



US 20130152378A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0152378 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **OVERSIZED ANTENNA FLEX**

**Publication Classification**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)  
(72) Inventors: **Fletcher R. Rothkopf**, Los Altos, CA (US); **Brian Lynch**, Portola Valley, CA (US); **Wey-Jiun Lin**, Los Altos Hills, CA (US); **Kyle H. Yeates**, Seattle, WA (US); **Yi Jiang**, Sunnyvale, CA (US)

(51) **Int. Cl.**  
**H01Q 1/00** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H01Q 1/00** (2013.01)  
USPC ..... **29/593; 29/600**

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(57) **ABSTRACT**

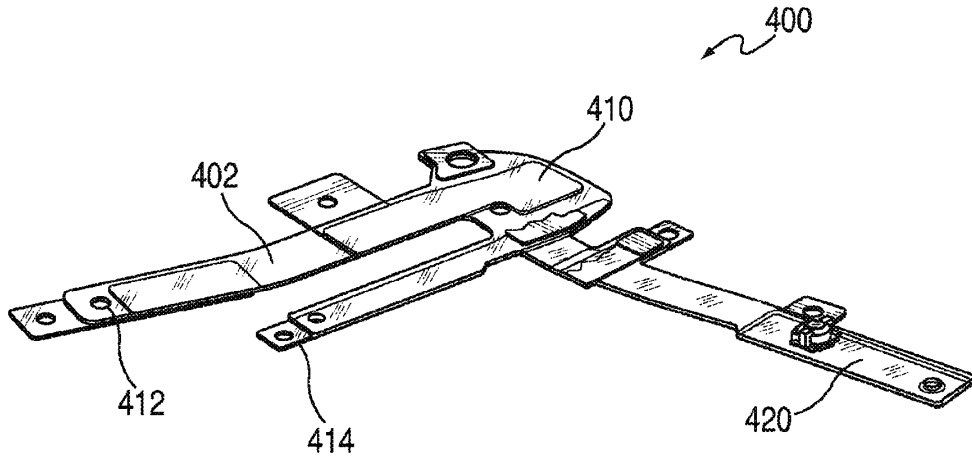
(21) Appl. No.: **13/768,177**

This is directed to an antenna for use in an electronic device. The antenna can be constructed from a flex and printed trace, such that the flex is originally defined to be as large or nearly as large as possible to fit within portion of the electronic device dedicated to the antenna. This can allow the antenna trace to vary as the antenna is tuned without requiring a new flex having a different shape. In addition, this can allow the antenna design to be decoupled from the mechanical considerations related to mounting the antenna within the electronic device.

(22) Filed: **Feb. 15, 2013**

**Related U.S. Application Data**

(62) Division of application No. 12/555,651, filed on Sep. 8, 2009, now Pat. No. 8,397,370.





US 20130154884A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154884 A1**

(43) **Pub. Date: Jun. 20, 2013**

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

(52) **U.S. Cl.**  
USPC ..... **343/700 MS**

(75) Inventors: **Shih-Chieh CHENG**, Kaohsiung City (TW); **Kuo-Chang LO**, Miaoli County (TW)

(57) **ABSTRACT**

(73) Assignee: **Arcadyan Technology Corporation**, Hsinchu (TW)

A broadband planar inverted-F antenna includes a first radiation conductor, a second radiation conductor and a third radiation conductor. The first radiation conductor includes a first inclined-plane portion and a feeding point. The feeding point is located at one end of the first inclined-plane portion. The second radiation conductor is connected to the first radiation conductor at the feeding point. The third radiation conductor is connected to the first radiation conductor, and includes a second inclined-plane portion and a ground point. The second inclined-plane portion is separated from and facing to the first inclined-plane portion. The ground point is located at one end of the second inclined-plane portion and facing to the feeding point, wherein the distance between the first inclined-plane portion and the second inclined-plane portion is gradually increased from the part near the feeding point along a direction departing from the feeding point.

(21) Appl. No.: **13/559,407**

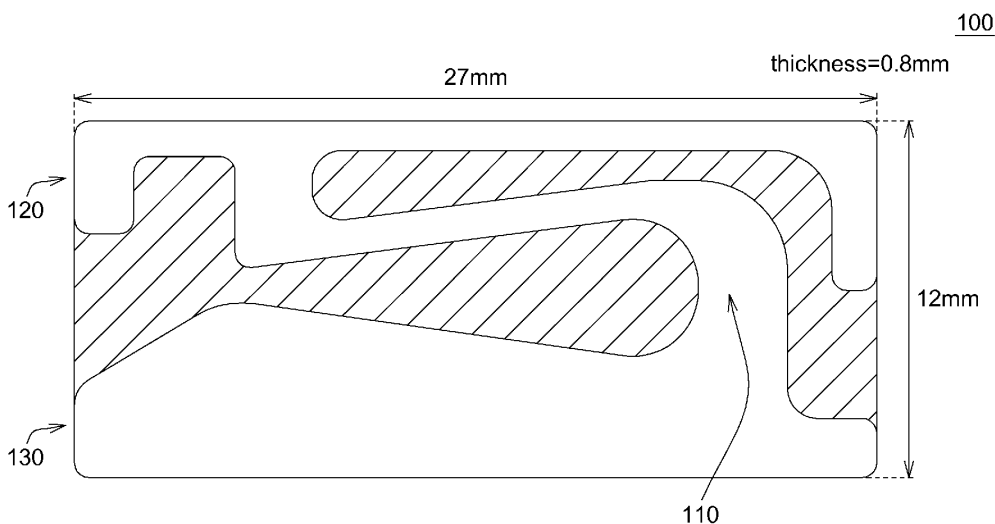
(22) Filed: **Jul. 26, 2012**

(30) **Foreign Application Priority Data**

Dec. 15, 2011 (TW) ..... 100146643

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/36** (2006.01)





US 20130154886A1

(19) **United States**

(12) **Patent Application Publication**  
**Isöhätälä**

(10) **Pub. No.: US 2013/0154886 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **LOOSELY-COUPLED RADIO ANTENNA APPARATUS AND METHODS**

(76) Inventor: **Anne Isöhätälä**, Kello (FI)

(21) Appl. No.: **13/331,802**

(22) Filed: **Dec. 20, 2011**

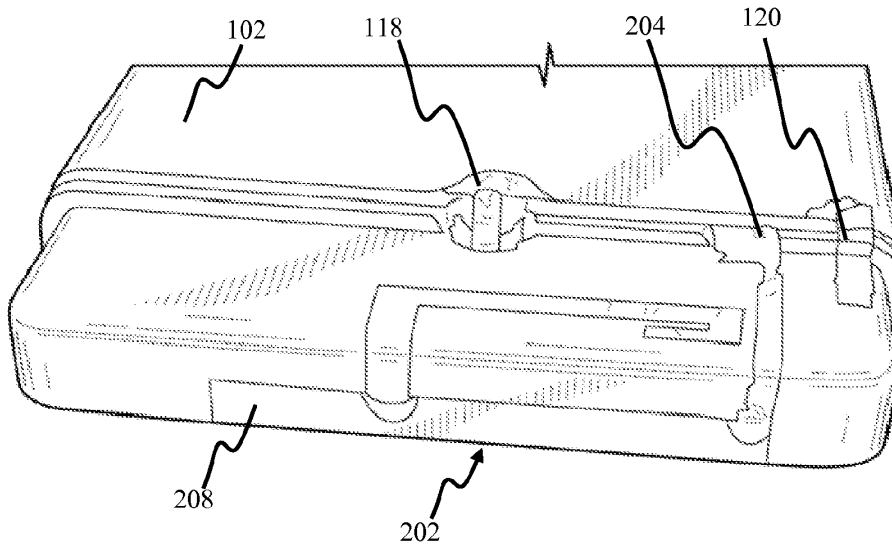
**Publication Classification**

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

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

(57) **ABSTRACT**

A multiband internal antenna apparatus and methods of tuning and utilizing the same. In one embodiment, the antenna configuration is used within a handheld mobile device (e.g., cellular telephone or smartphone). The device enclosure is fabricated from a conductive material and has two parts: the main portion, housing the device electronics and ground plane, and the antenna cap, which substantially envelops a directly fed radiator structure of the antenna. Electromagnetic coupling of the cap portion to the device feed effects formation of a parasitic antenna radiator in a lower frequency band. The cap portion is separated from the main portion by a narrow gap, extending along circumference of the device, and is grounded at a location selected to cause desired resonance and to widen antenna bandwidth. In one implementation, a second parasitic radiator is disposed proximate the directly feed radiator to further expand antenna frequency bands of operation.





US 20130154888A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154888 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **TUNABLE ANTENNA AND RELATED RADIO-FREQUENCY DEVICE**

(52) **U.S. Cl.**  
USPC ..... 343/745

(76) Inventors: **Hsiao-Yi Lin**, Hsinchu (TW);  
**Jhih-Yuan Ke**, Hsinchu (TW);  
**Chih-Ming Wang**, Hsinchu (TW)

(57) **ABSTRACT**

A tunable antenna is disclosed. The tunable antenna includes a ground element for providing grounding, a signal feed-in terminal, a radiation unit electrically connected to the signal feed-in terminal and including a long side extended from the signal feed-in terminal along a first direction, a short side extended from the signal feed-in terminal along a second direction, and a branch electrically connected between the signal feed-in terminal and the ground element, a coupling unit for coupling to the long side, and a switch unit for connecting or disconnecting the coupling unit to/from the ground element to change a coupling relationship between the coupling unit and the long side, such that the tunable antenna respectively operates in a first frequency band and a second frequency band.

(21) Appl. No.: **13/561,086**

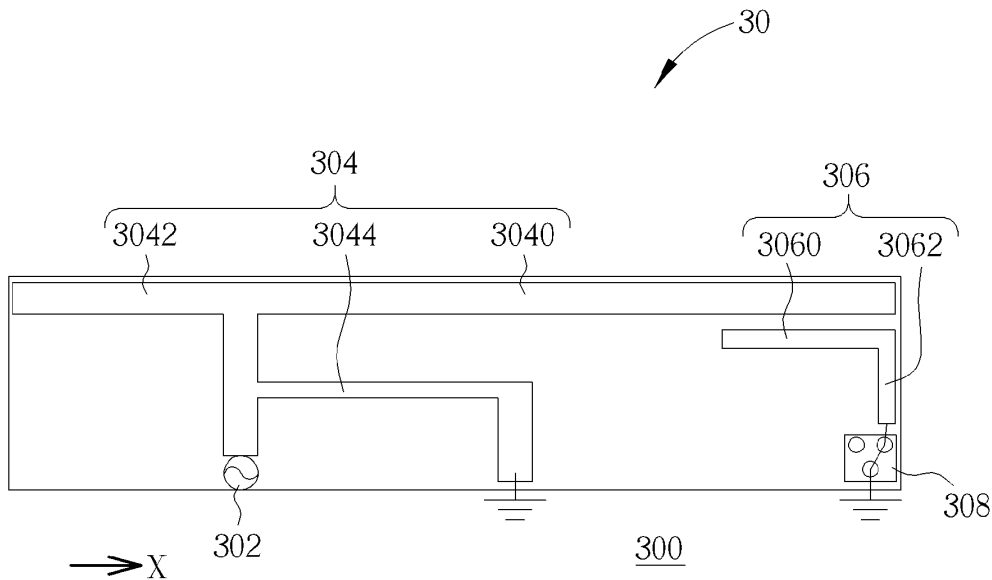
(22) Filed: **Jul. 30, 2012**

(30) **Foreign Application Priority Data**

Dec. 20, 2011 (TW) ..... 100147446

**Publication Classification**

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





US 20130154890A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154890 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **ANTENNA DEVICE**

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

USPC ..... 343/770

(75) Inventors: **Cheng-Geng JAN**, Hsinchu (TW);  
**I-Shan Chen**, Hsinchu (TW);  
**Chia-Hong Lin**, Hsinchu (TW);  
**Tien-Min Lin**, Hsinchu (TW); **Yi-Cheih Wang**, Hsinchu (TW); **Cheng-Hsiung Hsu**, Hsinchu (TW)

(57) **ABSTRACT**

(73) Assignee: **Wistron NeWeb Corporation**

An antenna device is provided and includes a bottom, two monopole antennas, and a cover assembled with the bottom. A projection plane is defined perpendicular to the bottom. The two monopole antennas substantially symmetrically protrude from the bottom, and a gap is formed between the two monopole antennas. Projections of the two monopole antennas on the projection plane intersect with each other. Each of the two monopole antennas includes a first frequency receiving portion adjacent to the bottom, a second frequency receiving portion, and a connection portion located between the first frequency receiving portion and the second frequency receiving portion. A slot is formed through the connection portion to adjust a received frequency of the first or second frequency receiving portion. An accommodating space is formed between the cover and the bottom to accommodate the two monopole antennas.

(21) Appl. No.: **13/440,189**

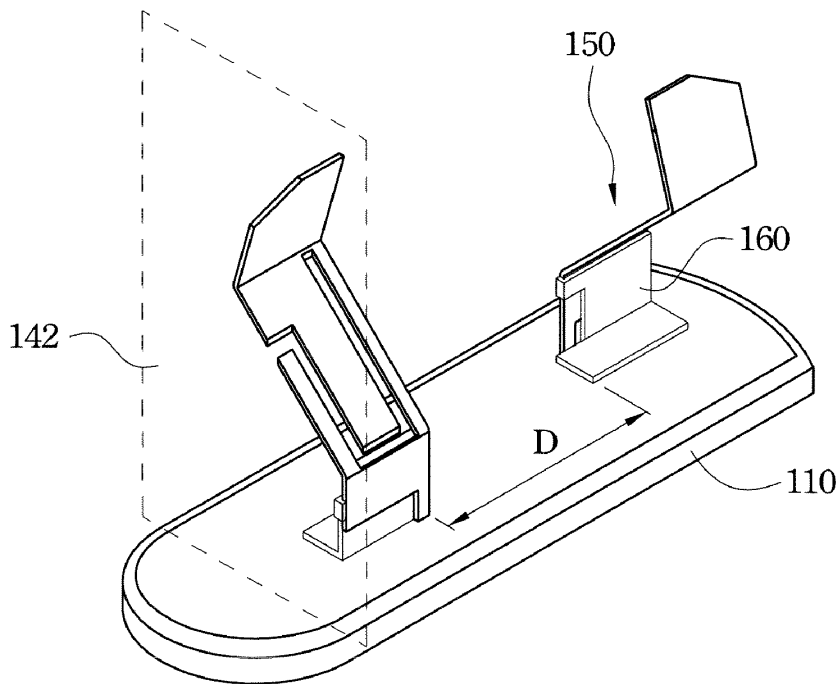
(22) Filed: **Apr. 5, 2012**

(30) **Foreign Application Priority Data**

Dec. 15, 2011 (TW) ..... 100146526

**Publication Classification**

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





US 20130154891A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154891 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **ANTENNA DEVICE AND COMMUNICATION  
TERMINAL DEVICE**

**Publication Classification**

(71) Applicant: **MURATA MANUFACTURING CO.,  
LTD.**, Kyoto-fu (JP)

(51) **Int. Cl.**  
**H01Q 7/06** (2006.01)

(72) Inventors: **Hiroyuki KUBO**, Kyoto-fu (JP);  
**Hiromitsu ITO**, Kyoto-fu (JP); **Kuniaki  
YOSUI**, Kyoto-fu (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 7/06** (2013.01)  
USPC ..... **343/788**

(73) Assignee: **MURATA MANUFACTURING CO.,  
LTD.**, Kyoto-fu (JP)

(57) **ABSTRACT**

(21) Appl. No.: **13/765,512**

(22) Filed: **Feb. 12, 2013**

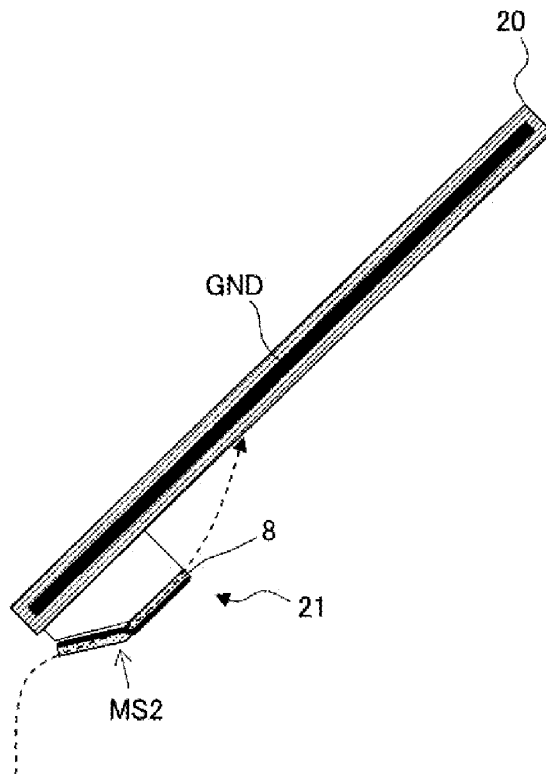
An antenna device or a communication terminal device including the antenna device includes ground conductor, which serves as a plate-shaped conductor and is provided in an inner layer of a circuit board. An antenna coil is mounted so that a first main surface of a magnetic core faces the circuit board. The antenna coil is arranged so that a first conductor portion of a coil conductor is at a position that is closer to the ground conductor than a second conductor portion. The antenna coil is arranged so that the first conductor portion of the coil conductor is positioned in the vicinity of a longitudinal direction end portion of a casing, and the first conductor portion of the coil conductor is bent in a direction toward the ground conductor.

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2011/057097,  
filed on Mar. 24, 2011.

**Foreign Application Priority Data**

(30) Aug. 12, 2010 (JP) ..... 2010-180925





US 20130154892A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154892 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **ANTENNA WITH DIVIDED GROUND PLANE**

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

(71) Applicants: **Sagiv Zeltser**, Tel Aviv (IL); **Yohan Cohen**, Oranit (IL)

CPC ..... **H01Q 1/48** (2013.01)

USPC ..... **343/848**

(72) Inventors: **Sagiv Zeltser**, Tel Aviv (IL); **Yohan Cohen**, Oranit (IL)

(57) **ABSTRACT**

(21) Appl. No.: **13/761,179**

(22) Filed: **Feb. 7, 2013**

**Related U.S. Application Data**

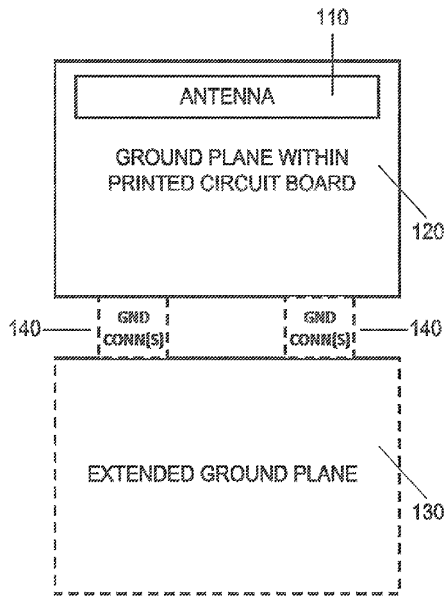
(63) Continuation of application No. 12/786,963, filed on May 25, 2010, now Pat. No. 8,384,612.

(60) Provisional application No. 61/180,894, filed on May 25, 2009.

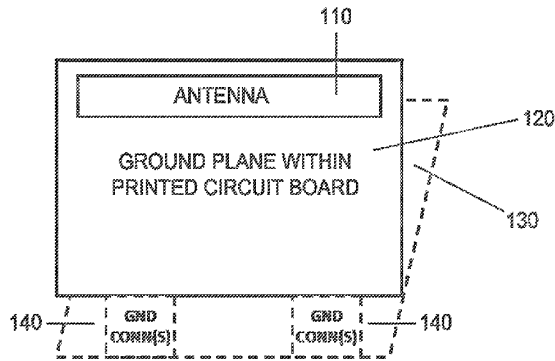
**Publication Classification**

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

A removable jacket for a modular communicator, including a connector for connecting the jacket to a modular communicator that includes an antenna and a ground plane for the antenna, wherein the jacket may be conveniently attached to and detached from the communicator, an extended ground plane for the antenna, and at least one ground contact, for connecting the extended ground plane to the ground plane of the communicator, wherein the ground plane of the communicator is too short for the antenna to resonate at a desired frequency, but the ground plane of the communicator when connected with the extended ground plane, provides a combined ground plane sufficient for the antenna to resonate at the desired frequency.



100A



100B



(19) **United States**

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

(10) **Pub. No.: US 2013/0154894 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **METHODS AND APPARATUSES FOR ADAPTIVELY CONTROLLING ANTENNA PARAMETERS TO ENHANCE EFFICIENCY AND MAINTAIN ANTENNA SIZE COMPACTNESS**

in-part of application No. 11/252,248, filed on Oct. 17, 2005, now Pat. No. 7,663,555.

(60) Provisional application No. 60/619,231, filed on Oct. 15, 2004.

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/50** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H01Q 1/50** (2013.01)  
USPC ..... **343/858**

(71) Applicants: **Frank M. Caimi**, Vero Beach, FL (US);  
**Gregory A. O'Neill, JR.**, Rockledge, FL (US);  
**Ping Chen**, Greensboro, NC (US);  
**Young-Min Jo**, Viera, FL (US)

(72) Inventors: **Frank M. Caimi**, Vero Beach, FL (US);  
**Gregory A. O'Neill, JR.**, Rockledge, FL (US);  
**Ping Chen**, Greensboro, NC (US);  
**Young-Min Jo**, Viera, FL (US)

(57) **ABSTRACT**

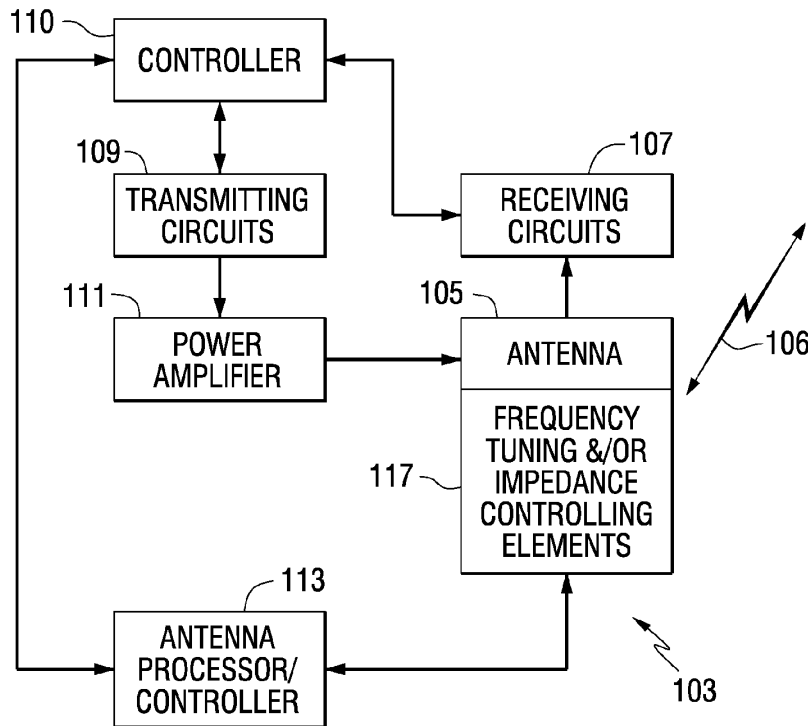
A communications apparatus. The apparatus comprises a transmitting antenna, a receiving antenna, a first serial configuration of a first power amplifier and a first matching network for producing a first signal, the first power amplifier operating in a first frequency band, a second serial configuration of a second power amplifier and a second matching network for producing a second signal, the second power amplifier operating in a second frequency band, a first switching element for switchably supplying the first signal or the second signal to the transmitting antenna, a first and a second receiver; and a second switching element for switchably directing a signal received at the receiving antenna to the first receiver or the second receiver.

(21) Appl. No.: **13/646,012**

(22) Filed: **Oct. 5, 2012**

**Related U.S. Application Data**

(63) Continuation of application No. 13/209,707, filed on Aug. 15, 2011, now abandoned, which is a continuation of application No. 11/623,307, filed on Jan. 15, 2007, now Pat. No. 8,000,737, which is a continuation-in-part of application No. 11/421,878, filed on Jun. 2, 2006, now Pat. No. 7,834,813, which is a continuation-







US 20130154895A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154895 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **INTEGRATED ANTENNA STRUCTURE**

**Publication Classification**

(75) Inventors: **Alireza Mahanfar**, Redmond, WA (US);  
**Carlos Manzanedo**, Kirkland, WA (US);  
**Jagdeep Singh Toor**, Redmond, WA  
(US); **Vinod L. Hingorani**, Redmond,  
WA (US); **Louis C. Barinaga**,  
Snohomish, WA (US)

(51) **Int. Cl.**  
**H01Q 1/50** (2006.01)  
**H01Q 1/38** (2006.01)  
(52) **U.S. Cl.**  
USPC ..... **343/860; 343/700 MS**

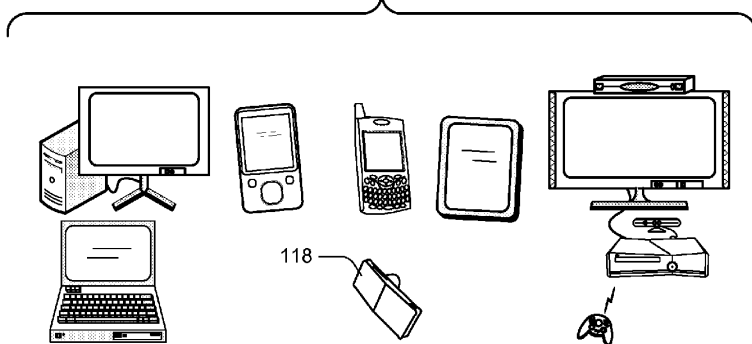
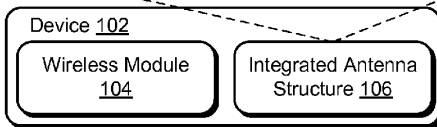
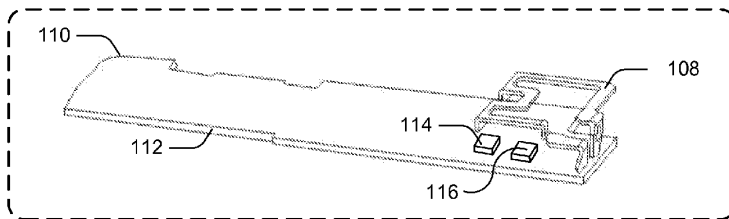
(73) Assignee: **MICROSOFT CORPORATION**,  
Redmond, WA (US)

(57) **ABSTRACT**  
Techniques for implementing an integrated antenna structure are described. In at least some embodiments, the integrated antenna structure includes an antenna that is folded and/or meandered in design to enable the antenna to be incorporated into a compact area. The integrated antenna structure further includes a printed circuit board (PCB) with a ground plane to which the antenna is connected. In implementations, the antenna and the PCB can be combined to form an integrated radiating structure that can be incorporated into a device to enable the device to transmit and/or receive wireless signals.

(21) Appl. No.: **13/330,401**

(22) Filed: **Dec. 19, 2011**

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(19) **United States**

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

(10) **Pub. No.: US 2013/0154897 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **METHODS AND APPARATUS FOR CONTROLLING TUNABLE ANTENNA SYSTEMS**

(52) **U.S. Cl.**  
USPC ..... 343/861

(76) Inventors: **Robert S. Sorensen**, Fremont, CA (US);  
**Qingxiang Li**, Mountain View, CA (US);  
**Matthew A. Mow**, Los Altos, CA (US);  
**Jinku Kim**, Cupertino, CA (US)

(57) **ABSTRACT**

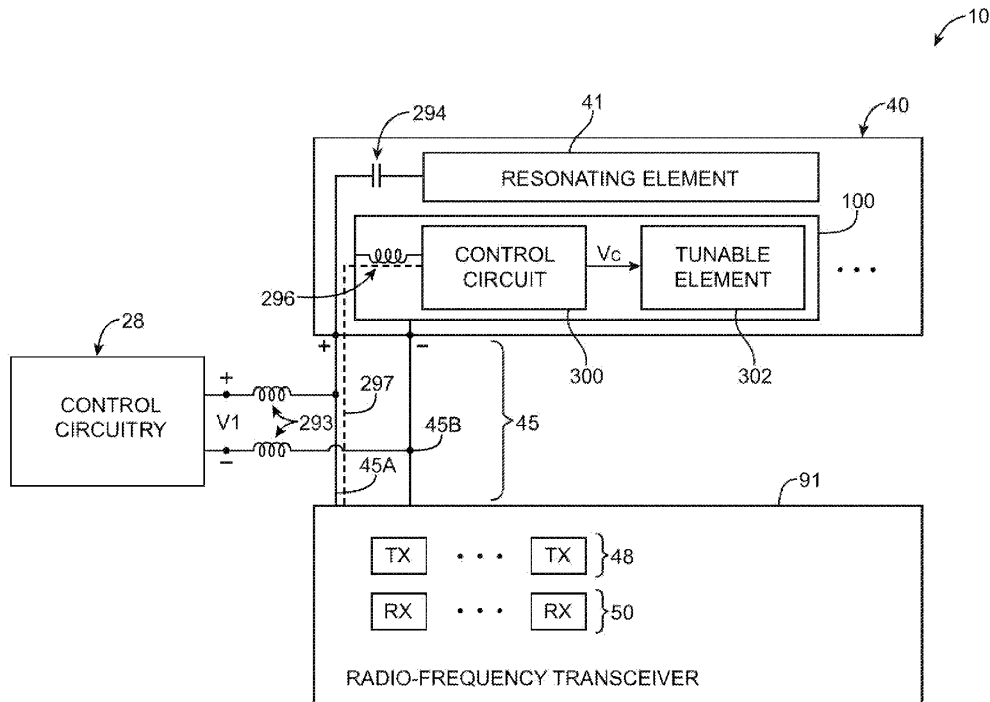
An electronic device may include an adjustable power supply, at least one antenna, and associated antenna tuning circuitry. The antenna tuning circuitry may be an integral part of the antenna and may include a control circuit and at least one tunable element. The tunable element may include radio-frequency switches, continuously/semi-continuously adjustable components such as tunable resistors, inductors, and capacitors, and other load circuits that provide desired impedance characteristics. The power supply may provide power supply voltage signals to the antenna tuning circuitry via inductive coupling. The power supply voltage signals may be modulated according to a predetermined lookup table during device startup so that the control circuit is configured to generate desired control signals. These control signals adjust the tunable element so that the antenna can support wireless operation in desired frequency bands.

(21) Appl. No.: 13/332,193

(22) Filed: Dec. 20, 2011

**Publication Classification**

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





US 20130154900A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0154900 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **WIRELESS COMMUNICATION DEVICE  
HAVING METAL END PORTION OF  
HOUSING THEREOF**

**Publication Classification**

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

(71) Applicants: **CHIH-YANG TSAI**, Shindian (TW);  
**HAO-YING CHANG**, Shindian (TW);  
**CHUAN-CHOU CHI**, Shindian (TW)

(52) **U.S. Cl.**  
USPC ..... **343/906**

(72) Inventors: **CHIH-YANG TSAI**, Shindian (TW);  
**HAO-YING CHANG**, Shindian (TW);  
**CHUAN-CHOU CHI**, Shindian (TW)

(57) **ABSTRACT**

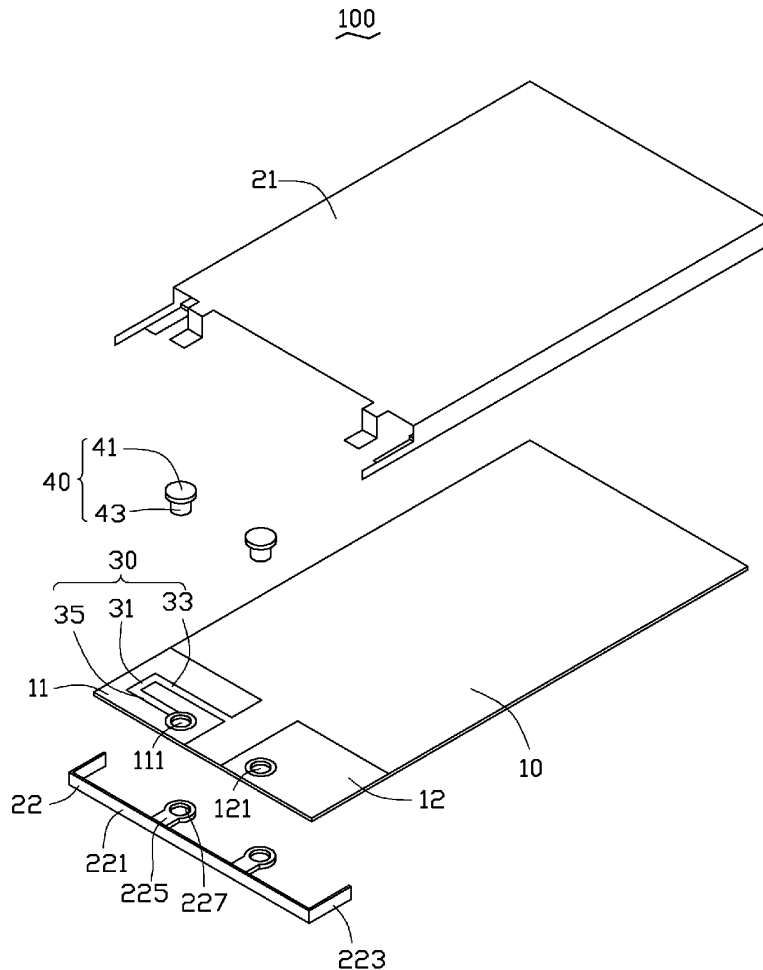
An exemplary wireless communication device includes a circuit board, a metal end portion, an antenna, and a connecting member. The antenna is positioned on the circuit board. The connecting member interconnects the circuit board and the end portion. The connecting member serves as a feeding point of the antenna. The end portion is a portion of a housing of the wireless communication device and further serves as a radiating portion of the antenna.

(21) Appl. No.: **13/655,492**

(22) Filed: **Oct. 19, 2012**

(30) **Foreign Application Priority Data**

Dec. 20, 2011 (TW) ..... 100147564





US 20130157592A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0157592 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **METHODS FOR REDUCING NEAR-FIELD RADIATION AND SPECIFIC ABSORPTION RATE (SAR) VALUES IN COMMUNICATIONS DEVICES**

60/916,655, filed on May 8, 2007, provisional application No. 60/925,394, filed on Apr. 20, 2007, provisional application No. 60/916,655, filed on May 8, 2007.

(71) Applicant: **SkyCross, Inc.**, Viera, FL (US)

**Publication Classification**

(72) Inventors: **Mark T. Montgomery**, Melbourne Beach, FL (US); **Frank M. Caimi**, Vero Beach, FL (US); **Paul A. Tornatta, JR.**, Melbourne, FL (US); **Mark W. Kishler**, Rockledge, FL (US); **Li Chen**, Melbourne, FL (US)

(51) **Int. Cl.**  
**H04B 1/40** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H04B 1/40** (2013.01)  
USPC ..... **455/78**

(73) Assignee: **SkyCross, Inc.**, Viera, FL (US)

(57) **ABSTRACT**

(21) Appl. No.: **13/726,871**

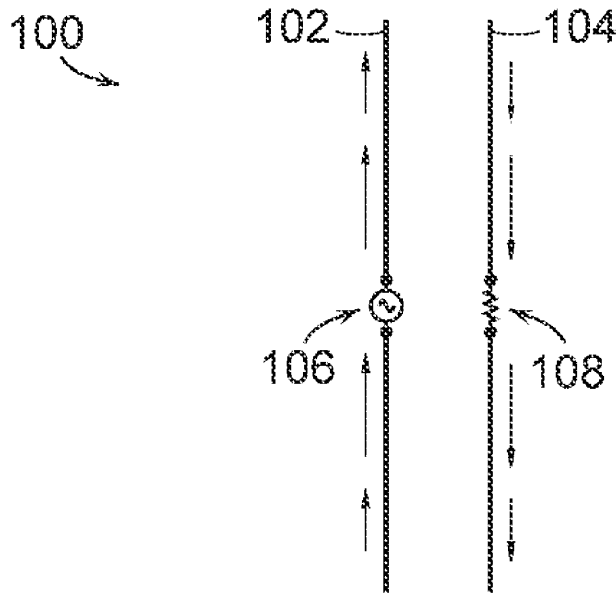
A method is provided for reducing near-field radiation and specific absorption rate values in a communications device that includes a multimode antenna structure transmitting and receiving electromagnetic signals and circuitry for processing signals communicated to and from the antenna structure. The method includes adjusting the relative phase between signals fed to neighboring antenna ports of the antenna structure such that a signal fed to the one antenna port has a different phase than a signal fed to the neighboring antenna port to provide antenna pattern control and to increase gain in a selected direction toward a receive point. The method features using a transmit power lower than the transmit power used in a non-pattern control operation of the antenna structure such that the communications device obtains generally equivalent wireless link performance with the receive point using reduced transmit power compared to the non-pattern control operation, thereby reducing the specific absorption rate.

(22) Filed: **Dec. 26, 2012**

**Related U.S. Application Data**

(63) Continuation of application No. 12/786,032, filed on May 24, 2010, now Pat. No. 8,344,956, which is a continuation-in-part of application No. 12/750,196, filed on Mar. 30, 2010, now Pat. No. 8,164,538, which is a continuation 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. 61/181,176, filed on May 26, 2009, provisional application No. 60/925,394, filed on Apr. 20, 2007, provisional application No.





US 20130162483A1

(19) **United States**

(12) **Patent Application Publication**  
**PARK**

(10) **Pub. No.: US 2013/0162483 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **ANTENNA ASSEMBLY, METHOD OF  
MANUFACTURING ANTENNA ASSEMBLY  
AND MOBILE TERMINAL HAVING  
ANTENNA ASSEMBLY**

**Publication Classification**

(51) **Int. Cl.**  
*H01Q 1/38* (2006.01)  
*H01P 11/00* (2006.01)  
(52) **U.S. Cl.**  
CPC . *H01Q 1/38* (2013.01); *H01P 11/00* (2013.01)  
USPC ..... **343/700 MS**; 29/600

(71) Applicant: **Kyungsoon PARK**, Seoul (KR)

(72) Inventor: **Kyungsoon PARK**, Seoul (KR)

(57) **ABSTRACT**

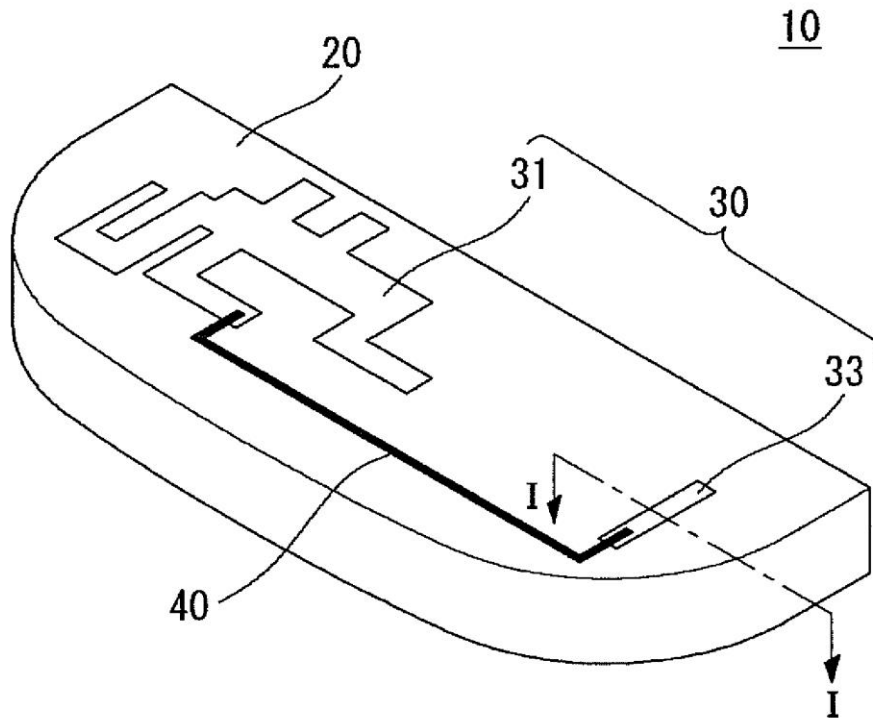
An antenna assembly may include a carrier and an antenna located on the carrier to transmit a frequency in a specific RF band. The antenna may include a first pattern and a second pattern formed separately from the first pattern and coupled to the first pattern. The antenna may be configured by combining the second pattern formed separately from the first pattern with the first pattern, and thus the antenna may have various frequency bands.

(21) Appl. No.: **13/672,062**

(22) Filed: **Nov. 8, 2012**

(30) **Foreign Application Priority Data**

Dec. 27, 2011 (KR) ..... 10-2011-0143622





US 20130162484A1

(19) **United States**

(12) **Patent Application Publication**  
**SHIMIZU**

(10) **Pub. No.: US 2013/0162484 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **ANTENNA APPARATUS**

(71) Applicant: **Hitachi Cable, Ltd.**, Tokyo (JP)

(72) Inventor: **Takayuki SHIMIZU**, Hitachi (JP)

(73) Assignee: **Hitachi Cable, Ltd.**, Tokyo (JP)

(21) Appl. No.: **13/717,486**

(22) Filed: **Dec. 17, 2012**

(30) **Foreign Application Priority Data**

Dec. 21, 2011 (JP) ..... 2011-279779

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 1/36** (2006.01)

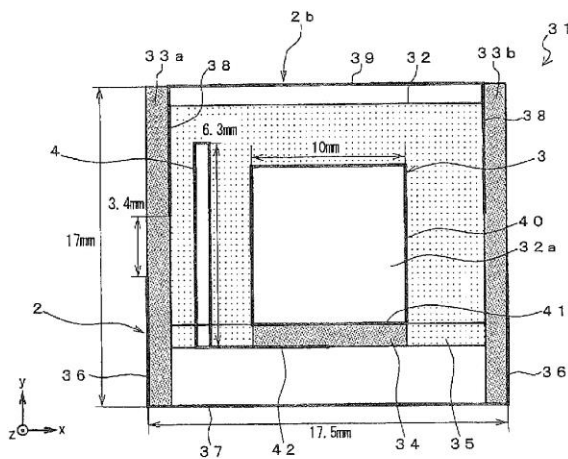
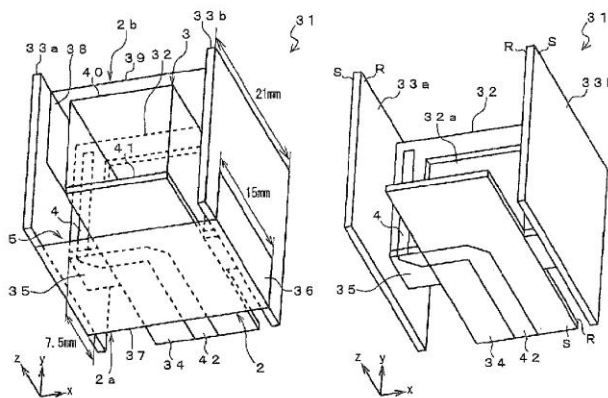
(52) **U.S. Cl.**

CPC ..... **H01Q 1/36** (2013.01)

USPC ..... **343/700 MS**

(57) **ABSTRACT**

An antenna apparatus includes a horizontal polarization antenna element, and the horizontal polarization antenna element includes a radiation conductor that includes two conductor plates subjected to bending work and arranged to be opposite to each other with a specific interval therebetween and has a tube shape extending in a vertical direction in whole, a ground conductor that is arranged in an inner space surrounded by the two conductor plates of the radiation conductor and is electrically grounded, and a feeding element that is arranged in the inner space, is arranged along inner walls of the conductor plates in a top view, operates as a reverse L antenna when electrical power is fed between one end thereof and the ground conductor, and feeds power to the radiation conductor by electromagnetic coupling.





US 20130162486A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0162486 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **SWITCHABLE DIVERSITY ANTENNA APPARATUS AND METHODS**

(57) **ABSTRACT**

(76) Inventors: **Heikki Korva**, Tupos (FI); **Ari Raappana**, Kello (FI); **Petteri Annamaa**, Oulunsalo (FI)

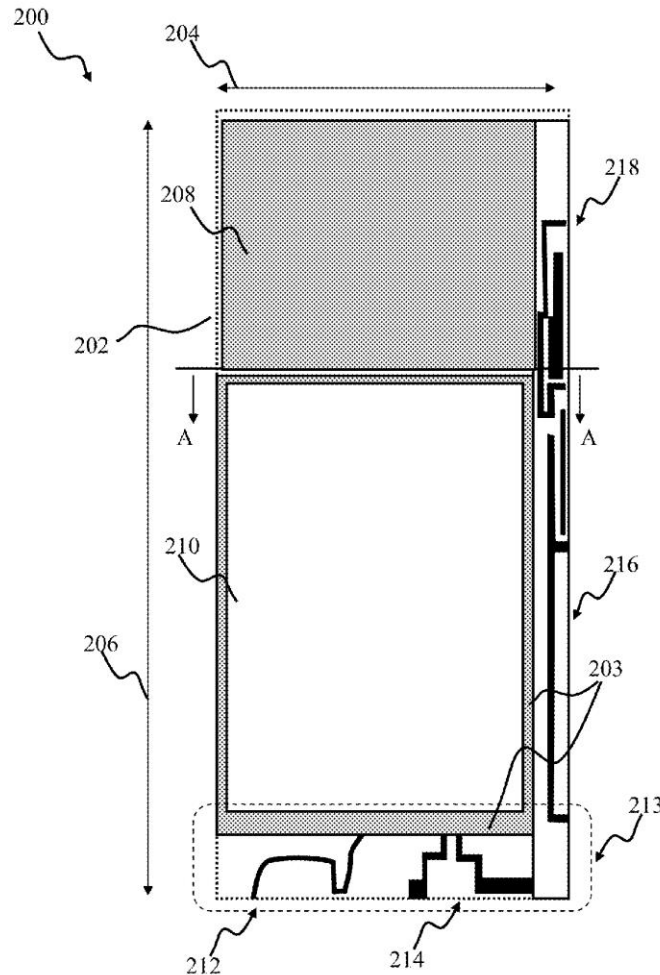
An active diversity antenna apparatus and methods of tuning and utilizing the same. In one embodiment, the active diversity antenna is used within a handheld mobile device (e.g., cellular telephone or smartphone), and enables device operation in several low frequency bands (LBs). The exemplary implementation of the active LB diversity antenna comprises a directly fed radiator portion and a grounded (coupled fed) radiator portion. The directly fed portion is fed via a feed element connected to an antenna feed. The coupled fed portion of the LB antenna is grounded, forming a resonating part of the low frequency band. A gap between the two antenna portions is used to adjust antenna Q-value. Resonant frequency tuning is achieved by changing the length of the grounded element. The LB feed element is disposed proximate the feed element of a high band diversity antenna, thus reducing transmission losses and improving diplexer operation.

(21) Appl. No.: **13/333,588**

(22) Filed: **Dec. 21, 2011**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 21/28** (2006.01)  
**H01Q 21/30** (2006.01)  
(52) **U.S. Cl.**  
USPC ..... **343/725**





US 20130162488A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0162488 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **ANTENNA UNIT AND RADIO COMMUNICATION DEVICE**

**Publication Classification**

(71) Applicant: **MURATA MANUFACTURING CO., LTD.**, Kyoto-fu (JP)

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

(72) Inventors: **Kengo ONAKA**, Kyoto-fu (JP); **Osamu SHIBATA**, Kyoto-fu (JP); **Yuichi KUSHIHI**, Kyoto-fu (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/30** (2013.01)  
USPC ..... **343/728**

(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Kyoto-fu (JP)

(57) **ABSTRACT**

(21) Appl. No.: **13/775,006**

An antenna unit and a radio communication device are provided. An antenna unit has a monopole antenna section and a loop antenna section. The monopole antenna section includes a linear radiating electrode that resonates at a first frequency and has an electrical length of one-quarter of the wave length corresponding to the first frequency. The loop antenna section includes a radiating electrode that resonates at a second frequency, is vertically erected on a non-ground region, and connected to a feed line. A proximal end of the radiating electrode of the loop antenna section is connected to an intermediate portion of the feed line, and a distal end thereof is connected to a ground region. The electrical length of the radiating electrode of the loop antenna section is one-half of the wave length of the second frequency.

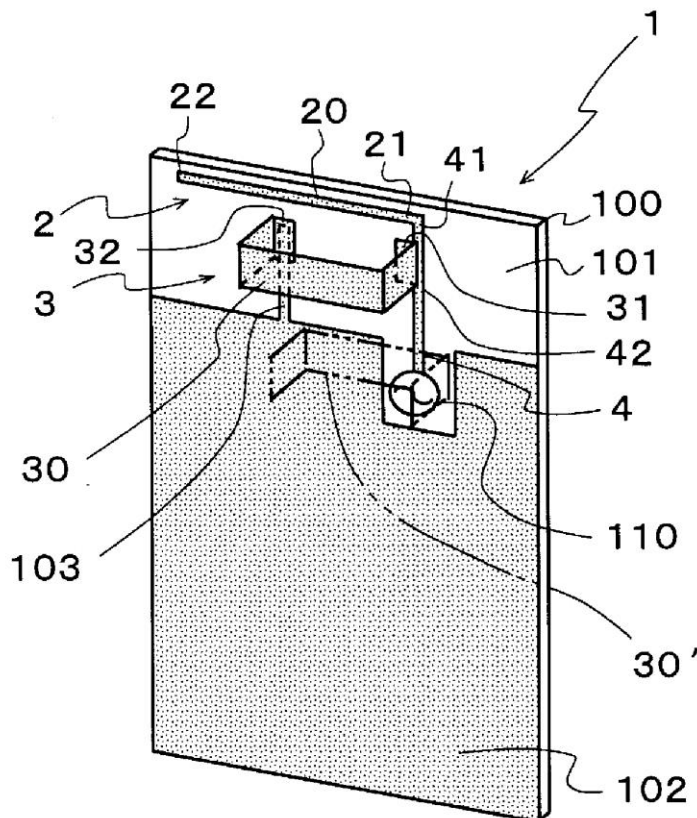
(22) Filed: **Feb. 22, 2013**

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2011/064596, filed on Jun. 25, 2011.

(30) **Foreign Application Priority Data**

Aug. 31, 2010 (JP) ..... 2010-194233







US 20130162489A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0162489 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **MULTIBAND ANTENNA**

**Publication Classification**

(76) Inventors: **Ramiro Quintero Illera**, Barcelona (ES); **Carles Puente Baliarda**, Barcelona (ES)

(51) **Int. Cl.**  
*H01Q 1/38* (2006.01)  
*H01Q 5/00* (2006.01)  
*H01Q 9/06* (2006.01)

(21) Appl. No.: **13/532,869**

(52) **U.S. Cl.**  
CPC . *H01Q 1/38* (2013.01); *H01Q 9/06* (2013.01);  
*H01Q 5/0031* (2013.01)

(22) Filed: **Jun. 26, 2012**

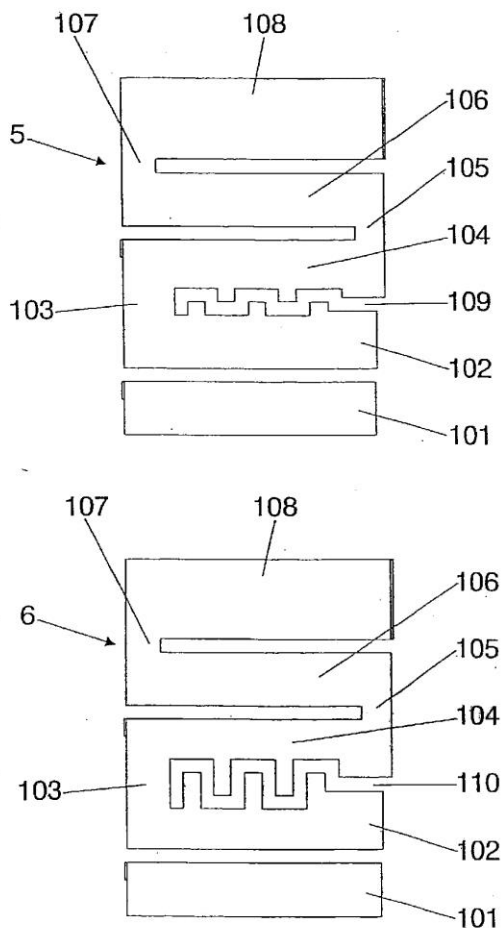
USPC ..... **343/749**; 343/700 MS; 343/843

**Related U.S. Application Data**

(63) Continuation of application No. 12/910,016, filed on Oct. 22, 2010, now Pat. No. 8,228,245, which is a continuation of application No. 12/229,483, filed on Aug. 22, 2008, now Pat. No. 7,920,097, which is a continuation of application No. 11/702,791, filed on Feb. 6, 2007, now Pat. No. 7,439,923, which is a continuation of application No. 10/823,257, filed on Apr. 13, 2004, now Pat. No. 7,215,287, which is a continuation of application No. PCT/EP01/11912, filed on Oct. 16, 2001.

(57) **ABSTRACT**

A multiband antenna includes at least two polygons. The at least two polygons are spaced by means of a non-straight gap shaped as a space-filling curve, in such a way that the whole gap length is increased yet keeping its size and the same overall antenna size allowing for an effective tuning of frequency bands of the antenna.





US 20130162491A1

(19) **United States**

(12) **Patent Application Publication**  
**Yu**

(10) **Pub. No.: US 2013/0162491 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **DUAL RADIATION PATTERNS ANTENNA**

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

USPC ..... 343/767; 343/700 MS; 343/819

(75) Inventor: **Ya Chung Yu**, Taipei (TW)

(57) **ABSTRACT**

(73) Assignee: **SJ ANTENNA DESIGN**, Taipei City (TW)

(21) Appl. No.: **13/557,191**

(22) Filed: **Jul. 24, 2012**

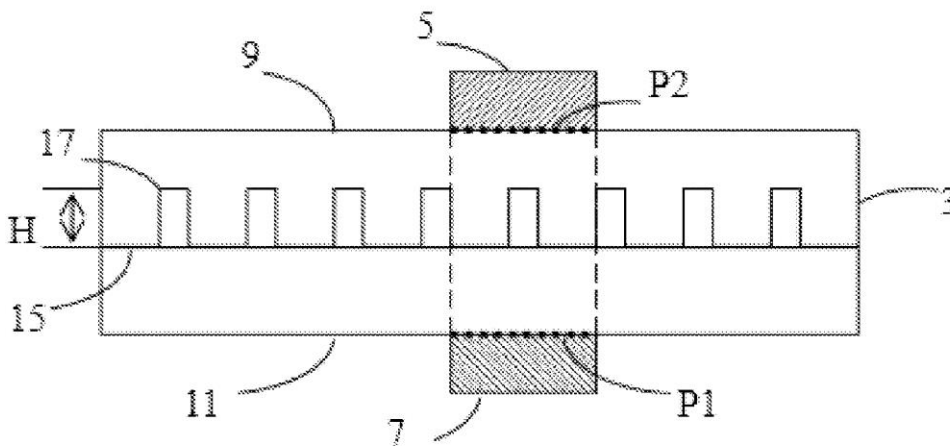
(30) **Foreign Application Priority Data**

Dec. 26, 2011 (TW) ..... 100148773

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 9/04** (2006.01)  
**H01Q 19/30** (2006.01)  
**H01Q 13/10** (2006.01)

A dual radiation patterns antenna is provided in the present invention. The dual radiation patterns antenna includes a substrate, a first antenna unit and a second antenna unit. The substrate has a first surface and a second surface opposite to the first surface. The first antenna is formed on the first surface of the substrate and used to radiate a first radiation pattern. The second antenna is formed on the second surface of the substrate and used to radiate a second radiation pattern. A first vertical projecting plane of the first antenna unit on the second surface is overlapped with the second antenna unit completely or partially. A second vertical projecting plane of the second antenna unit on the first surface is overlapped with the first antenna unit completely or partially. The first radiation pattern and the second radiation pattern are perpendicular each other.





US 20130162494A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0162494 A1**

(43) **Pub. Date: Jun. 27, 2013**

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

(52) **U.S. Cl.**  
USPC ..... **343/843; 343/895**

(76) Inventors: **Kin-Lu Wong**, New Taipei City (TW);  
**Tsung-Ju Wu**, New Taipei City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **13/449,318**

An antenna structure having a ground element and an antenna element is provided. The antenna element is disposed on a dielectric substrate, and includes a first radiation portion, a second radiation portion, and a spiral metal line. An end of the first radiation portion is a feeding point of the antenna element, and another end is open. An end of the second radiation portion is electrically coupled to the ground element, and the length of the second radiation portion is greater than that of the first radiation portion. The first radiation portion is surrounded by the second radiation portion. An end of the spiral metal line is coupled to the first radiation portion. The spiral metal line contributes a parallel resonance outside the antenna's operating band, and results in a resonant mode generated within the antenna element's operating band such that the operating bandwidth of the antenna element is increased.

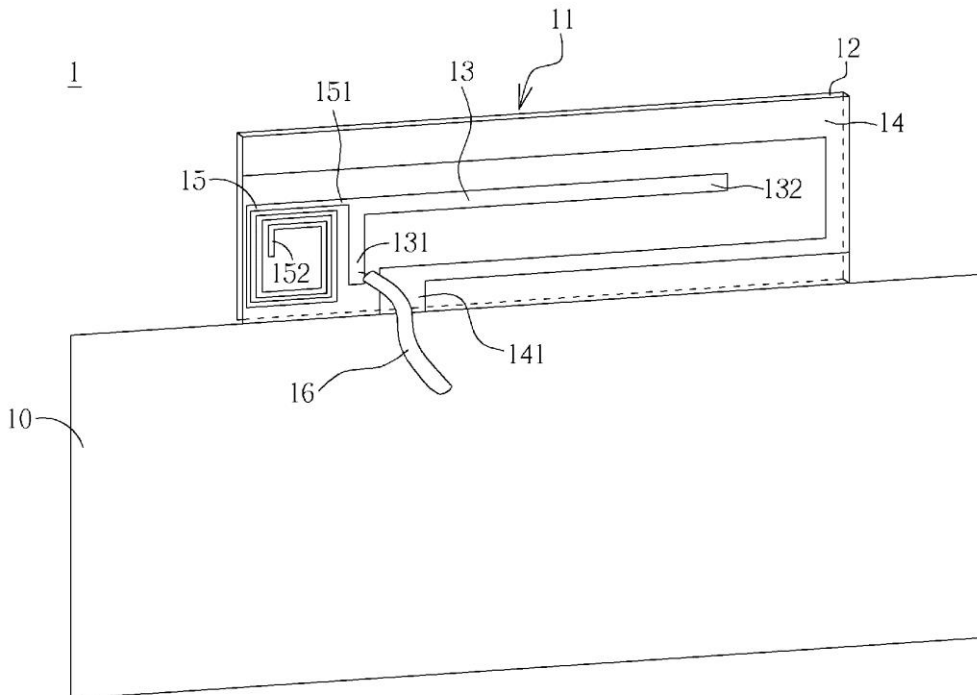
(22) Filed: **Apr. 18, 2012**

(30) **Foreign Application Priority Data**

Dec. 27, 2011 (TW) ..... 100148862

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 5/01** (2006.01)  
**H01Q 1/36** (2006.01)





US 20130162496A1

(19) **United States**

(12) **Patent Application Publication**  
**WAKABAYASHI**

(10) **Pub. No.: US 2013/0162496 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **MULTI-ANTENNA DEVICE AND COMMUNICATION APPARATUS**

**Publication Classification**

(71) Applicant: **Funai Electric Co., Ltd.**, Osaka (JP)

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

(72) Inventor: **Naoyuki WAKABAYASHI**, Osaka (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/00** (2013.01); **H01Q 21/0006** (2013.01)

(73) Assignee: **FUNAI ELECTRIC CO., LTD.**, Osaka (JP)

USPC ..... **343/853**; 343/893

(21) Appl. No.: **13/685,091**

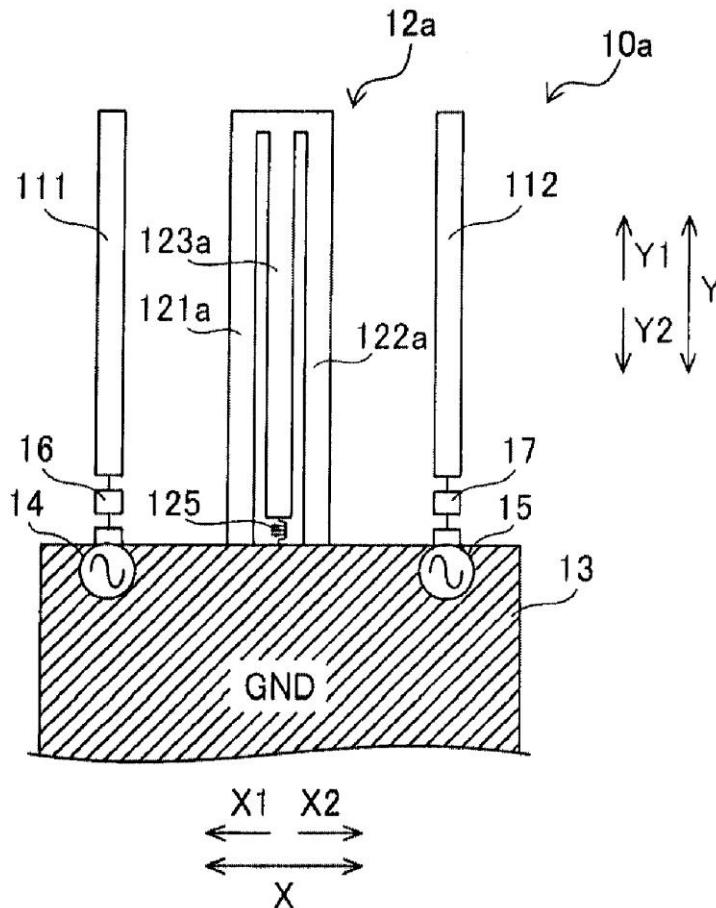
(57) **ABSTRACT**

(22) Filed: **Nov. 26, 2012**

A multi-antenna device includes a feeding element and a passive element. The feeding element has first and second antenna elements. The passive element is disposed between the first and second antenna elements. The passive element has a first portion that is grounded at one end, a second portion that is grounded at one end and a third portion that is grounded at one end via a serially connected member with inductance. The third portion is connected at the other end to the other ends of the first and second portions.

(30) **Foreign Application Priority Data**

Dec. 26, 2011 (JP) ..... 2011-282843





US 20130162497A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0162497 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **ANTENNA**

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

(75) Inventors: **Hiroshi Satou**, Kanagawa (JP); **Yoshio Koyanagi**, Kanagawa (JP); **Takanori Hirobe**, Ishikawa (JP); **Hiroyuki Uejima**, Ishikawa (JP)

CPC ..... **H01Q 21/28** (2013.01); **H01Q 21/0006** (2013.01)

USPC ..... **343/853**

(73) Assignee: **PANASONIC CORPORATION**, Osaka (JP)

(57) **ABSTRACT**

(21) Appl. No.: **13/821,368**

(22) PCT Filed: **May 16, 2012**

(86) PCT No.: **PCT/JP2012/003213**

§ 371 (c)(1),  
(2), (4) Date: **Mar. 7, 2013**

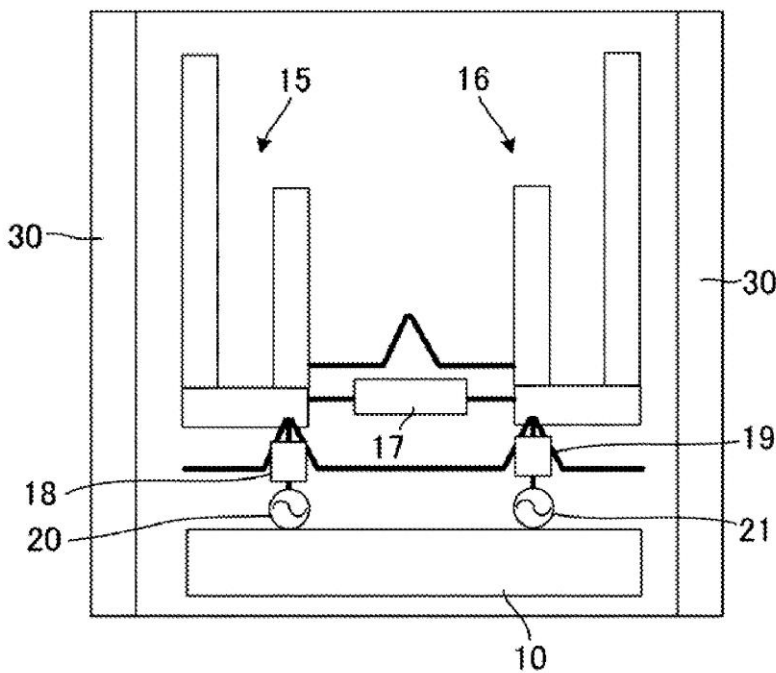
(30) **Foreign Application Priority Data**

May 19, 2011 (JP) ..... 2011-112274

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 21/28** (2006.01)  
**H01Q 21/00** (2006.01)

A first antenna element is embodied in a blanch structure, and a second antenna element is embodied in a blanch structure. A low coupling circuit for increasing susceptance with an increase in frequency is interposed between the first antenna element and the second antenna element. The first antenna element and the second antenna element exhibit resonance of a Y12 component of an admittance matrix between first and second frequencies and between second and third frequencies. The first branch element and the third branch element assume a value of nearly a quarter of a resonant electrical length of the Y12 component of the admittance matrix between the first and second frequencies. The second branch element and the fourth branch element assume a value of nearly a quarter of the resonant electrical length of the Y12 component of the admittance matrix between the second and third frequencies.



(a)



US 20130162498A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0162498 A1**

(43) **Pub. Date: Jun. 27, 2013**

(54) **LOW-PROFILE WIDE-BANDWIDTH RADIO FREQUENCY ANTENNA**

**Publication Classification**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

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

(72) Inventors: **Dean Kitchener**, Brentwood (GB);  
**Andrew Urquhart**, Hertfordshire (GB)

(52) **U.S. Cl.**  
CPC ..... **H01Q 1/50** (2013.01)  
USPC ..... **343/860**

(73) Assignee: **APPLE INC.**, Cupertino, CA (US)

(57) **ABSTRACT**

(21) Appl. No.: **13/764,899**

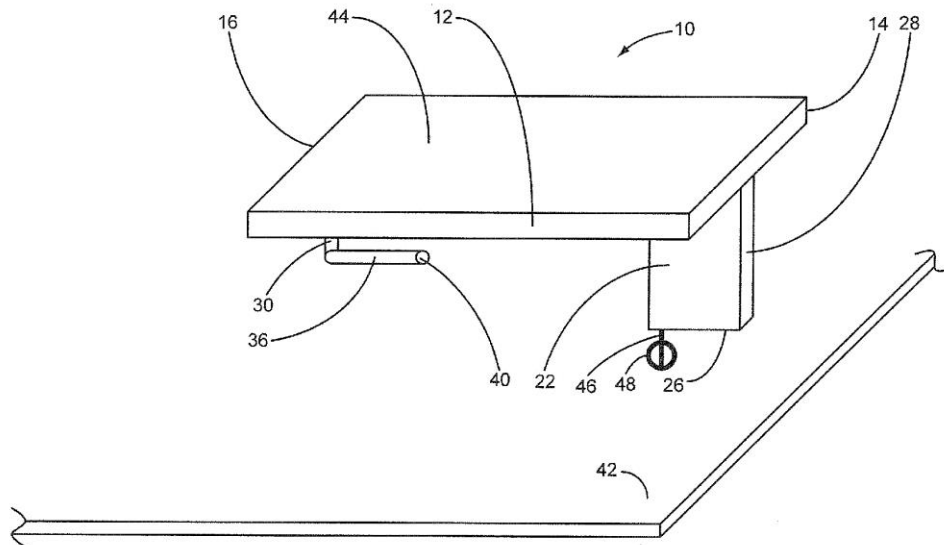
The present invention relates to an RF antenna structure that includes a planar structure and a loading plate, such that the planar structure is mounted between a ground plane and the loading plate to form an RF antenna. The loading plate may be about parallel to the ground plane and the planar structure may be about perpendicular to the loading plate and the ground plane. The loading plate may allow the height of the RF antenna structure above the ground plane to be relatively small. For example, the height may be significantly less than one-quarter of a wavelength of RF signals of interest. The planar structure may include two conductive matching elements to help increase the bandwidth of the RF antenna structure.

(22) Filed: **Feb. 12, 2013**

**Related U.S. Application Data**

(63) Continuation of application No. 13/229,870, filed on Sep. 12, 2011, now Pat. No. 8,416,137, which is a continuation of application No. 12/415,604, filed on Mar. 31, 2009, now Pat. No. 8,040,289.

(60) Provisional application No. 61/050,028, filed on May 2, 2008.





US 20130169223A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169223 A1**  
(43) **Pub. Date: Jul. 4, 2013**

(54) **ELECTRONIC DEVICE FOR REDUCING INTERFERENCE BETWEEN A CHARGING COIL AND AN ANTENNA**

(30) **Foreign Application Priority Data**

Jan. 4, 2012 (KR) ..... 10-2012-0000879

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

**Publication Classification**

(72) Inventors: **Woo-Ram LEE**, Gyeonggi-do (KR);  
**Ki-Hyun KIM**, Gyeonggi-do (KR);  
**Jin-Hyoung PARK**, Gangwon-do (KR);  
**Kil-Soo KO**, Gyeonggi-do (KR);  
**Joon-II KIM**, Seoul (KR); **Sung-Kweon PARK**, Gyeonggi-do (KR); **Se-Ho PARK**, Gyeonggi-do (KR)

(51) **Int. Cl.**  
**H02J 7/00** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H02J 7/0042** (2013.01)  
USPC ..... **320/108**

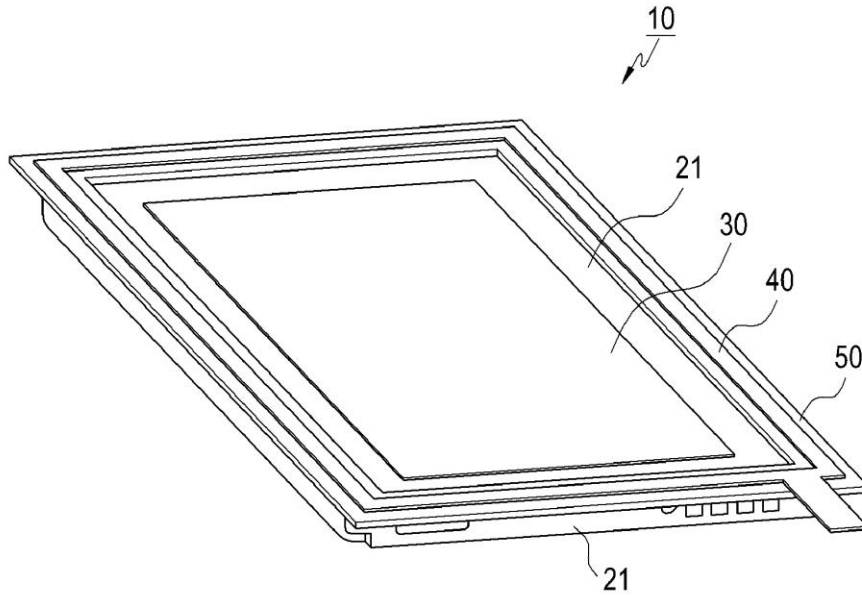
(73) Assignee: **Samsung Electronics Co., Ltd.**,  
Gyeonggi-do (KR)

(57) **ABSTRACT**

An electronic device is provided. The electronic device includes a main body including a battery pack and a battery cover; a non-contact near field communication antenna included in the battery pack; and a wireless charging coil portion included in the battery cover and disposed around an outer periphery of the antenna, such that the wireless coil portion does not overlap with the non-contact near field communication antenna.

(21) Appl. No.: **13/733,667**

(22) Filed: **Jan. 3, 2013**





US 20130169486A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169486 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **COMPOSITE ANTENNA STRUCTURE**

**Publication Classification**

(75) Inventors: **YUEH-PI HUANG**, MIAOLI COUNTY (TW); **MING-TSAN TSENG**, TAINAN CITY (TW); **MING-YI WU**, MIAOLI COUNTY (TW)

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

(52) **U.S. Cl.**  
USPC ..... **343/700 MS**

(73) Assignee: **INPAQ TECHNOLOGY CO., LTD.**, MIAOLI COUNTY (TW)

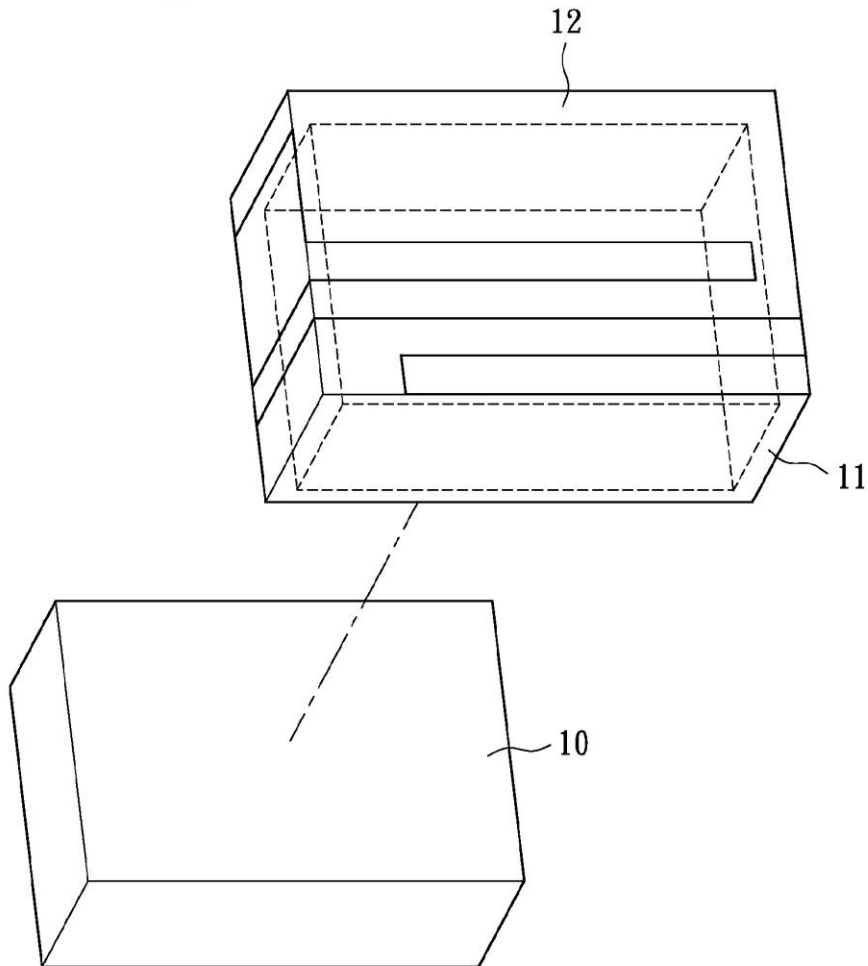
(57) **ABSTRACT**

A composite antenna structure includes a dielectric main body, a covering layer and a metallic transmission line structure. The dielectric constant of the dielectric main body is ranged from 1 to 200. The covering layer is disposed on the dielectric main body and has a pattern area defined thereon. The metallic transmission line structure is formed on the pattern area of the covering layer.

(21) Appl. No.: **13/343,014**

(22) Filed: **Jan. 4, 2012**

1







US 20130169491A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169491 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **DUAL FEED ANTENNA**

**Publication Classification**

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

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

(72) Inventors: **Mark T. Montgomery**, Melbourne Beach, FL (US); **Paul A. Tornatta, JR.**, Melbourne Beach, FL (US)

(52) **U.S. Cl.**  
CPC ..... **H01Q 9/06** (2013.01)  
USPC ..... **343/702**

(73) Assignee: **Skycross, Inc.**, Fremont, CA (US)

(57) **ABSTRACT**

(21) Appl. No.: **13/757,192**

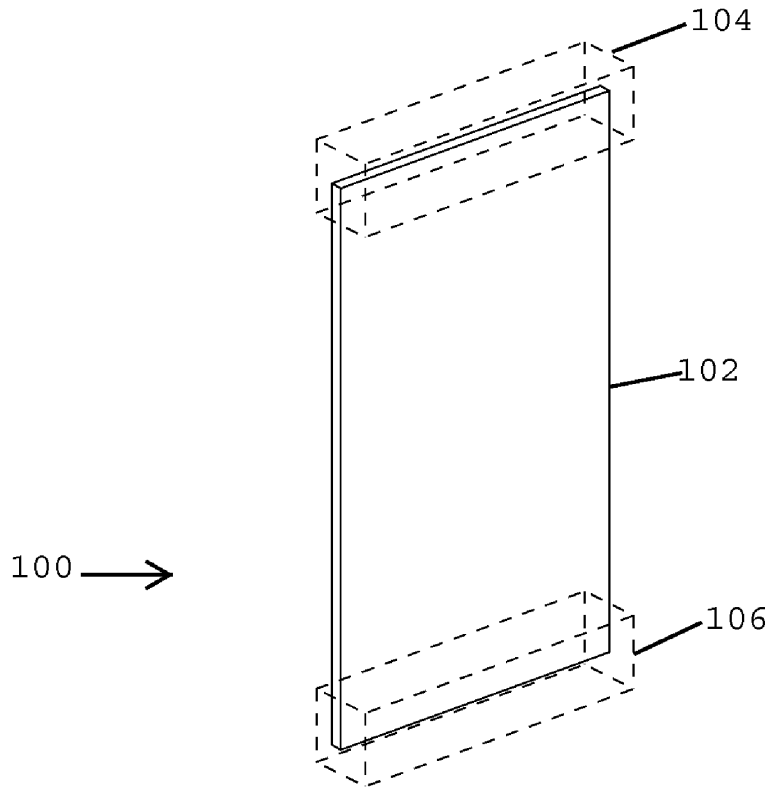
The subject disclosure may include, for example, a multi-port antenna structure including an antenna having a first antenna port to transmit electromagnetic signals and a second antenna port to receive electromagnetic signals, where the antenna is coupled to a housing assembly of a communication device to transmit energy between the housing assembly and the first antenna port and second antenna port, and where first resonant modes of the housing assembly for the first antenna port and second resonant modes of the housing assembly for the second antenna port are such that the first and second antenna ports are substantially isolated from each other. Other embodiments are disclosed.

(22) Filed: **Feb. 1, 2013**

**Related U.S. Application Data**

(63) Continuation of application No. 12/644,718, filed on Dec. 22, 2009, now Pat. No. 8,373,603.

(60) Provisional application No. 61/140,370, filed on Dec. 23, 2008.





US 20130169496A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169496 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **ANTENNA DEVICE WITH U-SHAPED SLIT**

**Publication Classification**

(71) Applicants: **Akira MIYOSHI**, Tokyo (JP); **Akihiro OSHIMA**, Tokyo (JP); **Yoshiaki IMANO**, Tokyo (JP)

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

(72) Inventors: **Akira MIYOSHI**, Tokyo (JP); **Akihiro OSHIMA**, Tokyo (JP); **Yoshiaki IMANO**, Tokyo (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 13/16** (2013.01)  
USPC ..... **343/767**

(73) Assignee: **MITSUMI ELECTRIC CO., LTD.**, Tama-shi (JP)

(57) **ABSTRACT**

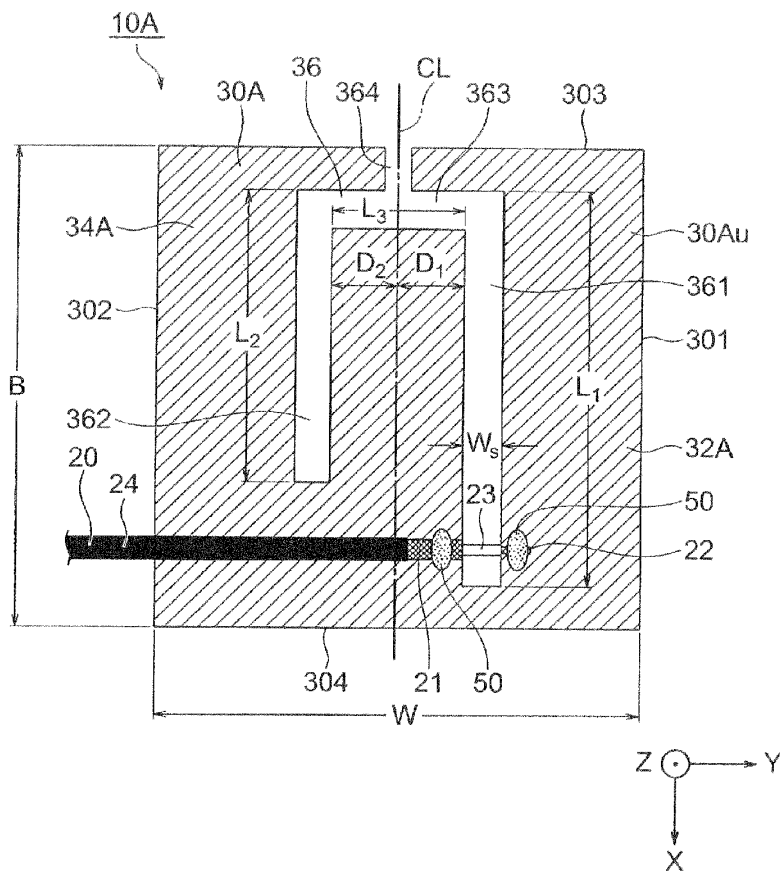
An antenna device includes a feeding line having a first conductor and a second conductor and an antenna element having a conductive flat plate in which a slit is formed. The conductive flat plate has first and second sides opposite to each other and a third side. The antenna element is divided into an antenna pattern portion and a ground pattern portion via the slit. The slit is configured with a first slit portion apart from a center line towards the first side, a second slit portion apart from the center line towards the second side, a third slit portion coupling the first slit portion with the second slit portion, and a cutting portion coupling the third slit portion with the third side.

(21) Appl. No.: **13/719,455**

(22) Filed: **Dec. 19, 2012**

(30) **Foreign Application Priority Data**

Dec. 28, 2011 (JP) ..... 2011-287556





US 20130169497A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169497 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **COMMUNICATION DEVICE AND ANTENNA  
STRUCTURE THEREIN**

(52) **U.S. Cl.**  
USPC ..... 343/770

(75) Inventors: **Kin-Lu WONG**, Kaohsiung City (TW);  
**Fang-Hsien CHU**, Kaohsiung City (TW)

(57) **ABSTRACT**

(73) Assignee: **ACER INCORPORATED**, Taipei  
Hsien (TW)

A communication device includes an antenna structure, wherein the antenna structure includes a ground element and an antenna element. One edge of the ground element has a notch, and the notch is extended into the interior of the ground element to form a slot region. The slot region is substantially extended along the edge of the ground element. The antenna element includes a first radiating portion and a second radiating portion. The first radiating portion is disposed in the slot region and is excited to form at least a resonant mode in the first operating band of the antenna element. The second radiating portion is an open-slot antenna and is formed by the slot region. The second radiating portion is excited to form a resonant mode in the second operating band of the antenna element.

(21) Appl. No.: **13/425,316**

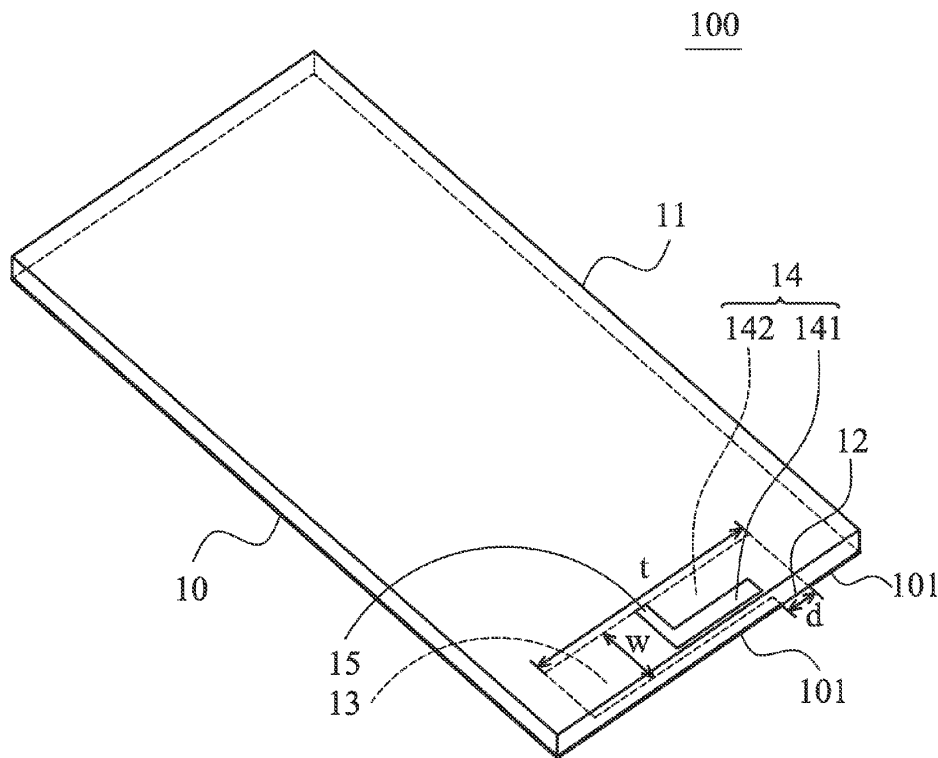
(22) Filed: **Mar. 20, 2012**

(30) **Foreign Application Priority Data**

Dec. 28, 2011 (TW) ..... 100149114

**Publication Classification**

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





US 20130169498A1

(19) **United States**

(12) **Patent Application Publication**  
**CHEN**

(10) **Pub. No.: US 2013/0169498 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **PACKAGING MATERIAL WITH T-SHAPED  
SLOT ANTENNA**

(52) **U.S. Cl.**  
CPC ..... **H01Q 13/10** (2013.01)  
USPC ..... **343/770**

(71) Applicant: **TAIWAN LAMINATION  
INDUSTRIES, INC.**, Chung Li City  
(TW)

(57) **ABSTRACT**

(72) Inventor: **Yung-Shun CHEN**, Chung Li City  
(TW)

(73) Assignee: **TAIWAN LAMINATION  
INDUSTRIES, INC.**, Chung Li City  
(TW)

(21) Appl. No.: **13/667,026**

(22) Filed: **Nov. 2, 2012**

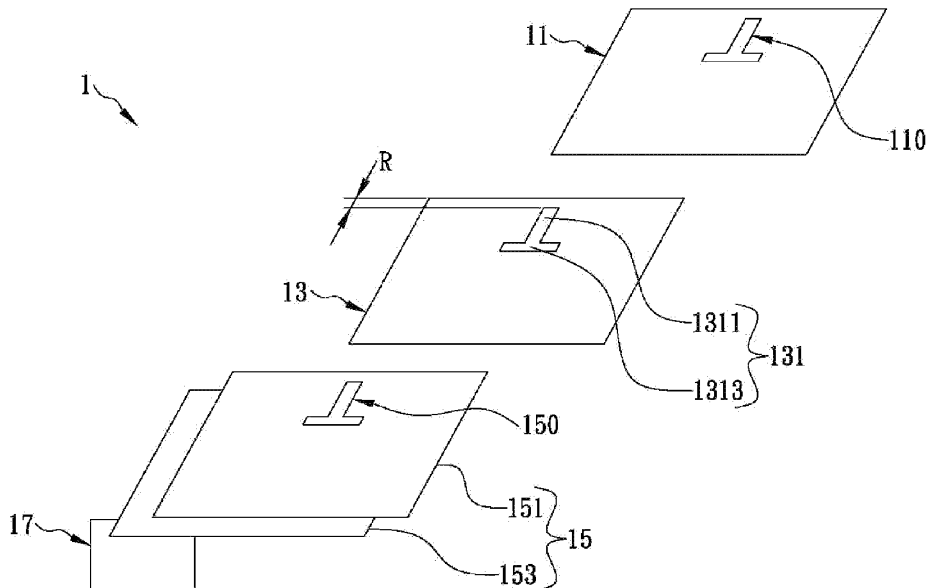
(30) **Foreign Application Priority Data**

Dec. 28, 2011 (TW) ..... 100149151

**Publication Classification**

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

The present invention is to provide a packaging material having a T-shaped slot antenna, which includes a surface material being a plastic film and having one surface coated with a metal layer, a bottom material being a plastic film and having one surface coated on the metal layer, and a communication device having two conductive sheets connected to either the surface or bottom material. The surface material, metal layer and bottom material are formed with a T-shaped slot for forming the T-shaped slot antenna, wherein the T-shaped slot includes a vertical groove having one end connected to central position of a horizontal groove and an opposite end extending toward a lateral edge of the metal layer. The corresponding lateral edges of the conductive sheets are spaced from each other and are connected with feed-in ends of a communication chip respectively for receiving or transmitting information via the T-shaped slot antenna.





US 20130169503A1

(19) **United States**

(12) **Patent Application Publication**  
**Fakharzadeh Jahromi**

(10) **Pub. No.: US 2013/0169503 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **PARASITIC PATCH ANTENNA**

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

USPC ..... 343/833

(76) **Inventor: Mohammad Fakharzadeh Jahromi,**  
Toronto (CA)

(57)

**ABSTRACT**

(21) **Appl. No.: 13/340,920**

(22) **Filed: Dec. 30, 2011**

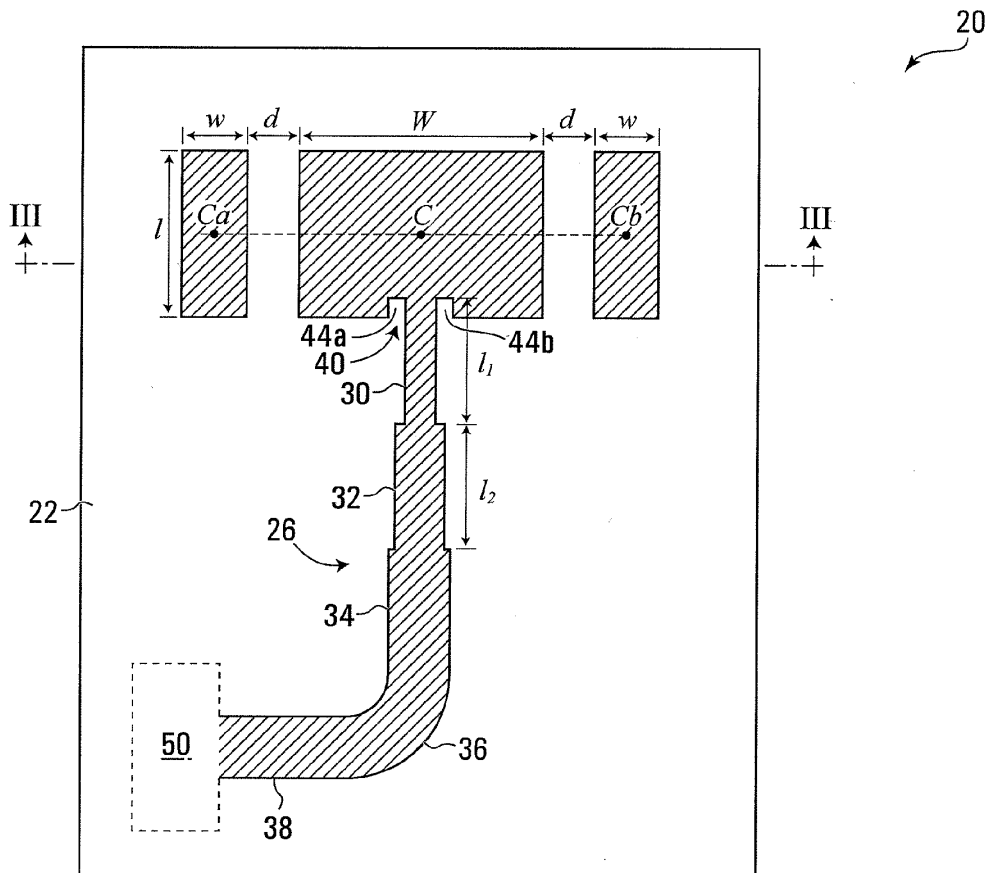
**Publication Classification**

A microstrip antenna includes at least one parasitic patch, located beside a central patch. The parasitic patch is electrically disconnected from the central patch, yet coupled to it, inductively or otherwise, to aid in transferring energy to/from the central patch.

(51) **Int. Cl.**

**H01Q 19/02**

(2006.01)





US 20130169506A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169506 A1**  
(43) **Pub. Date: Jul. 4, 2013**

(54) **ANTENNA**

**Publication Classification**

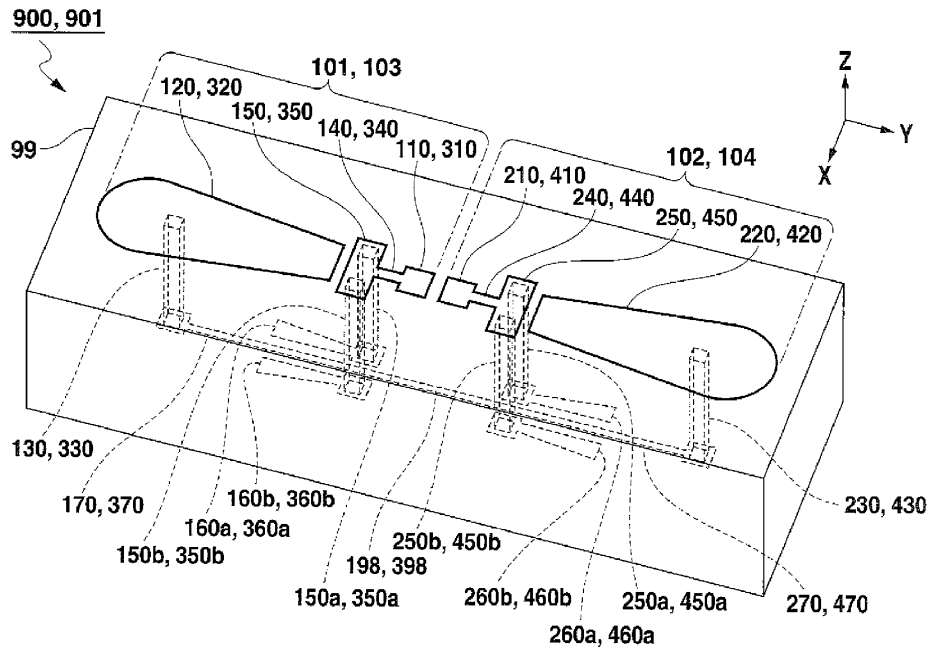
(75) Inventors: **Yutaka Aoki**, Ome-shi (JP); **Akira Saitou**, Machida-shi (JP); **Kazuhiko Honjo**, Tsukuba-shi (JP)  
  
(73) Assignees: **THE UNIVERSITY OF ELECTRO-COMMUNICATIONS**, Choufu-shi, Tokyo (JP); **CASIO COMPUTER CO., LTD.**, Shibuya-ku, Tokyo (JP)

(51) **Int. Cl.**  
*H01Q 21/06* (2006.01)  
*H01Q 21/00* (2006.01)  
(52) **U.S. Cl.**  
CPC ..... *H01Q 21/06* (2013.01); *H01Q 21/0006* (2013.01)  
USPC ..... **343/853**

(21) Appl. No.: **13/819,711**  
(22) PCT Filed: **Aug. 30, 2011**  
(86) PCT No.: **PCT/JP2011/069623**  
§ 371 (c)(1),  
(2), (4) Date: **Feb. 27, 2013**

(57) **ABSTRACT**  
A multi-frequency circularly polarized antenna (100) comprises a substrate and multi-frequency antennas (900, 901). The multi-frequency antennas (900, 901) comprise antenna elements (120, 220, 30, 420), shunt-inductor conductors (170, 270, 370, 470), series-capacitor conductors (160a, 160b, 260a, 260b, 360a, 360b, 460a, 460b), series-inductor capacitors (140, 240, 340, 440), a center point (199) and input/output terminals (1q0, 210, 310, 410). The multi-frequency circularly polarized antenna (100) is constructed by connecting the shunt-inductor conductors (170, 270, 370, 470) of the multi-frequency antennas (900, 901) at the center point (199) in a substantially perpendicular manner.

(30) **Foreign Application Priority Data**  
Aug. 31, 2010 (JP) ..... 2010-193530





US 20130169508A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0169508 A1**

(43) **Pub. Date: Jul. 4, 2013**

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

**Publication Classification**

(75) Inventors: **SHU-WEI CHANG**, Tu-Cheng (TW);  
**HSIN-HUNG LIU**, Tu-Cheng (TW);  
**FU-HSIUNG YANG**, Tu-Cheng (TW)

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

(52) **U.S. Cl.**  
USPC ..... **343/906**

(73) Assignee: **HON HAI PRECISION INDUSTRY CO., LTD.**, Tu-Cheng (TW)

(57) **ABSTRACT**

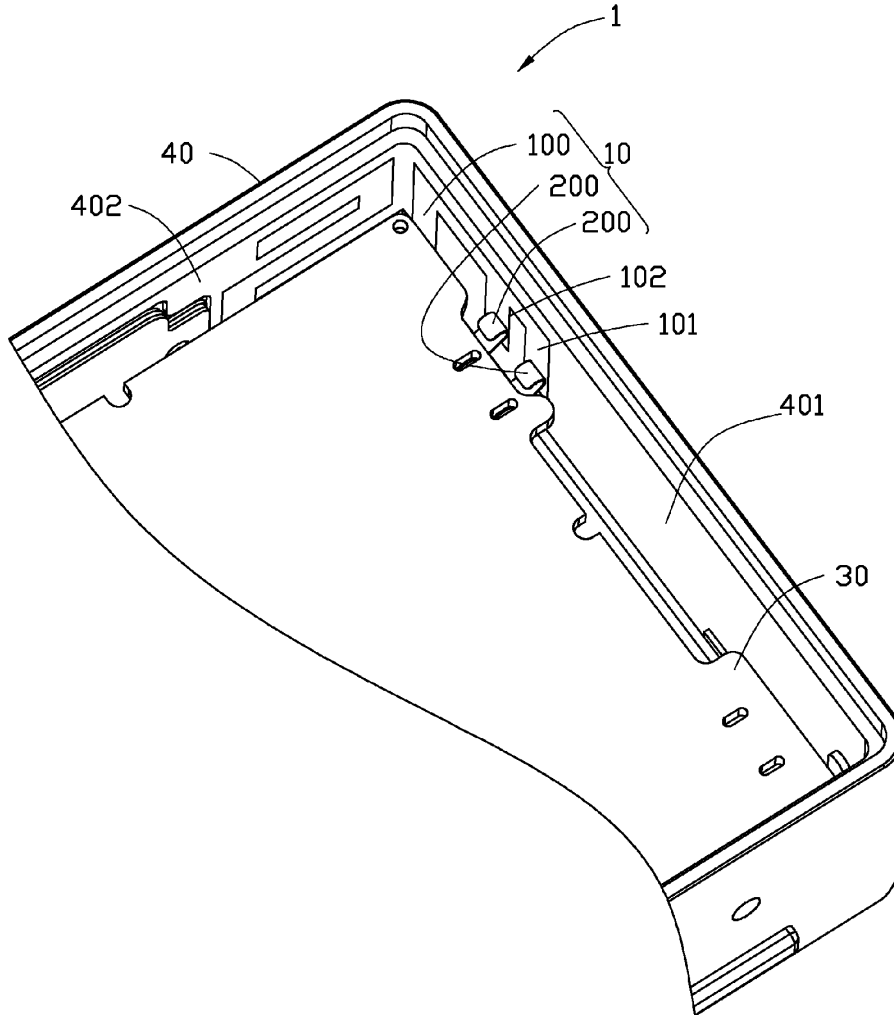
(21) Appl. No.: **13/563,759**

An antenna for use in an electronic device includes an antenna body and two elastic conductors, the antenna body is attached to the inside wall of the electronic device, includes a feeding-in portion and a grounding portion, the feeding-in portion is connected to a printed circuit board through an elastic conductor for feeding-in, and the grounding is connected to the printed circuit board for grounding.

(22) Filed: **Aug. 1, 2012**

(30) **Foreign Application Priority Data**

Dec. 28, 2011 (TW) ..... 100149073





US 20130173234A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0173234 A1**

(43) **Pub. Date: Jul. 4, 2013**

(54) **ANTENNA DESIGNING METHOD AND APPARATUS**

**Publication Classification**

(71) Applicant: FUJITSU LIMITED, Kawasaki-shi (JP)

(51) **Int. Cl.**  
**G06F 17/50** (2006.01)

(72) Inventors: **Takashi YAMAGAJO**, Yokosuka (JP);  
**Tabito TONOOKA**, Kawasaki (JP);  
**Masaki TOSAKA**, Kawasaki (JP)

(52) **U.S. Cl.**  
CPC ..... **G06F 17/5009** (2013.01)  
USPC ..... **703/2**

(57) **ABSTRACT**

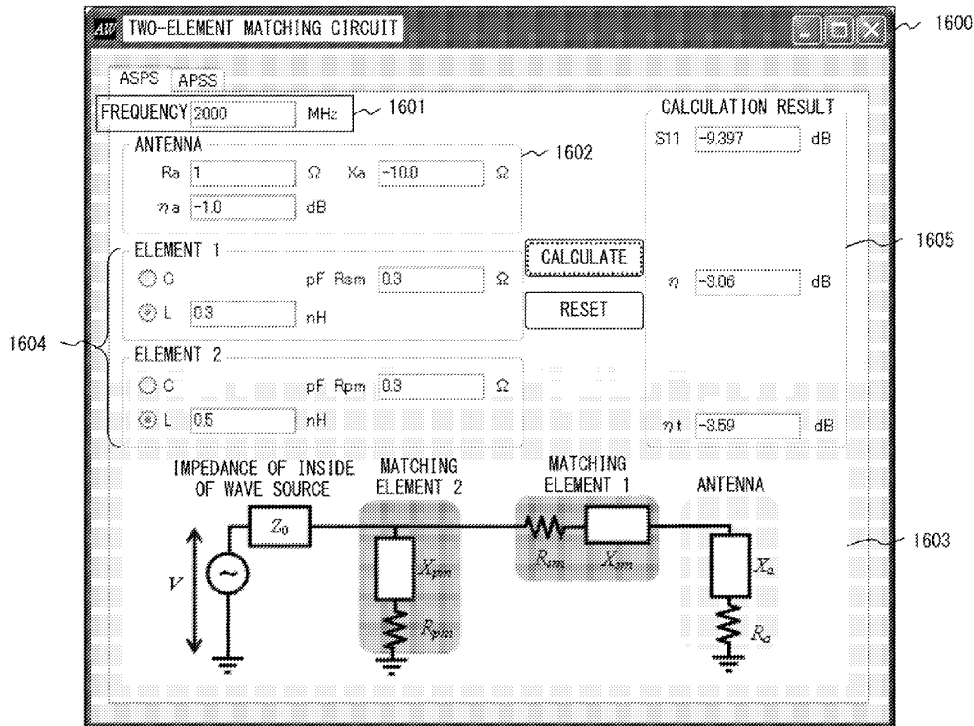
An antenna designing method, performed by a computer, includes: inputting a first antenna characteristic of an antenna; creating an antenna model that includes the antenna and a matching circuit which is connected to the antenna and is formed by a matching element including parasitic reactance and loss resistance; calculating a second antenna characteristic of the created antenna model by using the first antenna characteristic; determining whether or not the calculated second antenna characteristic satisfies a desired standard value; and displaying a determined result.

(21) Appl. No.: **13/686,387**

(22) Filed: **Nov. 27, 2012**

(30) **Foreign Application Priority Data**

Dec. 28, 2011 (JP) ..... 2011-289700







US 20130176178A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0176178 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **WIDEBAND ANTENNA**

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

USPC ..... 343/702; 343/700 MS

(76) Inventors: **Liang-Kai Chen**, Hsinchu (TW);  
**Ching-Chia Mai**, Hsinchu (TW);  
**Cheng-Han Lee**, Hsinchu (TW)

(57) **ABSTRACT**

A wideband antenna for a wireless communication device includes a grounding element, a radiating element, extending in a first direction, for transmitting and receiving wireless signals, a feed-in terminal electrically connected to the radiating element, for transmitting a feed-in signal to the radiating element, and a first parasitic radiating element, extending in the first direction, having a side separated from a side of the radiating element by a first distance, and another side separated from the grounding element by a second distance. The first distance allows the first parasitic radiating element and the radiating element to generate a coupling effect to form a slot antenna for transmitting and receiving wireless signals, and the second distance allows the first parasitic radiating element and the grounding element to generate a coupling effect to form a coupling path to the grounding element to increase bandwidth.

(21) Appl. No.: **13/409,042**

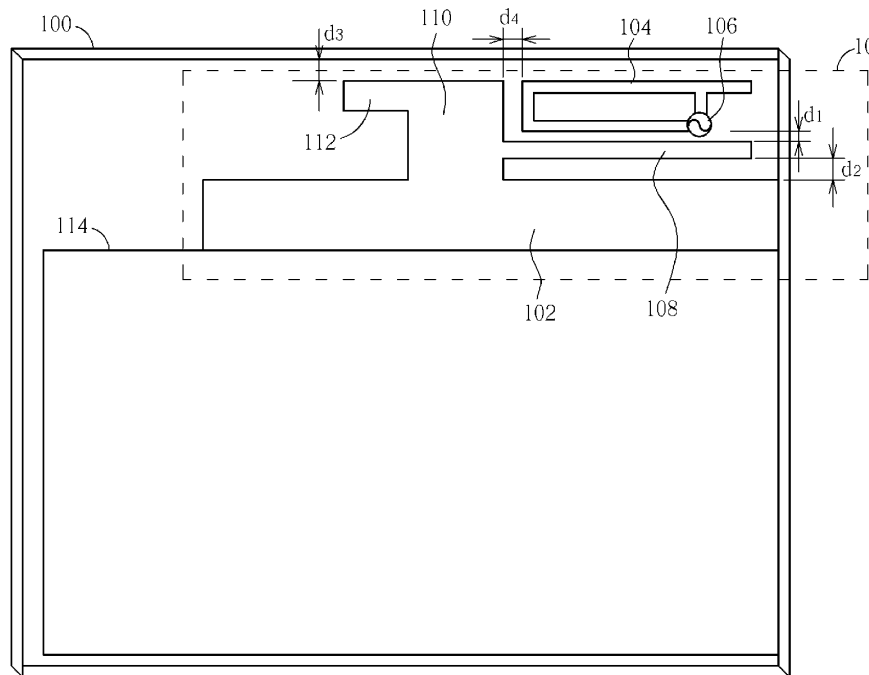
(22) Filed: **Feb. 29, 2012**

(30) **Foreign Application Priority Data**

Jan. 9, 2012 (TW) ..... 101100861

**Publication Classification**

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





US 20130176181A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0176181 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **ELECTRONIC DEVICES**

Jun. 21, 2011 (CN) ..... 201110167988.7

(75) Inventors: **Dafei Mo**, Beijing (CN); **Zhaowei Hu**,  
Beijing (CN); **Xiongbing Gong**, Beijing  
(CN); **Lin Wang**, Beijing (CN)

**Publication Classification**

(73) Assignees: **BEIJING LENOVO SOFTWARE LTD.**, Beijing (CN); **LENOVO (BEIJING) LIMITED**, Beijing (CN)

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H01Q 1/24** (2013.01)  
USPC ..... **343/702**

(21) Appl. No.: **13/824,234**

(22) PCT Filed: **Sep. 27, 2011**

(57) **ABSTRACT**

(86) PCT No.: **PCT/CN11/80196**

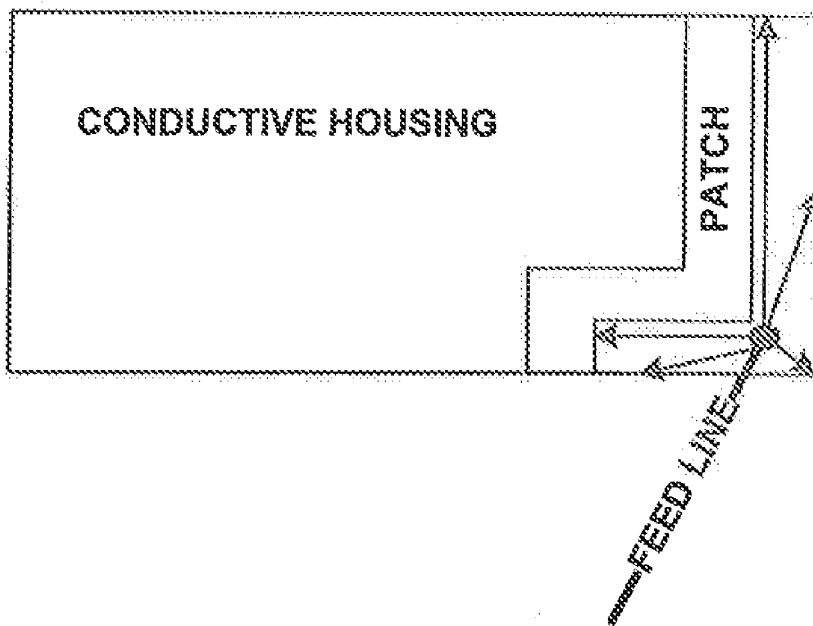
§ 371 (c)(1),

(2), (4) Date: **Mar. 15, 2013**

Disclosed are electronic devices. The electronic device includes a metal component configured as an antenna arm, wherein a current delivery path for delivering high-frequency current is formed on the metal component so that the high-frequency current is delivered in accordance with a predetermined path along the current delivery path on the metal component. In this way, the delivery path of the high-frequency current on the antenna can be adjusted to satisfy requirement on antenna performance.

(30) **Foreign Application Priority Data**

Sep. 30, 2010 (CN) ..... 201010502422.0  
Mar. 15, 2011 (CN) ..... 201110062622.3





US 20130176187A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0176187 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **ANTENNA**

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

(76) Inventors: **Mayumi Matsunaga**, Ehime (JP); **Kenji Kakemizu**, Ehime (JP)

CPC ... **H01Q 7/00** (2013.01); **H01Q 9/16** (2013.01)  
USPC ..... **343/793**; 343/866; 343/867

(21) Appl. No.: **13/820,336**

(57) **ABSTRACT**

(22) PCT Filed: **Aug. 26, 2011**

(86) PCT No.: **PCT/JP2011/069244**

§ 371 (c)(1),  
(2), (4) Date: **Mar. 1, 2013**

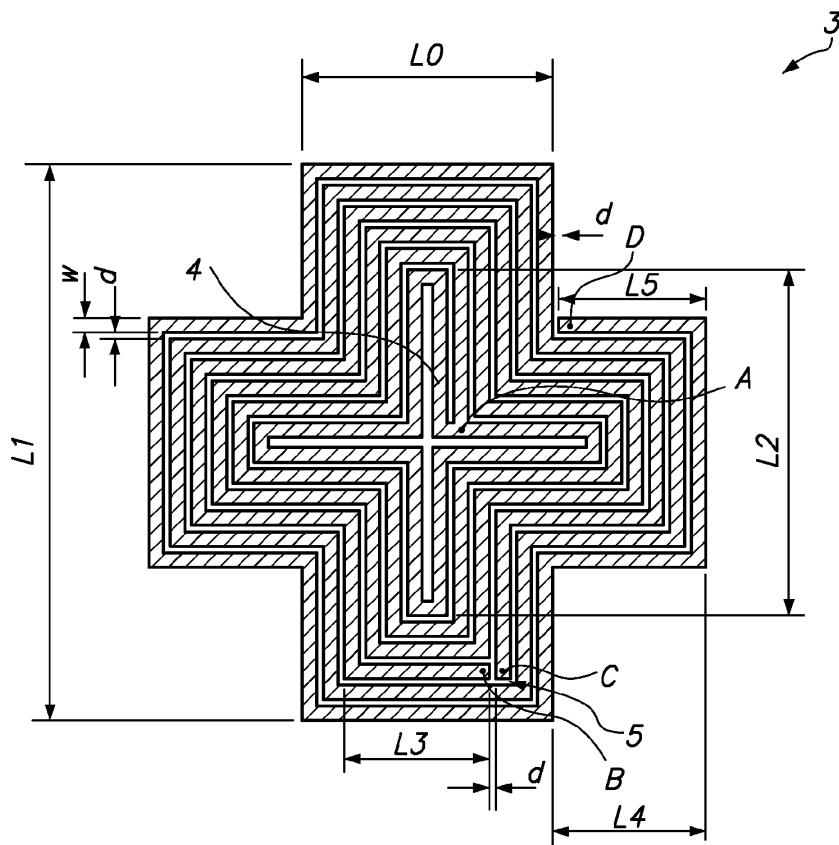
(30) **Foreign Application Priority Data**

Sep. 1, 2010 (JP) ..... 2010-196260

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 7/00** (2006.01)  
**H01Q 9/16** (2006.01)

It is an object of the present invention to provide a shared antenna capable of communicating radio waves with different frequencies or different polarization characteristics, having a simple configuration, and capable of being placed in a small device. An antenna 1 according to the invention includes a plurality of loops of the shape of a cross in a spiral fashion and includes a gap 5 provided at a certain midpoint in the spiral loops and a power supply portion 4 provided in a central portion. The distance of the gap 5 is set such that electromagnetic coupling is caused at a first frequency and no electromagnetic coupling is caused at a second frequency different from the first frequency.





US 20130178169A1

(19) **United States**

(12) **Patent Application Publication**

**Kuo et al.**

(10) **Pub. No.: US 2013/0178169 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **HIGH GAIN ANTENNA AND WIRELESS DEVICE USING THE SAME**

(52) **U.S. Cl.**  
USPC ..... 455/73; 343/818

(76) Inventors: **Cheng-Hao Kuo**, Hualien County (TW);  
**Hsiao-Ting Huang**, Hsinchu County (TW); **Shao-Chin Lo**, Miaoli County (TW)

(57) **ABSTRACT**

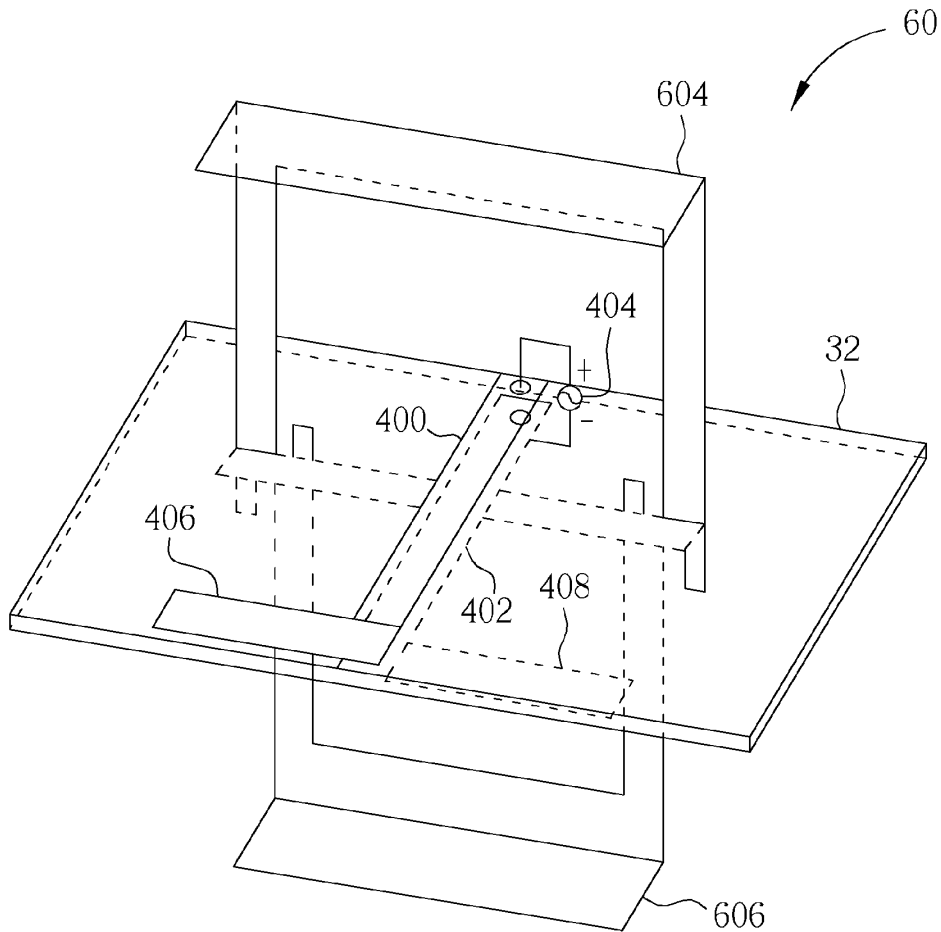
(21) Appl. No.: **13/347,635**

(22) Filed: **Jan. 10, 2012**

**Publication Classification**

(51) **Int. Cl.**  
**H01Q 19/10** (2006.01)  
**H04B 1/38** (2006.01)  
**H01Q 9/16** (2006.01)

The present invention discloses a high gain antenna. The high gain antenna includes a first dipole antenna, formed on a substrate; a parallel reflection metal sheet, formed on the substrate and in parallel with the first dipole antenna; a first vertical reflection metal sheet, vertically disposed on a front side of the substrate and behind the first dipole antenna; and a second vertical reflection metal sheet, vertically disposed on a back side of the substrate and behind the first dipole antenna.





US 20130178174A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0178174 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **PORTABLE ELECTRONIC DEVICE FOR REDUCING SPECIFIC ABSORPTION RATE**

**Publication Classification**

(75) Inventors: **Ryan Alexander GERIS**, Kitchener (CA); **Christopher David BERNARD**, Kitchener (CA); **Rene Pierre MARCHAND**, Waterloo (CA)

(51) **Int. Cl.**  
**H04B 1/38** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **455/90.3**

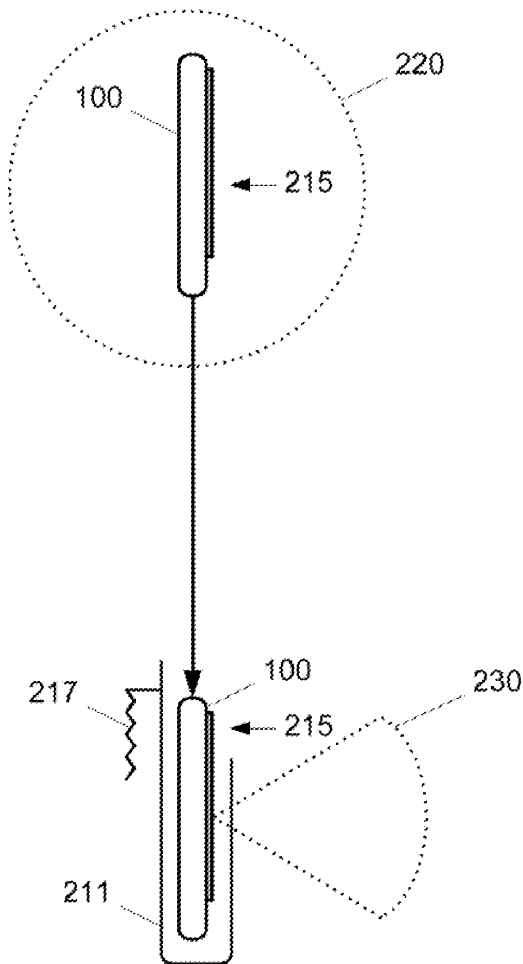
(73) Assignee: **RESEARCH IN MOTION LIMITED**, Waterloo (CA)

(57) **ABSTRACT**

A portable electronic device for reducing specific absorption rate (SAR) is provided. The portable electronic device comprises a processor, at least one antenna, and a sensor enabled by a complementary holder, the processor enabled to: determine that the sensor has detected the holder; and, responsively, switch the at least one antenna from an omnidirectional mode to a directional mode such that energy is radiated from a given side of the portable electronic device.

(21) Appl. No.: **13/343,741**

(22) Filed: **Jan. 5, 2012**





US 20130178180A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0178180 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **FRONT END MODULE**

(71) Applicant: **Taiyo Yuden Co., LTD.**, Tokyo (JP)

(72) Inventors: **Shinpei Oshima**, Tokyo (JP); **Hitoshi Ebihara**, Tokyo (JP)

(73) Assignee: **Taiyo Yuden Co., Ltd.**, Tokyo (JP)

(21) Appl. No.: **13/667,051**

(22) Filed: **Nov. 2, 2012**

(30) **Foreign Application Priority Data**

Nov. 11, 2011 (JP) ..... 2011-247287

**Publication Classification**

(51) **Int. Cl.**  
**H04B 1/16** (2006.01)

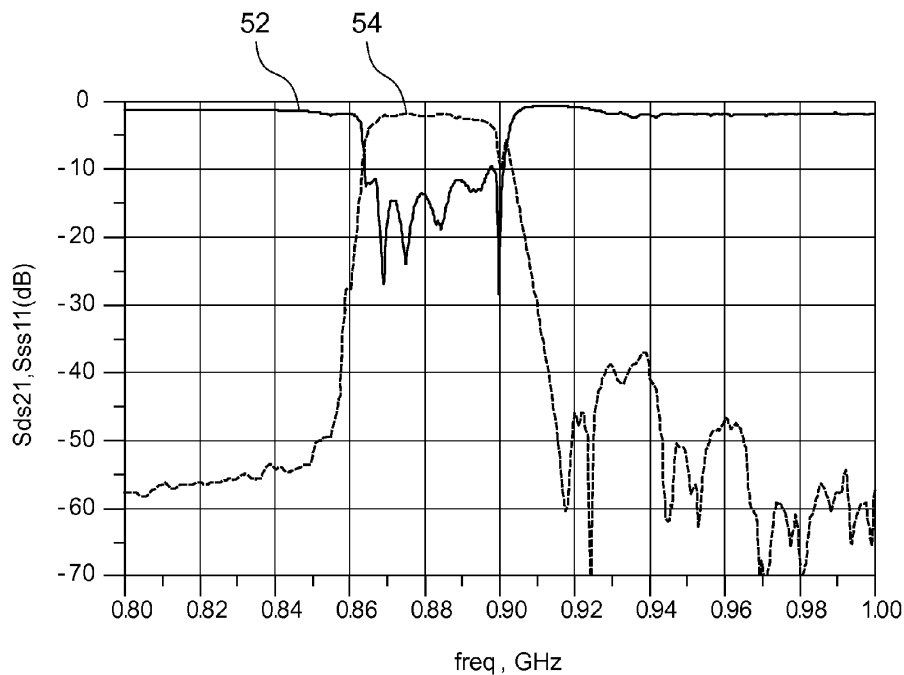
(52) **U.S. Cl.**

CPC ..... **H04B 1/16** (2013.01)

USPC ..... **455/188.1**

(57) **ABSTRACT**

Provided is a front end module which is provided with an output terminal shared in a plurality of frequency bands and in which insertion losses are suppressed. A front end module in an embodiment includes an antenna terminal, an output terminal, and a switch for selectively connecting the antenna terminal to a first band pass filter configured to cause a signal of a first pass band to pass therethrough or a second band pass filter configured to cause a signal of a second pass band, which is different from the first pass band, to pass therethrough. The front end module may include a phase shifter arranged between the switch and the first band pass filter.





US 20130178254A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0178254 A1**

(43) **Pub. Date: Jul. 11, 2013**

(54) **PORTABLE ELECTRONIC DEVICE HAVING AT LEAST ONE OF RESONATOR AND SHIELD**

(60) Provisional application No. 61/304,534, filed on Feb. 15, 2010.

(71) Applicant: **Research In Motion Limited**, Waterloo (CA)

**Publication Classification**

(72) Inventors: **Jay Robert SPOTO**, Boynton Beach, FL (US); **Douglas Wayne MOSKOWITZ**, Weston, FL (US); **Paul Brian KOCH**, Plantation, FL (US); **Marko Antonio ESCALANTE**, Miramar, FL (US)

(51) **Int. Cl.**  
**H04M 1/02** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H04M 1/0235** (2013.01)  
USPC ..... **455/575.4**

(73) Assignee: **RESEARCH IN MOTION LIMITED**, Waterloo, ON (CA)

(57) **ABSTRACT**

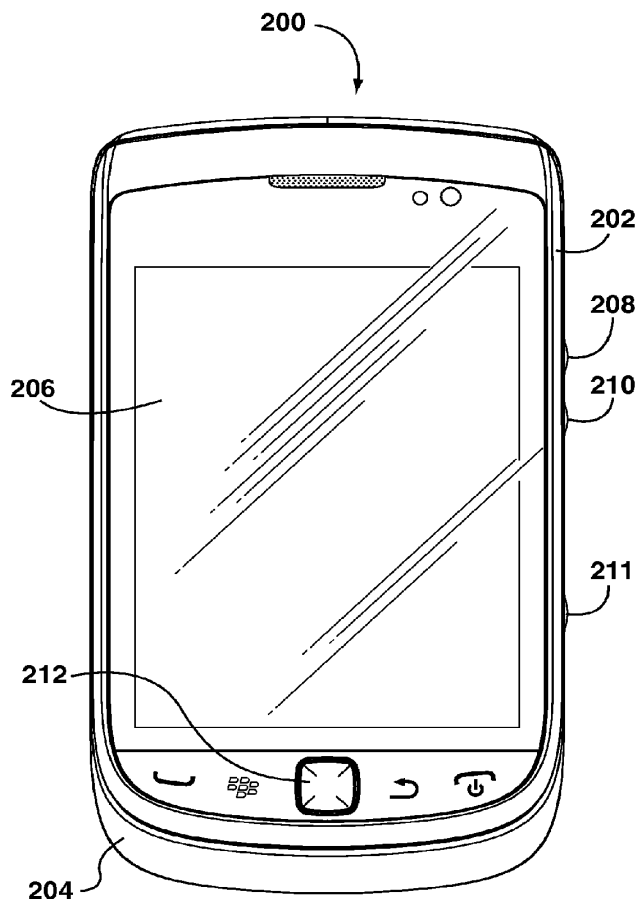
(21) Appl. No.: **13/786,069**

In some aspects, a portable electronic device, having a rear housing, an upper housing coupled to the rear housing and slideable relative thereto between a closed position and an open position, an antenna, and at least one element coupled to the antenna and configured to perform at least one of inhibiting low frequency shift and increasing high frequency sensitivity of the antenna.

(22) Filed: **Mar. 5, 2013**

**Related U.S. Application Data**

(63) Continuation of application No. 12/943,368, filed on Nov. 10, 2010, now Pat. No. 8,417,301.





US 20130181870A1

(19) **United States**

(12) **Patent Application Publication**  
**Suzuki**

(10) **Pub. No.: US 2013/0181870 A1**

(43) **Pub. Date: Jul. 18, 2013**

(54) **ANTENNA AND MOBILE TERMINAL INCLUDING THE ANTENNA**

**Publication Classification**

(75) Inventor: **Masaki Suzuki**, Shizuoka (JP)

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

(73) Assignees: **NEC CASIO MOBILE COMMUNICATIONS LTD.**, Kanagawa (JP); **NEC ACCESS TECHNICA, LTD.**, Shizuoka (JP)

(52) **U.S. Cl.**  
CPC ..... **H01Q 21/00** (2013.01)  
USPC ..... **343/700 MS**

(21) Appl. No.: **13/824,083**

(57) **ABSTRACT**

(22) PCT Filed: **Sep. 13, 2011**

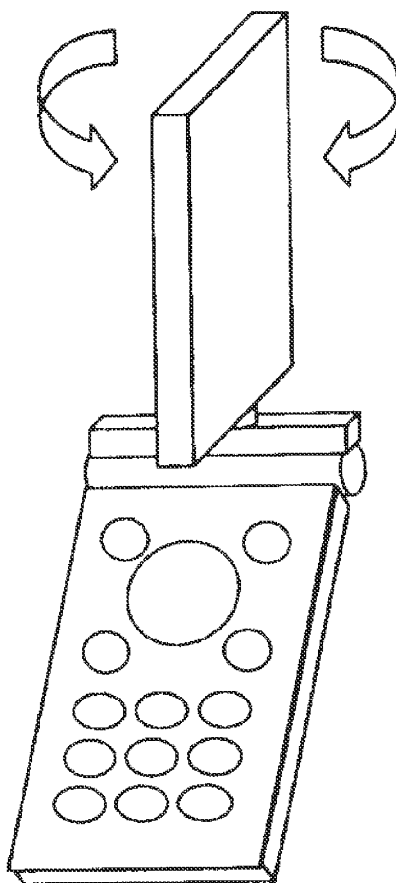
(86) PCT No.: **PCT/JP2011/070845**

§ 371 (c)(1),  
(2), (4) Date: **Mar. 15, 2013**

Provided is an antenna capable of preventing deterioration of antenna radiation characteristics in any of the open state, the closed state, and the reverse state of a mobile terminal. The antenna includes: a pair of antenna elements **1** and **2** arranged to be parallel to each other and to face each other; connecting member **3** for connecting the pair of antenna elements **1** and **2** at the tips thereof to electrically short-circuit the same; and power supply members **4** and **5** capacitively coupled to the feeding points of the pair of antenna elements **1** and **2** to supply power.

(30) **Foreign Application Priority Data**

Nov. 17, 2010 (JP) ..... 2010-256375







US 20130181871A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0181871 A1**

(43) **Pub. Date: Jul. 18, 2013**

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

**Publication Classification**

(75) Inventors: **Sang-Jin EOM**, Gyeonggi-do (KR);  
**Ho-Saeng KIM**, Gyeonggi-do (KR);  
**Hoon PARK**, Seoul (KR); **Joon-Ho  
BYUN**, Gyeonggi-do (KR); **Jun-Hwa  
OH**, Seoul (KR); **Bum-Jin CHO**,  
Gyeonggi-do (KR)

(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 1/00** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **343/702; 343/767; 343/720**

(73) Assignee: **SAMSUNG ELECTRONICS CO.,  
LTD.**, Gyeonggi-do (KR)

(57) **ABSTRACT**

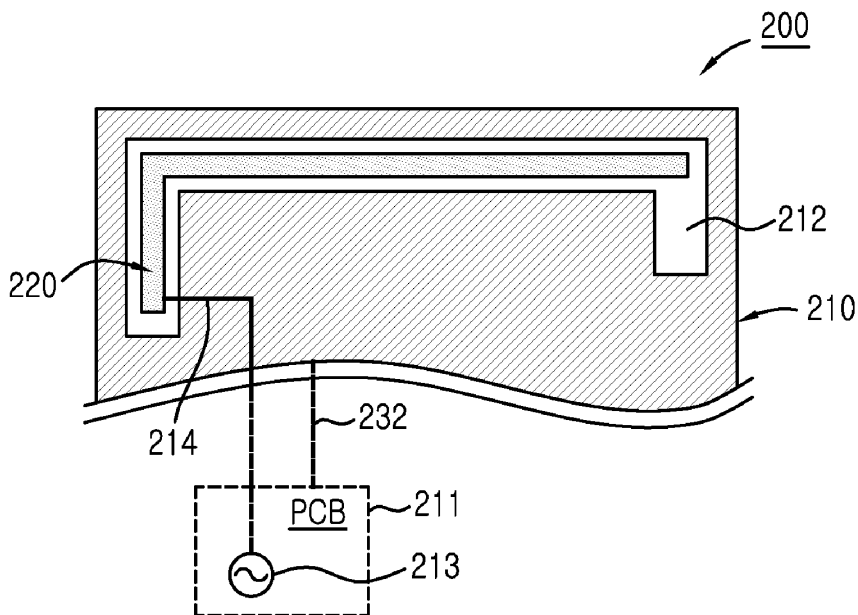
An antenna device for a portable terminal having a printed circuit board (PCB) is disclosed. The antenna device is comprised of first and second antenna elements. The first antenna element includes at least a portion of one or more metal members disposed within the portable terminal; is electrically connected with a ground surface of the PCB; and has a slot. The second antenna element, is disposed in proximity to the slot, spaced from and electromagnetically coupled to the first antenna element. The second antenna element receives RF power from the PCB and is configured to resonate at a frequency of the RF power.

(21) Appl. No.: **13/616,072**

(22) Filed: **Sep. 14, 2012**

(30) **Foreign Application Priority Data**

Jan. 18, 2012 (KR) ..... 10-2012-0005898





US 20130181875A1

(19) **United States**

(12) **Patent Application Publication**  
**CHARRAT**

(10) **Pub. No.: US 2013/0181875 A1**

(43) **Pub. Date: Jul. 18, 2013**

(54) **NFC ANTENNA WITH INTERLEAVED COILS**

**Publication Classification**

(71) Applicant: **INSIDE SECURE**, Aix-en-Provence (FR)

(51) **Int. Cl.**  
**H01Q 7/00** (2006.01)

(72) Inventor: **Bruno CHARRAT**, Aix-en-Provence (FR)

(52) **U.S. Cl.**  
CPC ..... **H01Q 7/005** (2013.01)  
USPC ..... **343/748**

(73) Assignee: **INSIDE SECURE**, Aix-en-Provence (FR)

(57) **ABSTRACT**

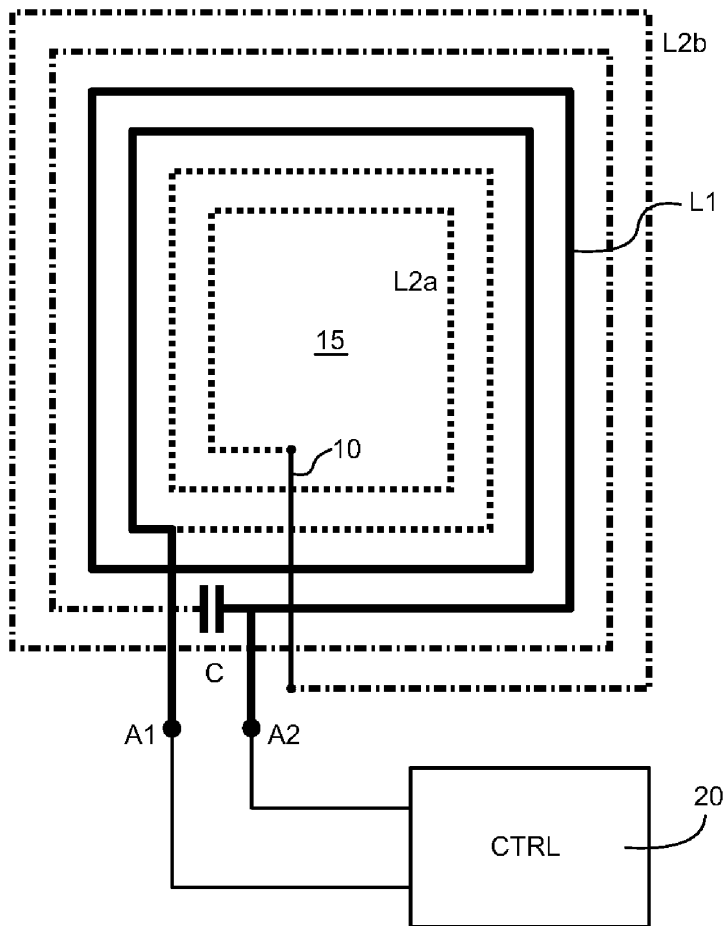
(21) Appl. No.: **13/743,769**

An antenna circuit for near-field communications includes a planar active winding, connected between a first and a second access terminal; an auxiliary winding coplanar with the active winding and connected by a first end to the first access terminal; and a tuning capacitor connected to the second end of the auxiliary winding. The turns of the active and auxiliary windings are interleaved.

(22) Filed: **Jan. 17, 2013**

(30) **Foreign Application Priority Data**

Jan. 18, 2012 (FR) ..... 12 50502





US 20130181876A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0181876 A1**

(43) **Pub. Date: Jul. 18, 2013**

(54) **ANTENNA DEVICE AND COMMUNICATION  
TERMINAL APPARATUS**

**Publication Classification**

(71) Applicant: **MURATA MANUFACTURING CO., LTD.**, Nagaokakyo-Shi (JP)  
  
(72) Inventors: **Tepei Miura**, Nagaokakyo-shi (JP); **Jun Sasaki**, Nagaokakyo-shi (JP); **Hiroyuki Kubo**, Nagaokakyo-shi (JP); **Katsumi Taniguchi**, Nagaokakyo-shi (JP); **Noboru Kato**, Nagaokakyo-shi (JP); **Masahiro Ozawa**, Nagaokakyo-shi (JP); **Satoshi Ishino**, Nagaokakyo-shi (JP)

(51) **Int. Cl.**  
**H01Q 7/00** (2006.01)  
**H01Q 7/06** (2006.01)  
(52) **U.S. Cl.**  
CPC ... **H01Q 7/00** (2013.01); **H01Q 7/06** (2013.01)  
USPC ..... **343/788**; 343/867

(57) **ABSTRACT**

(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Nagaokakyo-shi (JP)

An antenna device that includes coil antennas each having a coil conductor wound around a winding axis and a planar conductor including a surface and an edge end portion, the surface extending along the winding axis of the coil conductor, the edge end portion being adjacent to a coil opening of the coil conductor. A current flowing through the coil conductor induces a current in the planar conductor, this current produces a magnetic flux in a direction normal to the planar conductor, and thus the planar conductor acts as a booster antenna. The antenna device has directivity in the direction normal to the planar conductor because the magnetic flux produced by the coil antennas and that produced by the planar conductor are combined. This enables the antenna device to occupy a small area while achieving a predetermined communication distance.

(21) Appl. No.: **13/729,377**

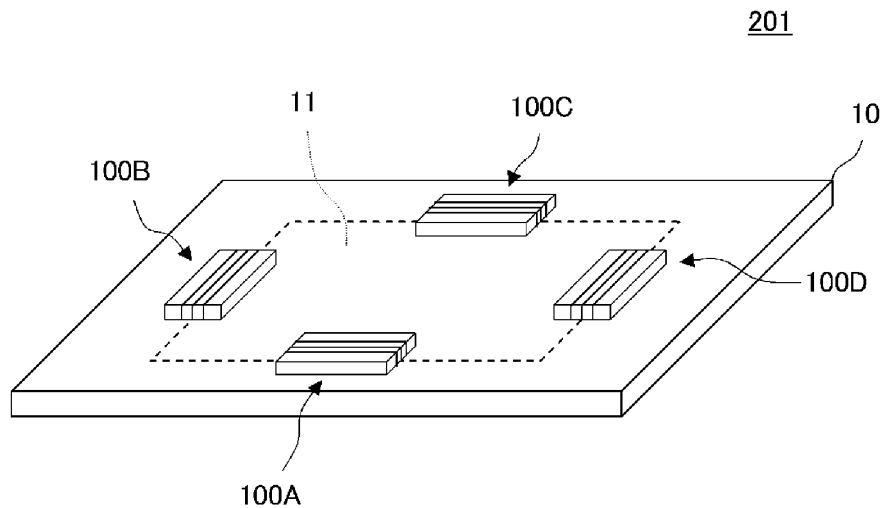
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(54) **SMALL ANTENNA APPARATUS AND METHOD FOR CONTROLLING THE SAME**

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(57) **ABSTRACT**

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An antenna apparatus for a mobile terminal is provided. The antenna apparatus includes an antenna pattern, a first electric circuit and a second electric circuit respectively connected between both ends of the antenna pattern and a system ground, and a third electric circuit disposed between the antenna pattern and a feeding line, wherein the first electric circuit and the second electric circuit extend electrical wavelengths of the antenna pattern and the third electric circuit increases input impedance matching.

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