



US 20120075069A1

(19) **United States**

(12) **Patent Application Publication**

Dickey et al.

(10) **Pub. No.: US 2012/0075069 A1**

(43) **Pub. Date: Mar. 29, 2012**

(54) **REVERSIBLY DEFORMABLE AND
MECHANICALLY TUNABLE FLUIDIC
ANTENNAS**

(75) Inventors: **Michael David Dickey**, Raleigh,
NC (US); **Gianluca Lazzi**, Cary,
NC (US); **Ju-Hee So**, Cary, NC
(US); **Jacob Thelen**, Raleigh, NC
(US); **Amit Qusba**, Raleigh, NC
(US); **Gerard James Hayes**, Wake
Forest, NC (US)

(73) Assignee: **NORTH CAROLINA STATE
UNIVERSITY**, Raleigh, NC (US)

(21) Appl. No.: **12/889,257**

(22) Filed: **Sep. 23, 2010**

Publication Classification

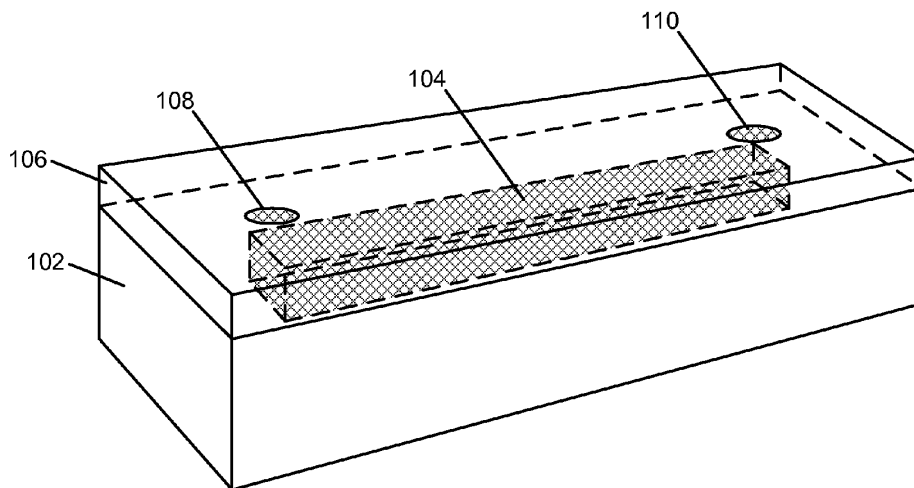
(51) **Int. Cl.**
H01Q 1/36 (2006.01)
H04B 17/00 (2006.01)
G06K 7/01 (2006.01)
H01P 11/00 (2006.01)

(52) **U.S. Cl. 340/10.1; 29/600; 343/908; 455/226.1**

(57) **ABSTRACT**

A method of manufacturing a fluidic structure is disclosed. A cavity that defines a shape of an element of the fluidic structure within a material is formed. The cavity is filled with liquid metal. The cavity is sealed. The fluidic structure behaves as an antenna. A fluidic antenna includes a material that defines a shape of the fluidic antenna by a cavity filled with liquid metal formed within the material, where the material further defines at least one mechanical property of the fluidic antenna.

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US 20120075146A1

(19) **United States**

(12) **Patent Application Publication**
HO

(10) **Pub. No.: US 2012/0075146 A1**

(43) **Pub. Date: Mar. 29, 2012**

(54) **ANTENNA AND PORTABLE DEVICE
EMPLOYING THE SAME**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/50 (2006.01)

(52) **U.S. Cl.** **343/702; 343/906**

(57) **ABSTRACT**

(75) **Inventor:** **CHIN-LUNG HO**, Tu-Cheng (TW)

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

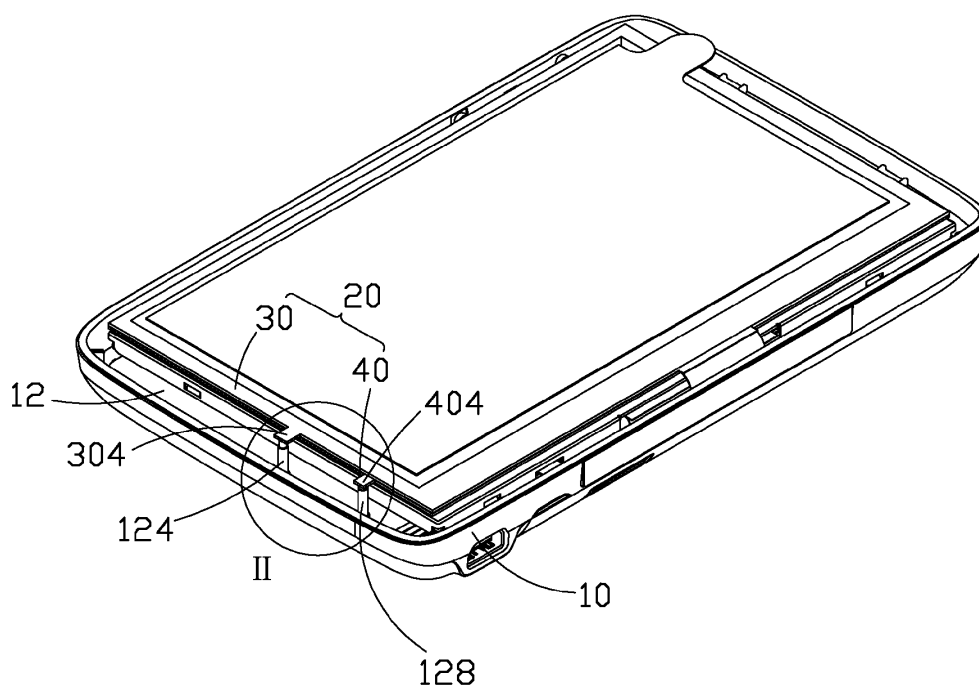
(21) **Appl. No.:** **12/910,845**

(22) **Filed:** **Oct. 24, 2010**

(30) **Foreign Application Priority Data**

Sep. 23, 2010 (TW) 99218371

A portable device includes a main body and an antenna mounted on the main body. The main body includes a printed circuit board (PCB). A first guide pole and a second guide pole are configured on the PCB. The antenna includes a first conductor portion, a second conductor portion and an insulated portion. The first conductor portion includes a first connecting end electrically connected to the PCB via the first guide pole. The first connecting end acts as a feed portion of the antenna. The second conductor portion is disposed between the first conductor portion and the PCB and includes a second connecting end electrically connected to the PCB via the second guide pole. The insulated portion is sandwiched between the first conductor portion and the second conductor portion to insulate the first conductor portion from the second conductor portion.



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US 20120075148A1

(19) **United States**

(12) **Patent Application Publication**
Cho

(10) **Pub. No.: US 2012/0075148 A1**

(43) **Pub. Date: Mar. 29, 2012**

(54) **NFC ANTENNA USING DUAL RESONANCE**

Publication Classification

(75) Inventor: **Young Bin Cho**, Seoul (KR)

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

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

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

(57) **ABSTRACT**

(21) Appl. No.: **13/376,775**

(22) PCT Filed: **Jun. 7, 2010**

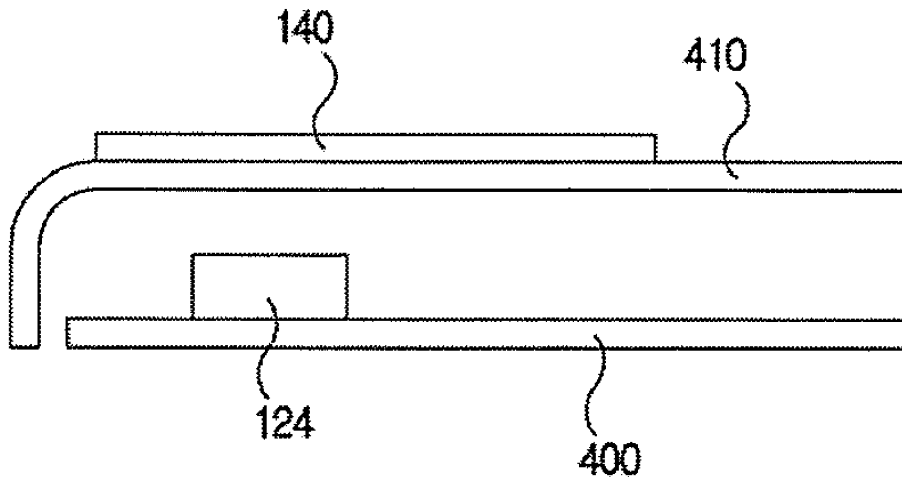
(86) PCT No.: **PCT/KR2010/003632**

§ 371 (c)(1),
(2), (4) Date: **Dec. 7, 2011**

The present invention is disclosed to provide an NFC antenna using dual resonance, wherein a closed circuit is formed by a capacitor and a loop antenna, and a relay unit is attached to a portable wireless terminal that forms a resonance to a predetermined frequency signal mutually transmitted between a portable wireless terminal reader and an NFC chip, and in the course of communicating between the NFC chip and the reader, the relay unit relays a signal transmitted by the reader to an NFC antenna unit, and the NFC chip relays a signal transmitted through the NFC antenna unit to the reader to thereby increase a recognition distance capable of obtaining predetermined information.

(30) **Foreign Application Priority Data**

Jun. 10, 2009 (KR) 10-2009-0051475



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US 20120075152A1

(19) **United States**

(12) **Patent Application Publication**

Usui et al.

(10) **Pub. No.: US 2012/0075152 A1**

(43) **Pub. Date: Mar. 29, 2012**

(54) **DISPLAY DEVICE**

Publication Classification

(76) Inventors: **Hideyuki Usui**, Kanagawa (JP);
Daisuke Nozue, Kanagawa (JP)

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

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

(21) Appl. No.: **13/248,303**

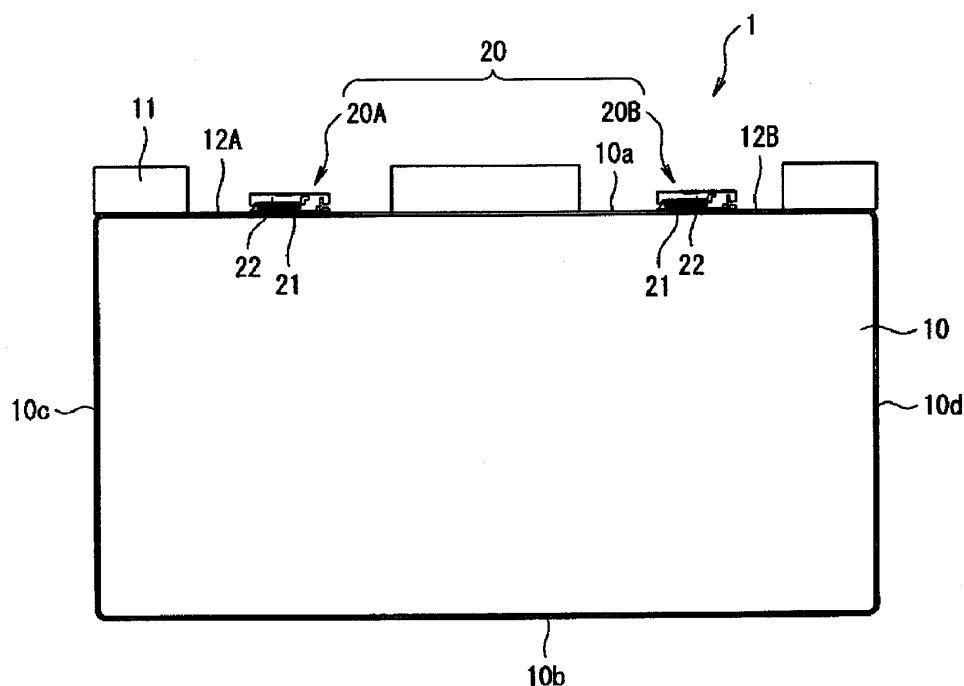
(57) **ABSTRACT**

(22) Filed: **Sep. 29, 2011**

A display device includes a flat-panel display, a metal plate, and an antenna device. The flat-panel display portion is positioned on an upper surface of display device. The metal plate is positioned on the flat-panel display portion along an front edge of the upper surface. The antenna device for a wireless LAN is positioned on the upper surface of the flat-panel display portion.

(30) **Foreign Application Priority Data**

Sep. 29, 2010 (JP) 2010-0219746



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US 20120075154A1

(19) **United States**

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

(10) **Pub. No.: US 2012/0075154 A1**

(43) **Pub. Date: Mar. 29, 2012**

(54) **MICROSTRIP-FED SLOT ANTENNA**

Publication Classification

(75) Inventors: **Behzad BIGLARBEGIAN**, North York (CA); **Mohammad-Reza NEZHAD-AHMADI**, Waterloo (CA); **Safieddin SAFAVI-NAEINI**, Waterloo (CA)

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

(52) **U.S. Cl.** **343/770; 343/767**

(73) Assignee: **ON SEMICONDUCTOR TRADING LTD.**, Hamilton (BM)

(57) **ABSTRACT**

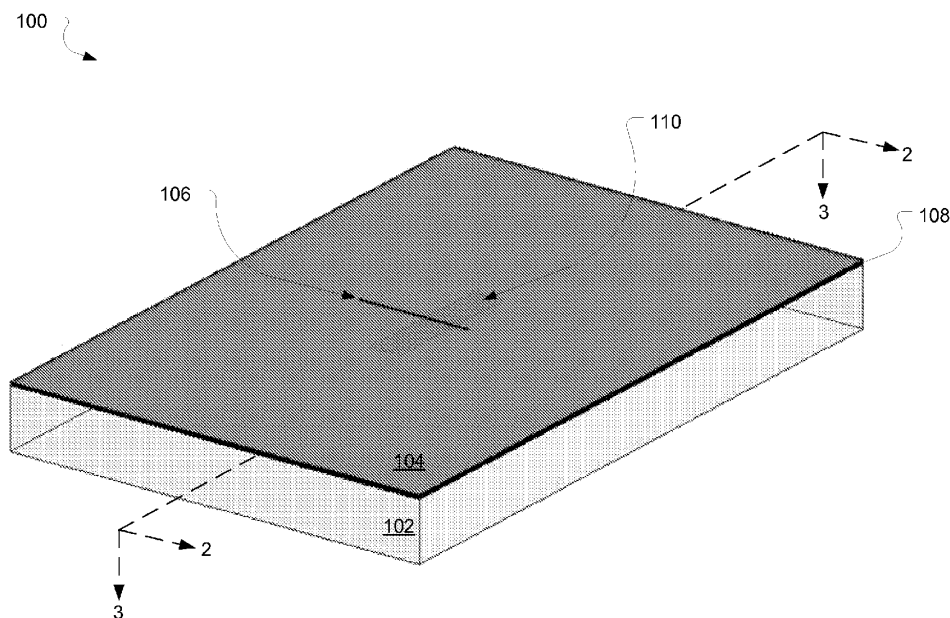
(21) Appl. No.: **13/177,756**

(22) Filed: **Jul. 7, 2011**

A microstrip-fed antenna is disclosed having a first dielectric substrate and a second dielectric substrate. The second dielectric substrate is disposed on the first dielectric substrate and the first dielectric substrate has a relative permittivity greater than or equal to the second dielectric substrate. The antenna further includes a microstrip line formed in the second dielectric substrate and a metal layer formed in the second dielectric substrate. The metal layer is positioned between the microstrip line and the first dielectric substrate and includes a slot.

Related U.S. Application Data

(60) Provisional application No. 61/362,827, filed on Jul. 9, 2010.



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US 20120075158A1

(19) **United States**(12) **Patent Application Publication**
KAWAHATA(10) **Pub. No.: US 2012/0075158 A1**(43) **Pub. Date: Mar. 29, 2012**(54) **ANTENNA MODULE****Publication Classification**(75) Inventor: **Kazunari KAWAHATA**, Kyoto-fu (JP)(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 21/28 (2006.01)(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Kyoto-fu (JP)(52) **U.S. Cl.** **343/858; 343/893**(21) Appl. No.: **13/310,197**(57) **ABSTRACT**(22) Filed: **Dec. 2, 2011**

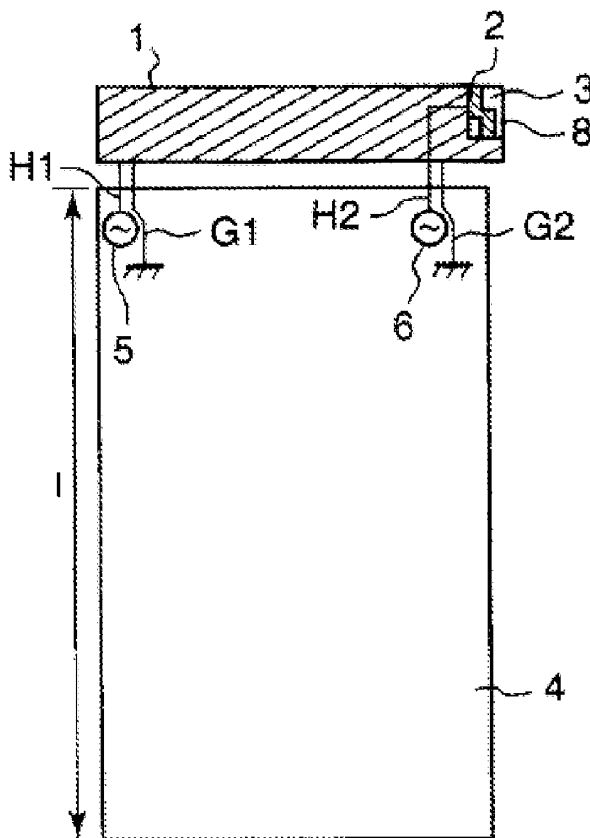
An antenna module is provided and includes two feeding parts and having different frequencies of feeding on a circuit board. A first feeding radiation electrode is connected to the feeding part on a lower frequency side and performs an antenna operation. A second feeding radiation electrode is connected to the feeding part on a higher frequency side and performs an antenna operation. The first and second feeding radiation electrodes electrically connected, and the second feeding radiation electrode is smaller than and on the first feeding radiation electrode with an insulating part therebetween. The first feeding radiation electrode is configured to serve as an electrode that also performs an antenna operation of the second feeding radiation electrode, in such a manner that the second feeding radiation electrode performs an antenna operation in which the second feeding radiation electrode and the first feeding radiation electrode are electrically coupled to each other.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2010/056695, filed on Apr. 14, 2010.

(30) **Foreign Application Priority Data**

Jun. 3, 2009 (JP) 2009-134228



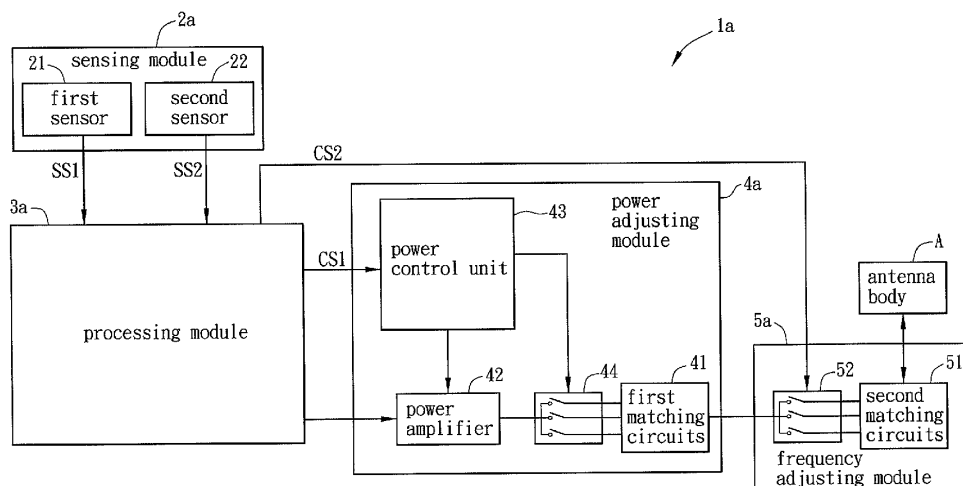
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US 20120075159A1

(19) **United States**(12) **Patent Application Publication**
CHANG et al.(10) **Pub. No.: US 2012/0075159 A1**(43) **Pub. Date: Mar. 29, 2012**(54) **ANTENNA MATCHING CIRCUIT CONTROL
DEVICE**(52) **U.S. CL. 343/860**(76) **Inventors:** **Chia-Hao CHANG**, Taipei (TW);
Meng-Huan Wu, Taipei (TW);
Kuo-Chu Liao, Taipei (TW)(21) **Appl. No.: 13/236,033**(22) **Filed: Sep. 19, 2011****Related U.S. Application Data**(60) Provisional application No. 61/387,476, filed on Sep.
29, 2010.**Publication Classification**(51) **Int. Cl.**
H01Q 1/50 (2006.01)(57) **ABSTRACT**

The antenna matching circuit control device with an antenna body includes a sensing module, a processing module, a power adjusting module and a frequency adjusting module. The sensing module senses an object that approaches the antenna body and outputs a sensing signal accordingly. The processing module is coupled to the sensing module and outputs a first control signal and a second control signal according to the sensing signal. The power adjusting module is coupled to the processing module and controls a power amplifier to couple with one of a plurality of first matching circuits according to the first control signal. The frequency adjusting module is coupled to the antenna body and the power adjusting module. The frequency adjusting module controls one of a plurality of second matching circuits to couple with one of the first matching circuits according to the second control signal.



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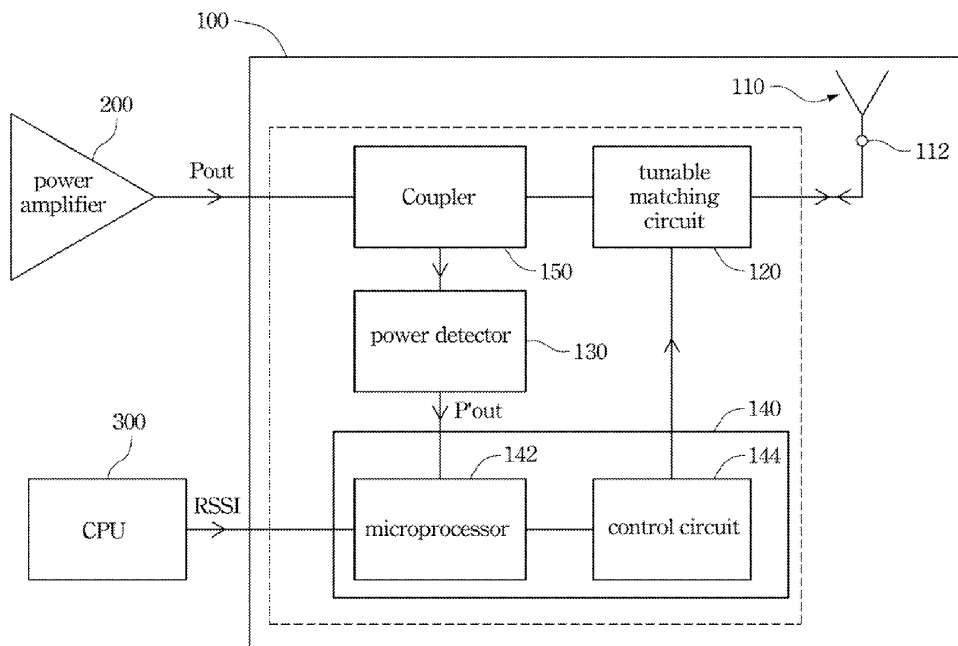
US 20120075160A1

(19) **United States**(12) **Patent Application Publication**
WU et al.(10) **Pub. No.: US 2012/0075160 A1**(43) **Pub. Date: Mar. 29, 2012**(54) **ANTENNA MODULE**(52) **U.S. CL. 343/861**(75) **Inventors:** **Wei-Yang WU**, Taoyuan County (TW); **Chien-Hua MA**, Taoyuan County (TW); **Yen-Chuan Lin**, Taoyuan County (TW)(73) **Assignee:** **HTC CORPORATION**, Taoyuan County (TW)(21) **Appl. No.:** **13/092,985**(22) **Filed:** **Apr. 25, 2011**(30) **Foreign Application Priority Data**

Sep. 28, 2010 (TW) 099132801

Publication Classification(51) **Int. Cl.**
H01Q 1/50 (2006.01)(57) **ABSTRACT**

An antenna module includes an antenna, a tunable matching circuit, a power detector and a control unit. The antenna comprises a feeding point. The tunable matching circuit, electrically connected between the antenna and the power detector and configured to provide a loading impedance, comprises a plurality of tunable impedance elements connected to each other and electrically connected to the feeding point as well. The power detector is electrically connected between the tunable matching circuit and a power amplifier and configured to detect a power indicator. The control unit, electrically connected to the tunable matching circuit and the power detector, is configured to read the power indicator and RSSI to generate a control signal for the tunable matching circuit, which consistently changes the loading impedance to achieve impedance matching.



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US 20120081252A1

(19) **United States**

(12) **Patent Application Publication**
Pan

(10) **Pub. No.: US 2012/0081252 A1**

(43) **Pub. Date: Apr. 5, 2012**

(54) **ULTRA WIDE BAND ANTENNA**

Publication Classification

(75) Inventor: **Sheng-gen Pan**, Kamp-Lintfort
(DE)

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
B05D 1/36 (2006.01)
B05D 5/12 (2006.01)

(73) Assignee: **TYCO ELECTRONICS AMP**
GMBH, Bensheim (DE)

(52) **U.S. Cl.** **343/700 MS; 427/123**

(21) Appl. No.: **13/251,956**

(57) **ABSTRACT**

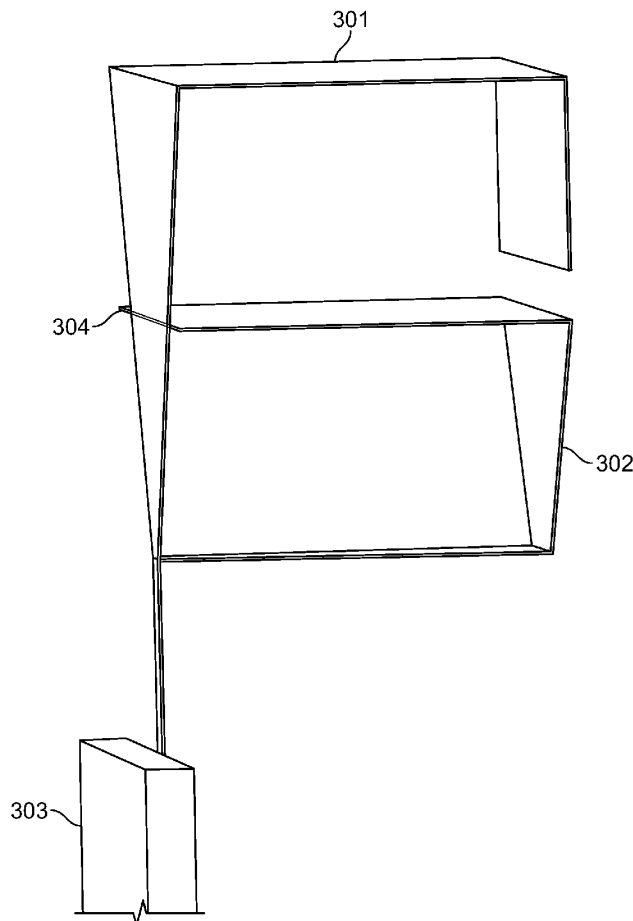
(22) Filed: **Oct. 3, 2011**

An ultrawideband antenna for use in communications equipment, comprising a first folded branch antenna element with an electrical connection at a first end and a second folded branch antenna element with an electrical connection at a first end. The folded branch antenna elements are of a triangular shape, or a combination of polygonal shapes. By using the present invention, the volume of an antenna is reduced and the ultra wide bandwidth can be achieved.

(30) **Foreign Application Priority Data**

Oct. 4, 2010 (EP) 10013277.8

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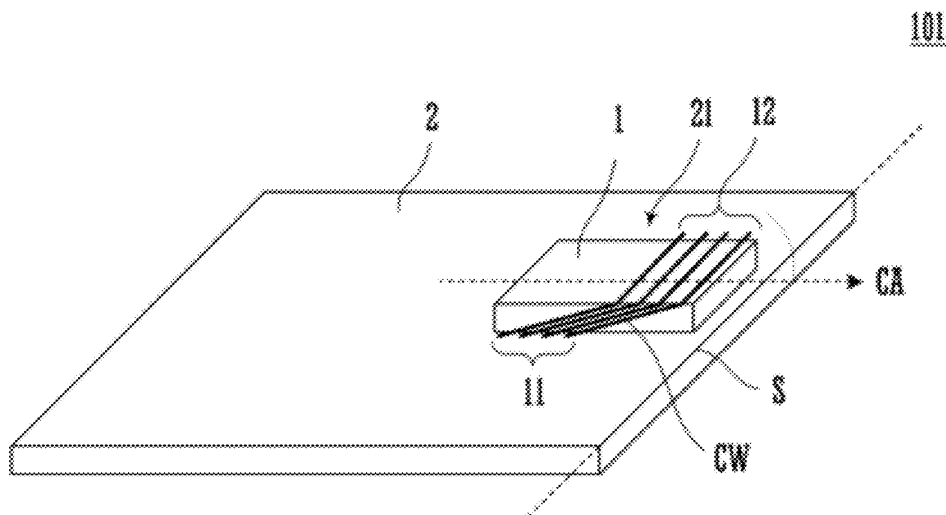
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US 20120081257A1

(19) **United States**(12) **Patent Application Publication**
YOSUI et al.(10) **Pub. No.: US 2012/0081257 A1**(43) **Pub. Date: Apr. 5, 2012**(54) **ANTENNA**(52) **U.S. CL. 343/788**(75) Inventors: **Kuniaki YOSUI**, Ishikawa-ken
(JP); **Hiroyuki KUBO**,
Ishikawa-ken (JP); **Hiromitsu ITO**,
Ishikawa-ken (JP)(73) Assignee: **MURATA MANUFACTURING**
CO., LTD., Kyoto-fu (JP)(21) Appl. No.: **12/894,954**(22) Filed: **Sep. 30, 2010****Publication Classification**(51) **Int. Cl.**
H01Q 7/08 (2006.01)(57) **ABSTRACT**

An antenna includes antenna coil having a magnetic-material core and a coil conductor. The antenna coil is arranged toward a side of a planar conductor, such as a circuit board. Of the coil conductor, a first conductor part close to a first main face of the magnetic-material core and a second conductor part close to a second main face of the magnetic-material core are provided such that the first conductor part is not over the second conductor part in view from a line in a direction normal to the first main face or the second main face of the magnetic-material core. In addition, a coil axis of the coil conductor is orthogonal to the side of the planar conductor.



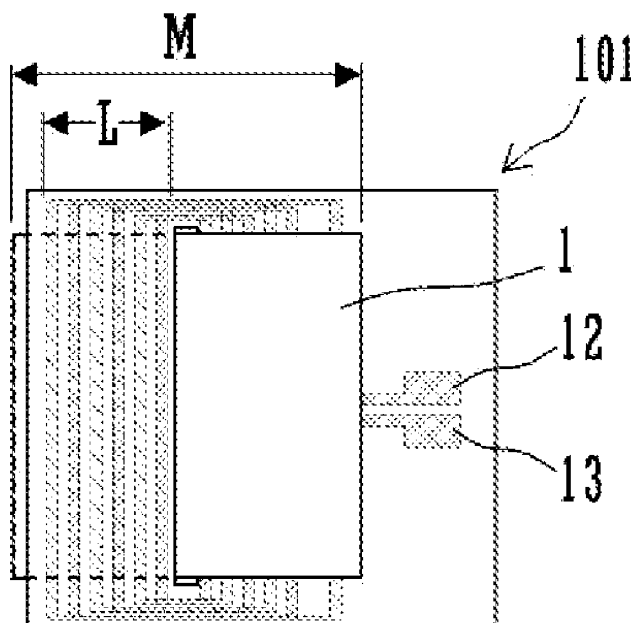
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US 20120081258A1

(19) **United States**(12) **Patent Application Publication****YOSUI et al.**(10) **Pub. No.: US 2012/0081258 A1**(43) **Pub. Date: Apr. 5, 2012**(54) **COIL ANTENNA AND ANTENNA
STRUCTURE**(52) **U.S. CL. 343/788**(75) **Inventors:** **Kuniaki YOSUI**, Ishikawa-ken
(JP); **Hiroyuki KUBO**,
Ishikawa-ken (JP); **Hiromitsu ITO**,
Ishikawa-ken (JP)(57) **ABSTRACT**(73) **Assignee:** **MURATA MANUFACTURING
CO., LTD.**, Kyoto-fu (JP)

The disclosure describes a compact coil antenna that can operate even if the coil antenna is arranged closely to its conductor plate, and that has a high degree of coupling with a target antenna. A lower coil conductor part and an upper coil conductor part each have a substantially rectangular and spiral form, and the inner end of the lower coil conductor part connects to the inner end of the upper coil conductor part to be connected in series to the inner end of the upper coil conductor part. In the lower coil conductor part and the upper coil conductor part, the arrangement interval in parallel-to-axis parts including segments that are parallel to the direction of the axis of a magnetic-material core is shorter than the arrangement interval of segments in orthogonal-to-axis parts that are orthogonal to the axis of the magnetic-material core.

(21) **Appl. No.: 12/895,048**(22) **Filed: Sep. 30, 2010****Publication Classification**(51) **Int. Cl.**
H01Q 7/08 (2006.01)**201**

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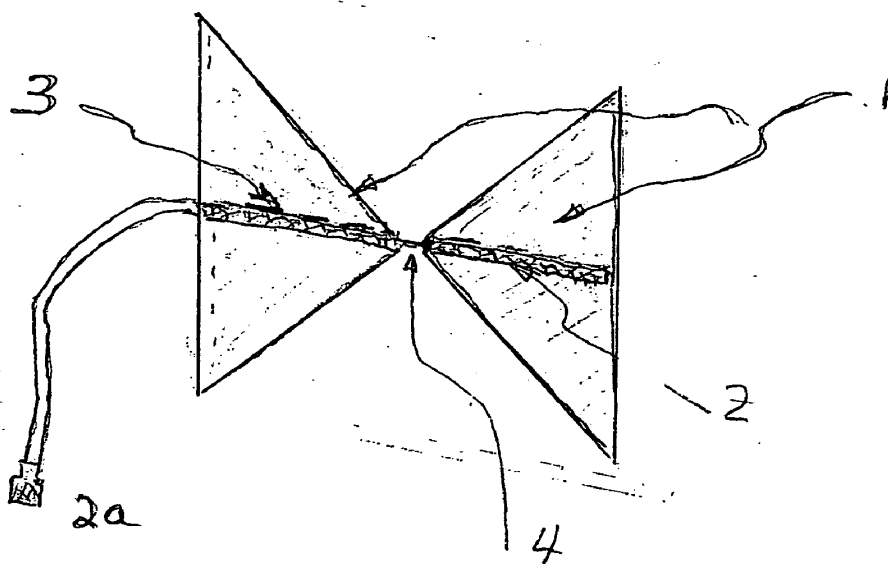
US 20120081260A1

(19) **United States**(12) **Patent Application Publication**
Wong et al.(10) **Pub. No.: US 2012/0081260 A1**(43) **Pub. Date: Apr. 5, 2012**(54) **HIGH PERFORMANCE HDTV ANTENNA
DESIGN AND FABRICATION**(52) **U.S. CL. 343/807**(76) **Inventors:** **Gary Gwoon Wong**, Torrance, CA
(US); **Calvin Gwoon Wong**,
Torrance, CA (US); **Kalem Gwoon
Wong**, Torrance, CA (US)(57) **ABSTRACT**

This invention discloses a design and fabrication of a high performance HDTV Antenna to receive public airwave signals. The subject antenna consists of a high efficient broadband element and a pair of reflecting surfaces. The reflecting surfaces produce a focusing effect. The backside radiation of the antenna is redirected, making it more energized to receive signals from the front side. This is a very desirable feature in a weak signal environment. The reflecting surfaces provide additional benefits in reducing unwanted multiple reflecting signals which often cause unstable pictures. The broadband radiating element composed a pair of triangular shape radiators which is excited by a new art infinite balun. With this design, it is unnecessary to reposition the antenna in order to receive all available public channels. A fixed location is generally adequate to provide good reception to all stations.

(21) **Appl. No.: 13/200,521**(22) **Filed: Sep. 26, 2011****Related U.S. Application Data**

(60) Provisional application No. 61/404,257, filed on Sep. 30, 2010.

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

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US 20120081264A1

(19) **United States**

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

(10) **Pub. No.: US 2012/0081264 A1**

(43) **Pub. Date: Apr. 5, 2012**

(54) **MULTI-BAND ANTENNA**

(52) **U.S. CL.** **343/905; 343/700 MS**

(75) **Inventors:** **Chun-Yuan Wang**, Tainan City
(TW); **Chi-Yin Fang**, Tao Yuan
Shien (TW)

(57) **ABSTRACT**

(73) **Assignee:** **Quanta Computer Inc.**, Tao Yuan
Hsien (TW)

A multi-band antenna includes a dielectric substrate, and a main antenna member and a metal piece disposed on the dielectric substrate. The main antenna member includes a feed-in portion for feeding with a radio frequency signal, a first conductor arm connected to the feed-in portion and adjacent to a first side edge of the dielectric substrate, a second conductor arm connected to the feed-in portion and having a length shorter than that of the first conductor arm, a third conductor arm connected to the feed-in portion, a fourth conductor arm extending along the third conductor arm, and a grounding portion adjacent to the feed-in portion. The metal piece is disposed at the first side edge and connected to the fourth conductor arm, resonates and couples with the first conductor arm to form a first radiator section, and cooperates with the fourth conductor arm to form a second radiator section.

(21) **Appl. No.: 13/066,505**

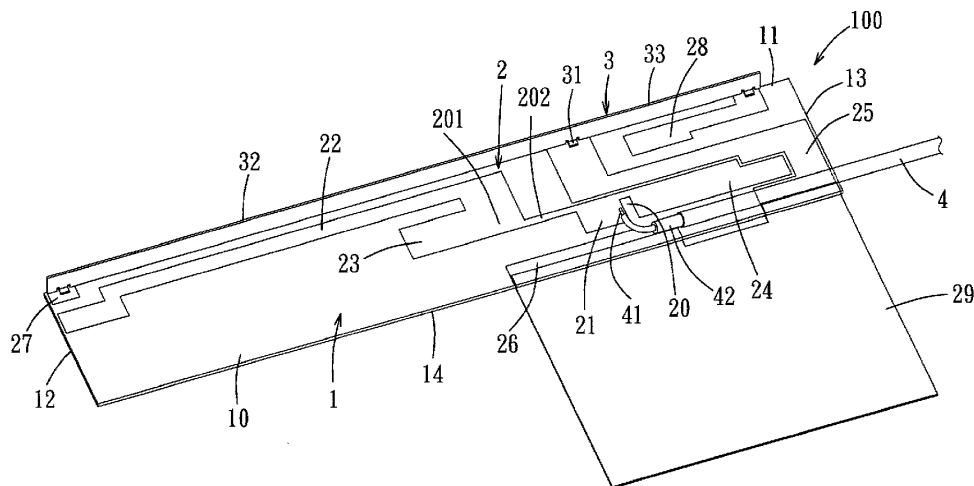
(22) **Filed: Apr. 14, 2011**

(30) **Foreign Application Priority Data**

Oct. 4, 2010 (TW) 099133683

Publication Classification

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



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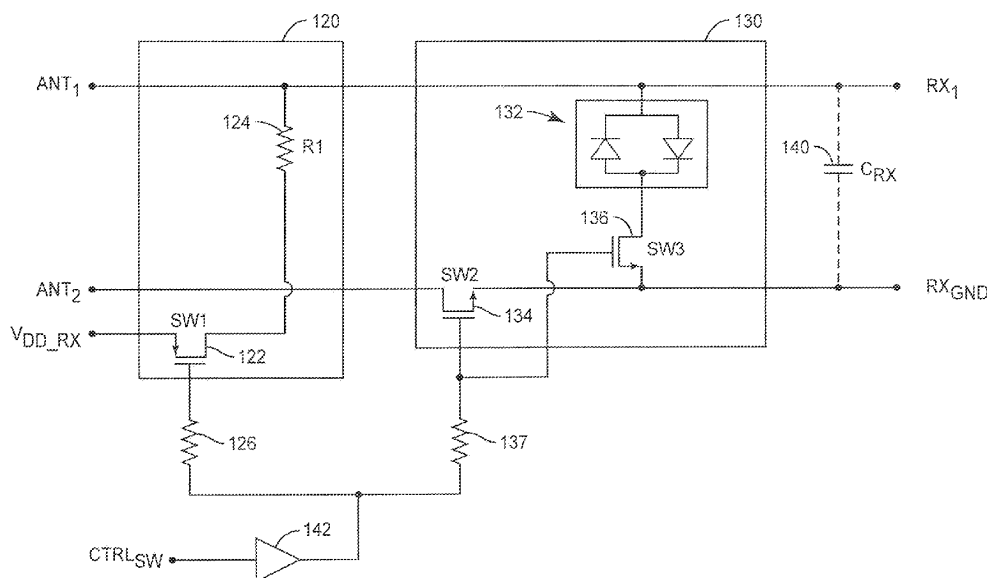
US 20120083224A1

(19) **United States**(12) **Patent Application Publication****Visser et al.**(10) **Pub. No.: US 2012/0083224 A1**(43) **Pub. Date: Apr. 5, 2012**(54) **ANTENNA SWITCH WITH ESD ISOLATION**(52) **U.S. CL. 455/83**(76) Inventors: **Hendrik Visser**, Wijchen (NL);
Berend Hendrik Essink,
Varsseveld (NL)(21) Appl. No.: **13/045,848**(22) Filed: **Mar. 11, 2011****Related U.S. Application Data**

(60) Provisional application No. 61/388,217, filed on Sep. 30, 2010.

Publication Classification(51) **Int. Cl.**
H04B 1/44 (2006.01)(57) **ABSTRACT**

A triple winding balun is combined with multiple switch assemblies to implement an antenna switch that provides good isolation, low loss, and good linearity with only a minor increase to the overall chip footprint. The antenna switch also isolates the receiver from power surges, where the power surges may be due to electrostatic discharge, undesirable WiMAX/LTE signals, etc. An exemplary antenna switch comprises a triple winding balun, a first switch subassembly, and an optional second switch subassembly. During stand-by and transmit modes, the first and second switch subassemblies respectively isolate the receiver from transmitter output current and connect a positive voltage bias to the third winding to prevent negative voltage swings at the receiver. During the receive mode, the configuration of the first and second switch subassemblies flips to connect the receiver to the third winding of the balun and to isolate the receiver from power surges.



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US 20120086604A1

(19) **United States**

(12) **Patent Application Publication**
Yang

(10) **Pub. No.: US 2012/0086604 A1**

(43) **Pub. Date: Apr. 12, 2012**

(54) **COMPACT MULTI-ELEMENT ANTENNA
WITH PHASE SHIFT**

Publication Classification

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

(52) **U.S. Cl.** **342/374; 342/368**

(57) **ABSTRACT**

(76) Inventor: **Xiao Ping Yang**, San Diego, CA
(US)

(21) Appl. No.: **13/329,895**

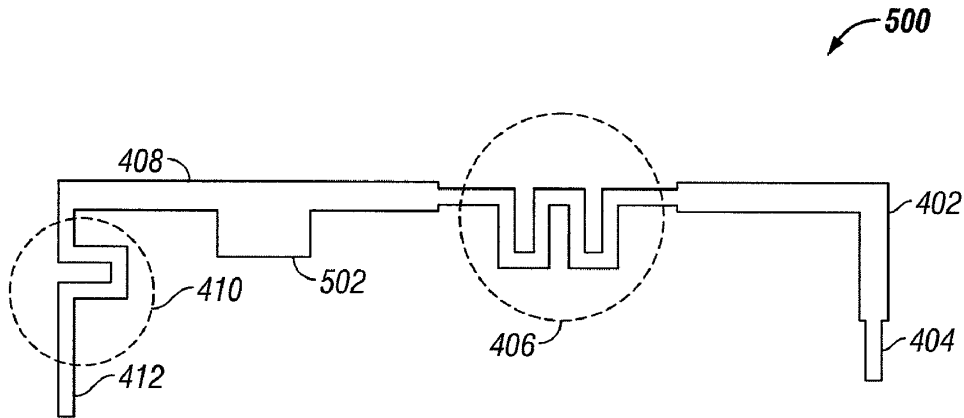
(22) Filed: **Dec. 19, 2011**

Related U.S. Application Data

(63) Continuation of application No. 11/866,354, filed on
Oct. 2, 2007, now Pat. No. 8,081,123.

(60) Provisional application No. 60/827,846, filed on Oct.
2, 2006.

A phased array antenna system includes a first radiation element that is made of a material and has a length selected to resonate at a desired frequency. A phase-shift element is coupled to one end of the first radiation element. A second radiation element is coupled to the end of the phase-shift element opposite the first radiation element, so that a radio signal passes through the first radiation element through the phase-shift element and through the second radiation element, the second radiation element is made of a material and has a length selected to resonate such that the first and second radiation elements cooperate to form a desired beam pattern from the antenna system.



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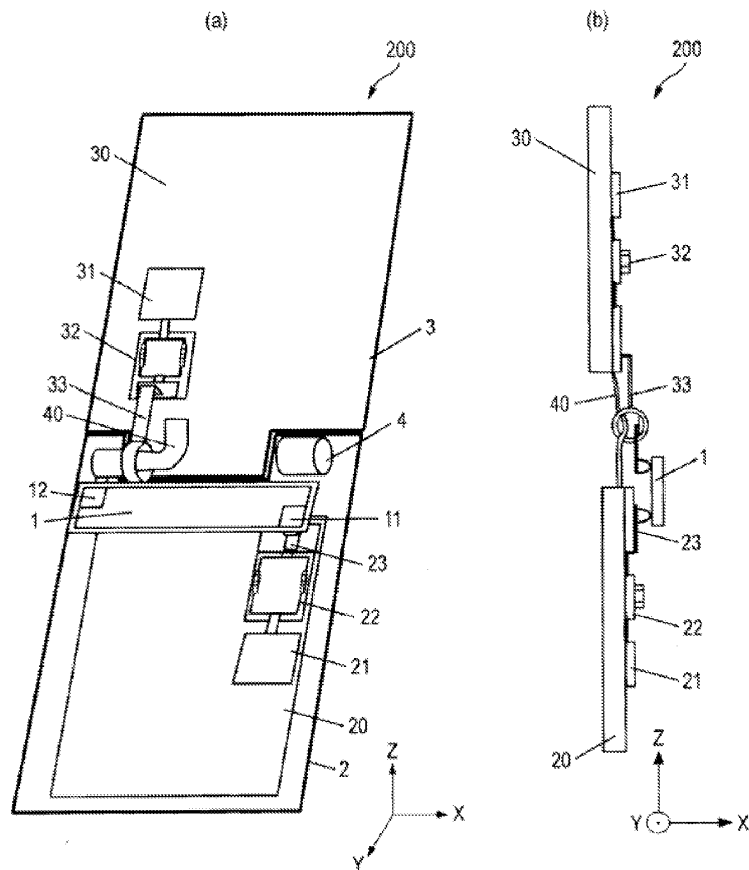


US 20120086609A1

(19) **United States**(12) **Patent Application Publication**
Kikuchi et al.(10) **Pub. No.: US 2012/0086609 A1**(43) **Pub. Date: Apr. 12, 2012**(54) **WIRELESS COMMUNICATION TERMINAL****Publication Classification**(75) Inventors: **Hironori Kikuchi**, Miyagi (JP);
Kenichi Sato, Miyagi (JP); **Daigo Imano**, Miyagi (JP); **Yasunori Komukai**, Miyagi (JP); **Hiroaki Ohmori**, Miyagi (JP)(51) **Int. Cl.**
H01Q 1/24 (2006.01)(52) **U.S. Cl.** **343/702**(73) Assignee: **PANASONIC CORPORATION**,
Osaka (JP)(57) **ABSTRACT**(21) Appl. No.: **13/258,966**(22) PCT Filed: **Dec. 3, 2010**(86) PCT No.: **PCT/JP2010/007069**§ 371 (c)(1),
(2), (4) Date: **Sep. 22, 2011**(30) **Foreign Application Priority Data**

Dec. 4, 2009 (JP) 2009-276293

There is provided a wireless communication terminal that can accept plural wireless systems different in operating frequency by one antenna element. An antenna element 1 and a second conductive element 33 are connected to each other through a first blocking part 22 that blocks a second frequency band, the antenna element 1 and a first conductive element 23 are connected to each other through a second blocking part 32 that blocks a first frequency band, and the first wireless circuit 21 and the second wireless circuit 31 are arranged on boards different in potential to improve an isolation performance between the plural wireless systems, thereby enabling an excellent antenna performance to be obtained.



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US 20120086610A1

(19) **United States**(12) **Patent Application Publication****Nishikido et al.**(10) **Pub. No.: US 2012/0086610 A1**(43) **Pub. Date: Apr. 12, 2012**(54) **ANTENNA AND PORTABLE WIRELESS
TERMINAL EQUIPPED THEREWITH****Publication Classification**(51) **Int. Cl.**
H01Q 1/24 (2006.01)(52) **U.S. Cl.** **343/702**(75) **Inventors:** **Tomoaki Nishikido**, Ishikawa (JP);
Yoshio Koyanagi, Kanagawa (JP);
Hiroiyuki Uno, Ishikawa (JP)(73) **Assignee:** **PANASONIC CORPORATION**,
Osaka (JP)(21) **Appl. No.:** **13/375,290**(22) **PCT Filed:** **Feb. 22, 2010**(86) **PCT No.:** **PCT/JP2010/001159**

§ 371 (c)(1),

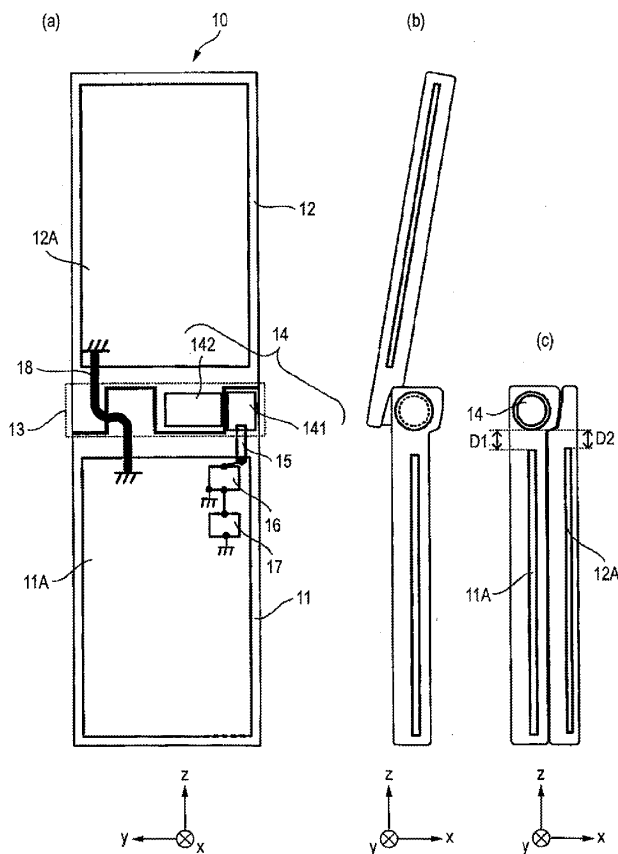
(2), (4) **Date:** **Nov. 30, 2011**(57) **ABSTRACT**

There is provided a flip portable radio that can be reduced in thickness and size; that requires a broadband characteristic for an antenna; and that can exhibit high communication performance according to various states of usage.

A flip portable radio has a matching circuit that feeds power to a metal rotary shaft 14 which makes an upper enclosure 12 and a lower enclosure 11 turnable and which matches impedance to 50 ohms at two operation frequencies or more. A diameter $L1$ of a cross section of a metal rotary shaft 14 is set to about $1/20$ or more of a wavelength λ . An effective length of a metal rotary shaft 14 is set to about $\lambda c/4$ of a wavelength λc of a center frequency of a high frequency band. The metal rotary shaft 14 is placed at a given interval away from a first circuit board 11A and a second circuit board 12A.

(30) **Foreign Application Priority Data**

Jun. 18, 2009 (JP) 2009-144904



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US 20120086621A1

(19) **United States**

(12) **Patent Application Publication**
YEOM

(10) **Pub. No.: US 2012/0086621 A1**

(43) **Pub. Date: Apr. 12, 2012**

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

Publication Classification

(75) Inventor: **Jung-Hwan YEOM**, Suwon-si
(KR)

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

(52) **U.S. Cl.** **343/845**

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

(57) **ABSTRACT**

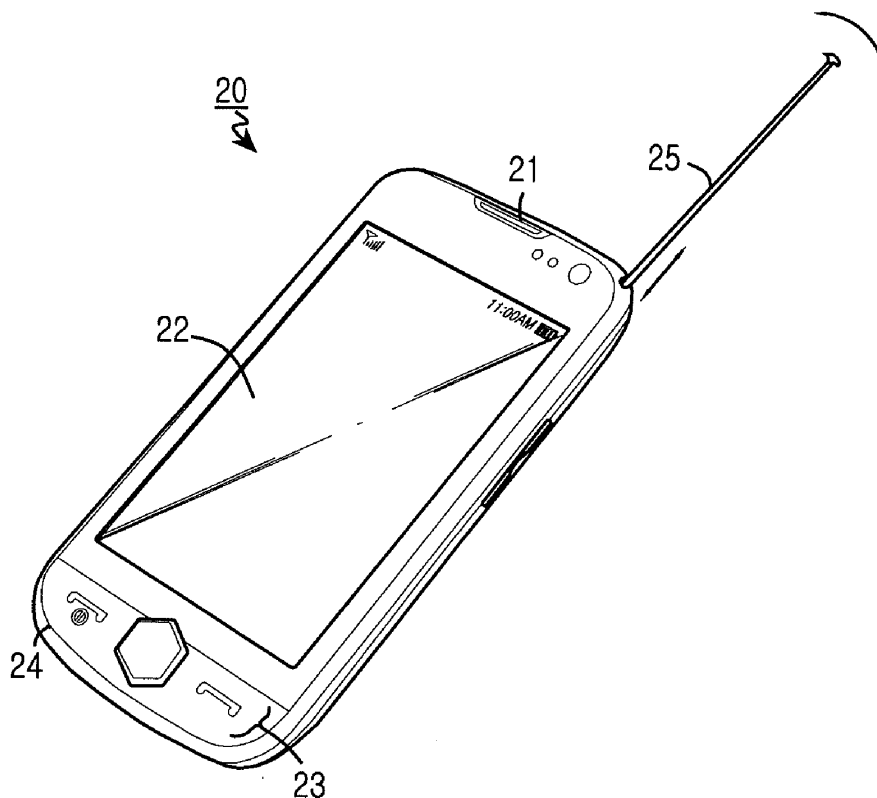
(21) Appl. No.: **13/222,203**

An antenna device of a portable terminal is provided. The device includes a main board, a bar antenna, and a connector. The main board includes a feeding portion for feeding electricity and a grounding portion for grounding. The bar antenna is movable while being electrically connected to the feeding portion so as to protrude to an outside of the portable terminal or to be inserted into the inside of the portable terminal. The connector electrically connects the grounding portion of the main board to the bar antenna only when the bar antenna is completely inserted into the portable terminal.

(22) Filed: **Aug. 31, 2011**

(30) **Foreign Application Priority Data**

Oct. 7, 2010 (KR) 10-2010-0097646



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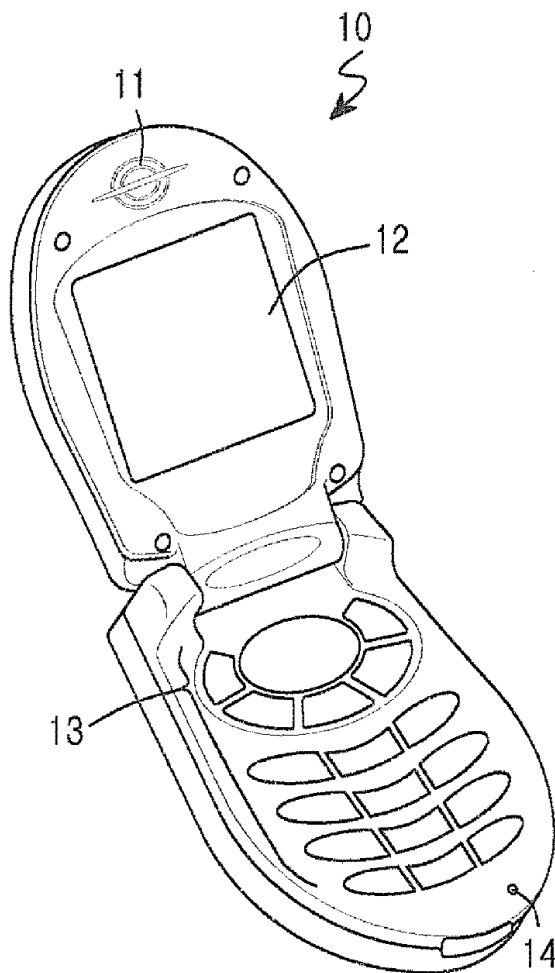
US 20120088542A1

(19) **United States**(12) **Patent Application Publication****Choi et al.**(10) **Pub. No.: US 2012/0088542 A1**(43) **Pub. Date: Apr. 12, 2012**(54) **METHOD CONSTRUCTION FOR REDUCING INTERFERENCE BETWEEN ANTENNA AND PERIPHERAL DEVICE****Publication Classification**(51) **Int. Cl.**
H04W 88/02 (2009.01)
H04B 1/10 (2006.01)(52) **U.S. Cl.** **455/554.2; 455/296**(57) **ABSTRACT**

A structure and method reduce interference between an antenna and a peripheral device. The structure includes an antenna module and a speaker module. The antenna module includes a carrier and the antenna attached to the carrier. The speaker module is mounted in the carrier and includes a speaker and a signal line electrically connected to the speaker. The structure changes at least one of a shape and a length of the signal line to secure a radiation performance of the antenna module.

(75) **Inventors:** **Min-Sung Choi**, Seoul (KR);
Chang-Ki Lee, Seoul (KR);
Won-Ik Do, Seoul (KR)(73) **Assignee:** **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)(21) **Appl. No.:** **13/167,799**(22) **Filed:** **Jun. 24, 2011**(30) **Foreign Application Priority Data**

Oct. 12, 2010 (KR) 10-2010-0099107





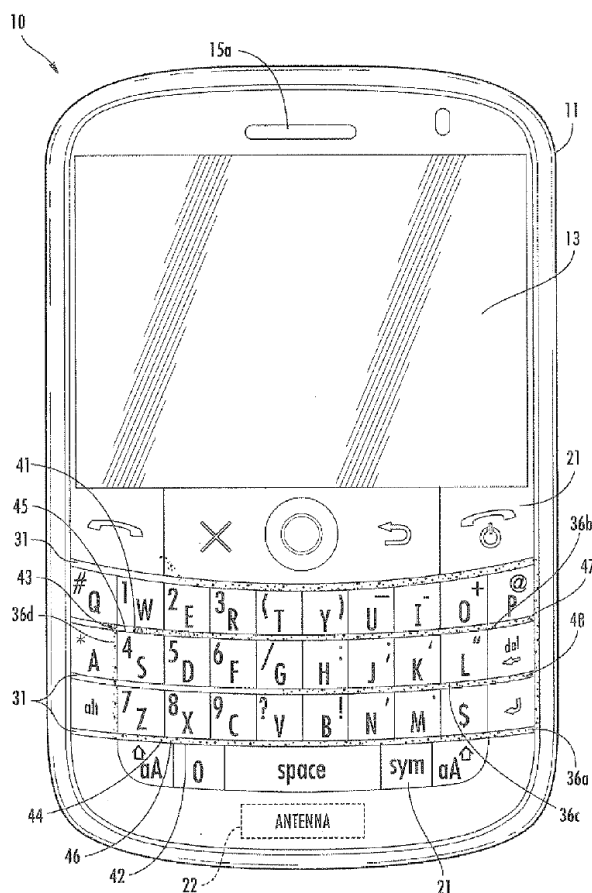
US 20120088560A1

(19) **United States**(12) **Patent Application Publication**
Wehrmann et al.(10) **Pub. No.: US 2012/0088560 A1**(43) **Pub. Date: Apr. 12, 2012**(54) **MOBILE WIRELESS COMMUNICATIONS
DEVICE INCLUDING SPACED APART
ELONGATE MEMBERS FOR REDUCING SAR
AND RELATED METHODS****Publication Classification**(51) **Int. Cl.**
H04W 88/02

(2009.01)

(52) **U.S. Cl.** **455/575.7**(57) **ABSTRACT**(75) **Inventors:** **Christopher Wehrmann**, Bochum
(DE); **Michael Kühn**, Bochum
(DE); **Adrian Piseu Davis**, Davie,
FL (US)(73) **Assignee:** **Research In Motion Limited**,
Waterloo (CA)(21) **Appl. No.:** **12/900,929**(22) **Filed:** **Oct. 8, 2010**

A mobile wireless communications device may include a portable housing and wireless transceiver circuitry carried by the portable housing. The mobile wireless communications device may also include an antenna carried by the portable housing and coupled to the wireless transceiver circuitry, and a light source carried by the portable housing. The device may further include a keyboard assembly carried by the portable housing including a light guide coupled to the light source and having input key receiving openings therein, and a mask carried by the light guide and having input key receiving openings. The mask may include spaced apart electrically conductive elongate members positioned relative to the antenna to reduce a Specific Absorption Rate value for the mobile wireless communications device.





US 20120092221A1

(19) **United States**(12) **Patent Application Publication****Schlub et al.**(10) **Pub. No.: US 2012/0092221 A1**(43) **Pub. Date: Apr. 19, 2012**(54) **HYBRID ANTENNAS FOR ELECTRONIC DEVICES**(52) **U.S. CL. 343/702; 343/729**

(76) Inventors: **Robert W. Schlub**, Campbell, CA (US); **Qingxiang Li**, Mountain View, CA (US); **Juan Zavala**, Watsonville, CA (US); **Robert J. Hill**, Salinas, CA (US)

(21) Appl. No.: **13/335,714**(22) Filed: **Dec. 22, 2011****Related U.S. Application Data**

(62) Division of application No. 12/120,008, filed on May 13, 2008, now Pat. No. 8,102,319.

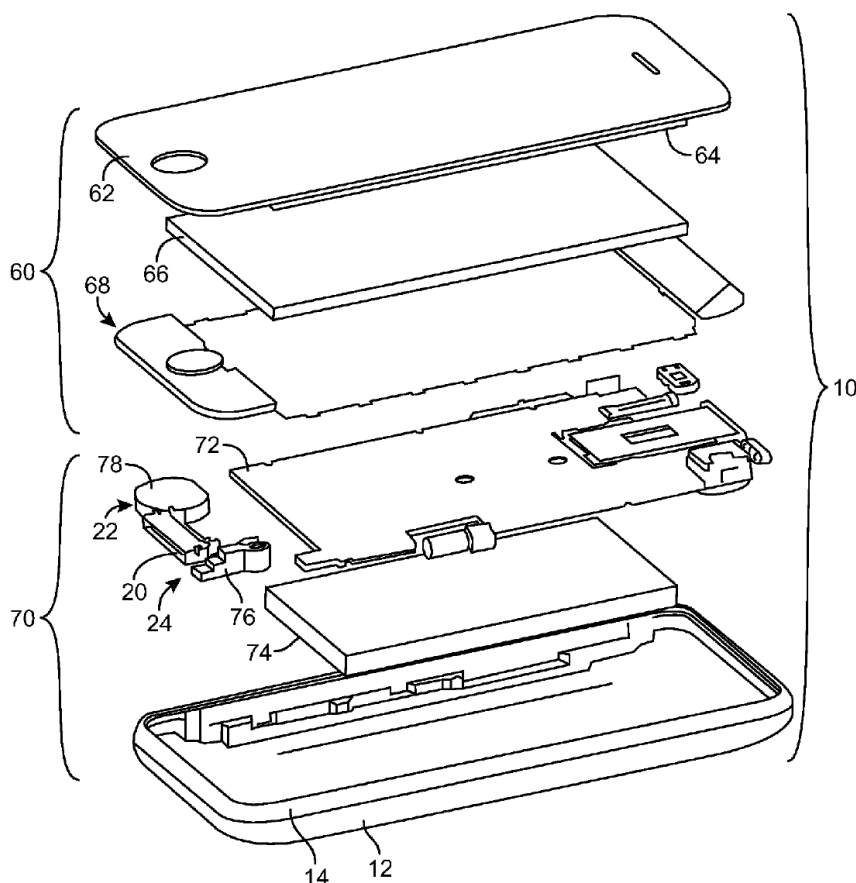
(60) Provisional application No. 61/044,456, filed on Apr. 11, 2008.

Publication Classification

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

(57) **ABSTRACT**

A portable electronic device is provided that has a hybrid antenna. The hybrid antenna may include a slot antenna structure and a planar inverted-F antenna structure. The planar inverted-F antenna structure may be formed from traces on a flex circuit substrate. A backside trace may form a series capacitance for the planar inverted-F antenna structure. The antenna slot may have a perimeter that is defined by the location of conductive structures such as flex circuits, metal housing structures, a conductive bezel, printed circuit board ground conductors, and electrical components. Springs may be used in electrically connecting these conductive elements. A spring-loaded pin may be used as part of an antenna feed conductor. The pin may connect a transmission line path on a printed circuit board to the planar inverted-F antenna structure while allowing the planar inverted-F antenna structure to be removed from the device for rework or repair.



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US 20120092222A1

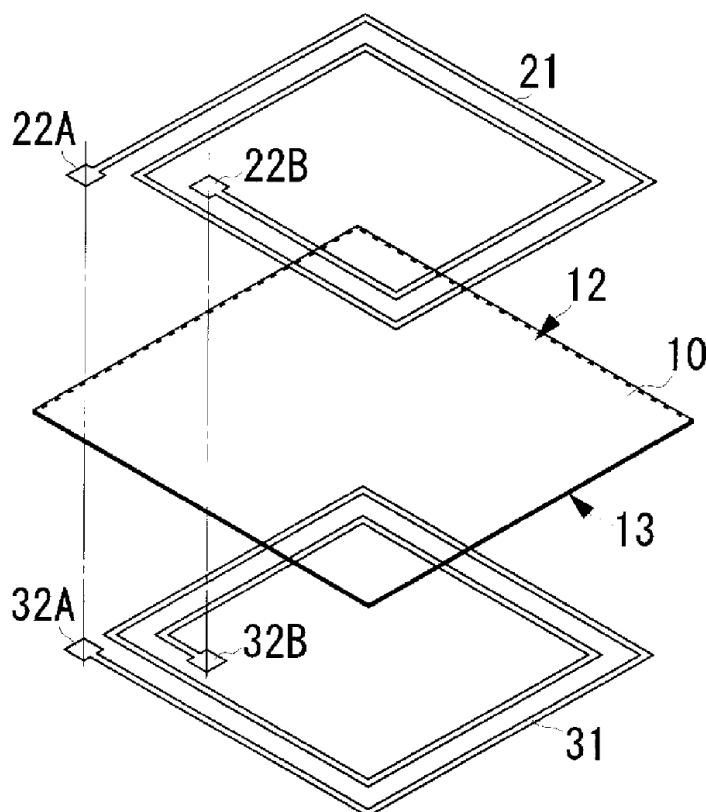
(19) **United States**(12) **Patent Application Publication**
KATO et al.(10) **Pub. No.: US 2012/0092222 A1**(43) **Pub. Date: Apr. 19, 2012**(54) **ANTENNA AND ANTENNA MODULE**(30) **Foreign Application Priority Data**(75) Inventors: **Noboru KATO**, Nagaokakyo-shi (JP); **Katsumi TANIGUCHI**, Nagaokakyo-shi (JP); **Nobuo IKEMOTO**, Nagaokakyo-shi (JP); **Hiromi MURAYAMA**, Nagaokakyo-shi (JP)

Jul. 3, 2009 (JP) 2009-158334

Publication Classification(51) **Int. Cl.**
H01Q 11/12 (2006.01)(52) **U.S. Cl.** **343/742**(57) **ABSTRACT**(73) Assignee: **MURATA MANUFACTURING CO., LTD.**, Nagaokakyo-shi (JP)(21) Appl. No.: **13/334,462**(22) Filed: **Dec. 22, 2011****Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2010/053496, filed on Mar. 4, 2010.

An antenna includes a flexible sheet that includes a first main surface including a first coil electrode located thereon and a second main surface including a second coil electrode located thereon. The first and second coil electrodes are wound in opposite directions when viewed from different directions. A first end of the first coil electrode faces a first end of the second coil electrode through the flexible sheet. Similarly, a second end of the first coil electrode faces a second end of the second coil electrode through the flexible sheet. The first and second coil electrodes define an inductor, the first ends of the first and second coil electrodes define a capacitor, and the second ends of the first and second coil electrodes define a capacitor whereby a resonant antenna is provided.





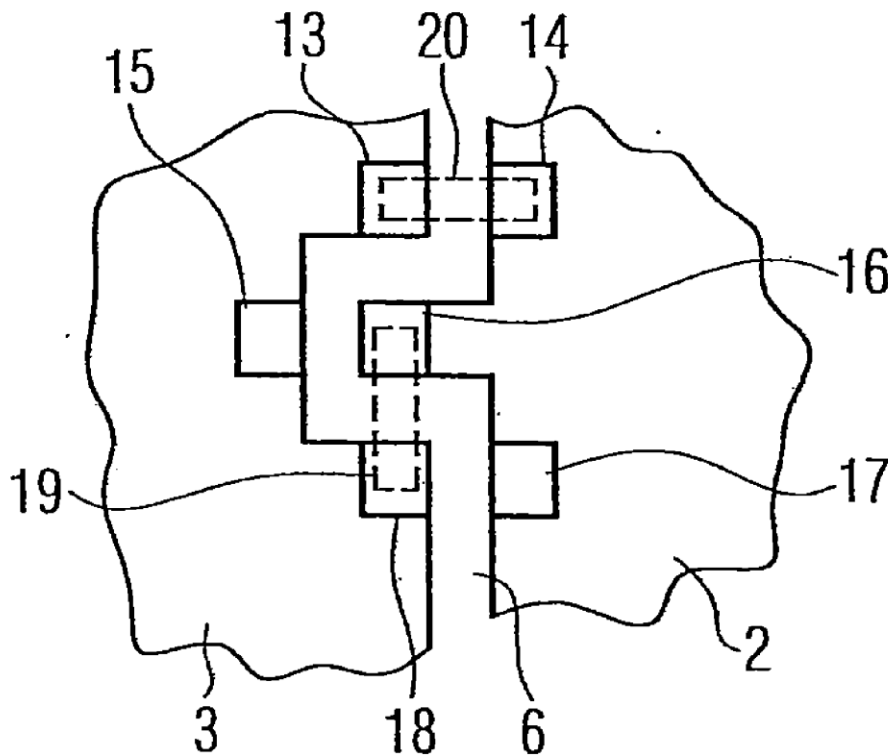
US 20120092226A1

(19) **United States**(12) **Patent Application Publication**
Baliarda et al.(10) **Pub. No.: US 2012/0092226 A1**(43) **Pub. Date: Apr. 19, 2012**(54) **SLOTTED GROUND-PLANE USED AS A SLOT
ANTENNA OR USED FOR A PIFA ANTENNA**(76) Inventors: **Carles Puente Baliarda**, Barcelona
(ES); **Jaime Anguera Pros**,
Castellon (ES)(21) Appl. No.: **13/336,127**(22) Filed: **Dec. 23, 2011****Related U.S. Application Data**(63) Continuation of application No. 12/958,522, filed on
Dec. 2, 2010, now Pat. No. 8,111,199, which is a
continuation of application No. 11/884,991, filed on
Sep. 20, 2007, now Pat. No. 7,872,605, filed as appli-
cation No. PCT/EP2006/060766 on Mar. 15, 2006.(30) **Foreign Application Priority Data**

Mar. 15, 2005 (EP) 05005540.9

Publication Classification(51) **Int. Cl.**
H01Q 1/48 (2006.01)(52) **U.S. Cl.** **343/848**(57) **ABSTRACT**

A wireless device includes a ground plane with at least two portions. On each of the at least two portions at least one connecting means is provided. The two connecting means are connected with an electric component for connecting the at least two portions of the ground plane. The ground plane is partially covered with an insulating material and the connecting means are given by a part of the ground plane which is not covered by any insulating material.



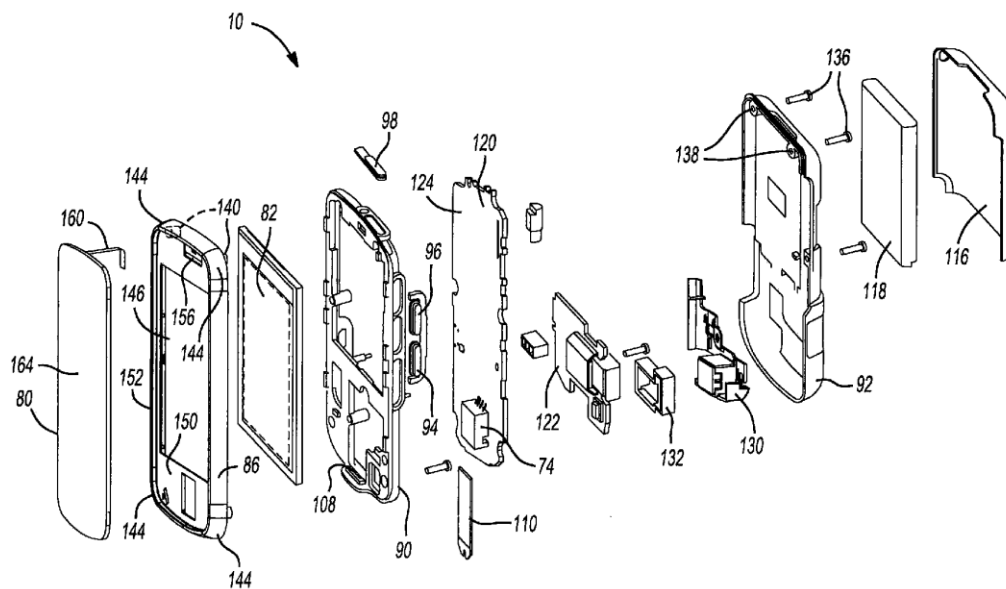
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US 20120092812A1

(19) **United States**(12) **Patent Application Publication****Lewis et al.**(10) **Pub. No.: US 2012/0092812 A1**(43) **Pub. Date: Apr. 19, 2012**(54) **HANDHELD DIABETES MANAGER WITH TOUCH SCREEN DISPLAY**(52) **U.S. CL. 361/679.01**(75) **Inventors:** **Joseph B. Lewis**, Indianapolis, IN (US); **Derek C. Lotarski**, Noblesville, IN (US); **Michael F. DeRossi**, Lindenhurst, IL (US)(57) **ABSTRACT**(73) **Assignee:** **ROCHE DIAGNOSTICS OPERATIONS, INC.**, Indianapolis, IN (US)

A handheld diabetes manager having a blood glucose measurement engine comprises a housing having a blood glucose measuring engine and a printed circuit board disposed in the housing. A touch screen can be coupled to the housing. The touch screen can have a transparent portion surrounded by a non-transparent portion. The non-transparent portion can have adhesive thereon that seals the touch screen to the housing. A flexible connector can electrically connect at least two independent electrical leads between the touch screen and the printed circuit board. An antenna assembly can be disposed in the housing and comprise a molded carrier, a conductive portion on the molded carrier and a speaker. The conductive portion can be electrically connected to the printed circuit board and be configured to receive a radio signal. The carrier can include a recess that receives the speaker and is configured to project sound from the speaker.

(21) **Appl. No.: 12/905,511**(22) **Filed: Oct. 15, 2010****Publication Classification**(51) **Int. Cl. H05K 5/00 (2006.01)**

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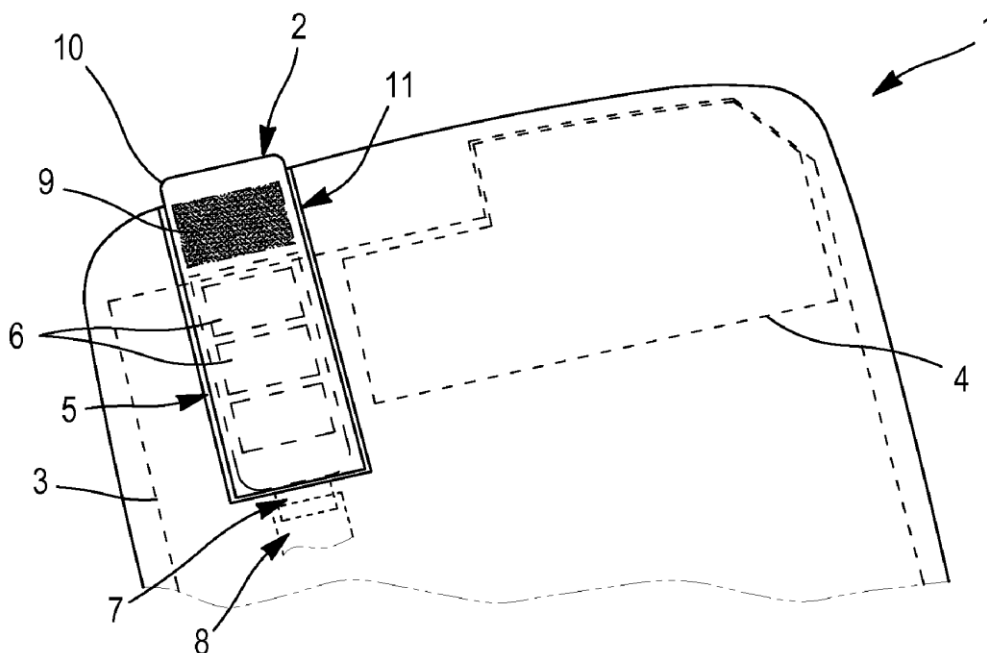
US 20120093205A1

(19) **United States**(12) **Patent Application Publication**
CROHAS et al.(10) **Pub. No.: US 2012/0093205 A1**(43) **Pub. Date: Apr. 19, 2012**(54) **ELECTRONIC DEVICE WITH REMOVABLE ACCESSORY**(52) **U.S. CL. 375/222**(75) **Inventors:** **Henri CROHAS,**
VERRIERES-LE-BUISSON (FR);
Yves GREGOIRE, CHATENAY
MALABRY (FR)(57) **ABSTRACT**(73) **Assignee:** **ARCHOS, IGNY (FR)**(21) **Appl. No.:** **13/107,340**(22) **Filed:** **May 13, 2011**(30) **Foreign Application Priority Data**

Oct. 18, 2010 (FR) 10 58463

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

An electronic device is arranged to receive a removable wireless remote data transmission accessory, in particular of the 3G "stick modem" or Wifi type, the accessory including an accessory body, at least one radio antenna, an accessory connection element linked to the accessory body, the device including a device connection element, arranged to connect with the removable accessory and to be coupled with the accessory connection element, characterized in that the device is arranged to receive the removable accessory in a slot, the device being structured so as to allow the radio antenna to transmit data remotely when the accessory body and/or the radio antenna is at least partially inserted in the slot, in an active data transmission position of the accessory. The invention relates in particular to devices receiving removable accessories of the "3G modem" or "Wifi" type.



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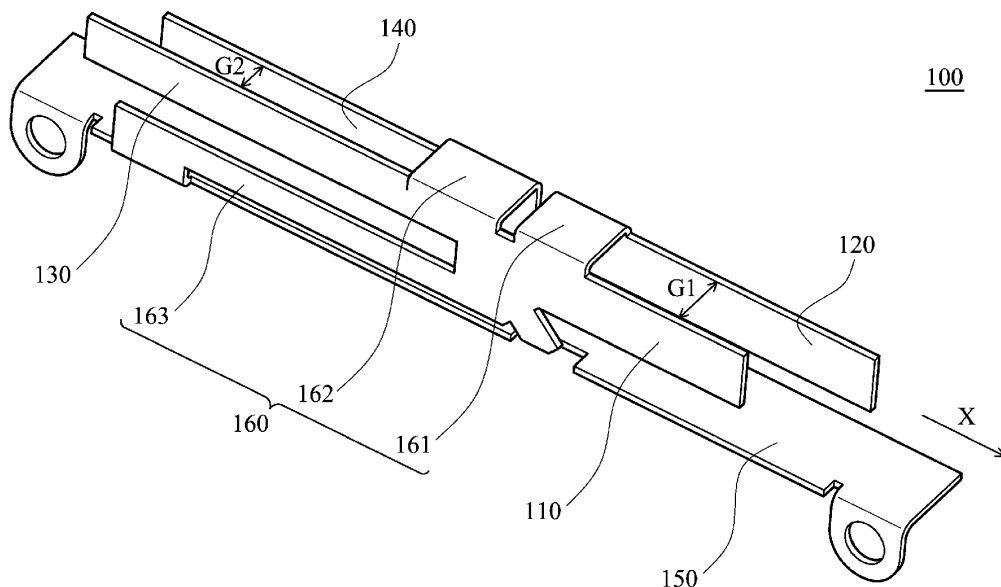
US 20120098707A1

(19) **United States**(12) **Patent Application Publication**
CHOU(10) **Pub. No.: US 2012/0098707 A1**(43) **Pub. Date: Apr. 26, 2012**(54) **ANTENNA**(52) **U.S. CL. 343/700 MS**(75) **Inventor:** **Chen-Yu CHOU**, New Tapei City
(TW)(73) **Assignee:** **WISTRON CORP.**, New Taipei
City (TW)(21) **Appl. No.:** **13/073,444**(22) **Filed:** **Mar. 28, 2011**(30) **Foreign Application Priority Data**

Oct. 20, 2010 (TW) TW99135708

Publication Classification(51) **Int. Cl.**
H01Q 1/36 (2006.01)(57) **ABSTRACT**

An antenna is provided. The antenna includes a ground element, a connection element, a first radiator and a second radiator. The connection element is connected to the ground element. The first radiator is connected to the connection element and extends toward a first direction, wherein the first radiator transmits a first wireless signal. The second radiator is connected to the connection element and extends toward the first direction, wherein the second radiator is parallel to the first radiator, the second radiator transmits a second wireless signal, and a frequency of the first wireless signal is different from a frequency of the second wireless signal, and when the antenna transmits the first and second wireless signals, the first radiator resonates with the second radiator.



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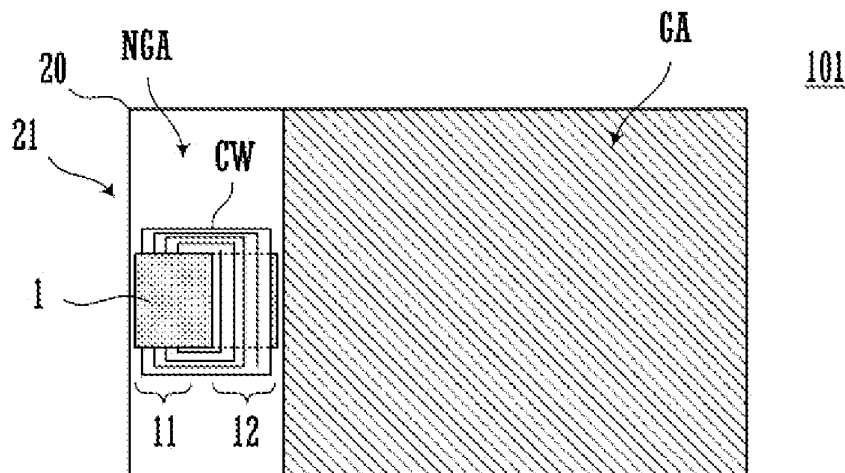
US 20120098711A1

(19) **United States**(12) **Patent Application Publication**
YOSUI et al.(10) **Pub. No.: US 2012/0098711 A1**(43) **Pub. Date: Apr. 26, 2012**(54) **ANTENNA DEVICE AND MOBILE
TERMINAL****Publication Classification**(75) Inventors: **Kuniaki YOSUI**, Kyoto-fu (JP);
Hiromitsu ITO, Kyoto-fu (JP);
Hiroyuki KUBO, Kyoto-fu (JP)(51) **Int. Cl.**
H01Q 7/08 (2006.01)(52) **U.S. Cl.** **343/702; 343/788**(73) Assignee: **MURATA MANUFACTURING
CO., LTD.**, Kyoto-fu (JP)(57) **ABSTRACT**(21) Appl. No.: **13/339,998**(22) Filed: **Dec. 29, 2011**

The disclosure provides an antenna device and mobile terminal including such an antenna device. The antenna device includes a coil including a conductor wound around a plate-shaped magnetic core. A flat conductor is positioned adjacent to the coil, and the coil is positioned such that it is closer than the flat conductor to an antenna of a communication partner positioned near the antenna device. The coil conductor includes a first conductor portion adjacent to a first main surface of the magnetic core and a second conductor portion adjacent to a second main surface thereof. The magnetic core and the coil conductor form an antenna coil. A circuit substrate includes a ground electrode formation area and a ground electrode non-formation area. The antenna coil is mounted on the ground electrode non-formation area of the circuit substrate with the first main surface of the magnetic core facing the circuit substrate.

Related U.S. Application Data(63) Continuation of application No. PCT/JP2010/063746,
filed on Aug. 13, 2010.(30) **Foreign Application Priority Data**

Sep. 25, 2009 (JP) 2009-221626



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US 20120098712A1

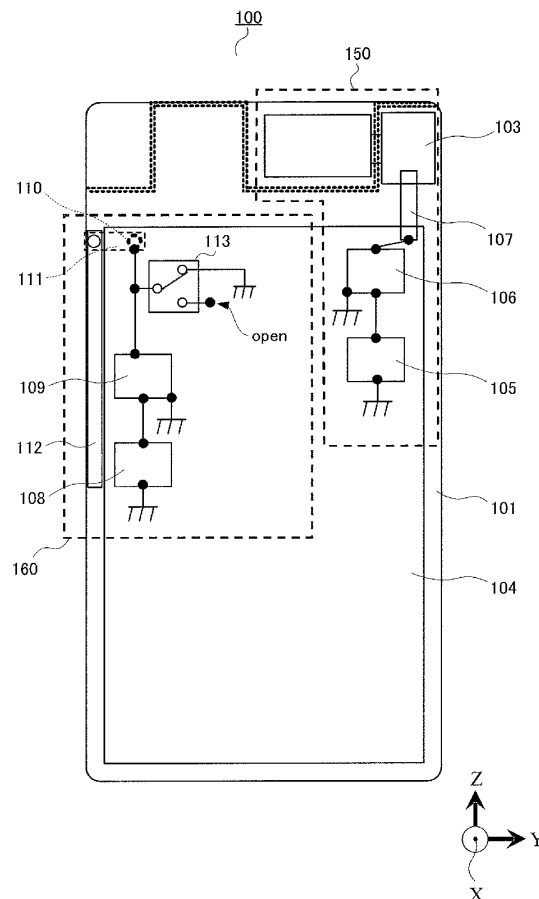
(19) **United States**(12) **Patent Application Publication**
Ishibana et al.(10) **Pub. No.: US 2012/0098712 A1**(43) **Pub. Date: Apr. 26, 2012**(54) **PORTABLE WIRELESS TERMINAL****Publication Classification**(75) Inventors: **Kyoko Ishibana**, Tokyo (JP);
Yoshio Koyanagi, Kanagawa (JP);
Yoshihiro Kanasaki, Ishikawa (JP)(51) **Int. Cl.**
H01Q 1/24 (2006.01)(52) **U.S. Cl.** **343/702**(57) **ABSTRACT**(73) Assignee: **PANASONIC CORPORATION**,
Osaka (JP)(21) Appl. No.: **13/379,876**(22) PCT Filed: **Jun. 23, 2010**(86) PCT No.: **PCT/JP2010/004185**

§ 371 (c)(1),

(2), (4) Date: **Dec. 21, 2011**(30) **Foreign Application Priority Data**

Jun. 23, 2009 (JP) 2009-148898

Disclosed is a portable wireless terminal wherein deterioration in antenna performance when placed on a metal desk or other structure can be prevented without sacrificing designability and without increasing the number of components. In this terminal, a hinge part (103) functions as an antenna which resonates at a frequency of a first wireless system (150). A whip antenna (112) faces the surface of a first circuit board (104) that is opposite the surface faced by an input device (105), is disposed substantially parallel to the first circuit board (104), and resonates at a frequency of a second wireless system (160). A second contact spring (110) electrically connects a second wireless circuit (108) to the antenna element of a whip antenna (112) and is disposed perpendicularly to the first circuit board (104). A switch (113) grounds the whip antenna (112) and second contact spring (110) to the first circuit board (104) when the second wireless system (160) is not operating.



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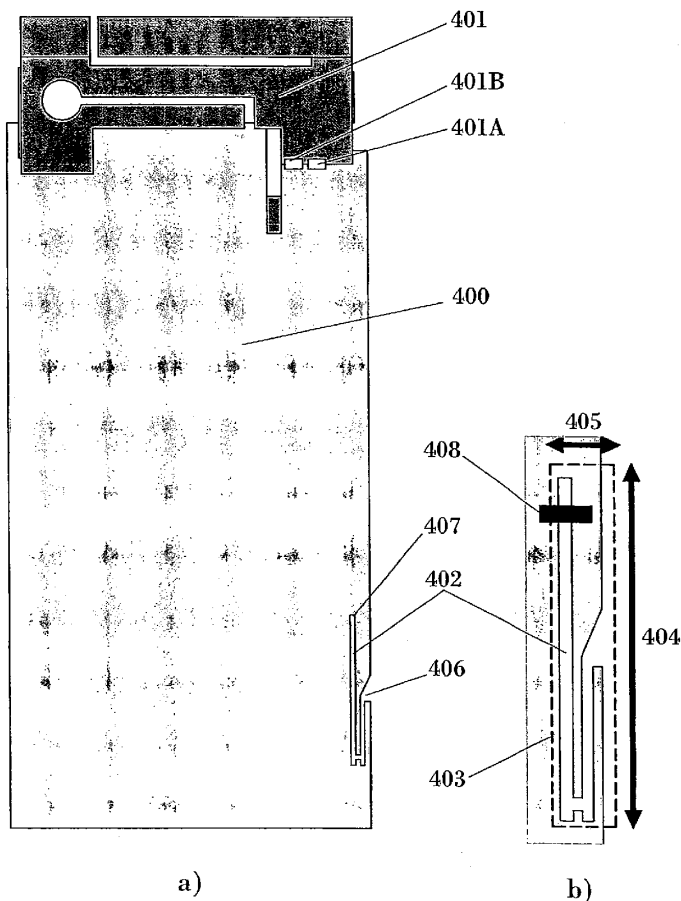
US 20120098719A1

(19) **United States**(12) **Patent Application Publication**
Mumbru et al.(10) **Pub. No.: US 2012/0098719 A1**(43) **Pub. Date: Apr. 26, 2012**(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

Publication Classification(76) Inventors: **Josep Mumbru**, Barcelona (ES);
Jaume Anguera, Castellon (ES);
Jordi Soler, Girona (ES); **Carles
Puente**, Barcelona (ES)(51) **Int. Cl.**
H01Q 21/28 (2006.01)(52) **U.S. Cl.** **343/725**(21) Appl. No.: **13/341,051**(22) Filed: **Dec. 30, 2011****Related U.S. Application Data**(63) Continuation of application No. 11/988,888, filed on
Sep. 30, 2008, now Pat. No. 8,115,686, filed as appli-
cation No. PCT/EP2006/007050 on Jul. 18, 2006.(60) Provisional application No. 60/702,205, filed on Jul.
25, 2005.(57) **ABSTRACT**

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.



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

(43) **Pub. Date:** **Apr. 26, 2012**

Publication Classification

(52) **U.S. Cl.** 343/725

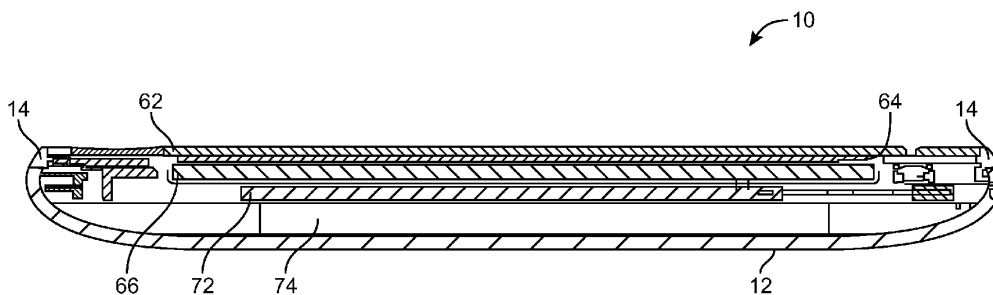
(57) **ABSTRACT**

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.

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

Related U.S. Application Data

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



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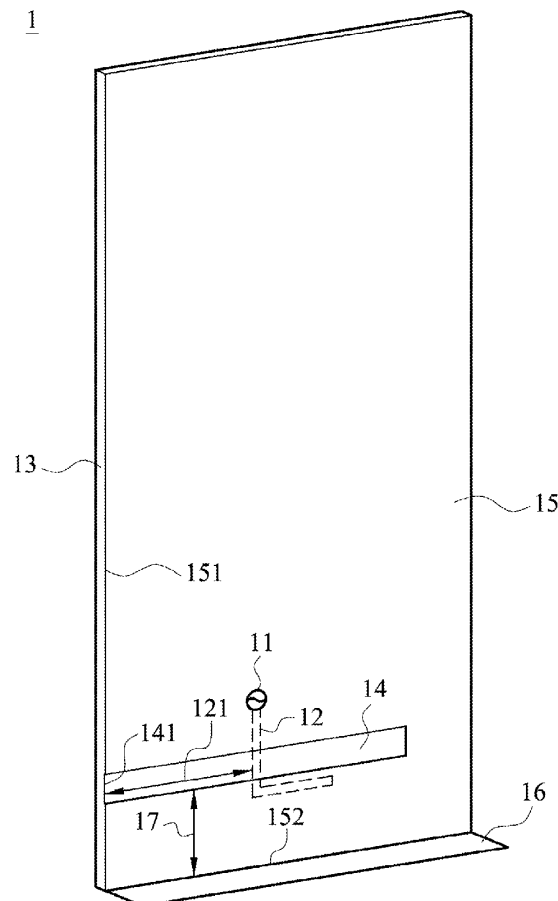
US 20120098721A1

(19) **United States**(12) **Patent Application Publication**
Wong et al.(10) **Pub. No.: US 2012/0098721 A1**(43) **Pub. Date: Apr. 26, 2012**(54) **MOBILE COMMUNICATION DEVICE AND ANTENNA**(52) **U.S. CL. 343/749; 343/767**(75) **Inventors:** **Kin-Lu Wong**, Hsichih (TW);
Po-Wei Lin, Hsichih (TW);
Chih-Hua Chang, Hsichih (TW)(57) **ABSTRACT**(73) **Assignee:** **Acer Incorporated**, Hsichih (TW)(21) **Appl. No.:** **13/088,561**(22) **Filed:** **Apr. 18, 2011**(30) **Foreign Application Priority Data**

Oct. 22, 2010 (TW) 99136065

Publication Classification(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 5/01 (2006.01)

A mobile communication device is provided. The mobile communication device includes a system circuit board with a surface, a ground plane having a monopole slot on the surface, a microstrip feedline, and a metal element, wherein the ground plane has a longer edge and a shorter edge. The monopole slot has a first operating band and a second operating band. The microstrip feedline is located on the system circuit board, wherein one end of the microstrip feedline passes over the monopole slot, and the other end of the microstrip feedline is connected to a signal source. The metal element is electrically connected to the shorter edge of the ground plane, and is substantially perpendicular to the ground plane. A distance between the open end of the monopole slot and the shorter edge of the ground plane where the metal element is connected is shorter than 0.05 wavelength of the lowest operating frequency of the first operating band.



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US 20120098724A1

(19) **United States**

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

(10) **Pub. No.: US 2012/0098724 A1**

(43) **Pub. Date: Apr. 26, 2012**

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

Publication Classification

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

(51) **Int. Cl.**
H04B 5/00 (2006.01)
H01Q 7/06 (2006.01)

(52) **U.S. Cl.** **343/788; 343/866**

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

(57) **ABSTRACT**

(21) Appl. No.: **13/340,022**

(22) Filed: **Dec. 29, 2011**

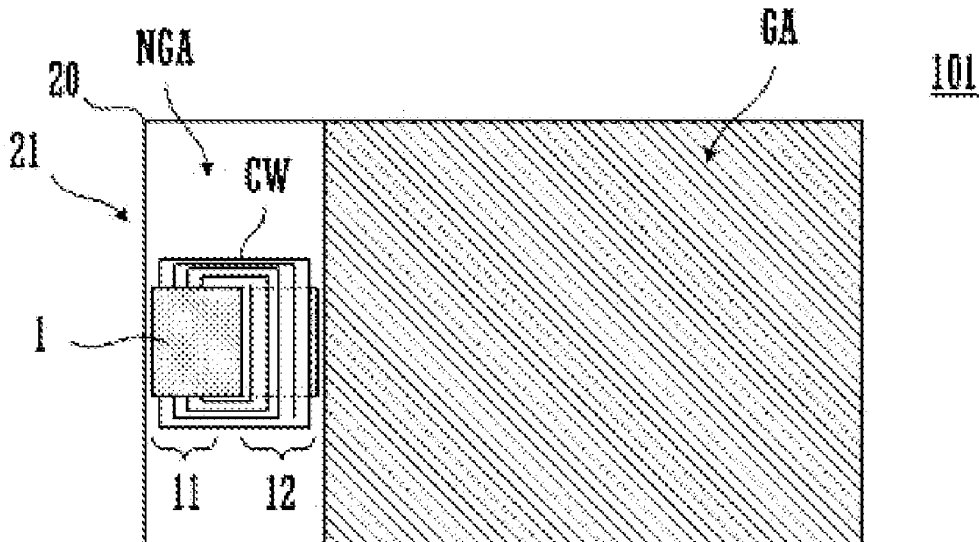
The disclosure provides an antenna device and communications terminal including such an antenna device. The antenna device includes a coil including a conductor wound around a plate-shaped magnetic core. A flat conductor is positioned adjacent to the coil, and the coil is positioned such that it is closer than the flat conductor to an antenna of a communication partner positioned near the antenna device. The coil conductor includes a first conductor portion adjacent to a first main surface of the magnetic core and a second conductor portion adjacent to a second main surface thereof. A circuit substrate includes a ground electrode formation area and a ground electrode non-formation area. The antenna coil is mounted on the ground electrode non-formation area of the circuit substrate with the first main surface of the magnetic core facing the circuit substrate.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2010/063747,
filed on Aug. 13, 2010.

(30) **Foreign Application Priority Data**

Sep. 25, 2009 (JP) 2009-221626



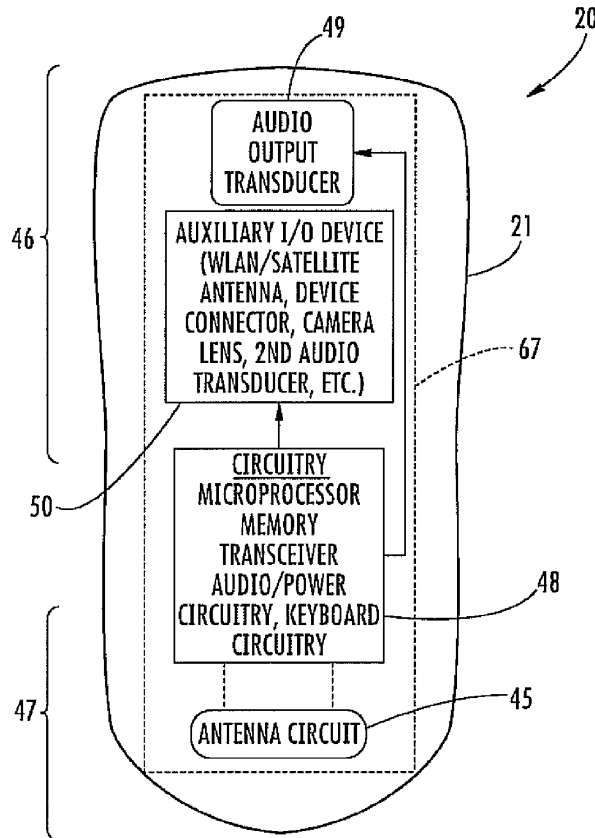
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US 20120100819A1

(19) **United States**(12) **Patent Application Publication**
ZHU et al.(10) **Pub. No.: US 2012/0100819 A1**(43) **Pub. Date: Apr. 26, 2012**(54) **MOBILE WIRELESS COMMUNICATIONS
DEVICE WITH REDUCED HARMONICS
RESULTING FROM METAL SHIELD
COUPLING****Publication Classification**(51) **Int. Cl.**
H04B 1/04 (2006.01)(52) **U.S. Cl.** 455/114.2(57) **ABSTRACT**(75) **Inventors:** **Lizhong ZHU**, Waterloo (CA);
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Ontario (CA)(21) **Appl. No.:** **13/325,099**(22) **Filed:** **Dec. 14, 2011****Related U.S. Application Data**(63) Continuation of application No. 12/117,036, filed on
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A mobile wireless communications device includes a housing, antenna, and circuit board carried by the housing and having radio frequency (RF) circuitry operative with the antenna for receiving and transmitting RF signals through the antenna. A power amplifier is connected within a transmission line for amplifying RF signals to be transmitted over the transmission line to the antenna. An antenna switch is connected to the antenna and RF circuitry. An RF shield surrounds the power amplifier and antenna switch and isolates the power amplifier and antenna switch from the antenna and RF circuitry. A low pass filter is connected to the power amplifier and antenna switch for reducing any RF coupling of voltage standing waves of upper harmonic frequencies from the power amplifier into the antenna switch through the RF shield while maintaining transmission of signals through the transmission line at a desired fundamental frequency.



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