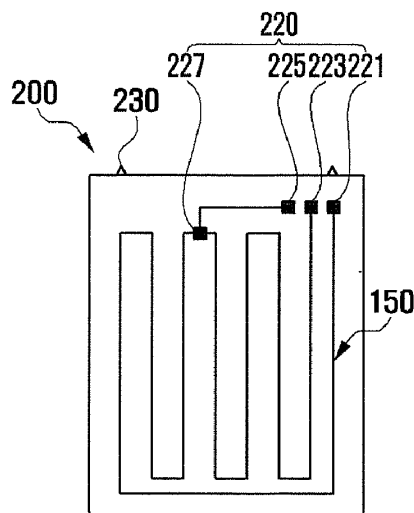
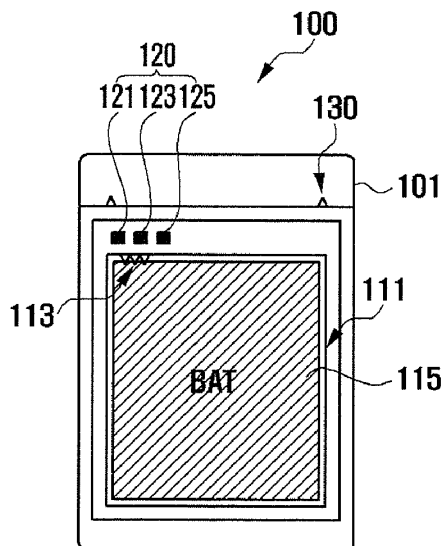
US 20120154226A1

(19) **United States**(12) **Patent Application Publication****Kim et al.**(10) **Pub. No.: US 2012/0154226 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **SINGLE UNIT ANTENNA FOR VARIOUS FUNCTIONS AND PORTABLE DEVICE INCLUDING THE SAME**(75) Inventors: **Hong Gu Kim**, Hwasung-si (KR); **Jae Min Seo**, Suwon-si (KR); **Hyo Sun You**, Suwon-si (KR)(73) Assignee: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)(21) Appl. No.: **13/326,237**(22) Filed: **Dec. 14, 2011**(30) **Foreign Application Priority Data**

Dec. 16, 2010 (KR) 10-2010-0128858

Publication Classification(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/50 (2006.01)(52) **U.S. Cl.** **343/702; 343/904; 343/876**(57) **ABSTRACT**

A portable device having a single unit antenna for various functions is provided. The device includes a main body configured to house a battery, a battery cover unit that is configured to be coupled with the main body and cover the battery, and a single unit antenna for various functions having a specified length, the antenna extending at least across a portion of the battery cover unit, and configured to support a plurality of functions.



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US 20120154230A1

(19) **United States**(12) **Patent Application Publication****WANG et al.**(10) **Pub. No.: US 2012/0154230 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **MULTI-BAND ANTENNA**(52) **U.S. CL. 343/725**

(75) Inventors: **Ying-Chih WANG**, Kuei Shan Hsiang (TW); **Ling-Chen WEI**, Tainan City (TW); **Tsung-Ming KUO**, Tainan City (TW)

(73) Assignee: **Quanta Computer Inc.**(21) Appl. No.: **13/151,032**(22) Filed: **Jun. 1, 2011**(30) **Foreign Application Priority Data**

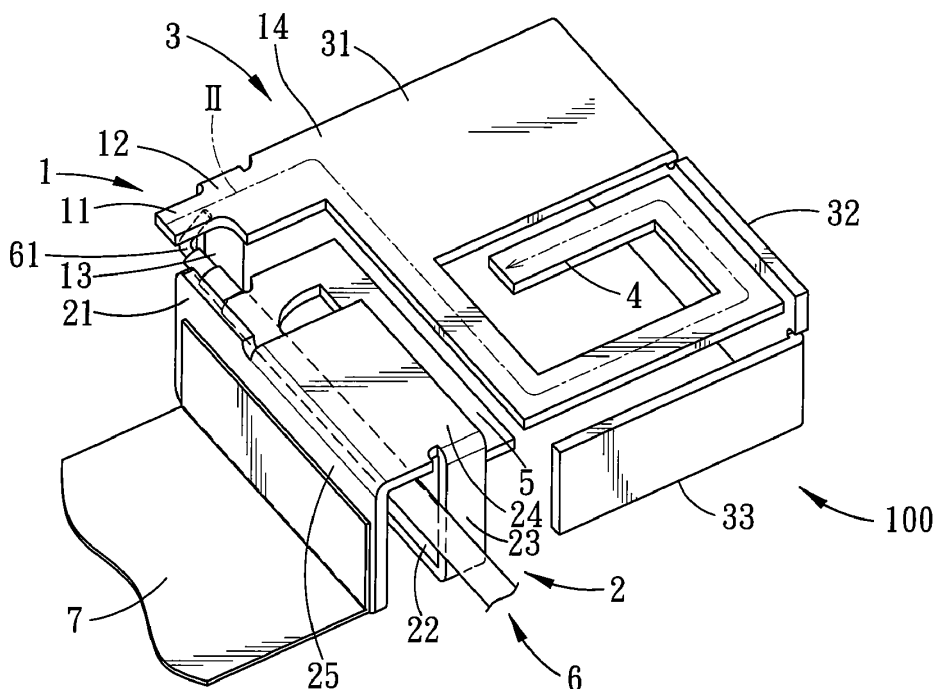
Dec. 20, 2010 (TW) 099144735

Publication Classification

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

(57) **ABSTRACT**

A multi-band antenna includes a feed-in section, a loop conductor, a first conductor arm, a second conductor arm, and a third conductor arm. The feed-in section includes a feed-in point for feeding of signals. The loop conductor extends from the feed-in section and has a grounding point disposed adjacent to the feed-in point. The first conductor arm is configured to resonate in a first frequency band and extends from the feed-in section. The second conductor arm is configured to resonate in a second frequency band and extends from the feed-in section. The third conductor arm is configured to resonate in a third frequency band and extends from the feed-in section. At least one of the loop conductor, the first conductor arm, the second conductor arm, and the third conductor arm is bent so as to be disposed in different planes.



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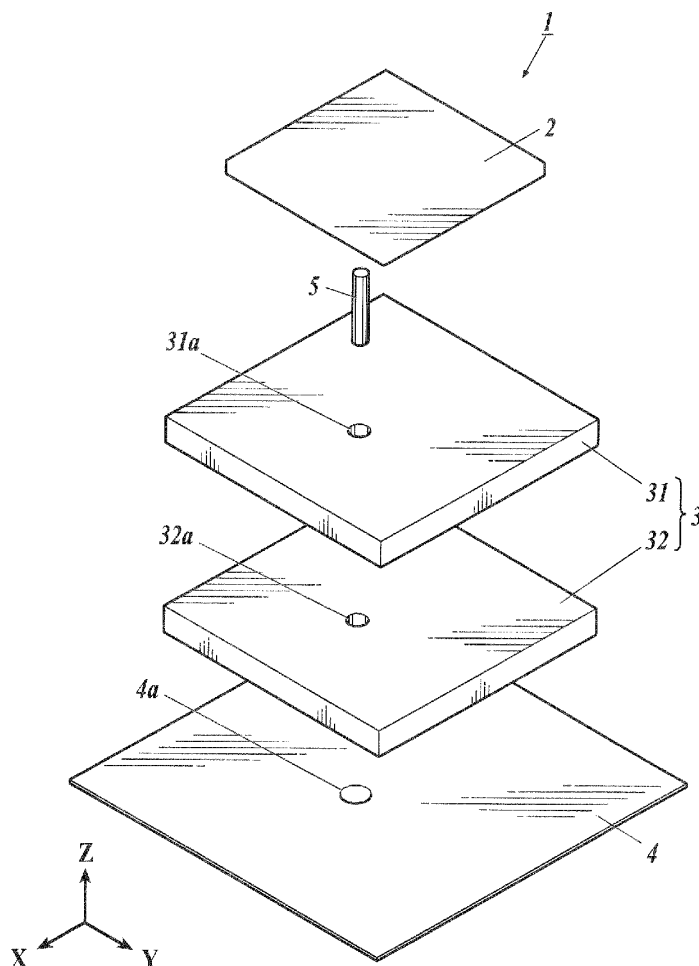
US 20120154235A1

(19) **United States**(12) **Patent Application Publication****Nakamura et al.**(10) **Pub. No.: US 2012/0154235 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **CIRCULARLY POLARISED ANTENNA**(30) **Foreign Application Priority Data**(75) Inventors: **Akira Nakamura**, Ebina-shi (JP);
Hiroki Yoshioka, Kawasaki-shi (JP)

Aug. 27, 2009 (JP) 2009-196296

Publication Classification(73) Assignee: **Mitsumi Electric Co. Ltd.**,
Tama-shi, Tokyo (JP)(51) **Int. Cl.**
H01Q 1/38 (2006.01)(52) **U.S. Cl.** **343/787**(21) Appl. No.: **13/392,579**(57) **ABSTRACT**(22) PCT Filed: **Aug. 2, 2010**(86) PCT No.: **PCT/JP2010/062994**§ 371 (c)(1),
(2), (4) Date:**Feb. 27, 2012**

A circularly polarised patch antenna includes: an antenna electrode; a ground section; a substrate, which is sandwiched between the antenna electrode and the ground section and which has insulating properties, a predetermined dielectric constant and single-axis magnetic anisotropy for a plurality of different magnetization directions; and a power feed pin which is electrically connected to the antenna electrode.



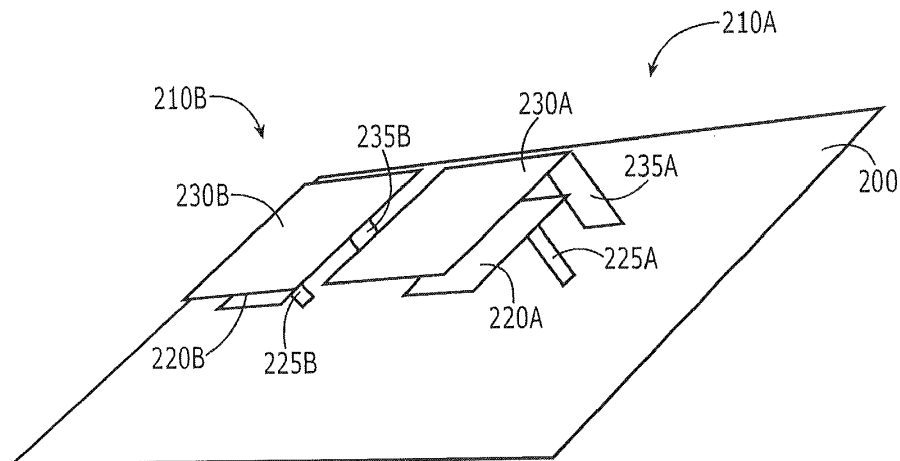
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US 20120154237A1

(19) **United States**(12) **Patent Application Publication**
Ying(10) **Pub. No.: US 2012/0154237 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **COMPACT ANTENNA FOR MULTIPLE
INPUT MULTIPLE OUTPUT
COMMUNICATIONS INCLUDING ISOLATED
ANTENNA ELEMENTS**(52) **U.S. CL. 343/833**(57) **ABSTRACT**

An antenna for MIMO communications includes a ground plane having a planar surface, a first feeding patch spaced apart from and parallel to the ground plane, and a first parasitic patch spaced apart from and parallel to the first feeding patch. The antenna further includes a second feeding patch spaced apart from and parallel to the ground plane and disposed adjacent the first feeding patch, and a second parasitic patch spaced apart from and parallel to the second feeding patch. The first parasitic patch may be capacitively coupled to the first feeding patch, and the second parasitic patch may be capacitively coupled to the second feeding patch. The ground plane may include an isolation notch therein arranged between the first and second feeding patches.

(76) **Inventor: Zhinong Ying, Lund (SE)**(21) **Appl. No.: 12/969,764**(22) **Filed: Dec. 16, 2010****Publication Classification**(51) **Int. Cl. H01Q 19/02 (2006.01)**

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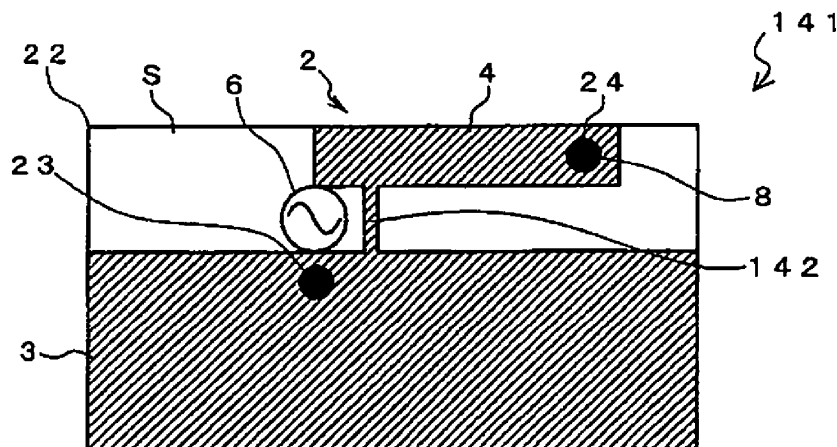
US 20120154240A1

(19) **United States**(12) **Patent Application Publication**
Shirakawa et al.(10) **Pub. No.: US 2012/0154240 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **ANTENNA AND WIRELESS DEVICE HAVING
SAME****Publication Classification**(51) **Int. Cl.**
H01Q 1/36 (2006.01)(52) **U.S. Cl.** **343/843**(57) **ABSTRACT**

An antenna includes an antenna element to transmit or receive electromagnetic signals, and a ground conductor to be grounded. The antenna element includes two conductors arranged substantially parallel to each other, a power feed portion provided between one conductor of the two conductors and the ground conductor, and connected to a feed system, a shorting portion for electrically connecting an other conductor of the two conductors and the ground conductor, and a conductor connecting portion for electrically connecting the two conductors together. The distance between the two conductors is not more than $\frac{1}{100}$ a wavelength equivalent to a minimum frequency of operating frequencies of the antenna.

(75) **Inventors:** **Yohei Shirakawa**, Hitachi (JP);
Kazuhiro Fujimoto, Hitachi (JP);
Masamichi Kishi, Hitachinaka
(JP); **Naoto Teraki**, Takahagi (JP);
Yoshitake Ageishi, Hitachi (JP)(73) **Assignee:** **Hitachi Cable Fine-Tech, Ltd.**,
Hitachi-shi (JP)(21) **Appl. No.:** **13/137,080**(22) **Filed:** **Jul. 19, 2011**(30) **Foreign Application Priority Data**

Dec. 16, 2010 (JP) 2010-280501



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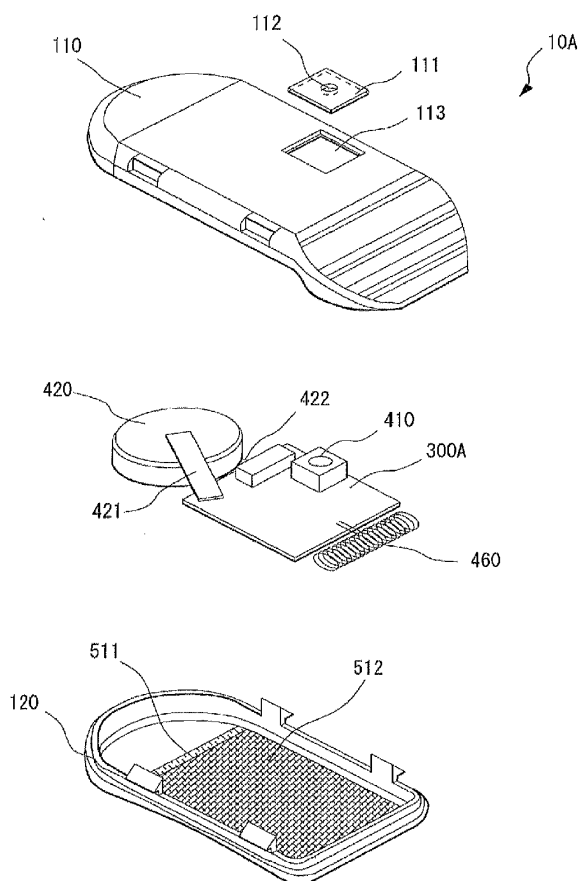
US 20120154242A1

(19) **United States**(12) **Patent Application Publication**
Nakatani(10) **Pub. No.: US 2012/0154242 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **TIRE-STATE DETECTION DEVICE****Publication Classification**(75) Inventor: **Koji Nakatani**, Hiratsuka-shi (JP)(51) **Int. Cl.**
H01Q 1/48 (2006.01)(73) Assignee: **THE YOKOHAMA RUBBER CO., LTD.**, Minato-ku, Tokyo (JP)(52) **U.S. Cl.** **343/848**(21) Appl. No.: **13/393,132**(57) **ABSTRACT**(22) PCT Filed: **May 18, 2010**(86) PCT No.: **PCT/JP2010/058351**§ 371 (c)(1),
(2), (4) Date: **Feb. 28, 2012**

A tire-state detection device including a sensor, an antenna having a predetermined frequency, a detection circuit, a case, and a planar conductor. The sensor detects a predetermined physical state of a tire. The detection circuit transmits information regarding a result of a detection made by the sensor from the antenna as radio waves. The case houses the sensor, the antenna and the detection circuit, and allows radio waves to pass. The case fits on a rim in the tire when the tire-state detection device is to be used. The planar conductor is electrically insulated from the antenna at a position set a predetermined distance away from the antenna so as to form an interface between the antenna and the rim when the case is fitted to the rim, and the planar conductor is set to a potential that is equivalent to a reference potential of the detection circuit.

(30) **Foreign Application Priority Data**

Sep. 1, 2009 (JP) 2009-201574



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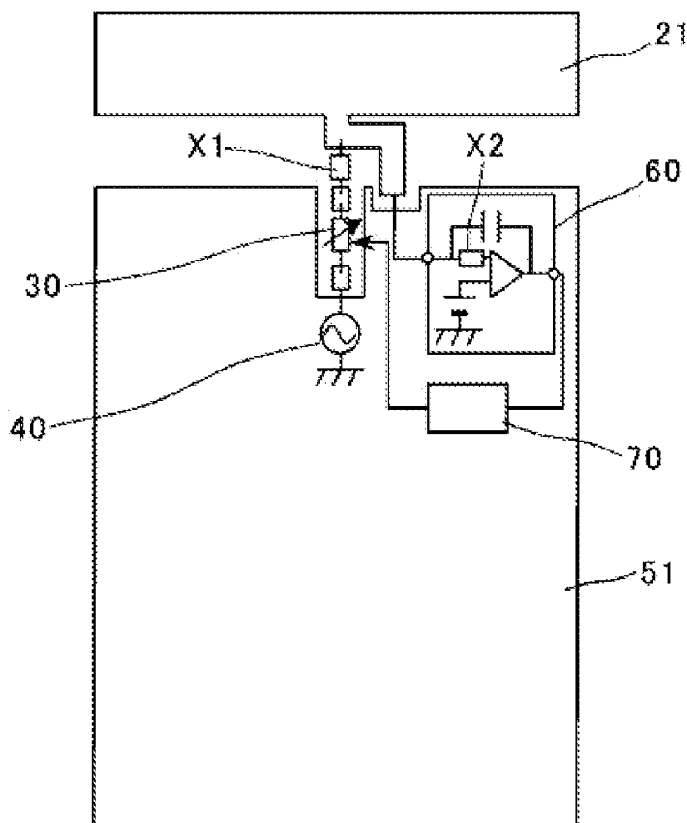


US 20120154245A1

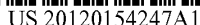
(19) **United States**(12) **Patent Application Publication**
NAGUMO et al.(10) **Pub. No.: US 2012/0154245 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **ANTENNA APPARATUS****Publication Classification**(75) Inventors: **Shoji NAGUMO**, Kyoto-fu (JP);
Masaaki TAKATA, Kyoto-fu (JP);
Noriyuki UEKI, Kyoto-fu (JP);
Hiromasa KOYAMA, Kyoto-fu (JP)(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 23/00 (2006.01)(52) **U.S. Cl.** **343/861**(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Kyoto-fu (JP)(57) **ABSTRACT**(21) Appl. No.: **13/404,039**(22) Filed: **Feb. 24, 2012****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2010/056431,
filed on Apr. 9, 2010.(30) **Foreign Application Priority Data**

Aug. 25, 2009 (JP) 2009-194738

This disclosure provides an antenna apparatus in which stable antenna characteristics are maintained by detecting surrounding conditions that affect the antenna characteristics and appropriately compensating the antenna characteristics. More specifically, when surrounding condition such as a human body (e.g., a palm or fingers) approaches and enters an electric field of a pseudo dipole formed by an antenna element electrode, a stray capacitance is sensed and stable antenna characteristics are maintained by appropriately controlling an antenna matching circuit to compensate for a change in the antenna characteristics due to the approach of the surrounding condition.



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

(43) **Pub. Date:** **Jun. 21, 2012**

Publication Classification

(52) **U.S. Cl.** 343/876

(57) **ABSTRACT**

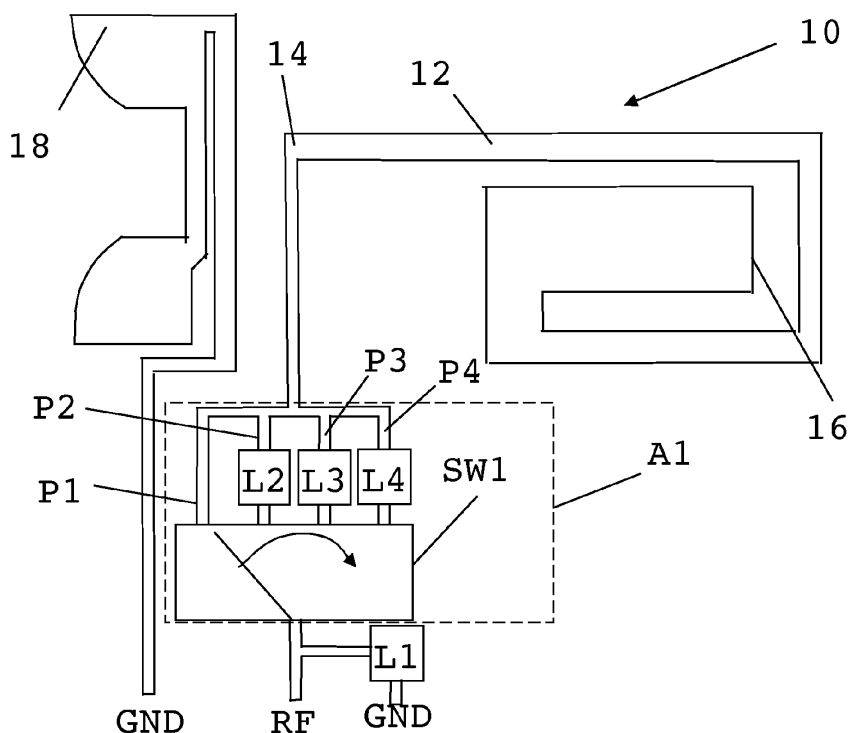
An antenna device for a portable radio communication device comprises a first electrically conductive radiating element including a basic resonance defining section having a first end, a length varying section connected between a feed point of the radiating element and the first end of the basic resonance defining section. The length varying section includes a set of parallel conductive paths and a first switching element selectively supplying radio signals between the feed point and the basic resonance defining section via one of the paths in the set. Each path influences the resonance of the radiating element in a separate way and at least one path includes a reactive element for adjusting the resonance of the first radiating element.

(21) Appl. No.: **13/274,017**

(22) Filed: **Oct. 14, 2011**

Related U.S. Application Data

(63) Continuation of application No. PCT/SE2009/050384, filed on Apr. 15, 2009.



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US 20120154248A1

(19) **United States**

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

(10) **Pub. No.: US 2012/0154248 A1**

(43) **Pub. Date: Jun. 21, 2012**

(54) **APPARATUS AND ASSOCIATED METHODS**

Publication Classification

(75) Inventors: **Samiul Haque**, Cambridge (GB);
Richard White, Huntingdon (GB)

(51) **Int. Cl.**
H01Q 3/01 (2006.01)
H01P 11/00 (2006.01)

(73) Assignee: **NOKIA CORPORATION**, Espoo
(FI)

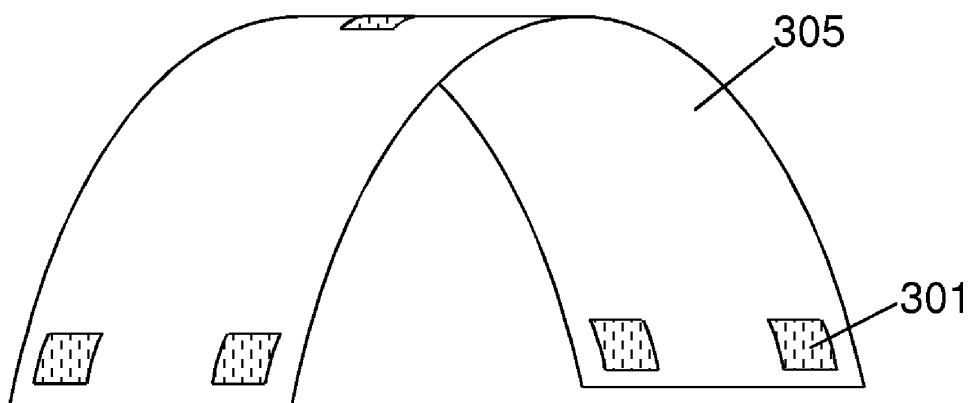
(52) **U.S. Cl.** **343/880; 29/600**

(21) Appl. No.: **12/971,072**

(57) **ABSTRACT**

(22) Filed: **Dec. 17, 2010**

An apparatus comprising an actuating substrate and an antenna in contact with the actuating substrate, the actuating substrate configured to undergo strain during actuation, wherein the strain in the actuating substrate varies the dimensions of the in-contact antenna and causes a change in the operational characteristics of the antenna.



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US 20120154687A1

(19) **United States**(12) **Patent Application Publication**
Yang et al.(10) **Pub. No.: US 2012/0154687 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **MULTI-BAND TUNABLE ANTENNA FOR
INTEGRATED DIGITAL TELEVISION
SERVICE ON MOBILE DEVICES****Publication Classification**(51) **Int. Cl.****H01Q 1/24**

(2006.01)

H04N 5/44

(2011.01)

H01Q 9/00

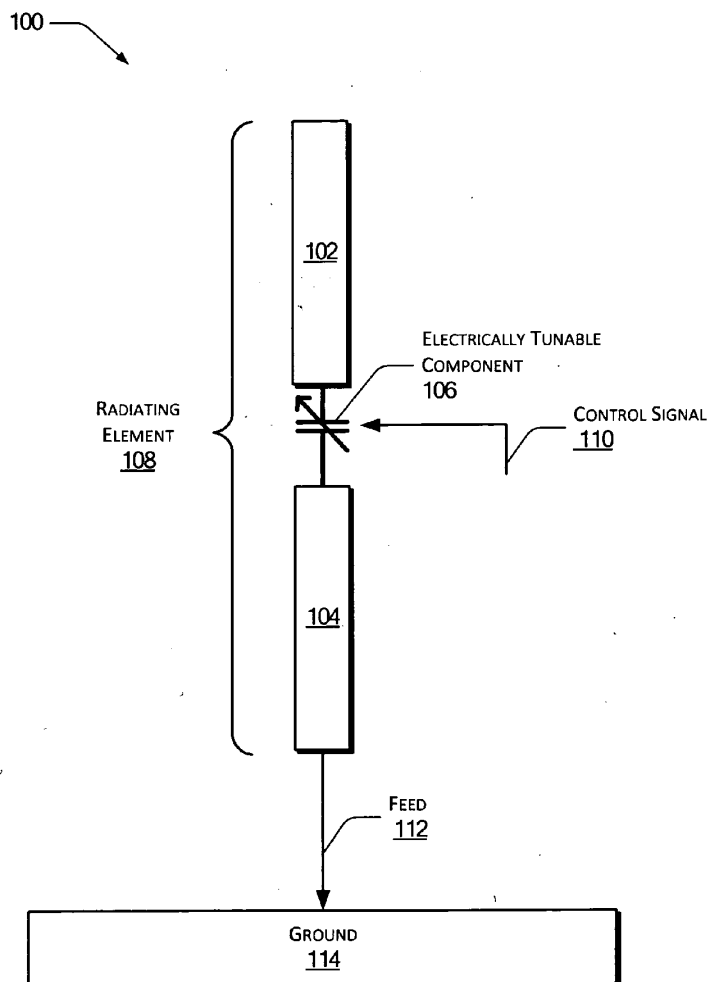
(2006.01)

(52) **U.S. Cl. ... 348/725; 343/750; 343/702; 348/E05.096**

(57)

ABSTRACT

A multi-band tunable antenna is implemented on device, where the multi-band tunable antenna supports both VHF and UHF frequencies at the same time, and particularly digital television frequencies. The multi-band tunable antenna includes a tunable component that connects metallic radiating elements. Changing the electrical property, such as capacitance, of the tunable component, changes the ability to receive particular frequencies.

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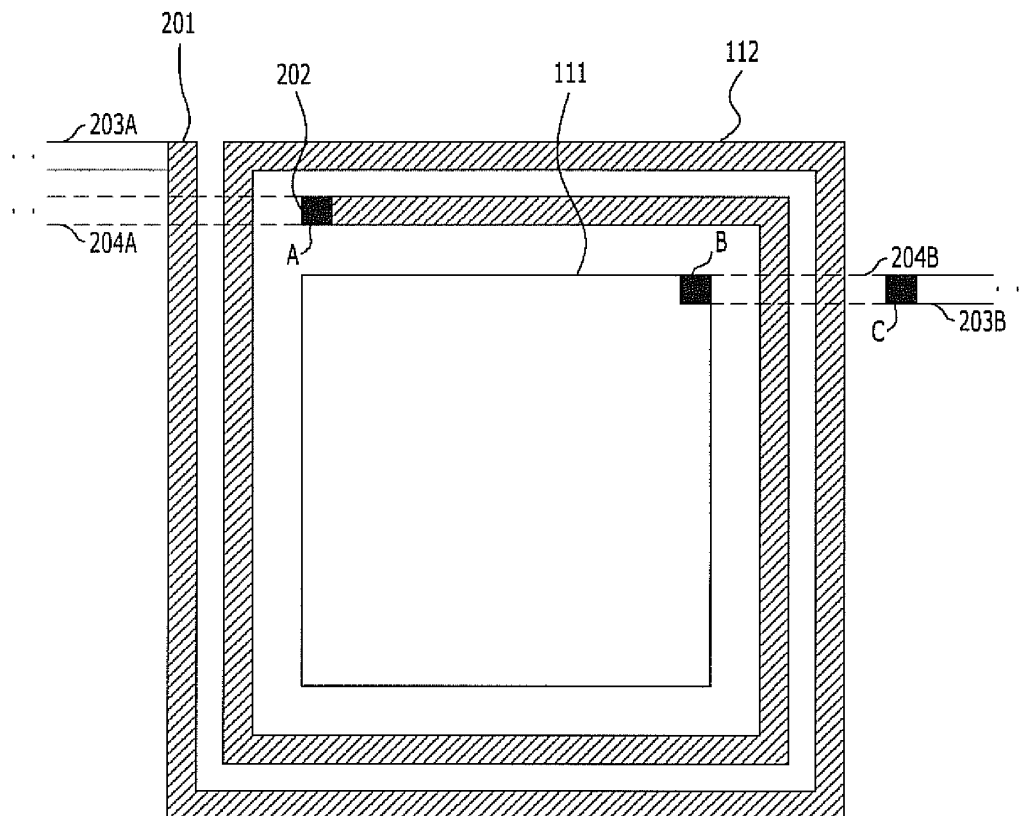


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(19) **United States**(12) **Patent Application Publication**
CHOI et al.(10) **Pub. No.: US 2012/0157015 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **SEMICONDUCTOR DEVICE AND
SEMICONDUCTOR CONTROL SYSTEM
INCLUDING THE SAME****Publication Classification**(51) **Int. Cl.**
H04B 1/38 (2006.01)
H01Q 1/38 (2006.01)(52) **U.S. Cl.** **455/90.2; 343/895**(57) **ABSTRACT**(76) **Inventors:** **Jun-Gi CHOI**, Gyeonggi-do (KR);
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A semiconductor device includes an interface pad, and an antenna formed to surround the interface pad. The semiconductor device may further include a buffer configured to receive a first input signal applied to the interface pad, a driver configured to output a first output signal to the interface pad a receiver configured to receive a second input signal transferred to the antenna, and a transmitter configured to output a second output signal to the antenna.



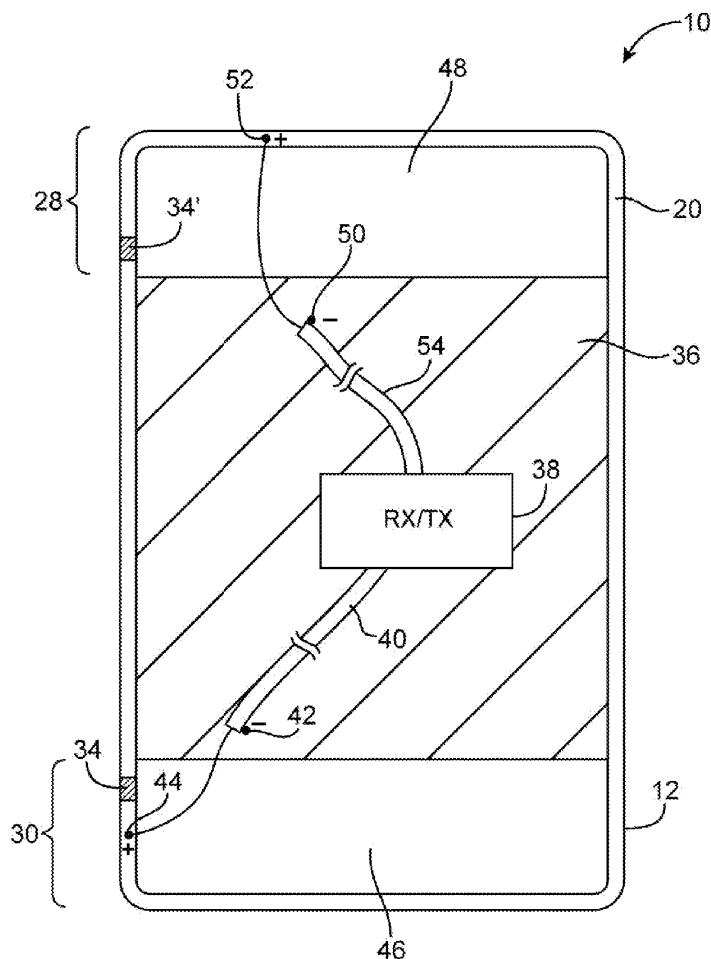
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(19) **United States**(12) **Patent Application Publication****Golko et al.**(10) **Pub. No.: US 2012/0157175 A1**(43) **Pub. Date: Jun. 21, 2012**(54) **PERIPHERAL ELECTRONIC DEVICE
HOUSING MEMBERS WITH GAPS AND
DIELECTRIC COATINGS**(52) **U.S. CL.** 455/575.7; 343/702; 174/520(57) **ABSTRACT**(76) **Inventors:** **Albert J. Golko**, Saratoga, CA
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H05K 5/00 (2006.01)
H01Q 1/24 (2006.01)

An electronic device such as a handheld device may have a rectangular housing with a rectangular periphery. A conductive peripheral housing member may run along the rectangular periphery and may surround the rectangular housing. Radio-frequency transceiver circuitry within the electronic device may be coupled to antenna structures for transmitting and receiving radio-frequency signals. The conductive peripheral housing member may form part of the antenna structures. A gap in the conductive peripheral housing member may be filled with dielectric. The conductive peripheral housing member may be configured to form a recess. The recess may have the shape of a rectangle, oval, diamond, or other shape that overlaps and is bisected by the gap. The recess may also have the shape of a groove that extends around the entire periphery of the housing. The dielectric in the recess may include one or more different materials such as clear and opaque polymers.



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