



US 20130214046A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0214046 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **READER ANTENNA AND RFID ELECTRONIC SHELF INCLUDING THE SAME**

(30) **Foreign Application Priority Data**

Feb. 17, 2012 (KR) 10-2012-0016593

(71) Applicant: **ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE, (US)**

Publication Classification

(72) Inventors: **Won Kyu Choi, Daejeon (KR); Jae-Young Jung, Daejeon (KR); Seung-Hwan Jeong, Daejeon (KR); Ji-Hoon Bae, Daejeon (KR); Gil Young Choi, Daejeon (KR); Jong-Suk Chae, Daejeon (KR); Chan-Won Park, Daejeon (KR); Cheol Sig Pyo, Daejeon (KR)**

(51) **Int. Cl.**
G06K 7/10 (2006.01)
H01Q 9/04 (2006.01)
H01Q 9/16 (2006.01)

(52) **U.S. Cl.**
CPC **G06K 7/10346** (2013.01); **H01Q 9/16** (2013.01); **H01Q 9/0407** (2013.01)
USPC **235/439**; 343/810; 343/700 MS

(73) Assignee: **ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE, Daejeon (KR)**

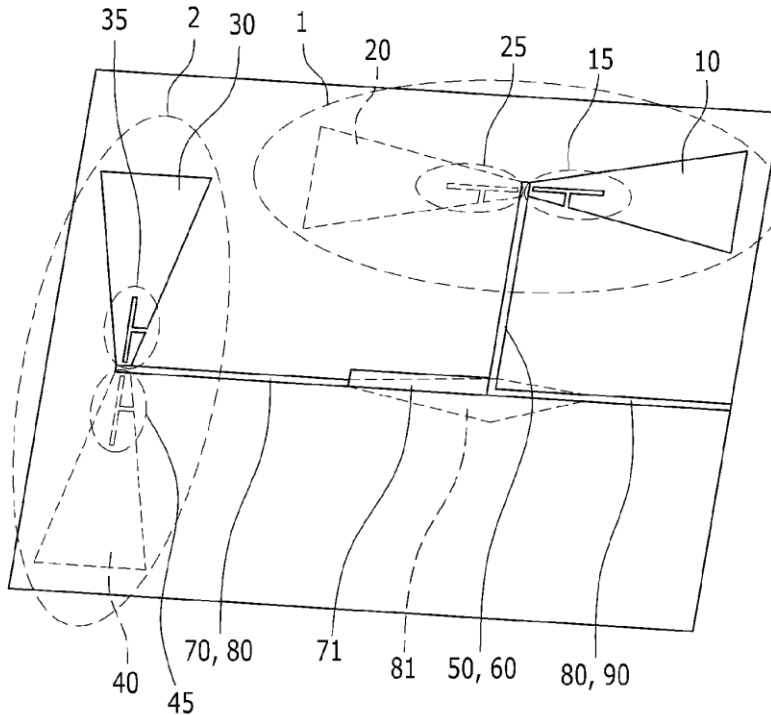
(57) **ABSTRACT**

A reader antenna includes dipole antennas, the dipole antennas including: a horizontal dipole antenna having the characteristic of horizontal polarization; and a dipole antenna perpendicular to the horizontal dipole antenna and including a vertical dipole antenna having the characteristic of vertical polarization, wherein the horizontal dipole antenna and the vertical dipole antenna may both have the characteristic of circular polarization. The reader antenna can be easily stored in an electronic shelf because it is realized in an ultrathin structure using a single-layered dielectric substrate.

(21) Appl. No.: **13/746,657**

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

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US 20130214977A1

(19) **United States**

(12) **Patent Application Publication**
Cheng

(10) **Pub. No.: US 2013/0214977 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **ANTENNA DEVICE FOR CIRCUIT BOARD**

Publication Classification

(71) Applicant: **Arcadyan Technology Corporation,**
(US)

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

(72) Inventor: **Shih-Chieh Cheng,** Hsinchu (TW)

(52) **U.S. Cl.**
CPC **H01Q 1/38** (2013.01)
USPC **343/700 MS**

(73) Assignee: **ARCADYAN TECHNOLOGY CORPORATION,** Hsinchu (TW)

(57) **ABSTRACT**

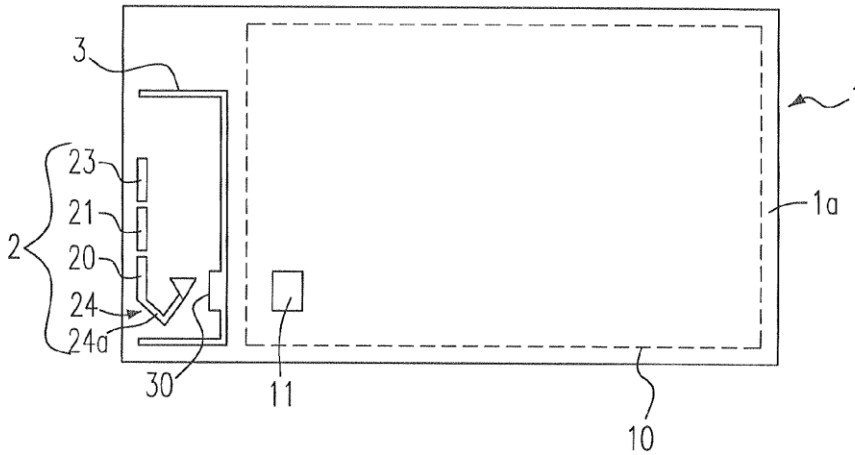
(21) Appl. No.: **13/678,523**

An antenna device is provided. The antenna device includes a circuit board including a first side configured with a transmission unit, and a second side opposite to the first side; a main radiator disposed at the first side, electrically connected to the transmission unit, and having a major axis direction; a first parasitical radiator adjacent to the main radiator, and coaxially disposed in the major axis direction at the first side; and a second parasitical radiator coaxially disposed in the major axis direction at the second side.

(22) Filed: **Nov. 15, 2012**

(30) **Foreign Application Priority Data**

Feb. 22, 2012 (TW) 101105912





US 20130214978A1

(19) **United States**

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

(10) **Pub. No.:** US 2013/0214978 A1

(43) **Pub. Date:** Aug. 22, 2013

(54) **ANTENNA STRUCTURE AND WIRELESS COMMUNICATION DEVICE EMPLOYING SAME**

Publication Classification

(71) Applicant: **FIH (Hong Kong) Limited**, Kowloon (HK)

(51) **Int. Cl.**
H01Q 1/12 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **CHIH-YANG TSAI**, New Taipei (TW);
CHUAN-CHOU CHI, New Taipei (TW);
CHI-SHENG LIU, New Taipei (TW);
HAO-YING CHANG, New Taipei (TW)

(52) **U.S. Cl.**
CPC *H01Q 1/1264* (2013.01); *H01Q 1/243* (2013.01)
USPC **343/702**

(73) Assignee: **FIH (HONG KONG) LIMITED**, Kowloon (HK)

(57) **ABSTRACT**

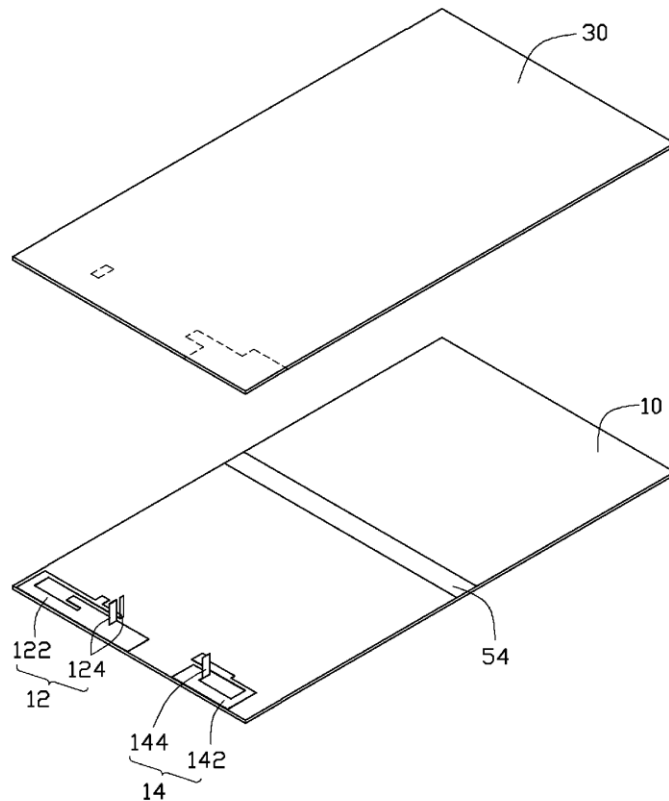
(21) Appl. No.: **13/688,251**

An antenna structure includes a first circuit board having a first antenna unit and a second antenna unit, a second circuit board having a first radio member and a second radio member, and a sliding mechanism. The first antenna unit and the second antenna unit are configured for receiving and transmitting different wireless signals. The sliding mechanism slides the second circuit board relative to the first circuit board, to separate or connect the first antenna unit with the first radio member and the second antenna unit with the second radio member, thus enabling the first antenna unit or a combination of the second antenna unit and the second radio member to receive and transmit a first wireless signal; the second antenna unit or a combination of the first antenna unit and the first radio member receive to transmit a second wireless signal.

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

(30) **Foreign Application Priority Data**

Feb. 16, 2012 (TW) 101105095





US 20130214979A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0214979 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **ELECTRONIC DEVICE ANTENNAS WITH
FILTER AND TUNING CIRCUITRY**

(57) **ABSTRACT**

(76) Inventors: **Emily B. McMilin**, Mountain View, CA (US); **Qingxiang Li**, Mountain View, CA (US); **Robert W. Schlub**, Cupertino, CA (US)

An electronic device may have an antenna that includes conductive antenna structures forming an antenna resonating element and an antenna ground. A band-stop filter may be coupled between first and second portions of the conductive structures. The band-stop filter may be formed from multiple series-connected resonant circuits. The band-stop filter and an impedance matching circuit may be coupled in series between the antenna resonating element and the antenna ground. The band-stop filter may be characterized by a stop band. The antenna may be configured to operate in a first communications band that is outside of the stop band and a second communications band that is covered by the stop band. The impedance matching circuit may be an adjustable circuit that is used to tune the antenna. The adjustable circuit may be a switch-based adjustable capacitor that is adjusted to tune the response of the antenna in the first communications band.

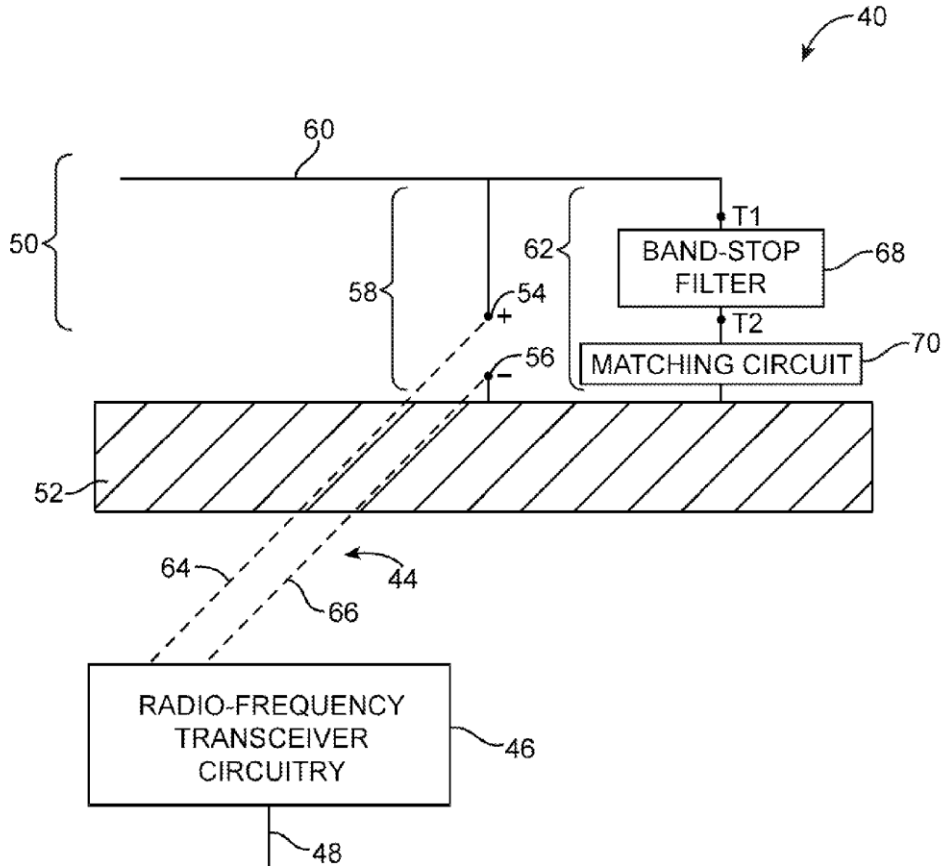
(21) Appl. No.: **13/399,800**

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

Publication Classification

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

(52) **U.S. Cl.**
USPC **343/750; 343/749**





US 20130214981A1

(19) **United States**

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

(10) **Pub. No.:** US 2013/0214981 A1

(43) **Pub. Date:** Aug. 22, 2013

(54) **ANTENNA DEVICE AND TRANSFORMER**

Publication Classification

(71) Applicant: **KABUSHIKI KAISHA TOSHIBA,**
(US)

(51) **Int. Cl.**
H01P 1/04 (2006.01)
H01Q 13/22 (2006.01)

(72) Inventors: **Yukako Tsutsumi,** Kanagawa-ken (JP);
Tetsu Shijo, Tokyo (JP); **Takayoshi Ito,**
Kanagawa-ken (JP); **Shuichi Obayashi,**
Kanagawa-ken (JP); **Hiroki Shoki,**
Tokyo (JP)

(52) **U.S. Cl.**
CPC . *H01P 1/04* (2013.01); *H01Q 13/22* (2013.01)
USPC **343/771**; 333/260; 333/254

(73) Assignee: **KABUSHIKI KAISHA TOSHIBA,**
Minato-ku (JP)

(57) **ABSTRACT**

(21) Appl. No.: **13/855,334**

A transformer between waveguide and transmission-line includes a high-frequency circuit module, transmission-lines, a waveguide, and feed pins. The high-frequency circuit module has differential-pair terminals to input and output a differential signal. The transmission-lines are connected to the differential-pair terminals. The waveguide includes a first to third metal walls. The feed pins are connected to the transmission-lines inside of the waveguide. The feed pins have a first distance of approximately $(\lambda_g/2)$ from each other. One of the feed pins has a second distance of approximately $(\lambda_g*(1+2\alpha)/4)$ from the third metal plane. " λ_g " is a wavelength in the waveguide and " α " is an integer which is equal or larger than "0". Each of the feed pins has a third distance of approximately $(a/2)$ from the first or second wall. " a " is length of the waveguide along the third metal wall.

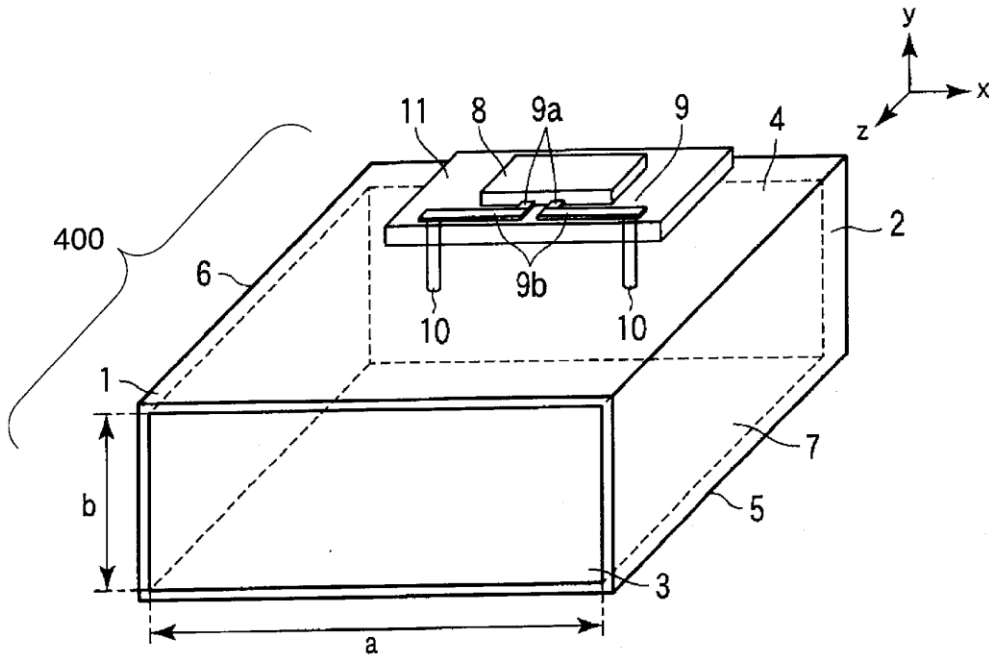
(22) Filed: **Apr. 2, 2013**

Related U.S. Application Data

(62) Division of application No. 12/634,162, filed on Dec. 9, 2009, now Pat. No. 8,441,405.

(30) **Foreign Application Priority Data**

Dec. 12, 2008 (JP) 2008-317003





US 20130214982A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0214982 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **DIPOLE ANTENNA ELEMENT WITH INDEPENDENTLY TUNABLE SLEEVE**

Publication Classification

(76) Inventors: **Stuart James Dean**, Kemptville (CA); **Hafedh Trigui**, Ottawa (CA); **Lin-Ping Shen**, Ottawa (CA); **Alauddin Javed**, Ottawa (CA)

(51) **Int. Cl.**
H01Q 9/28 (2006.01)

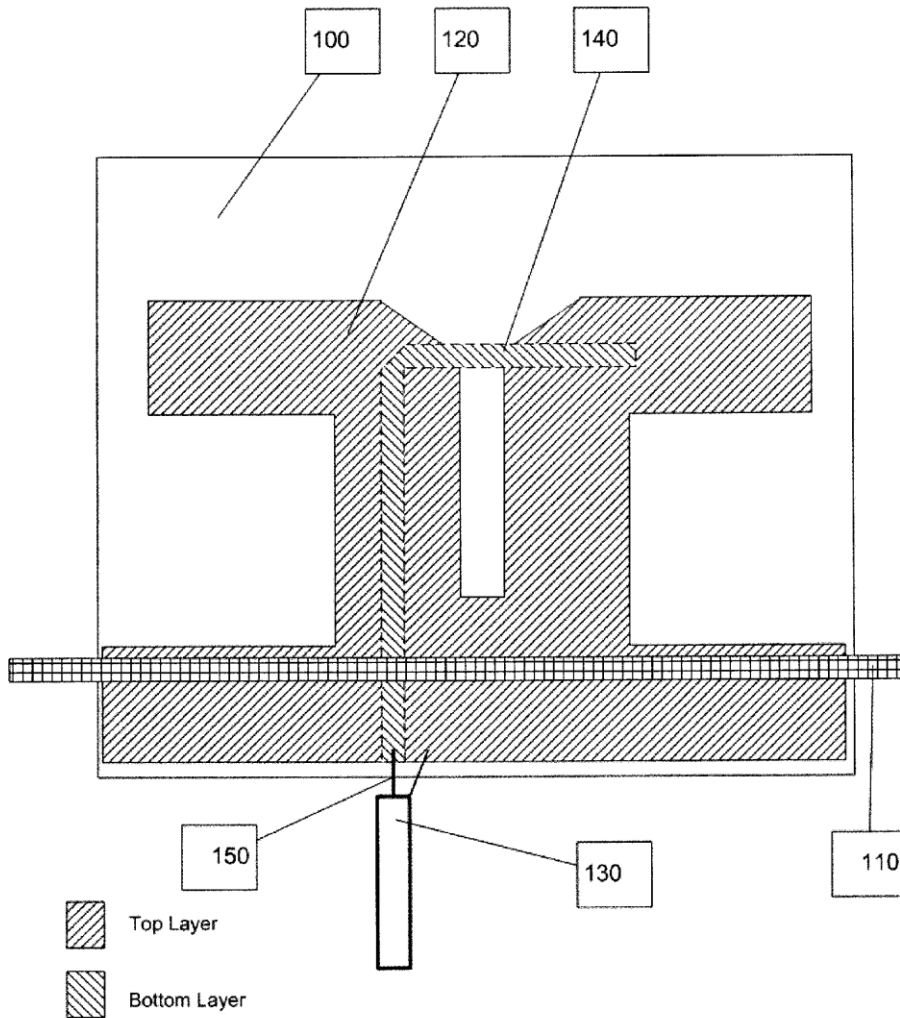
(52) **U.S. Cl.**
USPC **343/795**

(57) **ABSTRACT**

There is described herein a low profile dipole antenna element. A pair of these elements can be arranged in a crossed manner to provide two orthogonal polarized radiators. The antenna element may be combined with an electrically conductive surface and a feed cable and connected to a feed source.

(21) Appl. No.: **13/398,504**

(22) Filed: **Feb. 16, 2012**





US 20130214983A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0214983 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **COMPACT MULTI-COLUMN ANTENNA**

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

(75) Inventors: **Henrik Jidhage**, Molndal (SE); **Anders Ek**, Hisings Backa (SE)

CPC **H01Q 21/293** (2013.01); **H01Q 21/26** (2013.01); **H01Q 9/20** (2013.01); **H01P 11/00** (2013.01)

USPC **343/798**; 343/817; 343/844; 29/600

(73) Assignee: **Telefonaktiebolaget L M Ericsson (PUBL)**, Stockholm (SE)

(57) **ABSTRACT**

(21) Appl. No.: **13/882,727**

The invention provides an antenna arrangement having an operating frequency band with a mean wavelength λ and comprising at least two columns of antenna elements with at least two antenna elements in each column. Each column of antenna elements extends above a separate elongated column ground plane with a column separation defined as a distance between mid-points of neighbouring column ground planes. The antenna elements in each column are located along a column axis pointing in a longitudinal direction of the column ground plane wherein all column separations are below 0.9λ and wherein a parasitic element extends above at least one antenna element in each column. Parameters of the parasitic element are adapted for proper excitation thus achieving a reduced beamwidth for each of said columns of antennas. The invention also provides a method to manufacture the antenna arrangement.

(22) PCT Filed: **Nov. 1, 2010**

(86) PCT No.: **PCT/EP10/66568**

§ 371 (c)(1),

(2), (4) Date: **Apr. 30, 2013**

Publication Classification

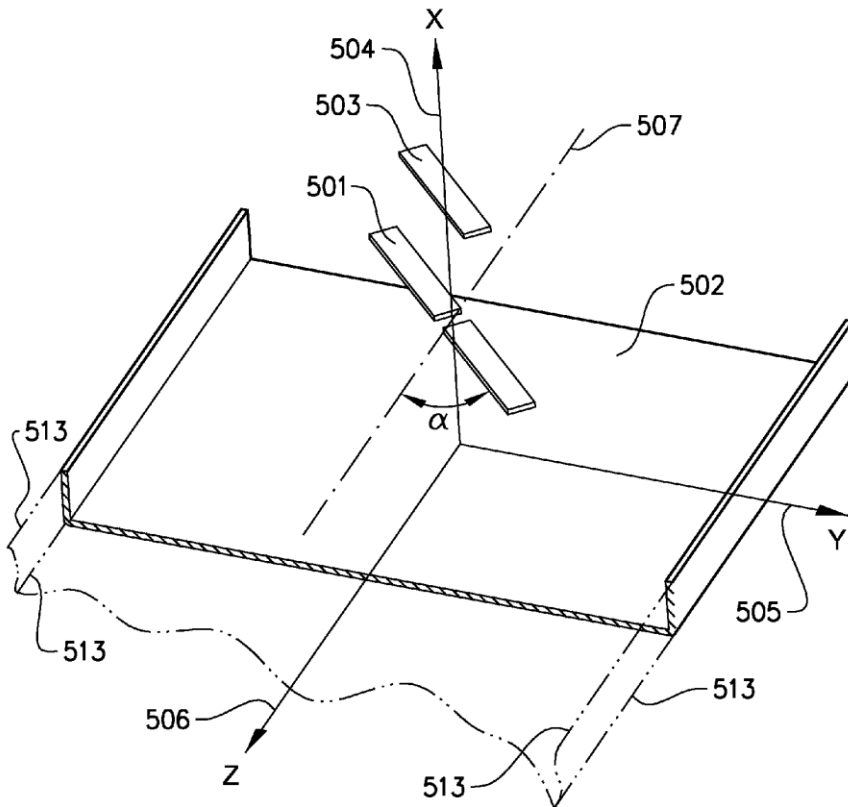
(51) **Int. Cl.**

H01Q 21/29 (2006.01)

H01Q 9/20 (2006.01)

H01P 11/00 (2006.01)

H01Q 21/26 (2006.01)





US 20130214985A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0214985 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **ANTENNA HAVING A PLANAR CONDUCTING ELEMENT WITH FIRST AND SECOND END PORTIONS SEPARATED BY A NON-CONDUCTIVE GAP**

Publication Classification

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/50 (2006.01)

(75) Inventors: **Forrest D. Wolf**, Reno, NV (US);
Claude Jean Michel Laurent, Aalborg (DK)

(52) **U.S. Cl.**
USPC **343/843**; 343/700 MS; 343/905

(73) Assignee: **PINYON TECHNOLOGIES, INC.**,
Reno, NV (US)

(57) **ABSTRACT**

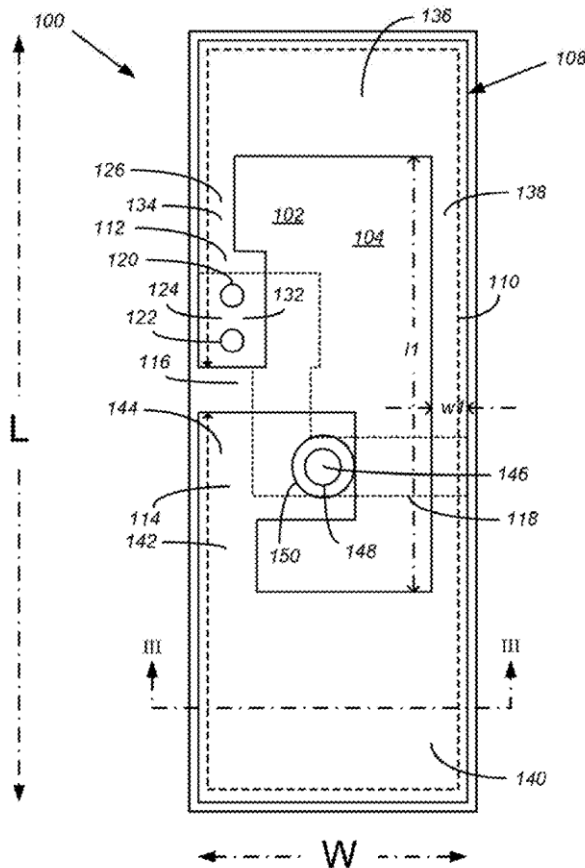
In one embodiment, an antenna includes a dielectric material and a planar conducting element. The dielectric material has a first side opposite a second side, with the planar conducting element residing on the first side. The planar conducting element defines a conductive path between first and second end portions of the planar conducting element, which end portions are separated by a non-conductive gap. In another embodiment, an antenna has a planar conducting element defining a conductive path between first and second end portions of the planar conducting element. The planar conducting element has at least two different widths transverse to the conductive path. The first and second end portions of the planar conducting element are separated by a non-conductive gap.

(21) Appl. No.: **13/434,594**

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

Related U.S. Application Data

(60) Provisional application No. 61/599,932, filed on Feb. 17, 2012.





US 20130214986A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0214986 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **ANTENNA WITH FOLDED MONOPOLE AND LOOP MODES**

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

USPC 343/848; 343/866

(76) Inventors: **Jiang Zhu**, Sunnyvale, CA (US);
Qingxiang Li, Mountain View, CA (US);
Rodney A. Gomez Angulo, Sunnyvale,
CA (US); **Robert W. Schlub**, Cupertino,
CA (US); **Ruben Caballero**, San Jose,
CA (US)

(57)

ABSTRACT

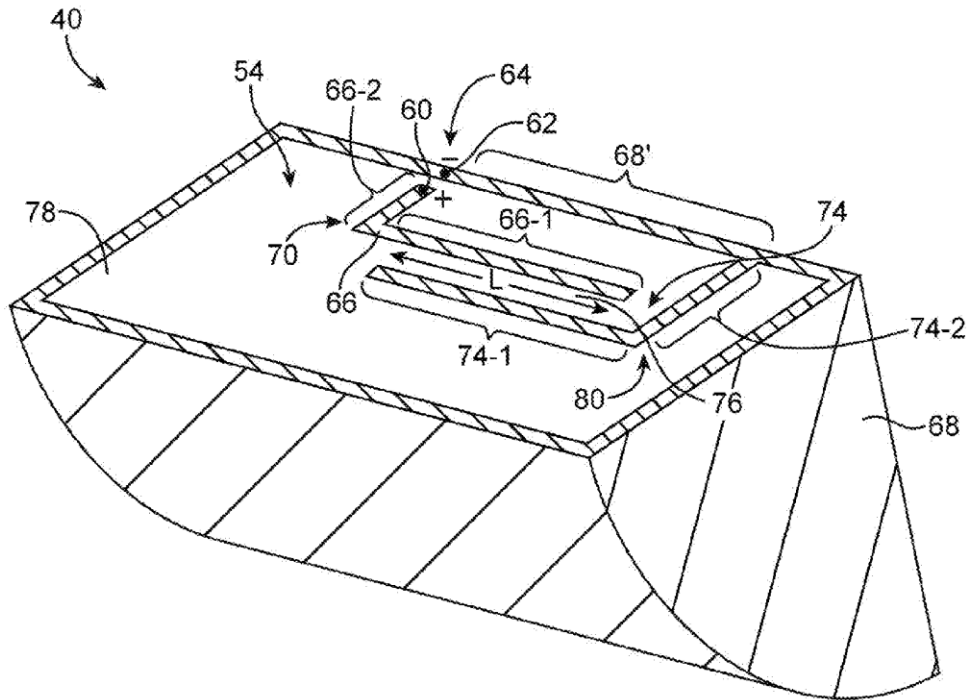
Electronic devices may be provided that contain wireless communications circuitry. The wireless communications circuitry may include radio-frequency transceiver circuitry and antennas. An antenna may have an antenna ground that is configured to form a cavity for the antenna. The antenna ground may be formed on a support structure. The antenna ground may have an opening. The support structure may have a planar surface on which the opening is formed. A folded monopole antenna resonating element and an L-shaped conductive antenna element may be formed in the opening and may be capacitively coupled. The folded monopole antenna resonating element may have an end at which a positive antenna feed terminal is formed. A ground antenna feed terminal may be formed on the antenna ground. A segment of the antenna ground may extend between the ground antenna feed terminal and an end of the L-shaped conductive antenna element.

(21) Appl. No.: **13/402,831**

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

Publication Classification

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





US 20130214992A1

(19) **United States**

(12) **Patent Application Publication**
SILVA

(10) **Pub. No.: US 2013/0214992 A1**

(43) **Pub. Date: Aug. 22, 2013**

(54) **ANTENNA ASSEMBLY AND METHOD OF MAKING SAME**

Publication Classification

(71) Applicant: **David SILVA**, Nuertingen (DE)

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

(72) Inventor: **David SILVA**, Nuertingen (DE)

(52) **U.S. Cl.**
CPC ... **H01Q 1/50** (2013.01); **H01Q 1/22** (2013.01)
USPC **343/906**; 156/292; 156/247; 156/250

(21) Appl. No.: **13/758,217**

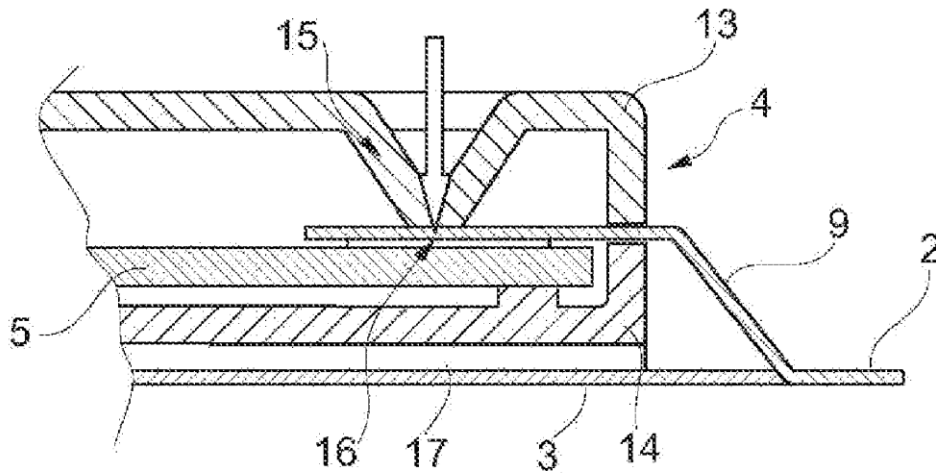
(57) **ABSTRACT**

(22) Filed: **Feb. 4, 2013**

An antenna having a base film carrying at least one antenna structure and one electronic device with a contact region of the at least one antenna structure being provided on a tab formed from the base film and contacted with a contact region of the electronic device is made by first providing the electronic device inside a housing. Then the tab is inserted into the housing. Finally the housing is adhesively adhered in place on the base.

(30) **Foreign Application Priority Data**

Feb. 7, 2012 (DE) 102012002182.8





US 20130221106A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0221106 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **RFID TAG HAVING CAPACITIVE LOAD**

Publication Classification

(71) Applicant: **China Steel Corporation, (US)**

(51) **Int. Cl.**
G06K 19/07 (2006.01)

(72) Inventors: **SUNG-LIN CHEN, Kaohsiung (TW);**
YI-AN WU, Kaohsiung (TW)

(52) **U.S. Cl.**
CPC **G06K 19/0723** (2013.01)
USPC **235/488**

(73) Assignee: **China Steel Corporation, Kaohsiung**
(TW)

(57) **ABSTRACT**

(21) Appl. No.: **13/864,695**

The present invention relates to an RFID tag having capacitive load, including: an antenna unit, a capacitive load and an RFID device. The antenna unit includes two metal sheets and a conductive substrate, and the metal sheets are disposed at a corresponding position above the conductive substrate and electrically connected to the conductive substrate. The capacitive load is electrically connected to the metal sheets. The RFID device feeds the antenna unit by electrically connecting to the metal sheets or coupling. This dramatically decreases the operating frequency, so the imaginary part of impedance is higher with the same size of the antenna unit, thereby reducing the size of the RFID tag. As a result, the weight is reduced, the manufacture process is simplified and the subsequent structure can be easily adjusted.

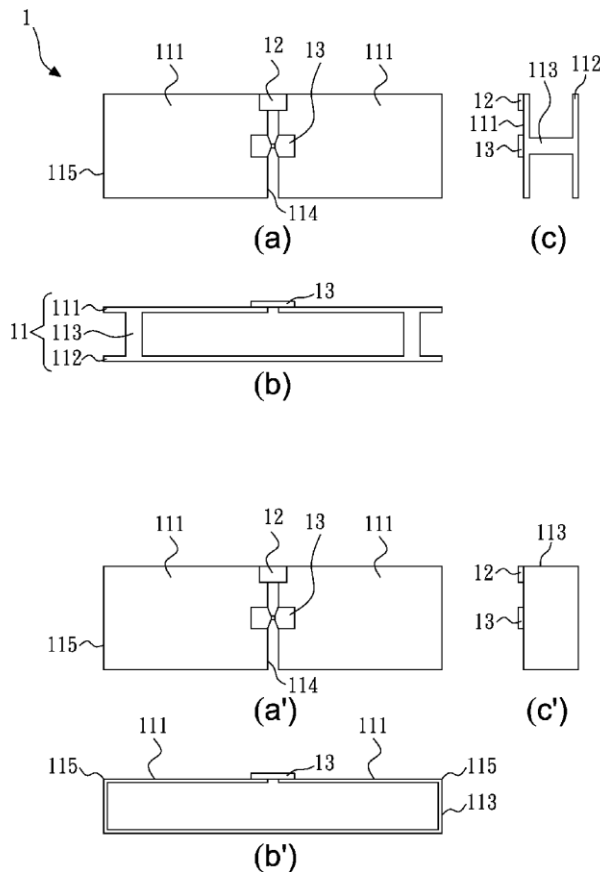
(22) Filed: **Apr. 17, 2013**

Related U.S. Application Data

(62) Division of application No. 13/111,276, filed on May 19, 2011.

Foreign Application Priority Data

May 28, 2010 (TW) 099117241





US 20130222186A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0222186 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **HIGH ISOLATION SINGLE LAMBDA ANTENNA FOR DUAL COMMUNICATION SYSTEMS**

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

(75) Inventors: **Chun Kai LEUNG**, Hong Kong (HK);
Corbett Ray ROWELL, Hong Kong (HK);
Tik Shun LEUNG, Hong Kong (HK);
Kuang Boon BEH, Hong Kong (HK)

(57) **ABSTRACT**

(73) Assignee: **Hong Kong Applied Science and Technology Research Institute Company Limited**, Hong Kong (HK)

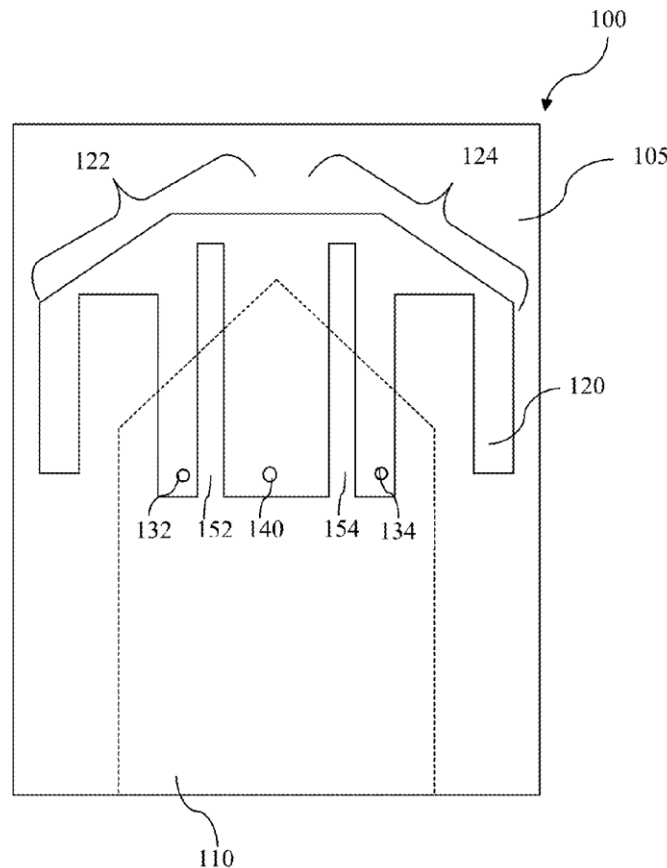
An antenna system includes an antenna element having two antenna feeds and a shared connection to a ground plane. A first antenna portion has a first resonant frequency length of at least one first wavelength formed from a first feed together with the shared ground connection. A second antenna portion has a second resonant frequency length formed from a second feed together with the shared ground connection. First and second slots are respectively positioned between the shared ground connection and the respective first and second feeds such that the slots create inductances. At least a portion of the ground plane is located directly beneath at least a portion of the first and second slots. The first and second slot inductances together with the ground plane capacitances form one or more filter components to isolate the first and second resonant frequencies in the antenna element.

(21) Appl. No.: **13/402,893**

(22) Filed: **Feb. 23, 2012**

Publication Classification

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





US 20130222187A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0222187 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **ANTENNA MODULE**

(75) Inventors: **CHING-WEI CHANG**, NEW TAIPEI CITY (TW); **YU TSUNG HUANG**, KAOHSIUNG CITY (TW); **JHE MIN LIN**, TAOYUAN COUNTY (TW)

(73) Assignee: **AUDEN TECHNO CORP.**, TAOYUAN COUNTY (TW)

(21) Appl. No.: **13/402,959**

(22) Filed: **Feb. 23, 2012**

Publication Classification

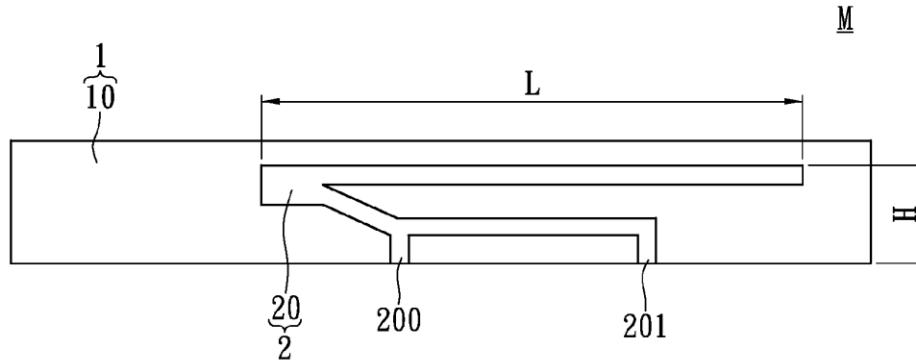
(51) **Int. Cl.**
H01Q 1/38 (2006.01)
B82Y 10/00 (2011.01)

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

USPC **343/700 MS**; 977/773; 977/950

(57) **ABSTRACT**

An antenna module capable includes a substrate unit and an antenna unit. The substrate unit includes at least one carrier substrate having a dielectric constant substantially between 7 and 13. The carrier substrate includes a dielectric body and a plurality of nano-scale microparticle structures distributed inside the dielectric body, and each nano-scale microparticle structure includes at least one nano-scale carbon particle and a nano-scale insulating encapsulation layer for totally encapsulating the nano-scale carbon particle. The antenna unit includes at least one antenna track disposed on the carrier substrate. The antenna track has an antenna usage volume that is adjustable within a predetermined volume range according to the VSWR value and the antenna efficiency maintained within a first and a second predetermined ranges, and the antenna track has at least one feeding portion and at least one grounding portion.





US 20130222190A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0222190 A1**

(43) **Pub. Date: Aug. 29, 2013**

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

Publication Classification

(75) Inventors: **Chen-Ta Hung**, Taipei City (TW);
Wei-Chih Huang, Taipei City (TW);
Chao-Chu Weng, Taipei City (TW);
Chieh-Tsao Hwang, Taipei City (TW)

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

(73) Assignee: **COMPAL ELECTRONICS, INC.**,
Taipei City (TW)

(57) **ABSTRACT**

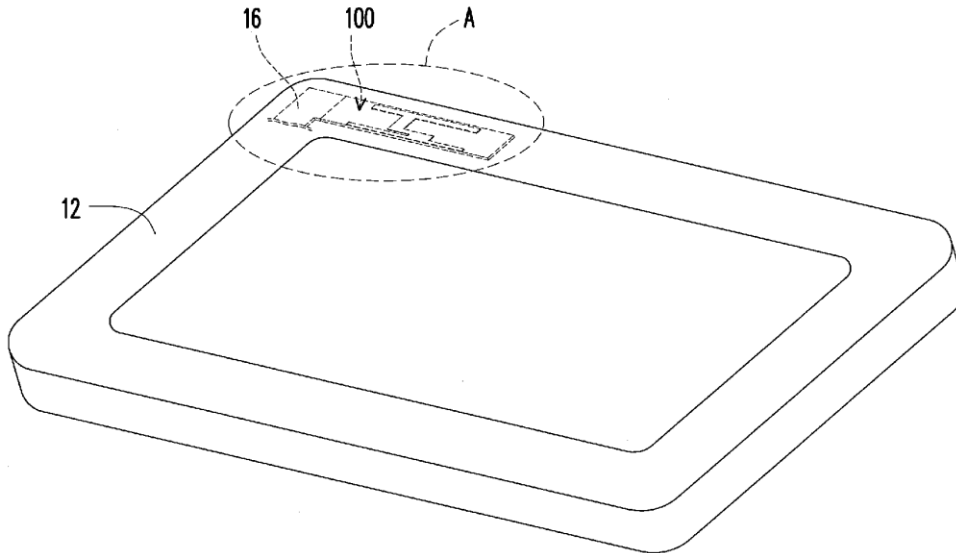
An antenna module and an electronic apparatus are provided. The electronic apparatus includes a housing and the antenna module. The housing has an inner surface. The antenna module includes a circuit board, a proximity sensor and a sensing antenna patch. The circuit board is disposed in the housing, and has a top surface and a bottom surface opposite to the top surface. The circuit board has a communication antenna pattern on the top surface. The proximity sensor is mounted on the bottom surface. The sensing antenna patch is assembled on the inner surface of the housing and electrically connected to the proximity sensor. An orthogonal projection of the communication antenna pattern on the inner surface overlaps the sensing antenna patch on the inner surface.

(21) Appl. No.: **13/462,833**

(22) Filed: **May 3, 2012**

(30) **Foreign Application Priority Data**

Feb. 24, 2012 (TW) 101106322





US 20130222195A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0222195 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **HYBRID ANTENNAS FOR ELECTRONIC DEVICES**

H01P 11/00 (2006.01)

H01Q 9/06 (2006.01)

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

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

CPC *H01Q 13/103* (2013.01); *H01Q 9/06* (2013.01); *H01Q 21/30* (2013.01); *H01P 11/00* (2013.01)

(72) Inventors: **Robert J. Hill**, Salinas, CA (US); **Scott A. Myers**, San Francisco, CA (US); **Robert W. Schlub**, Cupertino, CA (US); **Dean F. Darnell**, San Jose, CA (US); **Zhijun Zhang**, Beijing (CN)

USPC **343/725**; 343/750; 343/767; 29/601

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

(57) **ABSTRACT**

(21) Appl. No.: **13/848,454**

(22) Filed: **Mar. 21, 2013**

Related U.S. Application Data

(62) Division of application No. 13/343,420, filed on Jan. 4, 2012, now Pat. No. 8,410,986, which is a division of application No. 12/120,012, filed on May 13, 2008, now Pat. No. 8,106,836.

(60) Provisional application No. 61/044,448, filed on Apr. 11, 2008.

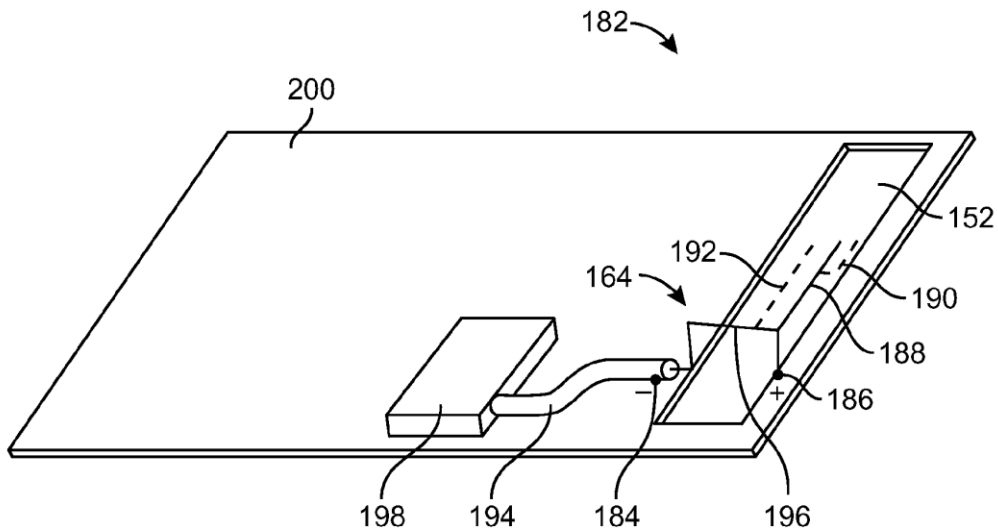
Publication Classification

(51) **Int. Cl.**

H01Q 13/10 (2006.01)

H01Q 21/30 (2006.01)

A portable electronic device is provided that has a hybrid antenna. The hybrid antenna may include a slot antenna structure and an inverted-F antenna structure. The slot antenna portion of the hybrid antenna may be used to provide antenna coverage in a first communications band and the inverted-F antenna portion of the hybrid antenna may be used to provide antenna coverage in a second communications band. The second communications band need not be harmonically related to the first communications band. The electronic device may be formed from two portions. One portion may contain conductive structures that define the shape of the antenna slot. One or more dielectric-filled gaps in the slot may be bridged using conductive structures on another portion of the electronic device. A conductive trim member may be inserted into an antenna slot to trim the resonant frequency of the slot antenna portion of the hybrid antenna.





US 20130222196A1

(19) **United States**

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

(10) **Pub. No.:** US 2013/0222196 A1

(43) **Pub. Date:** Aug. 29, 2013

(54) **WIRELESS DEVICE, AND INFORMATION PROCESSING APPARATUS AND STORAGE DEVICE INCLUDING THE WIRELESS DEVICE**

Publication Classification

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 13/10 (2006.01)

(75) **Inventors:** Koh HASHIMOTO, Yokohama-shi (JP); Yukako Tsutsumi, Kawasaki-shi (JP); Takayoshi Ito, Yokohama-shi (JP); Koji Akita, Yokohama-shi (JP); Keiju Yamada, Yokohama-shi (JP)

(52) **U.S. Cl.**
USPC 343/767; 343/700 MS

(73) **Assignee:** Kabushiki Kaisha TOSHIBA, Tokyo (JP)

(57) **ABSTRACT**

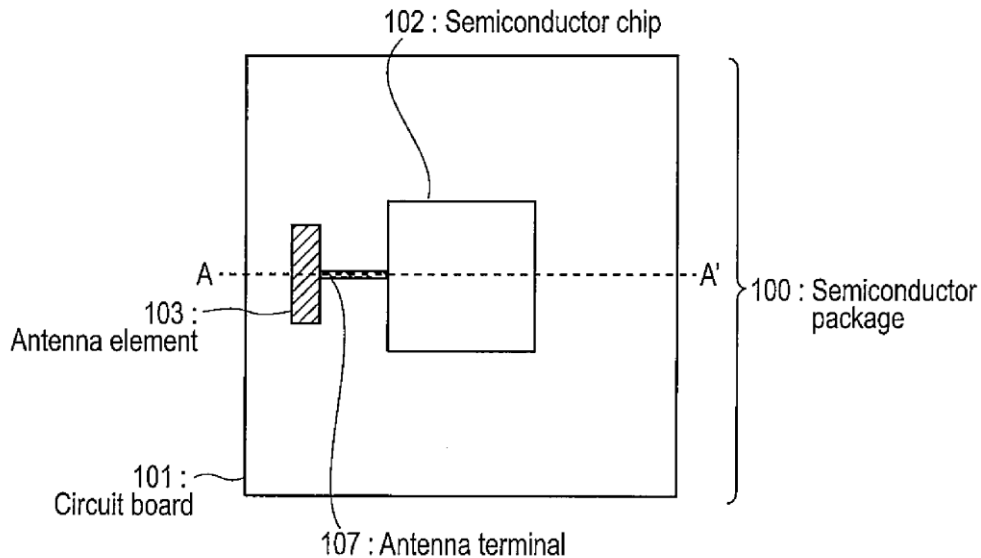
According to one embodiment, a wireless device includes a circuit board, a semiconductor chip, a sealing resin, a conductive film, and an antenna element. The semiconductor chip includes a transmitting/receiving circuit and is mounted on the circuit board. The sealing resin seals the semiconductor chip. The conductive film covers a first surface portion of the sealing resin. An aperture is formed in a portion of the conductive film that corresponds to a second surface portion of the sealing resin other than the first surface portion, and the second surface portion is included in a side surface of the sealing resin and closest to an antenna terminal connected to the antenna element.

(21) **Appl. No.:** 13/603,864

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

(30) **Foreign Application Priority Data**

Feb. 28, 2012 (JP) 2012-041832





US 20130222206A1

(19) **United States**

(12) **Patent Application Publication**
PARK

(10) **Pub. No.: US 2013/0222206 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **MULTIBAND PORTABLE TERMINAL AND METHOD FOR CONTROLLING THEREOF**

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

CPC . *H01Q 5/001* (2013.01); *H01Q 1/50* (2013.01)

USPC **343/876; 343/893**

(71) Applicant: **Pantech Co., Ltd.**, (US)

(72) Inventor: **Won Seok PARK**, Seoul (KR)

(73) Assignee: **Pantech Co., Ltd.**, Seoul (KR)

(21) Appl. No.: **13/780,568**

(22) Filed: **Feb. 28, 2013**

(30) **Foreign Application Priority Data**

Feb. 29, 2012 (KR) 10-2012-0020997

Publication Classification

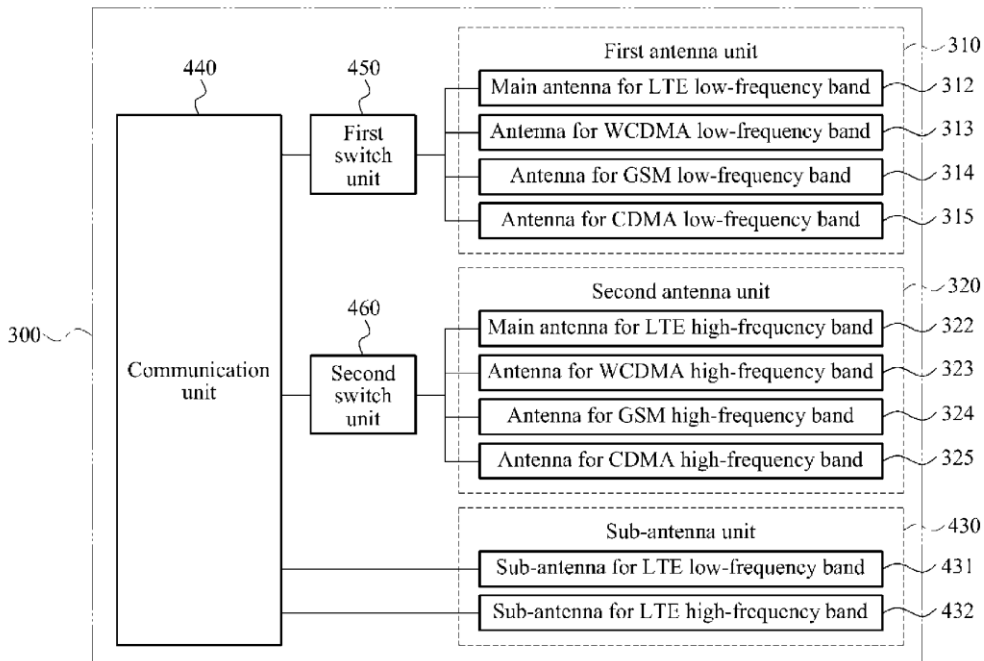
(51) **Int. Cl.**

H01Q 5/00 (2006.01)

H01Q 1/50 (2006.01)

(57) **ABSTRACT**

A portable terminal includes a first antenna unit including a low-frequency band antenna to service a low-frequency band; a second antenna unit including a high-frequency band antenna to service a high-frequency band; a first sub-antenna to support the low-frequency band antenna during communication; and a second sub-antenna to support the high-frequency band antenna during communication. A portable terminal includes a first antenna unit including a low-frequency band antenna to service a low-frequency band; a second antenna unit including a high-frequency band antenna to service a high-frequency band, in which the first antenna unit is disposed at a first portion of the portable terminal and the second antenna unit is disposed at a second portion of the portable terminal.





US 20130223836A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0223836 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **ELECTRONIC DEVICE ASSEMBLIES**

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

USPC **396/535; 361/749; 361/679.01**

(76) Inventors: **Kevin D. Gibbs**, San Carlos, CA (US);
Carl R. Peterson, Santa Clara, CA (US);
Erik A. Uttermann, San Francisco, CA (US);
Conor P. Lenahan, Cupertino, CA (US);
John P. Ternus, Los Altos Hills, CA (US);
Justin R. Wodrich, Saratoga, CA (US);
Elvis M. Kibiti, San Francisco, CA (US);
Derek Wright, San Francisco, CA (US)

(57) **ABSTRACT**

An electronic device may have a conductive housing. A dielectric structure may be mounted in the conductive housing to form an antenna window. An electrical component such as a camera, light sensor, or other device may press against a conductive foam structure. A printed circuit may have conductive traces that form an antenna ground and antenna resonating element. The printed circuit may be wrapped around a support structure. The electrical component, the conductive foam structure, and the printed circuit wrapped around the support structure may be compressed between a display cover layer and the antenna window. A camera window may be attached to a camera window trim using multiple adhesives. The trim may have a curved exterior surface that matches a curved housing surface. A flexible printed circuit cable may have a folded portion. A band structure may surround the folded portion to form a service loop.

(21) Appl. No.: **13/413,525**

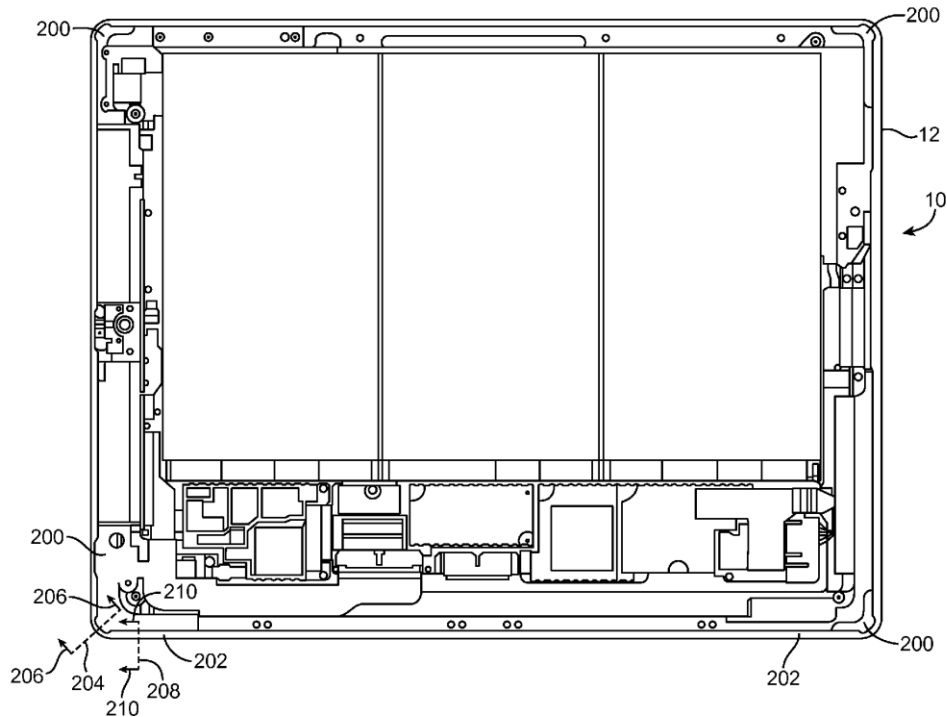
(22) Filed: **Mar. 6, 2012**

Related U.S. Application Data

(60) Provisional application No. 61/603,118, filed on Feb. 24, 2012.

Publication Classification

(51) **Int. Cl.**
G03B 17/02 (2006.01)
H05K 7/00 (2006.01)
H05K 7/02 (2006.01)





US 20130225088A1

(19) **United States**

(12) **Patent Application Publication**
Anderson

(10) **Pub. No.: US 2013/0225088 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **SIMPLE AUTOMATIC ANTENNA TUNING SYSTEM AND METHOD**

(75) Inventor: **William David Anderson**, Chapel Hill, NC (US)

(73) Assignee: **HTC CORPORATION**, Taoyuan City (TW)

(21) Appl. No.: **13/408,719**

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

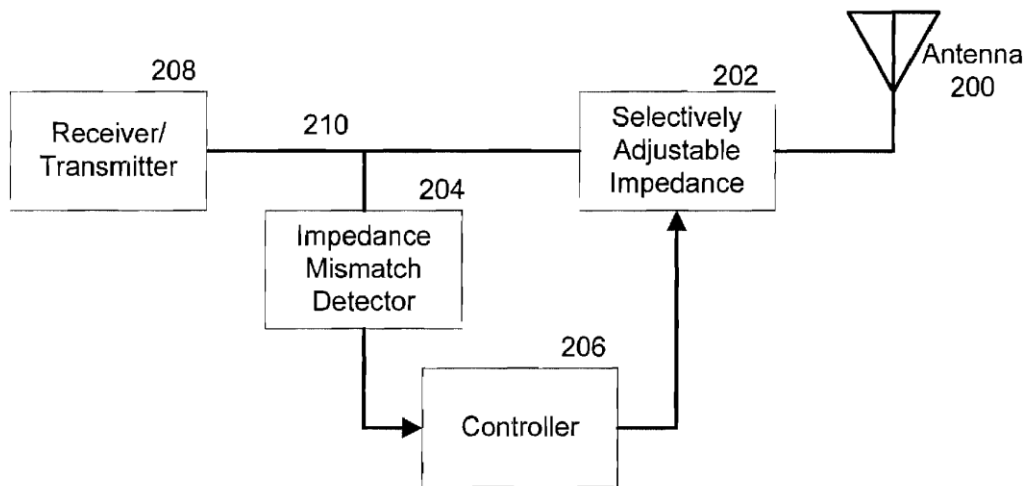
Publication Classification

(51) **Int. Cl.**
H04B 15/00 (2006.01)
H04B 1/40 (2006.01)
H04B 1/18 (2006.01)
H01Q 9/00 (2006.01)
G01R 29/08 (2006.01)

(52) **U.S. Cl.**
USPC **455/62**; 343/745; 343/894; 455/192.2

(57) **ABSTRACT**

Embodiments of a method for tuning the resonant frequency of an antenna in a wireless communication device are disclosed, along with embodiments of a wireless communication device using such a method. Embodiments sense the out-of-band impedance of the antenna, which comprises an antenna element and selectively adjustable impedance disposed between the antenna element and a ground plane of the wireless device, and adjust the selectively adjustable impedance to achieve a desired resonant frequency of the antenna. Embodiments separate an antenna signal into an in-band signal and out-of-band impedance, generate an error signal related to the out-of-band impedance, apply the error signal to a controller circuit configurable to generate an impedance error signal representing the change in antenna impedance, and apply the impedance error signal to the selectively adjustable impedance. Embodiments of a method and electronic circuit for determining the change in impedance of an antenna are also disclosed.





US 20130225234A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0225234 A1**

(43) **Pub. Date: Aug. 29, 2013**

(54) **MOBILE DEVICE AND WIDEBAND ANTENNA STRUCTURE THEREIN**

Publication Classification

(71) Applicant: **HTC Corporation**, (US)
(72) Inventors: **Chien-Chun CHENG**, Taoyuan City (TW); **Yu-Che LIN**, Taoyuan City (TW); **Chung-Ting HUNG**, Taoyuan City (TW)

(51) **Int. Cl.**
H04M 1/02 (2006.01)
H04W 88/06 (2006.01)
(52) **U.S. Cl.**
CPC *H04M 1/0274* (2013.01); *H04W 88/06* (2013.01)
USPC **455/552.1**; 455/575.7

(73) Assignee: **HTC CORPORATION**, Taoyuan City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **13/749,780**

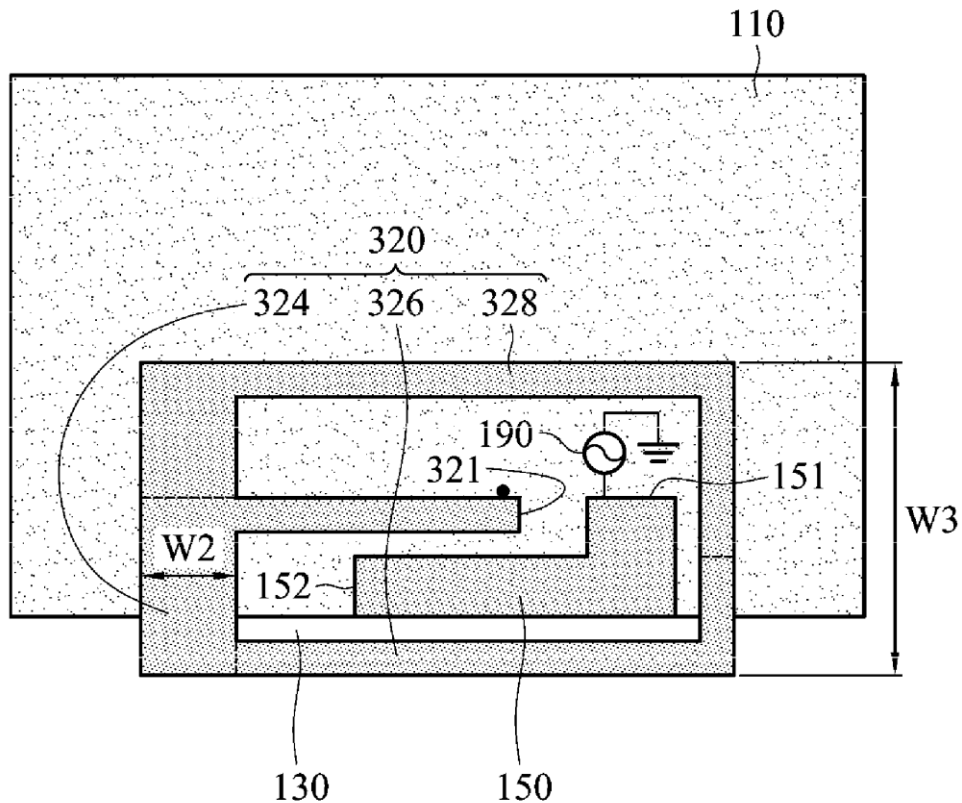
A mobile device includes a ground plane, a grounding trace, and a feeding trace. The grounding trace defines a notch, and has a shorted end coupled to the ground plane. The feeding trace is disposed adjacent to the grounding trace, and has a feeding end and an open end. An antenna structure is formed by the grounding trace and the feeding trace. The feeding end of the feeding trace is coupled to a signal source. The open end of the feeding trace substantially extends into the notch of the grounding trace.

(22) Filed: **Jan. 25, 2013**

Related U.S. Application Data

(60) Provisional application No. 61/602,843, filed on Feb. 24, 2012.

300





US 20130229312A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0229312 A1**

(43) **Pub. Date: Sep. 5, 2013**

(54) **ANTENNA MODULE AND WIRELESS COMMUNICATION DEVICE EMPLOYING SAME**

Publication Classification

(71) Applicant: **FIH (HONG KONG) LIMITED,**
Kowloon (HK)

(51) **Int. Cl.**
H01Q 5/00 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **CHUAN-CHOU CHI,** New Taipei (TW); **CHIH-YANG TSAI,** New Taipei (TW); **CHI-SHENG LIU,** New Taipei (TW); **HAO-YING CHANG,** New Taipei (TW)

(52) **U.S. Cl.**
CPC **H01Q 5/0055** (2013.01); **H01Q 1/243** (2013.01)
USPC **343/702**; 343/882

(73) Assignee: **FIH (HONG KONG) LIMITED,**
Kowloon (HK)

(57) **ABSTRACT**

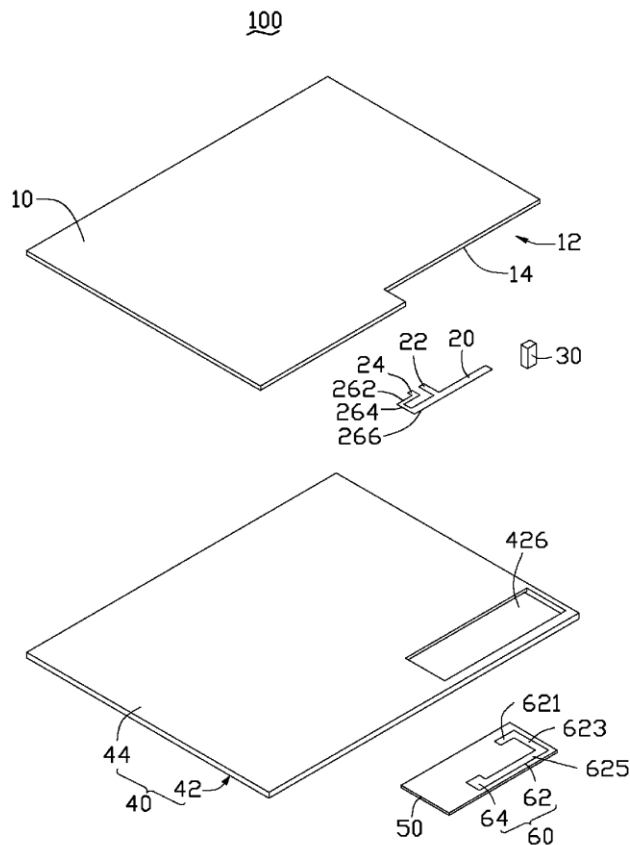
(21) Appl. No.: **13/693,046**

An antenna module includes an antenna, a connecting member attached to the antenna, a sliding board configured for sliding relative to connecting member, and a radiation member attached to the sliding board. When the sliding board is slid by a user, the radiation member makes contact with or separates from the connecting member, enabling one antenna module to receive and transmit wireless signals of different wavelengths.

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

(30) **Foreign Application Priority Data**

Mar. 1, 2012 (TW) 101106826





US 20130229313A1

(19) **United States**

(12) **Patent Application Publication**
CHIU

(10) **Pub. No.: US 2013/0229313 A1**

(43) **Pub. Date: Sep. 5, 2013**

(54) **ELECTRONIC APPARATUS**

(71) Applicant: **ASUSTEK COMPUTER INC.**, Taipei (TW)

(72) Inventor: **Min-Yuan CHIU**, Taipei (TW)

(73) Assignee: **ASUSTEK COMPUTER INC.**, Taipei (TW)

(21) Appl. No.: **13/718,497**

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

(30) **Foreign Application Priority Data**

Mar. 1, 2012 (CN) 201210051689.1

Publication Classification

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

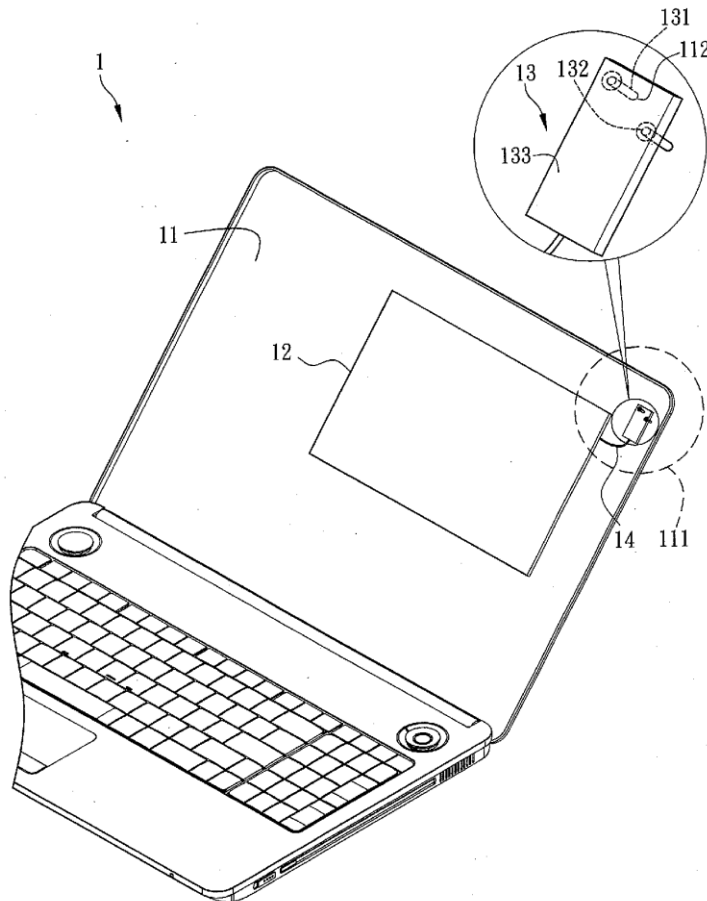
(52) **U.S. Cl.**

CPC **H01Q 1/44** (2013.01)

USPC **343/702**

(57) **ABSTRACT**

An electronic apparatus includes a casing, a circuit board, and a feeding element. The casing is made of conducting material, and comprises at least one feeding point. The circuit board is disposed in the casing. The feeding element is disposed in the electronic apparatus, and contacts the feeding point of the casing for transmitting signals between the circuit board and the casing, so that the casing functions as a radiation body of an antenna. Accordingly, the signal shielding of the antenna can be avoided, and it is unnecessary to change the material of the casing to plastic, which needs additional manufacturing process. After several times of tests, configuring the feeding point at the corner of the casing can provide higher performance of transmission.





US 20130229316A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0229316 A1**
(43) **Pub. Date: Sep. 5, 2013**

(54) **METHOD AND APPARATUS FOR CONTROLLING AN ANTENNA**

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

CPC *H01Q 23/00* (2013.01)
USPC **343/729**

(71) Applicant: **SKYXCROSS, INC.**, Fremont, CA (US)

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

(57) **ABSTRACT**

A system that incorporates the subject disclosure may include, for example, a method for coupling a primary antenna to an auxiliary antenna portion with a current-controlled switch. The method further includes generating a unidirectional direct current or a first bias voltage having a first polarity to cause the current-controlled switch to substantially form a conduction channel between the primary antenna and the auxiliary antenna portion. While the conduction channel is present, a first resonance frequency range of the primary antenna is frequency shifted to a second resonance frequency range. The method can also include removing the unidirectional direct current or generating a second bias voltage having a second polarity to cause the current-controlled switch to form an open circuit between the primary antenna and the auxiliary antenna portion. While the open circuit is present, the first resonance frequency range of the primary antenna is restored. Other embodiments are disclosed.

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

(21) Appl. No.: **13/768,834**

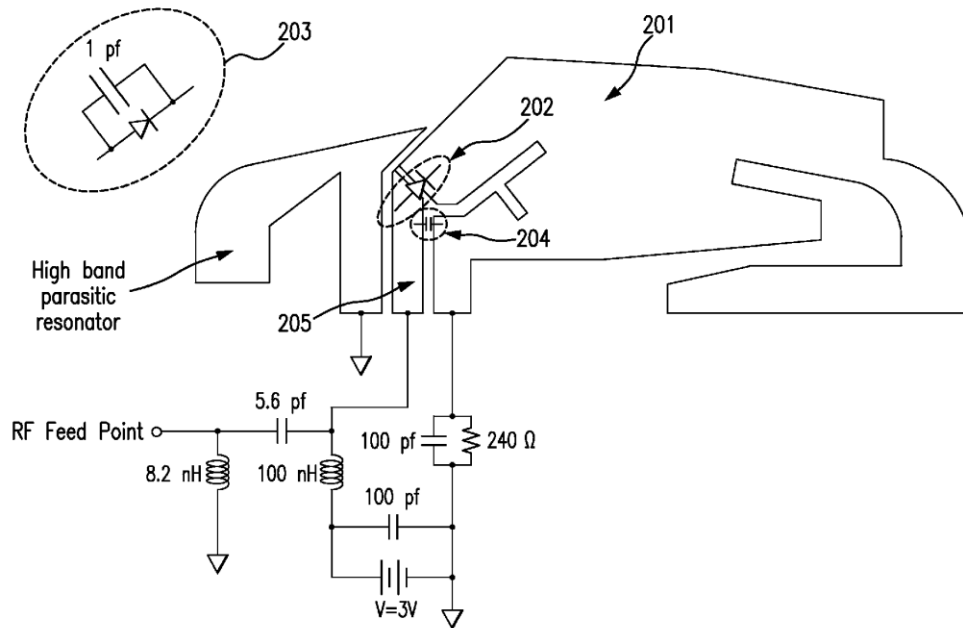
(22) Filed: **Feb. 15, 2013**

Related U.S. Application Data

(60) Provisional application No. 61/600,240, filed on Feb. 17, 2012.

Publication Classification

(51) **Int. Cl.**
H01Q 23/00 (2006.01)





US 20130229317A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0229317 A1**

(43) **Pub. Date: Sep. 5, 2013**

(54) **HANDHELD DEVICE WITH TWO ANTENNAS, AND METHOD OF ENHANCING THE ISOLATION BETWEEN THE ANTENNAS**

(30) **Foreign Application Priority Data**

Jul. 21, 2005 (EP) 05106694.2

(71) Applicant: **FRACTUS, S.A.**, Sant Cugat del Valles (ES)

Publication Classification

(72) Inventors: **Josep Mumbru**, Barcelona (ES); **Jaume Anguera**, Castellon (ES); **Jordi Soler**, Mataro (ES); **Carles Puente**, Sant Cugat del Valles (ES)

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 13/10 (2006.01)

(73) Assignee: **Fractus, S.A.**, Sant Cugat del Valles (ES)

(52) **U.S. Cl.**
CPC . **H01Q 1/52** (2013.01); **H01Q 13/10** (2013.01)
USPC **343/767**; 343/841

(21) Appl. No.: **13/718,348**

(57) **ABSTRACT**

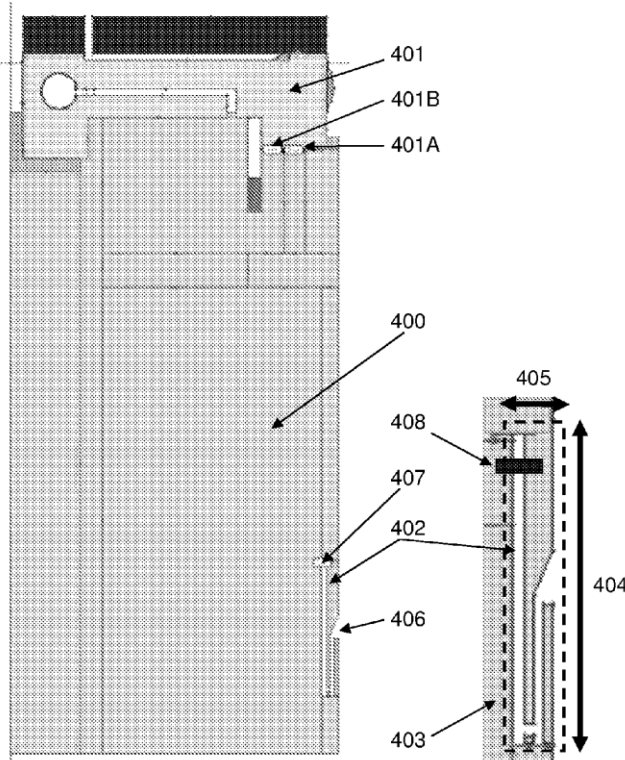
(22) Filed: **Dec. 18, 2012**

Related U.S. Application Data

(63) Continuation of application No. 13/341,051, filed on Dec. 30, 2011, now Pat. No. 8,362,960, which is a continuation of application No. 11/988,888, filed on Sep. 30, 2008, now Pat. No. 8,115,686, filed as application No. PCT/EP2006/007050 on Jul. 18, 2006.

The invention relates to a handheld device comprising a first antenna (401, 701, 901, 931, 961, 1101, 1151, 1301, 1501) arranged to operate in at least a first frequency band, and a second antenna (402, 702, 902, 1102, 1302, 1502, 2210) arranged to operate in at least a second frequency band, wherein said second frequency band is different from said first frequency band. According to the invention, the second antenna comprises a slot antenna comprising at least one slot in at least one conductive layer. The invention also relates to enhancement of the isolation between first and second antennas in a handheld device.

(60) Provisional application No. 60/702,205, filed on Jul. 25, 2005.





US 20130229318A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0229318 A1**

(43) **Pub. Date: Sep. 5, 2013**

(54) **MULTI-BAND PLANAR INVERTED-F (PIFA) ANTENNAS AND SYSTEMS WITH IMPROVED ISOLATION**

Publication Classification

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 13/10 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/523* (2013.01); *H01Q 13/106* (2013.01)
USPC **343/770; 343/767; 343/841**

(75) Inventors: **Kok Jiunn Ng**, Butterworth (MY); **Ee Wei Sim**, Prai (MY); **Joshua Ooi Tze Meng**, Selangor Darul Ehsan (MY)

(73) Assignee: **Laird Technologies, Inc.**, Earth City, MO (US)

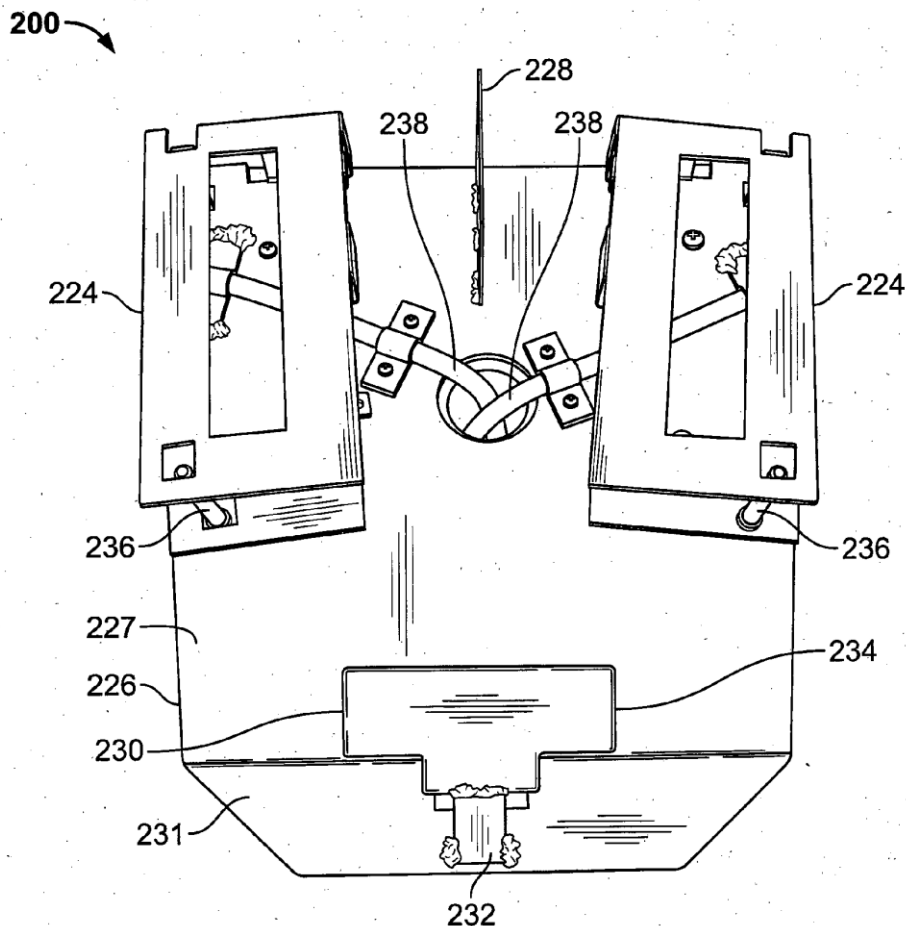
(21) Appl. No.: **13/988,163**

(22) PCT Filed: **Feb. 18, 2011**

(86) PCT No.: **PCT/MY2011/000014**

§ 371 (c)(1),
(2), (4) Date: **May 17, 2013**

(57) **ABSTRACT**
Exemplary embodiments are provided of multi-band Planar Inverted-F antennas and antenna systems including the same. In an exemplary embodiment, a Planar Inverted-F antenna (PIFA) generally includes a planar radiator or upper radiating patch element having a slot. A lower surface of the PIFA is spaced apart from the upper radiating patch element. First and second shorting elements electrically connect the planar radiator to the lower surface. The PIFA also includes a feeding element electrically connected between the upper radiating patch element and the lower surface. The PIFA may be mounted on a ground plane that is larger than the lower surface of the PIFA.





US 20130229319A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0229319 A1**

(43) **Pub. Date: Sep. 5, 2013**

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

Publication Classification

(75) Inventors: **Tepei MIURA**, Nagaokakyo-shi (JP);
Nobuo IKEMOTO, Nagaokakyo-shi
(JP); **Jun SASAKI**, Nagaokakyo-shi
(JP); **Noboru KATO**, Nagaokakyo-shi
(JP); **Nobuhito TSUBAKI**,
Nagaokakyo-shi (JP)

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

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

(57) **ABSTRACT**

(21) Appl. No.: **13/599,108**

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

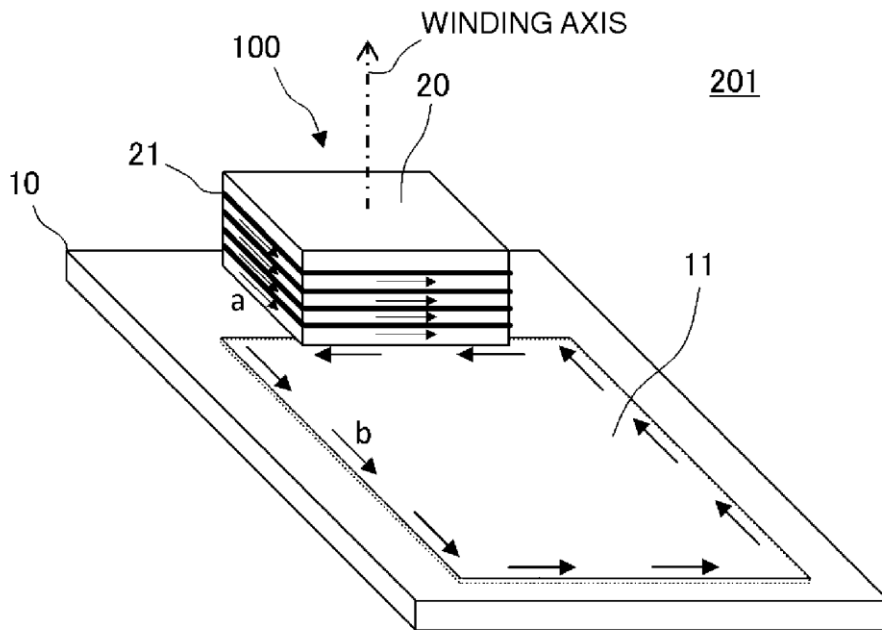
An antenna device includes a base including a planar conductor disposed thereon, and a coil antenna. The coil antenna includes a coil conductor wound around a magnetic core. The coil antenna is arranged such that a coil opening of the coil conductor is closed to an edge of the planar conductor. A current passing through the coil conductor induces a current in the planar conductor. Thus, a first magnetic flux occurs in the coil antenna, and a second magnetic flux occurs in the planar conductor. Therefore, a third magnetic flux occurs in an area of the planar conductor. Accordingly, the antenna device achieves a small footprint, a small-sized communication terminal apparatus and a desired communication distance.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2012/052217,
filed on Feb. 1, 2012.

Foreign Application Priority Data

(30) Feb. 15, 2011 (JP) 2011-029315





US 20130229320A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0229320 A1**
(43) **Pub. Date: Sep. 5, 2013**

(54) **SMALL ANTENNA APPARATUS OPERABLE IN MULTIPLE BANDS INCLUDING LOW-BAND FREQUENCY AND HIGH-BAND FREQUENCY AND SHIFTING LOW-BAND FREQUENCY TO LOWER FREQUENCY**

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

(76) Inventors: **Kenichi Asanuma**, Kyoto (JP); **Atsushi Yamamoto**, Kyoto (JP); **Tsutomu Sakata**, Osaka (JP)

(57) **ABSTRACT**

(21) Appl. No.: **13/882,573**

(22) PCT Filed: **Aug. 31, 2012**

(86) PCT No.: **PCT/JP2012/005535**

§ 371 (c)(1),
(2), (4) Date: **Apr. 30, 2013**

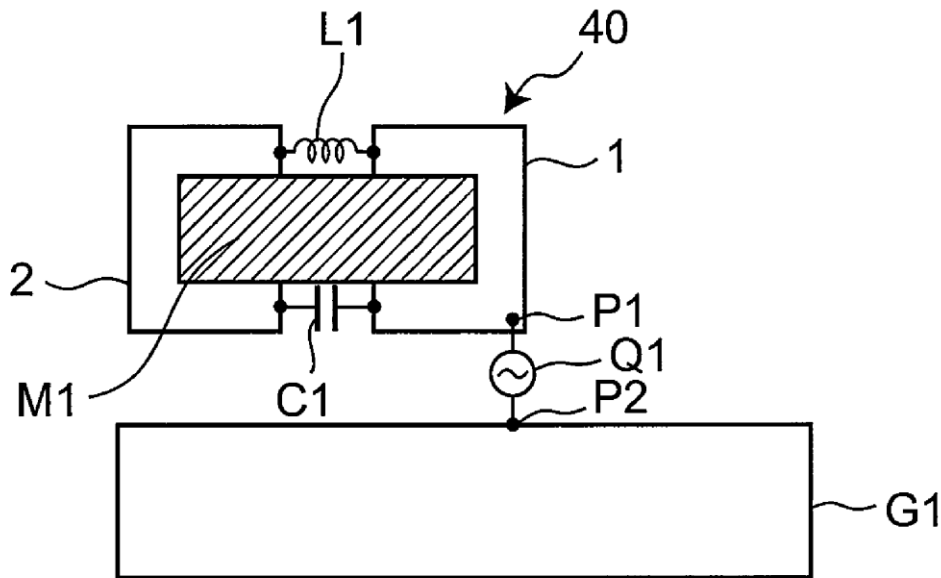
(30) **Foreign Application Priority Data**

Oct. 6, 2011 (JP) 2011-221691

Publication Classification

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

A radiator is provided with a looped radiation conductor, a capacitor, an inductor, a feed point on the radiation conductor, and a magnetic block provided at at least a part of the inside of a loop of the radiation conductor. When the radiator is excited at a low-band resonance frequency, a first current flows through a first path extending along an inner perimeter of the loop of the radiation conductor and including the inductor and the capacitor. Magnetic flux produced by the first current passes through the magnetic block, thus increasing the inductance of the radiation conductor. When the radiator is excited at a high-band resonance frequency, a second current flows through a second path including a section extending along an outer perimeter of the loop of the radiation conductor, the section including the capacitor but not including the inductor, the section extending between the feed point and the inductor.





US 20130229322A1

(19) **United States**

(12) **Patent Application Publication**
Wang

(10) **Pub. No.: US 2013/0229322 A1**

(43) **Pub. Date: Sep. 5, 2013**

(54) **ANTENNA SYSTEM**

division of application No. 11/486,223, filed on Jul. 12, 2006, now Pat. No. 7,773,041.

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

Publication Classification

(72) Inventor: **Shu-Li Wang**, Stafford, TX (US)

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 7/00 (2006.01)

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

(52) **U.S. Cl.**
CPC ... *H01Q 1/22* (2013.01); *H01Q 7/00* (2013.01)
USPC **343/866**

(21) Appl. No.: **13/858,865**

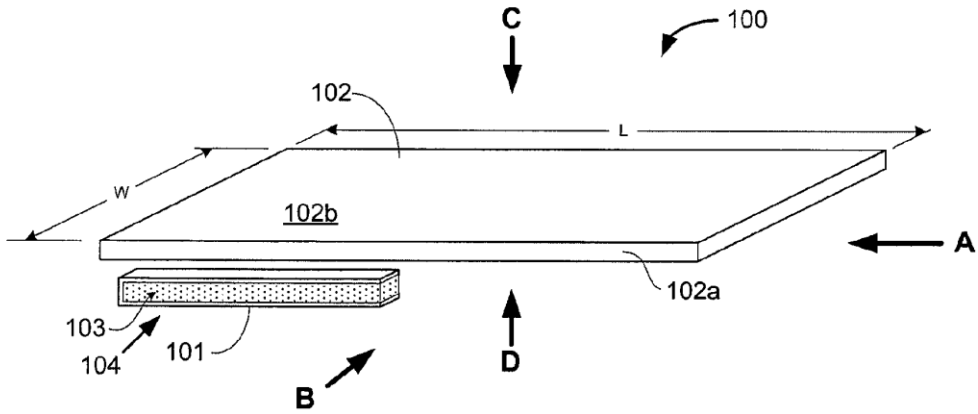
(22) Filed: **Apr. 8, 2013**

(57) **ABSTRACT**

Related U.S. Application Data

An antenna system includes a dielectrically-loaded loop element electromagnetically coupled to a planar element. The antenna system exhibits uniform, broadband radiation and reception patterns.

(60) Continuation of application No. 12/764,788, filed on Apr. 21, 2010, now Pat. No. 8,427,377, which is a





US 20130234895A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234895 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **MULTI-BAND BROADBAND ANTENNA WITH MAL-POSITION FEED STRUCTURE**

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

(76) Inventors: **Chia-Mei Peng**, Taipei City (TW);
I-Fong Chen, New Taipei City (TW);
Jin-Hao Liou, Taichung City (TW)

(57) **ABSTRACT**

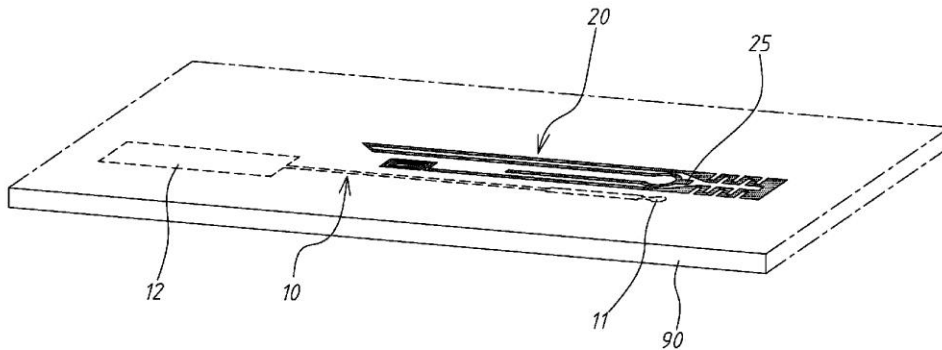
(21) Appl. No.: **13/413,199**

(22) Filed: **Mar. 6, 2012**

Publication Classification

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

A multi-band broadband antenna with mal-position feed structure includes a signal line of high-frequency radiation path with a signal feed-in point, and a ground line of low-frequency radiation path with opposing ground feed-in point and top-loading portion. The design exhibits a mal-position feed structure so that a co-planar waveguide structure is formed in the multi-band broadband antenna to increase the antenna's operating bandwidth.





US 20130234896A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234896 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **DUAL-BAND MIMO ANTENNA SYSTEM**

(52) **U.S. CL.**

USPC 343/700 MS

(75) Inventors: **MOHAMMAD S. SHARAWI,**
DHAHRAN (SA); **MOHAMMAD**
AZAM JAN, DHAHRAN (SA)

(57) **ABSTRACT**

(73) Assignee: **KING FAHD UNIVERSITY OF**
PETROLEUM AND MINERALS,
DHAHRAN (SA)

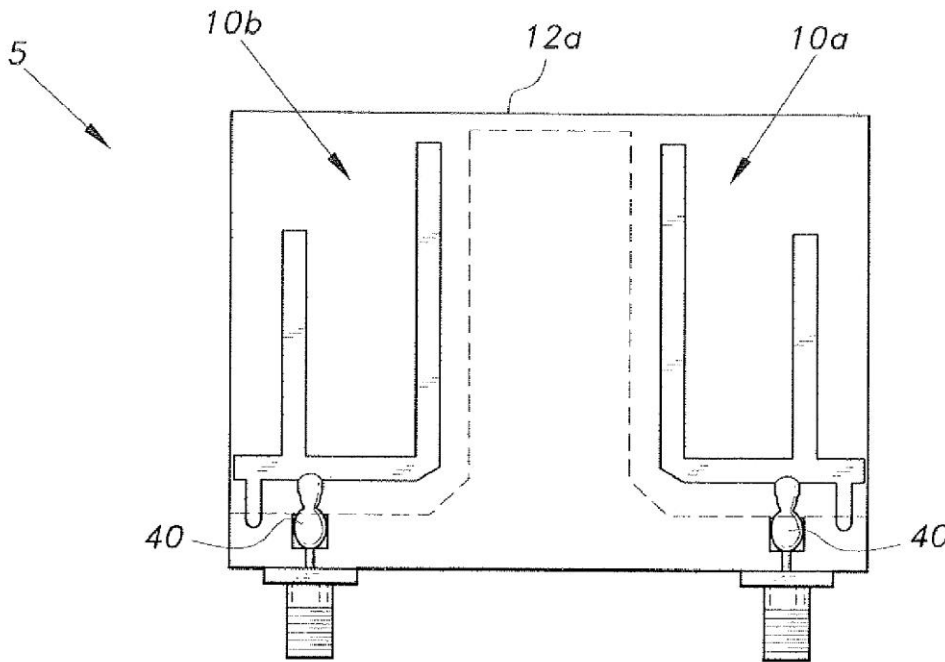
The dual-band MIMO antenna system includes antenna elements arranged on a printed circuit board. For the plurality of antennas on the board, the opposing antennae are arranged in mirror-image fashion. Each antenna has a first elongate vertical element connected to and extending vertically from one end of a horizontal element. A second, shorter elongate vertical element is disposed proximate an opposite end of the horizontal element and extends upward therefrom in parallel with the first elongate member. First (feed) and second (short) stubby vertical elements are disposed on the horizontal element proximate the second elongate member and extend downward from the horizontal element. A ground plane is formed on the opposite face of the printed circuit board.

(21) Appl. No.: **13/418,177**

(22) Filed: **Mar. 12, 2012**

Publication Classification

(51) **Int. Cl.**
H01Q 5/00 (2006.01)
H01Q 9/04 (2006.01)





US 20130234897A1

(19) **United States**

(12) **Patent Application Publication**
YOON

(10) **Pub. No.: US 2013/0234897 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **MOBILE TERMINAL APPARATUS AND METHOD FOR PERFORMING WIRELESS COMMUNICATION USING AN INDIRECT FEEDING ANTENNA**

Publication Classification

(51) **Int. Cl.**
H01Q 19/00 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 19/00** (2013.01)
USPC **343/700 MS; 29/600**

(71) Applicant: **PANTECH CO., LTD.**, Seoul (KR)

(72) Inventor: **Hee-June YOON**, Seoul (KR)

(73) Assignee: **PANTECH CO., LTD.**, Seoul (KR)

(21) Appl. No.: **13/785,244**

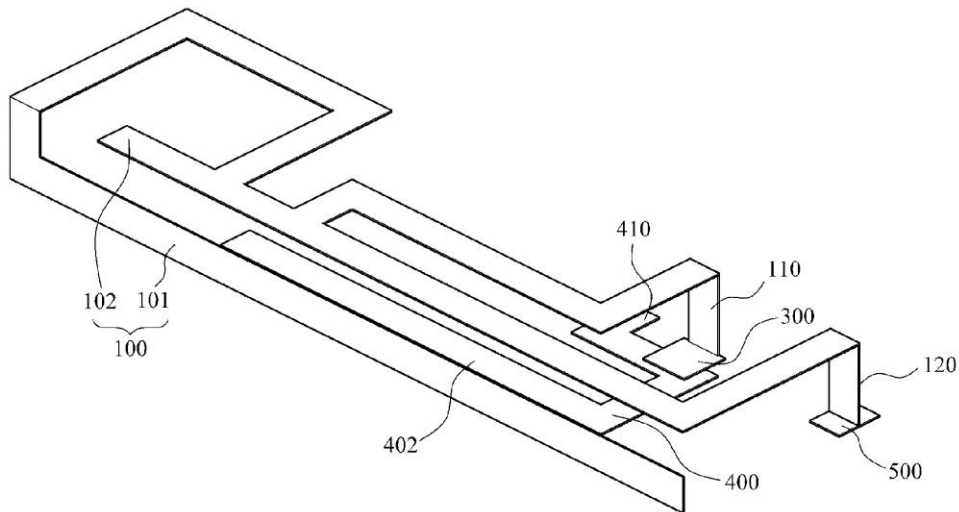
(22) Filed: **Mar. 5, 2013**

(30) **Foreign Application Priority Data**

Mar. 7, 2012 (KR) 10-2012-0023172

(57) **ABSTRACT**

A mobile terminal apparatus and method for performing wireless communication, including a main antenna to transmit or receive signals at one or more first frequency bands, a sub antenna to transmit or receive signals at least at one second frequency band, and a feeding pad connected to the main antenna to directly supply power or signals to the main antenna to transmit or receive signals at the one or more first frequency bands, the feeding pad being spaced apart from or disposed within a reference proximity to and electrically coupled to the sub antenna to indirectly supply power or signals to the sub antenna to transmit or receive signals in the at least one second frequency band.





US 20130234900A1

(19) **United States**

(12) **Patent Application Publication**
KIM

(10) **Pub. No.: US 2013/0234900 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **TERMINAL INCLUDING ANTENNA**

(71) Applicant: **PANTECH CO., LTD.**, Seoul (KR)

(72) Inventor: **Joo Sung KIM**, Seoul (KR)

(73) Assignee: **PANTECH CO., LTD.**, Seoul (KR)

(21) Appl. No.: **13/711,082**

(22) Filed: **Dec. 11, 2012**

(30) **Foreign Application Priority Data**

Mar. 8, 2012 (KR) 10-2012-0023956

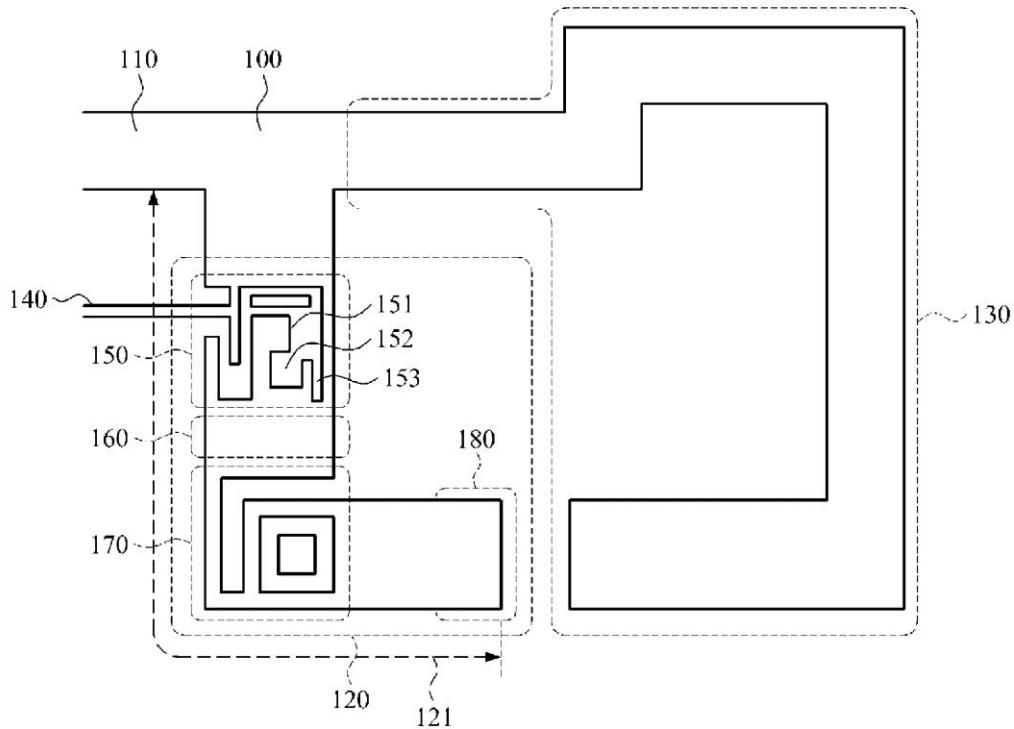
Publication Classification

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

(52) **U.S. Cl.**
CPC **H01Q 5/01** (2013.01)
USPC **343/729**

(57) **ABSTRACT**

Provided is a terminal including an antenna apparatus capable of securing a wideband characteristic in a multiple input multiple output (MIMO) antenna system. The antenna apparatus may include a band pass filter for blocking or reducing interference from another antenna apparatus. The antenna apparatus may maintain a resonant frequency band to be wide by forming a sub resonance using a plurality of uneven shapes.





US 20130234901A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234901 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **TUNABLE SLOT ANTENNA**

Publication Classification

(75) Inventors: **Chih-Hua Chang**, New Taipei City (TW); **Yu-Kai Hung**, New Taipei City (TW)

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

(52) **U.S. Cl.**
USPC **343/746**

(73) Assignee: **ACER INCORPORATED**, New Taipei City (TW)

(57) **ABSTRACT**

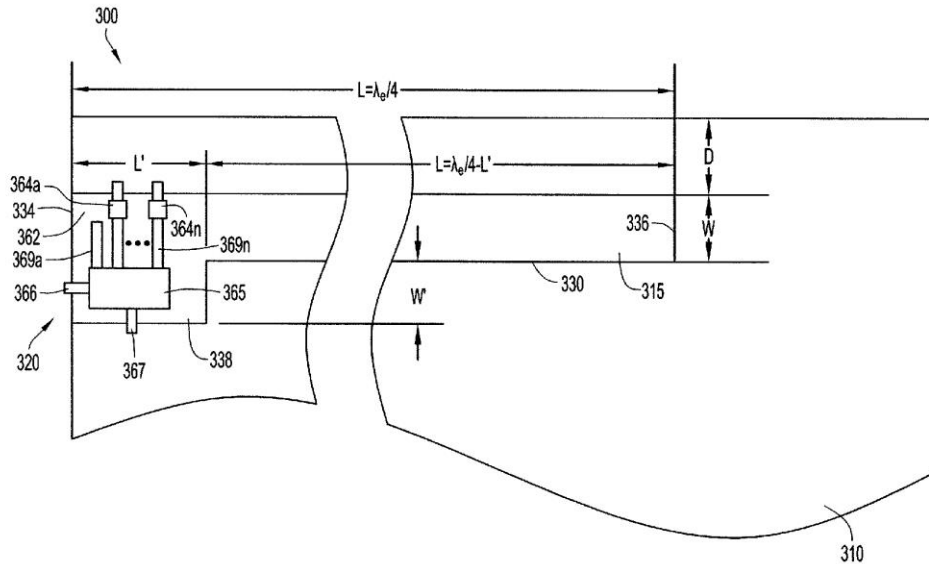
(21) Appl. No.: **13/557,310**

An open slot antenna is formed in a planar conductor on a dielectric substrate. A tuning circuit is disposed toward an open end of the slot antenna and is used to select a resonant frequency of the antenna by electrically connecting one of multiple tuning elements across opposing sides of the slot. The tunable antenna so constructed may be incorporated into a handheld mobile communication device that can be operated in different geographic regions, each having different regional communication standards under which mobile communications are conducted.

(22) Filed: **Jul. 25, 2012**

(30) **Foreign Application Priority Data**

Mar. 8, 2012 (TW) 101107827





US 20130234902A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234902 A1**
(43) **Pub. Date: Sep. 12, 2013**

(54) **SMALL ANTENNA APPARATUS OPERABLE IN MULTIPLE BANDS INCLUDING LOW-BAND FREQUENCY AND HIGH-BAND FREQUENCY AND INCREASING BANDWIDTH INCLUDING HIGH-BAND FREQUENCY**

Publication Classification

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 1/52** (2013.01)
USPC **343/749**

(76) Inventors: **Kenichi Asanuma**, Kyoto (JP); **Atsushi Yamamoto**, Kyoto (JP); **Tsutomu Sakata**, Osaka (JP)

(57) **ABSTRACT**

A radiator is provided with a looped radiation conductor, a capacitor, an inductor, a feed point on the radiation conductor, and a dielectric block provided in a portion where the radiation conductor and the ground conductor are close to each other. At a low-band resonance frequency, a current flows through a path extending along an inner perimeter of the loop of the radiation conductor and including the inductor and the capacitor. At a high-band resonance frequency, a current flows through a path including a section extending along an outer perimeter of the loop of the radiation conductor, including the capacitor but not including the inductor, and extending between the feed point and the inductor, and a parallel resonant circuit is formed from: a capacitance between the radiation conductor and the ground conductor between which the dielectric block is provided; and an inductance of the radiation conductor.

(21) Appl. No.: **13/883,871**

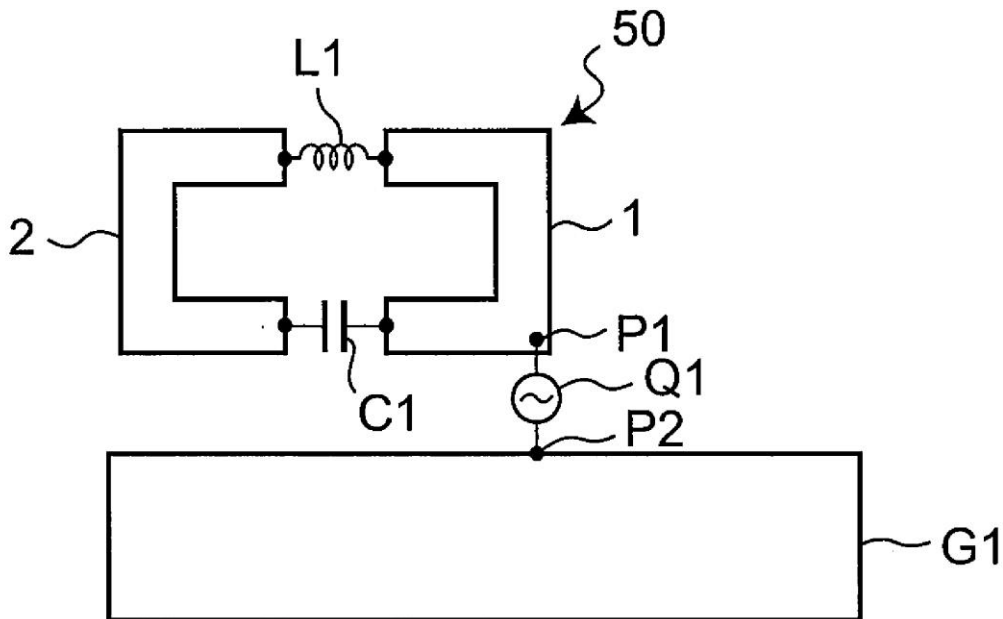
(22) PCT Filed: **Aug. 31, 2012**

(86) PCT No.: **PCT/JP2012/005537**

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

(30) **Foreign Application Priority Data**

Oct. 6, 2011 (JP) 2011-221692





US 20130234903A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234903 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **BUILT-IN ANTENNA FOR ELECTRONIC DEVICE**

Publication Classification

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**, Gyeonggi-do (KR)

(51) **Int. Cl.**
H01Q 5/00 (2006.01)

(72) Inventors: **Yong-Soo KWAK**, Gyeonggi-do (KR);
A-Hyun SIN, Gyeonggi-do (KR);
Dong-Hyun LEE, Ulsan (KR);
Seong-Tae JEONG, Gyeonggi-do (KR);
Joon-Ho BYUN, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC **H01Q 5/0034** (2013.01)
USPC **343/750; 343/749**

(57) **ABSTRACT**

A built-in antenna apparatus for an electronic device is provided. The antenna apparatus comprises a PCB with conductive and non-conductive areas. An antenna radiator is disposed at the non-conductive area of the PCB; the antenna radiator has a feeding portion and at least a first radiating portion configured in a first pattern branched from the feeding portion and has an end portion electrically connected to the conductive area. At least one capacitor is electrically connected in series within the first radiating portion. A resonant frequency of the first radiating portion is a function of a capacitance value of the at least one capacitor. The antenna can be provided in a smaller size for a given frequency band due to the capacitance. A second antenna radiator branched from the feeding portion can also be provided for operation at a different frequency band.

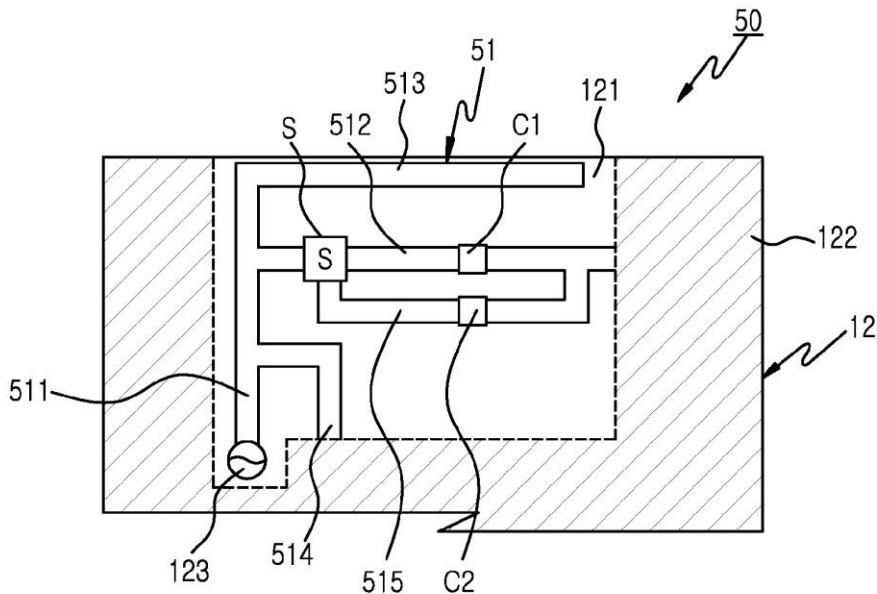
(73) Assignee: **SAMSUNG ELECTRONICS CO., LTD.**, Gyeonggi-do (KR)

(21) Appl. No.: **13/747,829**

(22) Filed: **Jan. 23, 2013**

(30) **Foreign Application Priority Data**

Mar. 9, 2012 (KR) 10-2012-0024590





US 20130234907A1

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

(10) **Pub. No.: US 2013/0234907 A1**
(43) **Pub. Date: Sep. 12, 2013**

(54) **WIRELESS TERMINAL WITH A PLURALITY OF ANTENNAS**

Publication Classification

(71) Applicant: **PANTECH CO., LTD.**, Seoul (KR)

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

(72) Inventor: **Kyoung-Sang YOO**, Seoul (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/846**

(73) Assignee: **Pantech Co., Ltd.**, Seoul (KR)

(57) **ABSTRACT**

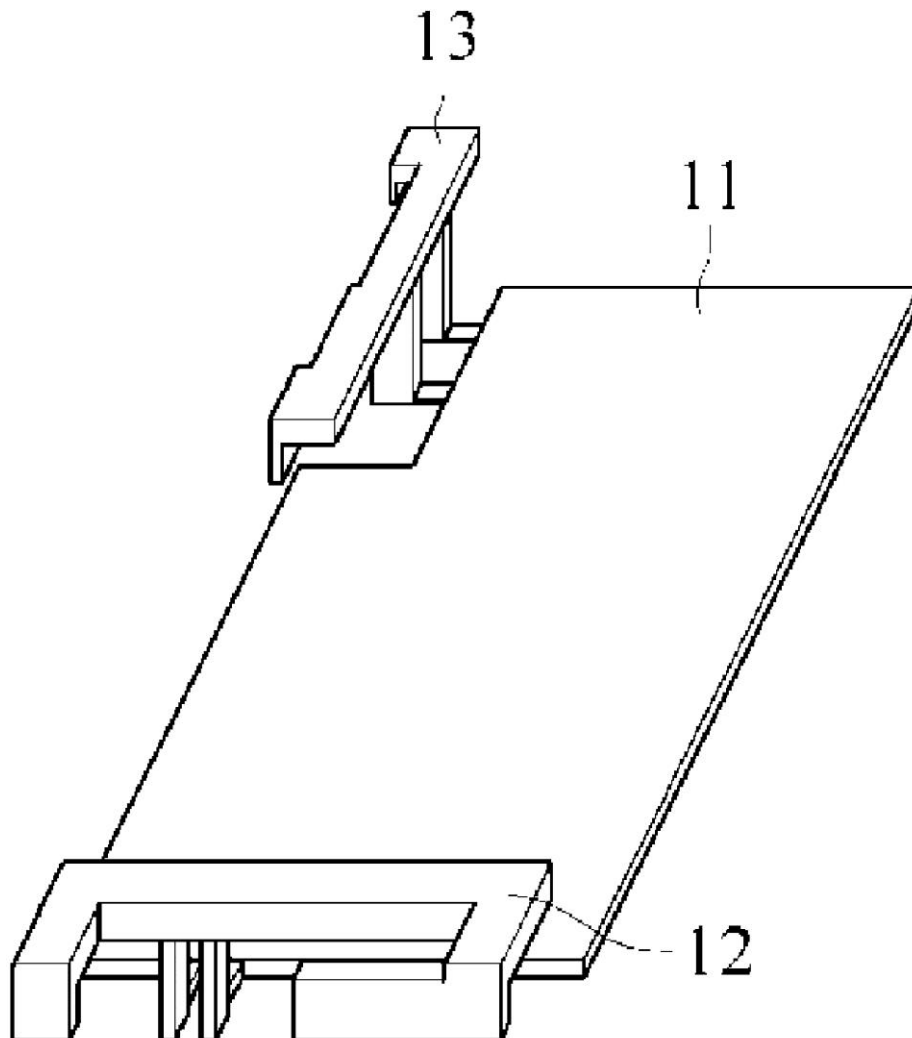
(21) Appl. No.: **13/777,408**

(22) Filed: **Feb. 26, 2013**

A terminal includes a main ground including a first portion and a second portion; a primary antenna connected to the first portion of the main ground; a secondary antenna connected to the second portion of the main ground; and a first dummy ground disposed within a reference proximity to at least one of the primary antenna and the secondary antenna.

(30) **Foreign Application Priority Data**

Mar. 7, 2012 (KR) 10-2012-0023170





US 20130234910A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234910 A1**

(43) **Pub. Date: Sep. 12, 2013**

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

Publication Classification

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**, Gyeonggi-do (KR)

(51) **Int. Cl.**
H01Q 1/42 (2006.01)

(72) Inventors: **Jun-Hwa OH**, Seoul (KR); **Joon-Ho BYUN**, Gyeonggi-do (KR); **Jae-Hee KIM**, Gyeonggi-do (KR); **Bum-Jin CHO**, Gyeonggi-do (KR); **Sang-Jin EOM**, Gyeonggi-do (KR)

(52) **U.S. Cl.**
CPC **H01Q 1/42** (2013.01)
USPC **343/872**

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

(57) **ABSTRACT**

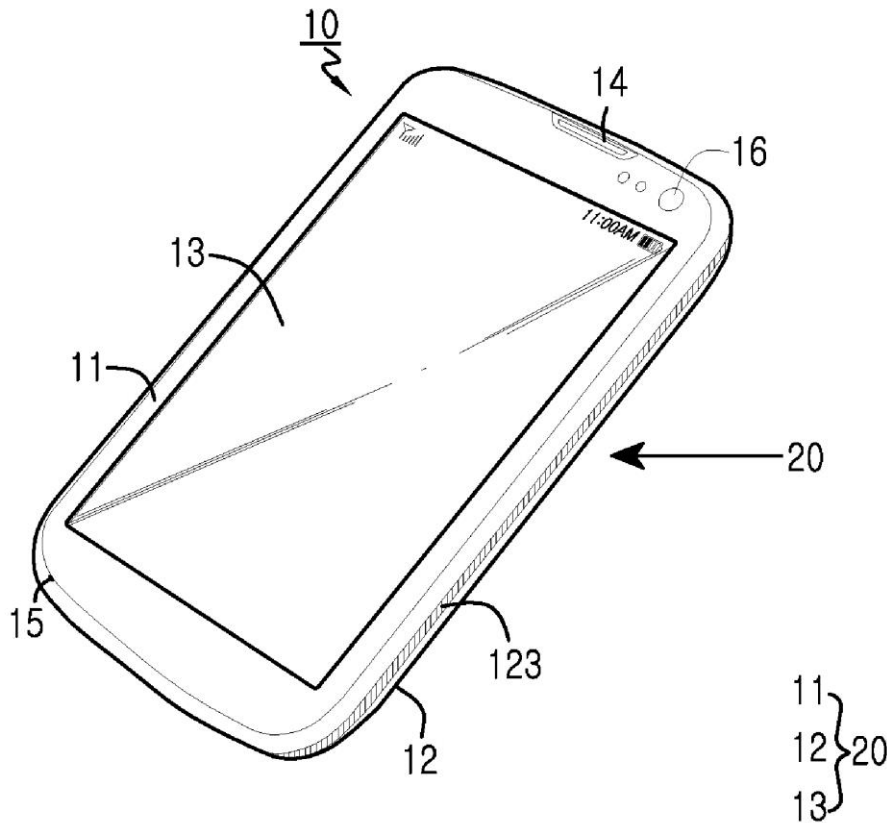
An antenna apparatus for a portable terminal is provided. The portable terminal includes a printed circuit board (PCB) having a ground surface and RF components to process a wireless signal received through at least one antenna element. A housing forms an external appearance of the portable terminal, and has a non-conductive member with a plurality of metal fragments attached thereto. At least one of the metal fragments is electrically connected to the ground surface. The metal fragments may enhance the texture and durability of the housing. Preferably, the shapes, sizes and distances separating the metal fragments are designed to minimally impact, or improve, the antenna performance provided by the at least one antenna element.

(21) Appl. No.: **13/790,695**

(22) Filed: **Mar. 8, 2013**

(30) **Foreign Application Priority Data**

Mar. 12, 2012 (KR) 10-2012-0025126





US 20130234911A1

(19) **United States**

(12) **Patent Application Publication**
LEE

(10) **Pub. No.: US 2013/0234911 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **MOBILE COMMUNICATION TERMINAL WITH IMPROVED ISOLATION**

Publication Classification

(71) Applicant: **PANTECH CO., LTD**, Seoul (KR)

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

(72) Inventor: **Hu-Jang LEE**, Seoul (KR)

(52) **U.S. Cl.**
CPC **H01Q 21/28** (2013.01)
USPC **343/893**

(73) Assignee: **Pantech Co., Ltd**, Seoul (KR)

(21) Appl. No.: **13/787,299**

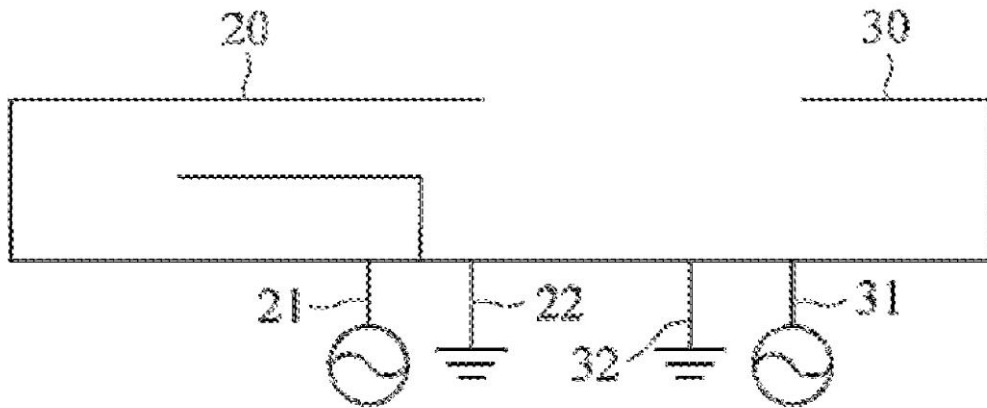
(57) **ABSTRACT**

(22) Filed: **Mar. 6, 2013**

A terminal includes a main ground disposed on a substrate, a first antenna connected to the main ground, a second antenna spaced apart by a reference distance from the first antenna and connected to the main ground, and a dummy pattern disposed within a reference proximity to at least one of the first antenna and the second antenna

(30) **Foreign Application Priority Data**

Mar. 7, 2012 (KR) 10-2012-0023171





US 20130234912A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0234912 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **ANTENNA APPARATUS**

(30) **Foreign Application Priority Data**

(71) Applicants: **SUMITOMO ELECTRIC PRINTED CIRCUITS, INC.**, Koka-shi (JP);
SUMITOMO ELECTRIC INDUSTRIES, LTD., Osaka (JP)

Mar. 7, 2012 (JP) 2012-050493

Publication Classification

(72) Inventors: **Masahiko KOUCHI**, Koka-shi (JP);
Katsuyuki IMAI, Osaka (JP);
Masatoshi KURODA, Osaka (JP);
Rikio TANAKA, Osaka (JP)

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

(52) **U.S. Cl.**
CPC **H01Q 1/38** (2013.01)
USPC **343/906**

(73) Assignees: **SUMITOMO ELECTRIC INDUSTRIES, LTD.**, Osaka (JP);
SUMITOMO ELECTRIC PRINTED CIRCUITS, INC., Koka-shi (JP)

(57) **ABSTRACT**

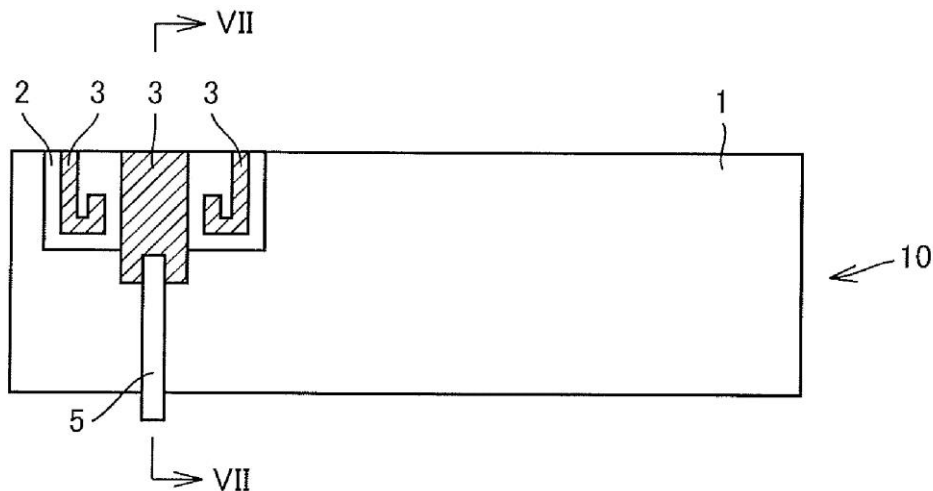
An antenna apparatus capable of improving antenna characteristics as well as miniaturizing a size is provided. An antenna apparatus includes a base, an antenna conductor, and a terminal as an external connection terminal. The base is made of a dielectric composite material containing resin and ceramic powder. The antenna conductor is arranged on a surface of the base. The terminal is electrically connected to the antenna conductor. A relative permittivity (ϵ_r) and a dielectric tangent ($\tan \delta$) of the dielectric composite material satisfy a relation of: $\tan \delta \leq 0.0024 \times e^{(0.0341 \times \epsilon_r)}$.

(21) Appl. No.: **13/785,593**

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

Related U.S. Application Data

(60) Provisional application No. 61/703,385, filed on Sep. 20, 2012.





US 20130235703A1

(19) **United States**

(12) **Patent Application Publication**
Fujisawa

(10) **Pub. No.: US 2013/0235703 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **TIMEPIECE WITH INTERNAL ANTENNA**

Publication Classification

(71) Applicant: **SEIKO EPSON CORPORATION**,
Tokyo (JP)

(51) **Int. Cl.**
G04C 9/00 (2006.01)

(72) Inventor: **Teruhiko Fujisawa**, Nagano-ken (JP)

(52) **U.S. Cl.**
CPC **G04C 9/02** (2013.01)
USPC **368/28**

(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

(57) **ABSTRACT**

(21) Appl. No.: **13/875,520**

A timepiece includes a case that is made at least in part from a conductive material; a dial that is made from a nonconductive material; a solar panel that has an opening and is disposed at a side opposite a display side of the dial, and that receives light incident from the display side of the dial; a patch antenna that is disposed at a side opposite of a light receiving side of the solar panel, and at a position overlapping the opening in plan view; and a date wheel made from nonconductive material that is disposed between the solar panel and the patch antenna in lateral view, and is disposed at a position overlapping, at least in part, the patch antenna in plan view. The dial has a date window, formed at a position overlapping the opening in plan view, for exposing at least part of the date wheel.

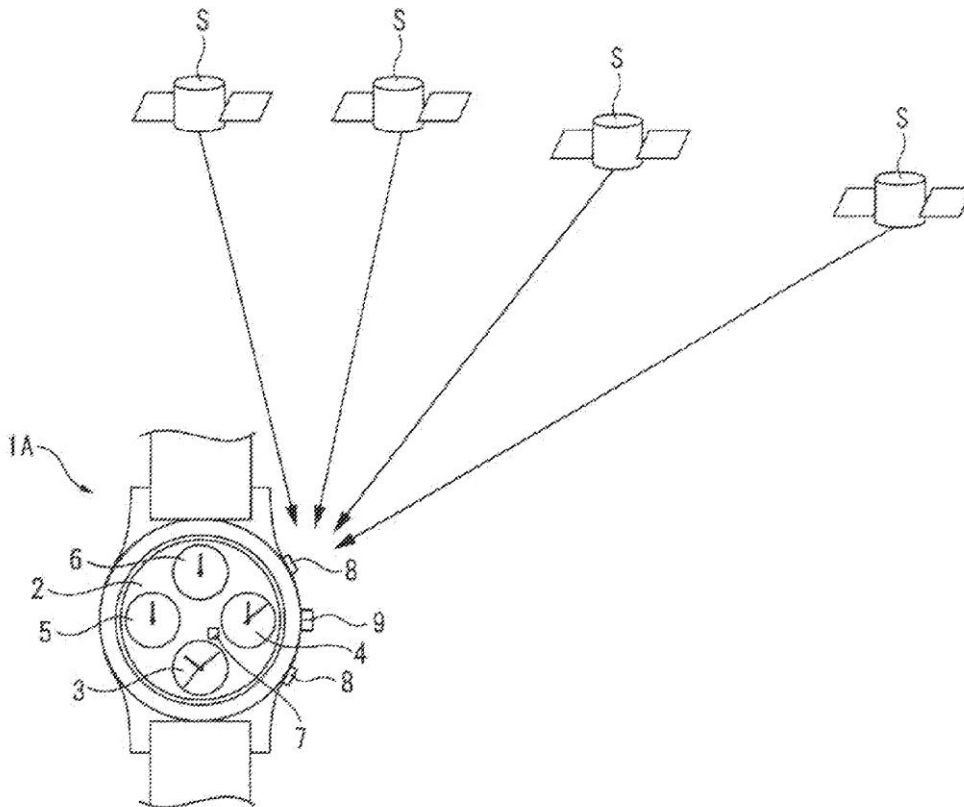
(22) Filed: **May 2, 2013**

Related U.S. Application Data

(63) Continuation of application No. 12/871,483, filed on Aug. 30, 2010, now Pat. No. 8,467,272.

(30) **Foreign Application Priority Data**

Sep. 1, 2009 (JP) 2009-201557
Jun. 24, 2010 (JP) 2010-143886





US 20130237162A1

(19) **United States**

(12) **Patent Application Publication**
YOON

(10) **Pub. No.: US 2013/0237162 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **MOBILE COMMUNICATION DEVICE**

(71) Applicant: **PANTACH CO., LTD.**, Seoul (KR)

(72) Inventor: **Jong Cheal YOON**, Seoul (KR)

(73) Assignee: **Pantach Co., Ltd.**, Seoul (KR)

(21) Appl. No.: **13/748,958**

(22) Filed: **Jan. 24, 2013**

(30) **Foreign Application Priority Data**

Mar. 7, 2012 (KR) 10-2012-0023485

Publication Classification

(51) **Int. Cl.**
H04B 1/38 (2006.01)
H01Q 1/50 (2006.01)

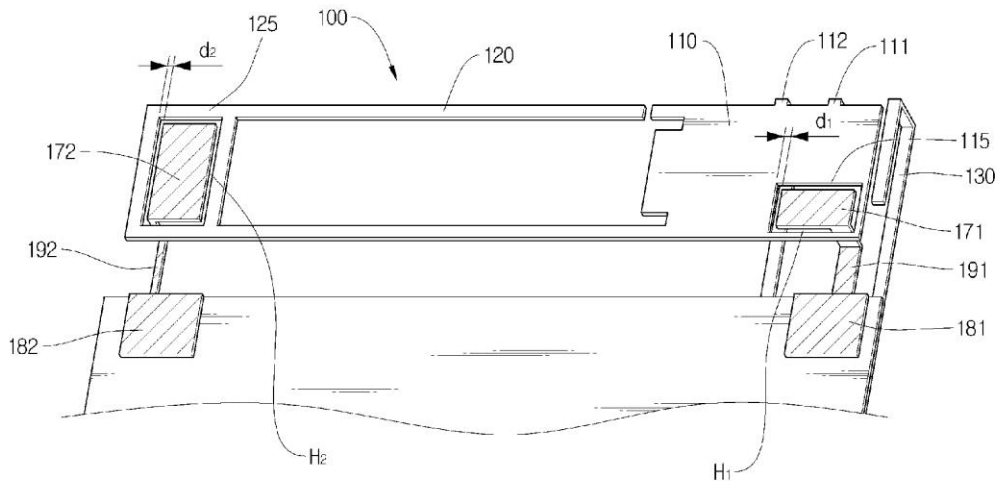
(52) **U.S. Cl.**

CPC **H04B 1/3827** (2013.01); **H01Q 1/50** (2013.01)

USPC **455/77; 343/750**

(57) **ABSTRACT**

A mobile communication device includes an antenna unit to operate in multiple frequency bands by shifting the resonance frequency of the antenna using capacitors. A first capacitor unit may be formed by the disposal of a first electrode in a hole in a first antenna pattern and the formation of a second electrode in the portion of the first antenna pattern opposing the first electrode. The first capacitor unit may be formed in various ways to be activated by a switch. The connection of the first capacitor unit to a voltage supply and ground may trigger a shift in the resonant frequency of the first antenna pattern.





US 20130237284A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0237284 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **SINGLE INPUT/MULTIPLE OUTPUT (SIMO)
OR MULTIPLE INPUT/SINGLE OUTPUT
(MISO) OR MULTIPLE INPUT/MULTIPLE
OUTPUT (MIMO) ANTENNA MODULE**

Publication Classification

(51) **Int. Cl.**
H01Q 13/16 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 13/16* (2013.01)
USPC **455/557**

(71) Applicant: **MEDIATEK INC.**, Hsin-Chu (TW)

(72) Inventors: **Ming-Hao YEH**, Taipei City (TW);
Kuo-Fong HUNG, Changhua City (TW)

(73) Assignee: **MediaTek Inc.**, Hsin-Chu (TW)

(21) Appl. No.: **13/867,554**

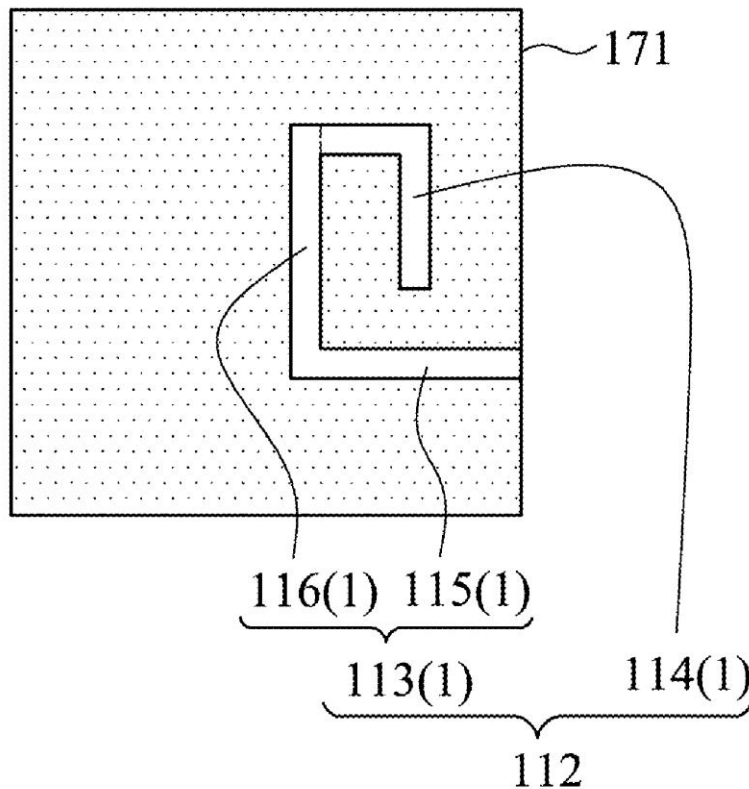
(22) Filed: **Apr. 22, 2013**

Related U.S. Application Data

(62) Division of application No. 13/032,713, filed on Feb. 23, 2011.

(57) **ABSTRACT**

An antenna module is provided. The antenna module includes a first slot antenna unit and a second slot antenna unit. The first slot antenna unit is coupled to a radio frequency (RF) unit. The second slot antenna unit is coupled to the RF unit. The first and second slot antenna units are embedded in a wireless communications dongle, and the wireless communications dongle operates as a modem to transmit or receive a wireless signal to or from a wireless telephony communications network for a computer via the first and second slot antenna units when the wireless communication dongle connects to the computer.





US 20130237289A1

(19) **United States**

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

(10) **Pub. No.: US 2013/0237289 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **MOUNTING STRUCTURES FOR PORTABLE ELECTRONIC DEVICES**

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

CPC *H04M 1/026* (2013.01)

USPC **455/567**

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

(72) Inventors: **Adam D. Mittleman**, Portola Valley, CA (US); **Kenneth A. Jenks**, Cupertino, CA (US); **Karen Y. Cheng**, Palo Alto, CA (US)

(57)

ABSTRACT

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

(21) Appl. No.: **13/858,937**

(22) Filed: **Apr. 8, 2013**

Related U.S. Application Data

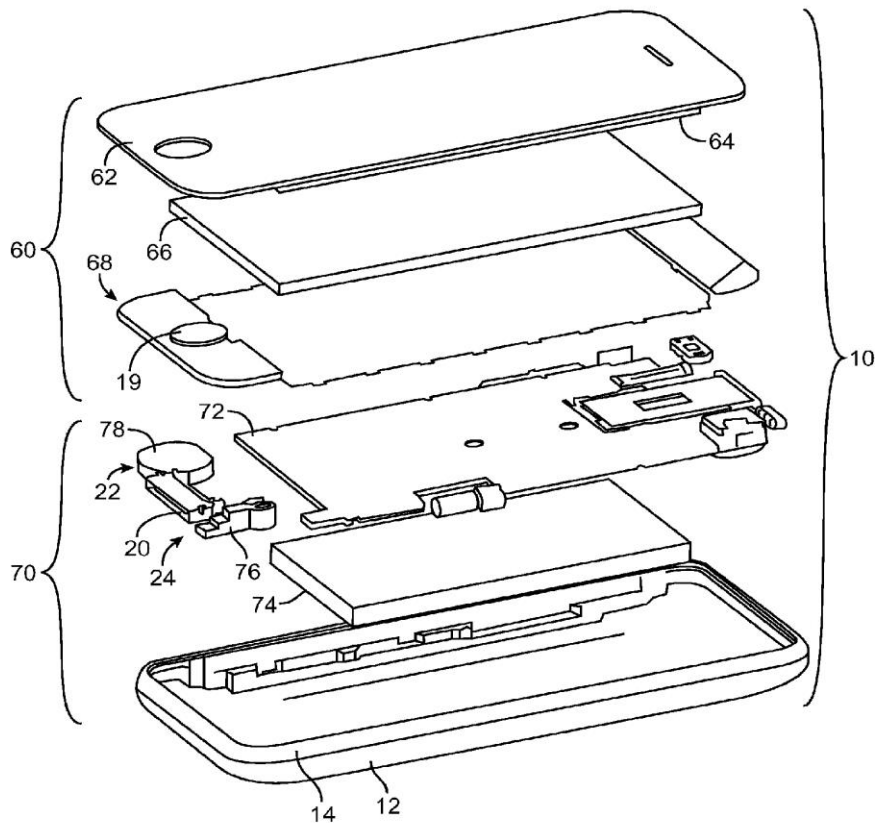
(62) Division of application No. 12/113,908, filed on May 1, 2008, now Pat. No. 8,417,298.

Publication Classification

(51) **Int. Cl.**
H04M 1/02

(2006.01)

A portable electronic device such as a handheld electronic device is provided. The device may have upper and lower portions. The upper portion may have clips that attach to springs on the lower portion. The device may have a housing with a bezel. A prong on the springs may ground the bezel. A vibrator mounting bracket may hold a vibrator in place within the housing. The vibrator mounting bracket may have an end that engages the housing. A threaded insert may be welded to the spring. A screw that passes through a hole in the vibrator mounting bracket may be screwed into the threaded insert to attach the vibrator to the housing. An elastomeric member may bias the vibrator towards the bracket. An acoustic module may serve as a subassembly for the device. Components such as an antenna, dock connector, microphone, and speaker may be attached to the acoustic module.





US 20130237295A1

(19) **United States**

(12) **Patent Application Publication**
AYATOLLAHI

(10) **Pub. No.: US 2013/0237295 A1**

(43) **Pub. Date: Sep. 12, 2013**

(54) **MOBILE WIRELESS COMMUNICATIONS
DEVICE HAVING AN ANTENNA ASSEMBLY
WITH CORNER COUPLED RECTANGULAR
BASE CONDUCTOR PORTIONS AND
RELATED METHODS**

(52) **U.S. Cl.**
CPC *H04M 1/026* (2013.01)
USPC *455/575.7; 29/601*

(57) **ABSTRACT**

(71) Applicant: **RESEARCH IN MOTION LIMITED,
WATERLOO (CA)**

A mobile wireless communications device may include a portable housing, a substrate carried by the portable housing, and wireless communications circuitry carried by the substrate. The mobile wireless communications device may also include at least one an antenna assembly carried by the substrate and coupled to the wireless communications circuitry. The at least one antenna assembly may include an electrically conductive base conductor having a first rectangular base portion and a second rectangular base portion offset therefrom. The first and second base portions may be coupled at respective diagonally opposing corners thereof and having an antenna feed defined along an outer portion of one of the first and second rectangular base portions. The at least one antenna assembly may include at least one electrically conductive arm extending along at least one side of one of the first and second rectangular base portions and spaced apart therefrom.

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(21) Appl. No.: **13/869,278**

(22) Filed: **Apr. 24, 2013**

Related U.S. Application Data

(63) Continuation of application No. 13/114,476, filed on
May 24, 2011, now Pat. No. 8,457,699.

Publication Classification

(51) **Int. Cl.**
H04M 1/02 (2006.01)

