



US007728773B2

(12) **United States Patent**
Oh et al.

(10) **Patent No.:** **US 7,728,773 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

- (54) **MULTI-BAND ANTENNA**
- (75) Inventors: **Sae-Won Oh**, Incheon (KR);
Seung-Yong Lee, Pucheon-si (KR)
- (73) Assignee: **Ace Antenna Corp.**, Incheon (KR)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 186 days.

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- (21) Appl. No.: **12/090,045**
- (22) PCT Filed: **Oct. 11, 2006**
- (86) PCT No.: **PCT/KR2006/004083**
§ 371 (c)(1),
(2), (4) Date: **Apr. 11, 2008**
- (87) PCT Pub. No.: **WO2007/043800**
PCT Pub. Date: **Apr. 19, 2007**

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Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—LRK Patent Law Firm

- (65) **Prior Publication Data**
US 2008/0252532 A1 Oct. 16, 2008

(57) **ABSTRACT**

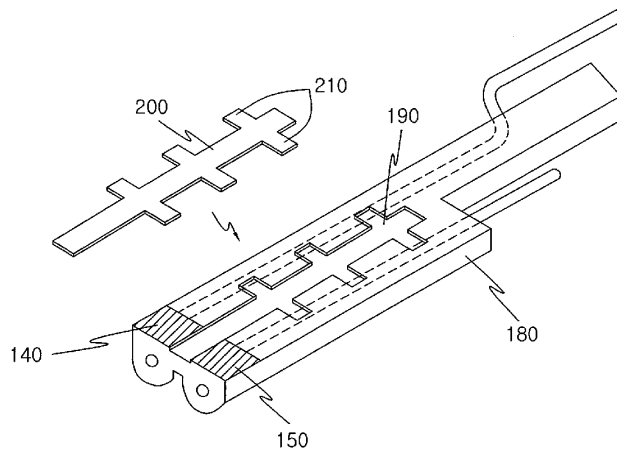
The present invention relates to a multi-band antenna and, more particularly, to a sub multi-band antenna, in which a planer conducting part, which has a plurality of protruding portions, is inserted into a depression, which is formed on the surface of a body part formed through injection molding using a mold having a specific shape to surround first and second wire members, and the fitting depression of a fastening part, which is formed through the cutting or die casting of a metal material, and to a sub-band built-in chip antenna, in which sub radiation patterns having a predetermined length are formed on the interior surface of a body part, which is formed through injection molding using a dielectric material or is formed of a layered substrate a dielectric material.

- (30) **Foreign Application Priority Data**
Oct. 11, 2005 (KR) 10-2005-0095578
Oct. 11, 2005 (KR) 10-2005-0095583

- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS**
- (58) **Field of Classification Search** **343/700 MS**
See application file for complete search history.

- (56) **References Cited**
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13 Claims, 8 Drawing Sheets





US007728776B2

(12) **United States Patent**
Lin et al.

(10) **Patent No.:** **US 7,728,776 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

(54) **DUAL-BAND ANTENNA**

(75) Inventors: **Ching-Chi Lin**, Taipei Hsien (TW);
Jia-Hung Su, Taipei Hsien (TW); **Kai Shih**, Taipei Hsien (TW); **Yu-Yuan Wu**, Taipei Hsien (TW)

(73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 188 days.

(21) Appl. No.: **11/858,520**

(22) Filed: **Sep. 20, 2007**

(65) **Prior Publication Data**

US 2009/0079643 A1 Mar. 26, 2009

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

(52) **U.S. Cl.** **343/702; 343/745**

(58) **Field of Classification Search** **343/702, 343/745**

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Douglas W Owens

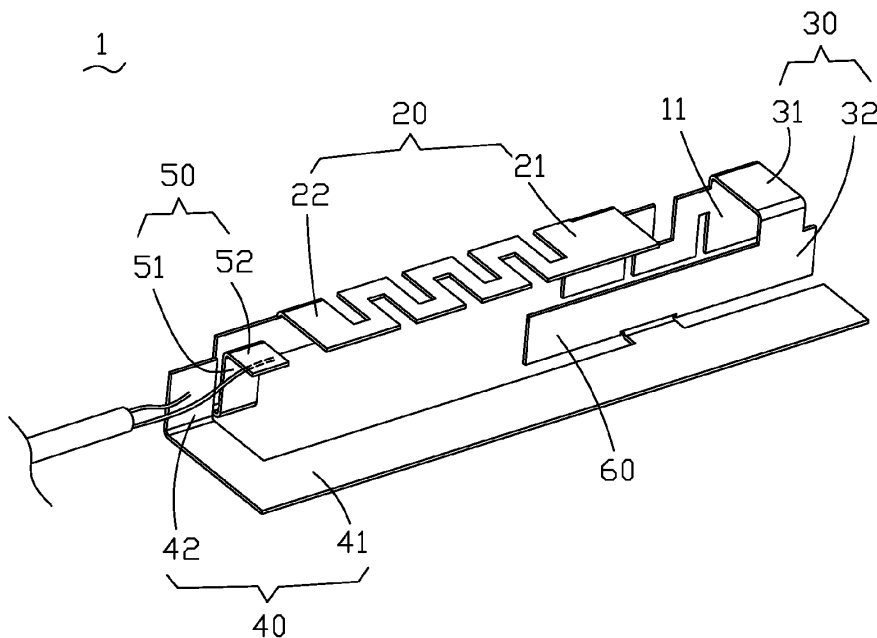
Assistant Examiner—Kyana R Robinson

(74) *Attorney, Agent, or Firm*—WPAT, P.C.; Anthony King

(57) **ABSTRACT**

A dual-band antenna has a first meandering portion, a second meandering portion and a connection portion defining two ends. The first meandering portion and the second meandering portion have different length. One end of the first meandering portion connects one end of the second meandering portion. The other end of the first meandering portion connects one end of the connection portion. The other end of the second meandering portion connects a ground portion. The other end of the connection portion connects a ground portion. The feeding portion, the second meandering portion, the first meandering portion and the connection portion obtain an electrical resonance corresponding to a first frequency range. The second meandering portion obtains an electrical resonance corresponding to a second frequency range.

10 Claims, 3 Drawing Sheets





US007728777B2

(12) **United States Patent**
Gapski et al.

(10) **Patent No.:** **US 7,728,777 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

- (54) **ANTENNA DEVICE FOR RADIO TELEPHONES**
- (75) Inventors: **Dietmar Gapski**, Bocholt (DE);
Stephan Herrmann, Bottrop (DE)
- (73) Assignee: **Gigaset Communications GmbH**,
Munich (DE)
- (*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 219 days.
- (21) Appl. No.: **11/922,677**
- (22) PCT Filed: **Apr. 12, 2006**
- (86) PCT No.: **PCT/EP2006/061555**

§ 371 (c)(1),
(2), (4) Date: **Dec. 21, 2007**
- (87) PCT Pub. No.: **WO2007/000360**

PCT Pub. Date: **Jan. 4, 2007**
- (65) **Prior Publication Data**
US 2009/0231209 A1 Sep. 17, 2009
- (30) **Foreign Application Priority Data**
Jun. 29, 2005 (DE) 10 2005 030 384
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702; 343/700 MS**
- (58) **Field of Classification Search** **343/702,**
343/700 MS, 846, 873

See application file for complete search history.

- (56) **References Cited**
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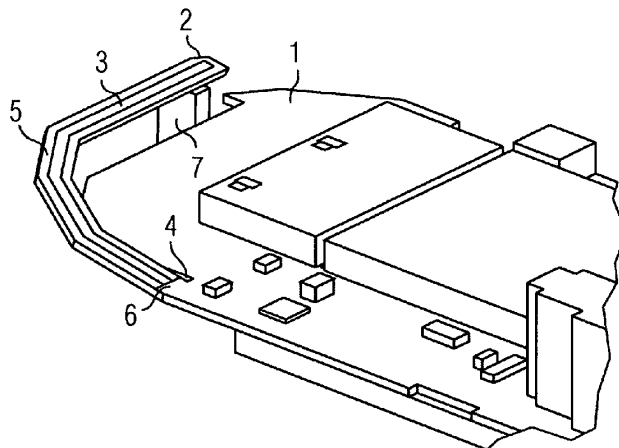
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DE 696 22 451 T2, DE 201 12 076 U1 and FR 2 748 161.
Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Staas & Halsey LLP

(57) **ABSTRACT**

An antenna device for radio telephone based on a printed circuit board antenna or a strip conductor antenna and simple to produce and has a high efficiency, but nevertheless ensures that the user of the radio telephone is less exposed to the effects of electromagnetic radiation and the parasitic interference of the telephone caused by the user is reduced. To this end, the strip conductor carrier is cut around strip conductors used as the antenna up to a section used for the connection of the strip conductor used as the antenna to the other strip conductors of the strip conductor carrier. Furthermore, at least when the strip conductor carrier is mounted in the radio telephone, the cut-out regions of the strip conductor carrier, carrying the strip conductor used as the antenna is deflected out of the plane of the other regions of the strip conductor carrier.

6 Claims, 2 Drawing Sheets





US007728778B2

(12) **United States Patent**
Tsao et al.

(10) **Patent No.:** **US 7,728,778 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

(54) **PORTABLE ELECTRONIC DEVICE WITH RECEIVER AND ANTENNA**

(58) **Field of Classification Search** 343/702,
343/700 MS; 455/575.5, 557
See application file for complete search history.

(75) Inventors: **Mei-Tsu Tsao**, Tu-Cheng (TW);
Hung-Chuan Wen, Tu-Cheng (TW)

(56) **References Cited**

(73) Assignee: **Chi Mei Communication Systems, Inc.**, Tu-Cheng, Taipei County (TW)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 165 days.

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2006/0089184 A1 * 4/2006 Kim et al. 455/575.5

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(21) Appl. No.: **11/952,967**

Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Jeffrey T. Knapp

(22) Filed: **Dec. 7, 2007**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2009/0021433 A1 Jan. 22, 2009

A portable electronic device (22) includes a receiver (21), an antenna (25) attached to the receiver, an antenna circuit board (24) electrically connected with the antenna, and a container (26) therein. The receiver has a resonance cavity (2113) defined therein. The antenna circuit board is fixed to the receiver and is used for obturating the resonance cavity. The container is used for receiving the antenna circuit board and the receiver therein.

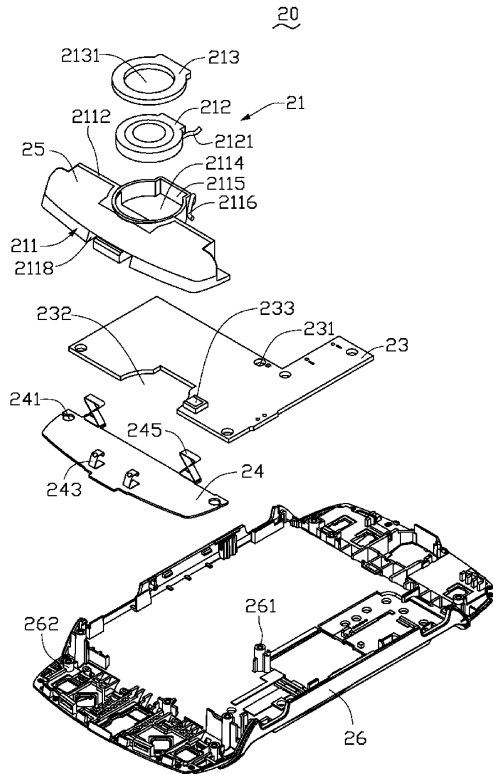
(30) **Foreign Application Priority Data**

Jul. 18, 2007 (CN) 2007 1 0075207

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

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

14 Claims, 3 Drawing Sheets





US007728780B2

(12) **United States Patent**
Ishida

(10) **Patent No.:** **US 7,728,780 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

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

7,236,070 B2* 6/2007 Ajioka et al. 333/247
7,372,408 B2* 5/2008 Gaucher et al. 343/700 MS
7,583,237 B2* 9/2009 Noro et al. 343/860

(75) Inventor: **Masaaki Ishida**, Kawasaki (JP)

FOREIGN PATENT DOCUMENTS

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

JP 2006-33076 2/2006

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 205 days.

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Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(21) Appl. No.: **12/129,087**

(57) **ABSTRACT**

(22) Filed: **May 29, 2008**

(65) **Prior Publication Data**

US 2008/0297422 A1 Dec. 4, 2008

(30) **Foreign Application Priority Data**

May 30, 2007 (JP) 2007-144030

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

(52) **U.S. Cl.** **343/702**; 343/846

(58) **Field of Classification Search** 343/702,
343/700 MS, 846, 848

See application file for complete search history.

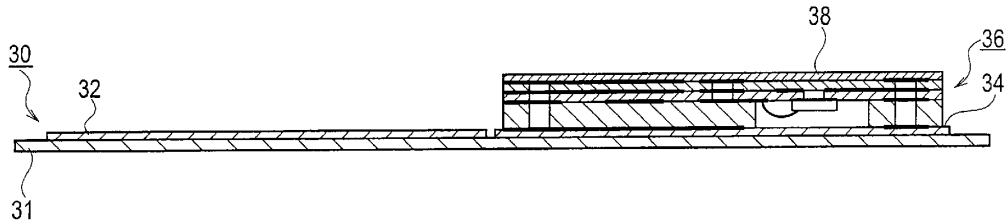
An antenna device includes an antenna substrate **30** and a multilayer substrate **36** mounted on the antenna substrate **30**. The antennal substrate **30** includes an insulating part **31**, an antenna element **32** composed of a conductor pattern formed on a predetermined principal surface and a ground part **34** connected to the antenna element **32** electrically and formed on the principal surface. The multilayer substrate **36** includes a wiring pattern formed in an inside layer, an opening through which the wiring pattern is exposed on the side of one principal surface of the multilayer substrate **36**, a plurality of through-holes formed so as to surround the opening and penetrate the inside layer of the multilayer substrate **36** while extending from the one principal surface and a ground layer **38** arranged to make contact with respective other ends of the through-holes and arranged in a position to interleave the wiring pattern against the opening. The antenna substrate **30** is electrically joined to the multilayer substrate **36** through the through-holes.

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9 Claims, 9 Drawing Sheets





US007728783B2

(12) **United States Patent**
Su et al.

(10) **Patent No.:** **US 7,728,783 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

(54) **ANTENNA STRUCTURE**

(75) Inventors: **Jia-Hung Su**, Tu-Cheng (TW);
Ching-Chi Lin, Tu-Cheng (TW);
Hung-Jen Chen, Tu-Cheng (TW); **Kai Shih**, Tu-Cheng (TW); **Yu-Yuan Wu**, Tu-Cheng (TW)

(73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 202 days.

(21) Appl. No.: **11/828,934**

(22) Filed: **Jul. 26, 2007**

(65) **Prior Publication Data**

US 2009/0027275 A1 Jan. 29, 2009

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 9/42 (2006.01)

(52) **U.S. Cl.** **343/846; 343/829**

(58) **Field of Classification Search** **343/700 MS, 343/702, 829, 846, 828, 848**

See application file for complete search history.

(56) **References Cited**

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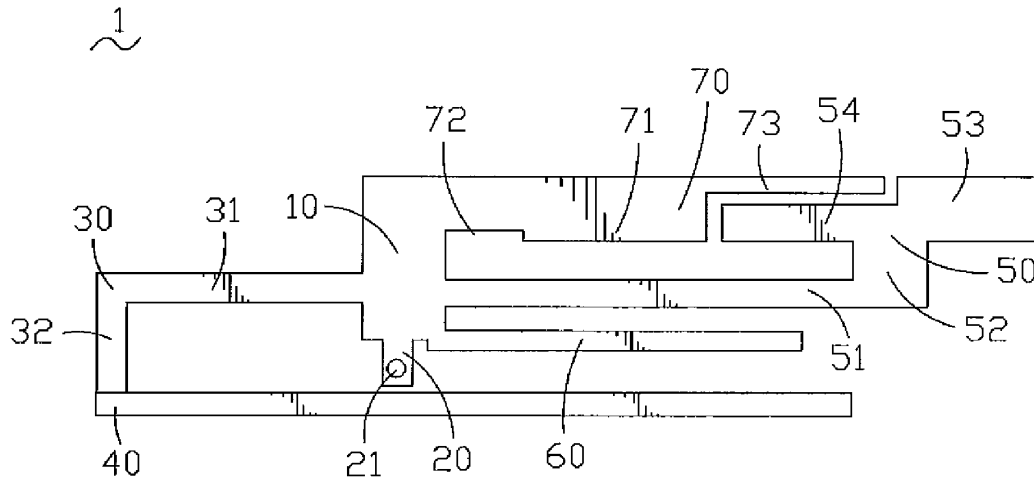
Primary Examiner—Michael C Wimer

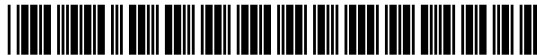
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

An antenna structure includes a connection portion. A feed portion connecting to the connection portion defines a feed point thereon. An inductance portion extends from the connection portion, and a free end of the inductance portion connects to a ground end. A capacitance portion that is in a long narrow strip shape extends from the connection portion and is parallel with and adjacent to the ground end. And radiating portions connect to the connection portion respectively. The antenna structure employs the inductance portion, the capacitance portion and the ground end to simulate a LC parallel connection to substitute for an inductor and a capacitor. Therefore, the antenna structure achieves an aim of adjusting a resonance frequency and an impedance matching without the inductor and the capacitor, simplifying the design of the antenna structure, decreasing the manufacture cost and attaining a good performance.

15 Claims, 2 Drawing Sheets





US007728785B2

(12) **United States Patent**
Ozden

(10) **Patent No.:** **US 7,728,785 B2**

(45) **Date of Patent:** **Jun. 1, 2010**

(54) **LOOP ANTENNA WITH A PARASITIC RADIATOR**

6,917,339 B2 7/2005 Li et al. 343/702
7,119,748 B2 10/2006 Autti 343/702
7,298,338 B2 11/2007 Vesterinen 343/702

(75) Inventor: **Sinasi Ozden**, Copenhagen (DK)

(73) Assignee: **Nokia Corporation**, Espoo (FI)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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EP 0923-158 A2 6/1999

(21) Appl. No.: **11/350,155**

(22) Filed: **Feb. 7, 2006**

(Continued)

(65) **Prior Publication Data**

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Virga, K.L., et al., "Low-Profile Enhanced-Bandwidth PIFA Antennas for Wireless Communications Packaging", IEEE Transactions on Microwave Theory and Techniques, vol. 45, No. 10, Oct. 1997, pp. 1879-1888.

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

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

(58) **Field of Classification Search** 343/866,
343/702, 748, 895, 700 MS; 455/575.1,
455/575.7

See application file for complete search history.

Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Harrington & Smith

(57) **ABSTRACT**

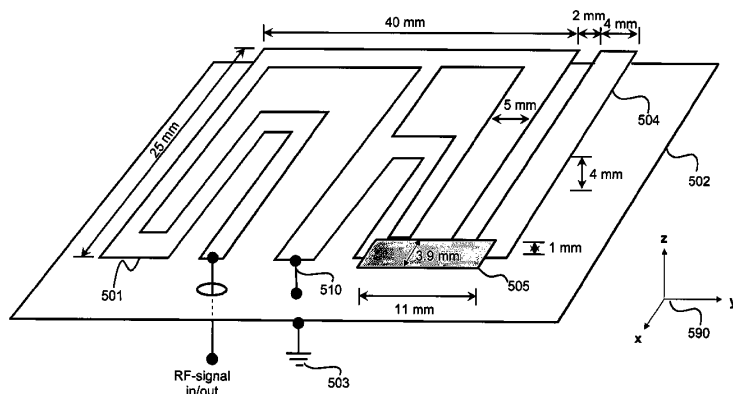
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6,707,428	B2	3/2004	Gram	343/700
6,765,536	B2	7/2004	Phillips et al.	343/702
6,885,342	B2 *	4/2005	Saegrov et al.	343/700 MS
6,917,335	B2 *	7/2005	Kadambi et al.	343/700 MS

It is an objective of the present invention to provide an antenna construction that allows the thickness of an antenna structure be lower than that of planar antennas according to prior art without sacrificing the radiation efficiency at the desired RF-bands as 900 MHz GSM and 1800 MHz/1900 MHz DCS/PCS. A further object of the invention is to provide an antenna construction that is insensitive to changes in positions of electrically conductive objects in the vicinity. The objectives of the invention are achieved by a loop antenna structure equipped with an electrically conductive parasitic radiator that is electro-magnetically coupled with the antenna loop. Performance at the DCS/PCS bands can be further improved by using an electrically conductive tuner element that provides a stronger electromagnetic coupling between the antenna loop and the parasitic radiator.

22 Claims, 9 Drawing Sheets





US007729721B2

(12) **United States Patent**
Kim

(10) **Patent No.:** **US 7,729,721 B2**
(45) **Date of Patent:** **Jun. 1, 2010**

(54) **ANTENNA INTEGRATED SPEAKER ASSEMBLY, MANUFACTURING METHOD THEREOF, AND WIRELESS COMMUNICATION DEVICE HAVING THE SAME**

(52) **U.S. Cl.** **455/550.1; 455/350; 455/575.7**
(58) **Field of Classification Search** **455/550.1, 455/557, 90.1, 90.3, 575.1, 575.3, 575.7, 455/350, 569.1, 562.1, 274, 347**
See application file for complete search history.

(75) Inventor: **Hyun-Jun Kim**, Gyeonggi-Do (KR)

(56) **References Cited**

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 879 days.

7,167,130 B2 * 1/2007 Hayes 343/702
7,376,447 B2 * 5/2008 Yoshida et al. 455/569.1

(21) Appl. No.: **11/521,450**

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(22) Filed: **Sep. 15, 2006**

Primary Examiner—Eugene Yun
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

(65) **Prior Publication Data**

US 2007/0066274 A1 Mar. 22, 2007

(57) **ABSTRACT**

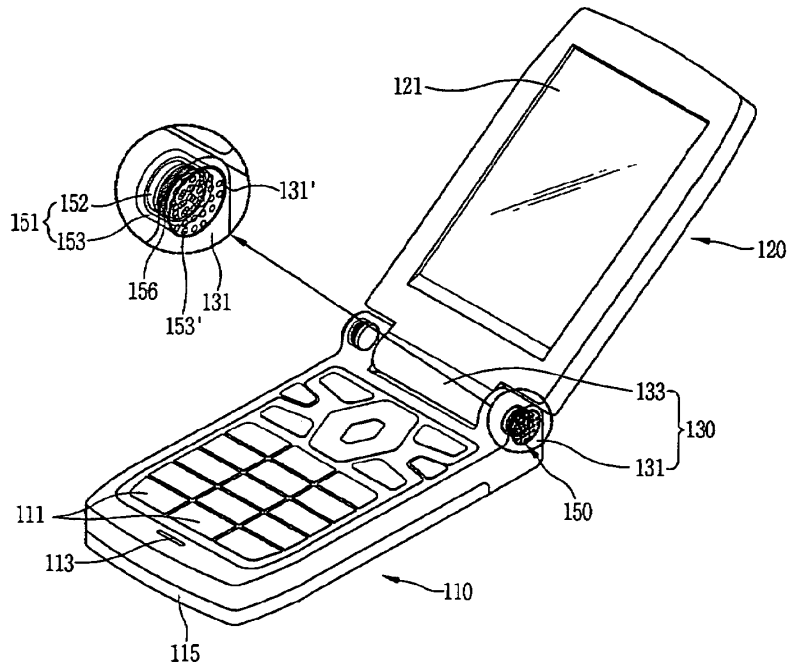
(30) **Foreign Application Priority Data**

Sep. 16, 2005 (KR) 10-2005-0087119
Sep. 16, 2005 (KR) 10-2005-0087120

An antenna integrated speaker assembly, a manufacturing method thereof, and a wireless communication device having the same. The antenna integrated speaker assembly comprises a speaker unit for outputting sound corresponding to an electric signal of a controller; and an antenna unit formed at the speaker unit, for transceiving an electric signal by an interwork with the controller. Accordingly, an installation space for an antenna and a speaker is minimized.

(51) **Int. Cl.**
H04M 1/00 (2006.01)
H04B 1/08 (2006.01)

15 Claims, 6 Drawing Sheets





US007733271B2

(12) **United States Patent**
Moon et al.

(10) **Patent No.:** **US 7,733,271 B2**
(45) **Date of Patent:** **Jun. 8, 2010**

(54) **DUAL-BAND PLANAR INVERTED-F ANTENNA**
(75) Inventors: **Young-min Moon**, Seoul (KR);
Young-eil Kim, Suwon-si (KR);
Gyoo-soo Chae, Cheonan-si (KR)

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2007/0069958	A1 *	3/2007	Ozkar	343/700 MS
2008/0168384	A1 *	7/2008	Platzer et al.	715/784

(73) Assignee: **Samsung Electronics Co., Ltd.**,
Suwon-si (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 11 days.

(21) Appl. No.: **11/347,217**

(22) Filed: **Feb. 6, 2006**

(65) **Prior Publication Data**
US 2006/0176226 A1 Aug. 10, 2006

(30) **Foreign Application Priority Data**
Feb. 4, 2005 (KR) 10-2005-0010759

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

(52) **U.S. Cl.** **343/700 MS; 343/833; 343/834**

(58) **Field of Classification Search** **343/700 MS, 343/833-834**
See application file for complete search history.

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6,795,028	B2 *	9/2004	Stutzman et al.	343/702
7,026,996	B2 *	4/2006	Harano	343/700 MS
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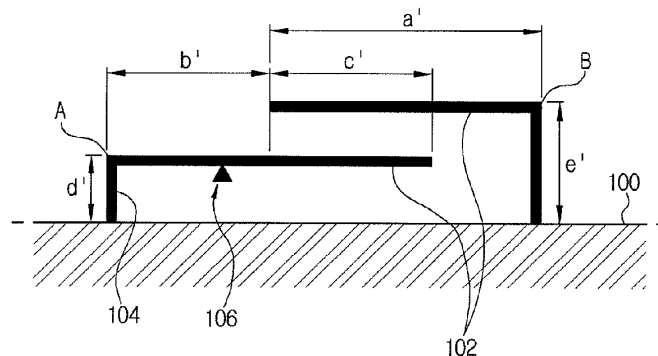
"Antenna Frequency Scaling" from "The ARRL Antenna Book", Published by The American Radio Relay League, Copyright @1988, p. 2-24 to 2-25.*

Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

An improved and more compact structure of a built-in antenna for handheld terminals, improving radiation pattern and efficiency. Provided is a planar inverted-F antenna having a radiation part having an inductive radiation portion and a parasitic radiation portion which are spaced in a certain distance apart from a ground surface, a power-supply part horizontally spaced apart from the ground surface and for directly supplying currents to the connected inductive radiation portion, and connection parts for connecting the radiation portions to the ground. The planar inverted-F antenna has an inductive antenna portion and a parasitic antenna portion, thereby reducing its volume compared to the conventional inverted-F antenna. Complicated manufacturing and processing procedures are simplified by connecting the power-supply part and a PCB.

12 Claims, 7 Drawing Sheets





US007733276B2

(12) **United States Patent**
Levy et al.

(10) **Patent No.:** US 7,733,276 B2
(45) **Date of Patent:** Jun. 8, 2010

(54) **ANTENNA SYSTEM FOR NOTEBOOK
COMPUTER AND METHOD FOR
COMMUNICATING IN MULTIPLE
WIRELESS SYSTEMS**

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(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 881 days.

(21) Appl. No.: **11/558,139**

(22) Filed: **Nov. 9, 2006**

(65) **Prior Publication Data**

US 2008/0111746 A1 May 15, 2008

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 3/24 (2006.01)

(52) **U.S. Cl.** **343/702; 343/876; 343/858**

(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**

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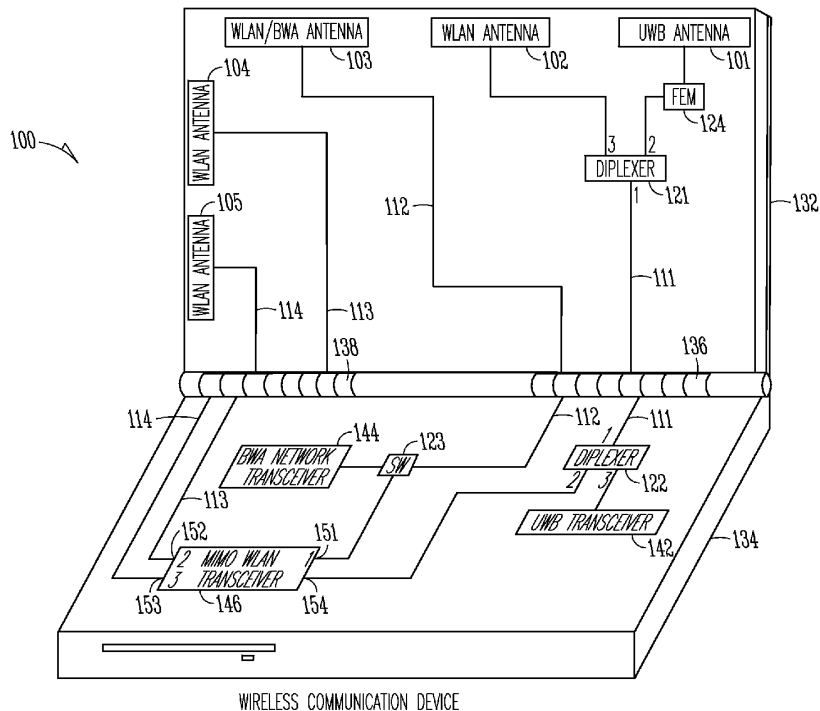
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(74) *Attorney, Agent, or Firm*—Schwegman, Lundberg & Woessner, P.A.; Gregory J. Gorrie

(57) **ABSTRACT**

Embodiments of an antenna system for notebook, laptop and portable computers and methods for communicating in multiple wireless systems are generally described herein. Other embodiments may be described and claimed. In some embodiments, a notebook computer comprises a plurality of transceivers, a plurality of antennas coupled to the transceivers with coaxial cables, and signal separation circuitry coupled to at least one of the coaxial cables to allow the at least one coaxial cable to be shared by two or more of the transceivers.

11 Claims, 1 Drawing Sheet





US007733277B2

(12) **United States Patent**
Lin et al.

(10) **Patent No.:** **US 7,733,277 B2**
(45) **Date of Patent:** **Jun. 8, 2010**

(54) **WIDE BAND ANTENNA**

7,319,432 B2 * 1/2008 Andersson 343/702
2005/0068234 A1 * 3/2005 Hung et al. 343/702

(75) Inventors: **Ching-Chi Lin**, Taipei Hsien (TW);
Jia-Hung Su, Taipei Hsien (TW); **Kai Shih**, Taipei Hsien (TW); **Yu-Yuan Wu**, Taipei Hsien (TW)

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(73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)

TW 095216657 9/2006

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 364 days.

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Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—WPAT, P.C.; Anthony King

(21) Appl. No.: **11/782,224**

(57) **ABSTRACT**

(22) Filed: **Jul. 24, 2007**

(65) **Prior Publication Data**

US 2009/0027273 A1 Jan. 29, 2009

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 19/10 (2006.01)

A wide band antenna mounted to a dielectric element has a first patch, a second patch spaced from the first patch and a ground patch. The first patch has a first portion with a feeding point thereat and a second portion connecting the first portion. The second patch has a third portion and a fourth portion connecting the third portion. The first portion and the second portion of the first patch space from and parallel the third portion and the fourth portion of the second patch respectively. The ground patch is close to the first portion of the first patch and the third portion of the second patch. The first patch obtains a first frequency range. The second patch responds electromagnetic energy from the first patch to obtain a second frequency range. Scope of the first and the second frequency ranges covers portion of ultra wide band communication frequency.

(52) **U.S. Cl.** **343/702**; 343/700 MS; 343/818

(58) **Field of Classification Search** 343/700 MS, 343/702, 818, 846
See application file for complete search history.

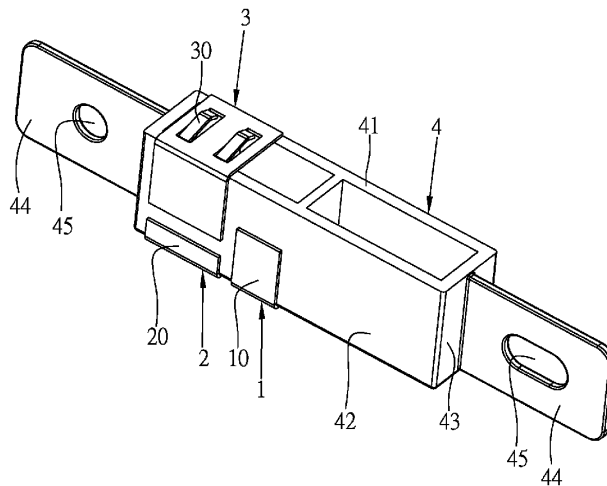
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5 Claims, 4 Drawing Sheets

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US007733278B2

(12) **United States Patent**
Kanasaki et al.

(10) **Patent No.:** **US 7,733,278 B2**
(45) **Date of Patent:** **Jun. 8, 2010**

(54) **PORTABLE WIRELESS DEVICE** 7,162,284 B2 * 1/2007 Kobayashi et al. 455/575.5
7,376,449 B2 * 5/2008 Mizuta et al. 455/575.3
(75) Inventors: **Yoshihiro Kanasaki**, Ishikawa (JP);
Akiyoshi Takeuchi, Ishikawa (JP);
Yutaka Saito, Ishikawa (JP); **Kouta**
Aoki, Kanagawa (JP) 7,436,364 B2 * 10/2008 Nishikido et al. 343/702
7,529,571 B2 * 5/2009 Byun et al. 455/575.4

(73) Assignee: **Panasonic Corporation**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 229 days.

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JP 3-280625 12/1991

(21) Appl. No.: **11/817,512**

(22) PCT Filed: **Feb. 21, 2006**

(86) PCT No.: **PCT/JP2006/303012**

§ 371 (c)(1),
(2), (4) Date: **Aug. 31, 2007**

(87) PCT Pub. No.: **WO2006/092979**

PCT Pub. Date: **Sep. 8, 2006**

(65) **Prior Publication Data**

US 2009/0033563 A1 Feb. 5, 2009

(30) **Foreign Application Priority Data**

Mar. 4, 2005 (JP) 2005-060787

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

(52) **U.S. Cl.** **343/702; 455/575.4**

(58) **Field of Classification Search** 343/702,
343/846; 455/575.1, 575.3, 575.4, 575.7,
455/575.8, 90.1, 90.3

See application file for complete search history.

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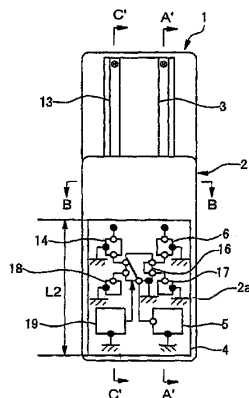
Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Pearne & Gordon LLP

(57) **ABSTRACT**

A portable wireless device is provided that eliminates the need for an antenna protruding from an housing by including a first housing and a second housing operating as a dipole antenna thus ensuring portability and delivering a high antenna performance despite its compact, low-profile and lightweight design.

The portable wireless device according to the invention includes a first housing 1; a second housing 2; and a sliding unit 21 for slidably coupling the first housing 1 and the second housing 2 to each other; wherein the first housing 1 is arranged a predetermined spacing apart from the second housing 2 and includes a power feeding unit 7 for feeding power: between the first housing 1 and the second housing 2 and wherein the first housing 1 and the second housing 2 operate as a dipole antenna. The portable wireless device does not include an antenna protruding from an housing. This ensures portability and delivers a high antenna performance despite its compact, low-profile and lightweight design.

5 Claims, 8 Drawing Sheets





US007733279B2

(12) **United States Patent**
Hozouri

(10) **Patent No.:** **US 7,733,279 B2**
(45) **Date of Patent:** **Jun. 8, 2010**

(54) **MULTI-BAND OR WIDE-BAND ANTENNA INCLUDING DRIVEN AND PARASITIC TOP-LOADING ELEMENTS**

6,788,257 B2 9/2004 Fang et al.

(Continued)

(76) Inventor: **Behzad Tavassoli Hozouri**, 3707 Poinciana Dr. #91, Santa Clara, CA (US) 95051

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 289 days.

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(21) Appl. No.: **11/918,021**

Guo, Yong-Xin et al., a Quarter-Wave U-Shaped Patch Antenna With Two Unequal Arms for Wideband and Dual-Frequency Operation, IEEE Transactions on Antennas and Propagation, vol. 50, No. 8, Aug. 2002.

(22) PCT Filed: **Apr. 6, 2006**

(86) PCT No.: **PCT/US2006/013128**

§ 371 (c)(1),
(2), (4) Date: **Oct. 5, 2007**

(Continued)

Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Workman Nydegger

(87) PCT Pub. No.: **WO2006/110564**

(57) **ABSTRACT**

PCT Pub. Date: **Oct. 19, 2006**

(65) **Prior Publication Data**

US 2009/0109096 A1 Apr. 30, 2009

A monopole-type antenna (10) for multi- or wide-band use to transmit or receive radio frequency electromagnetic energy. A feed point (12) provides energy into the antenna or receives energy from the antenna. A driven radiating section (16) includes a first top-loading element (22) and a feed conductor (20) that electrically connects the feed point linearly to the first top-loading element, yet with the driven radiating section not electrically connected to a grounding surface (14). A parasitic radiating section (18) includes a second top-loading element (26) and a bridge conductor (24) that electrically connects the second top-loading element linearly to the grounding surface. When energy is then provided at the feed point and conducted to the driven radiating section, it produces a first resonance mode, coupling at least some of the energy into and exciting the parasitic radiating section to produce a second resonance mode.

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

(52) **U.S. Cl.** **343/702; 343/700 MS**

(58) **Field of Classification Search** **343/700 MS, 343/702, 846**

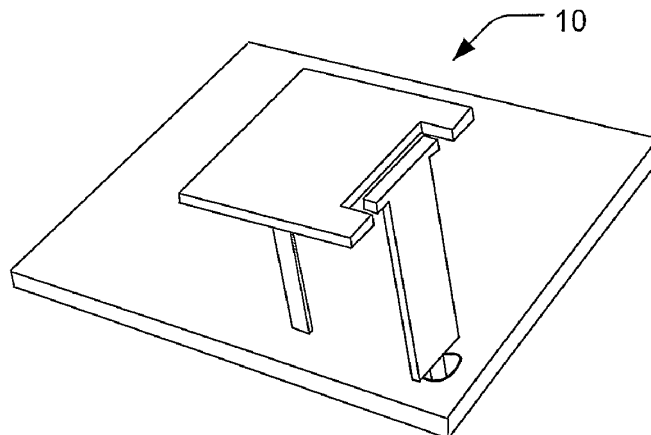
See application file for complete search history.

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- 6,433,756 B1 8/2002 Sievenpiper et al.
- 6,670,921 B2 12/2003 Sievenpiper et al.
- 6,727,854 B2 4/2004 Fang et al.

18 Claims, 6 Drawing Sheets





US007733286B2

(12) **United States Patent**
Chen et al.

(10) **Patent No.:** **US 7,733,286 B2**
(45) **Date of Patent:** **Jun. 8, 2010**

(54) **WIDEBAND PRINTED DIPOLE ANTENNA FOR WIRELESS APPLICATIONS**

(75) Inventors: **Wen-Shan Chen**, Kaohsiung (TW);
Yen-Hao Yu, Taipei (TW)

(73) Assignee: **Southern Taiwan University**, Tainan County (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 186 days.

(21) Appl. No.: **12/126,960**

(22) Filed: **May 26, 2008**

(65) **Prior Publication Data**

US 2009/0289867 A1 Nov. 26, 2009

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

(52) **U.S. Cl.** **343/795; 343/793; 343/700 MS**

(58) **Field of Classification Search** **343/700 MS, 343/793, 795, 820**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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et al. 343/700 MS

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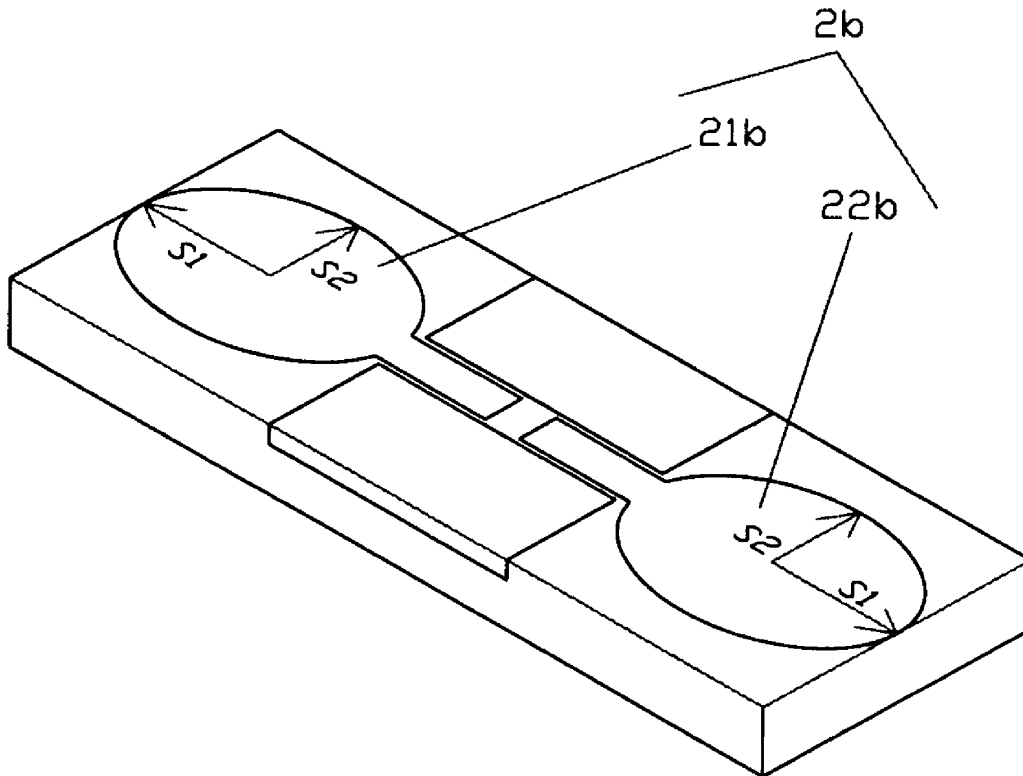
Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Rosenberg, Klein & Lee

(57) **ABSTRACT**

In a broadband printed dipole antenna for wireless applications, metal plates of a radiation portion, a feed-in portion and a bandwidth modulation portion are formed on a substrate. Two radiation portions come with a specific shape and have an interval between the two radiation portions. The feed-in portion is composed of two separated long bars and coupled to one of the specific shaped radiation portions. The bandwidth modulation portion is disposed symmetrically adjacent to the feed-in portion, such that the impedance matching can be adjusted to form a broadband dipole antenna for WiMAX applications.

6 Claims, 27 Drawing Sheets





US007737897B2

(12) **United States Patent**
Takeuchi et al.

(10) **Patent No.:** **US 7,737,897 B2**
(45) **Date of Patent:** **Jun. 15, 2010**

(54) **PORTABLE WIRELESS APPARATUS** 2006/0121933 A1* 6/2006 Ikeda 455/550.1
2009/0128424 A1* 5/2009 Suzuki et al. 343/702

(75) Inventors: **Akiyoshi Takeuchi**, Ishikawa (JP);
Yutaka Saito, Ishikawa (JP); **Kouta Aoki**, Kanagawa (JP)

(73) Assignee: **Panasonic Corporation**, Kadoma-shi (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/815,312**

(22) PCT Filed: **Feb. 1, 2006**

(86) PCT No.: **PCT/JP2006/301687**

§ 371 (c)(1),
(2), (4) Date: **Sep. 17, 2008**

(87) PCT Pub. No.: **WO2006/082860**

PCT Pub. Date: **Aug. 10, 2006**

(65) **Prior Publication Data**

US 2009/0033562 A1 Feb. 5, 2009

(30) **Foreign Application Priority Data**

Feb. 1, 2005 (JP) 2005-025007

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

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

(58) **Field of Classification Search** 343/702,
343/745, 748, 850; 455/575.7

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Huedung Mancuso

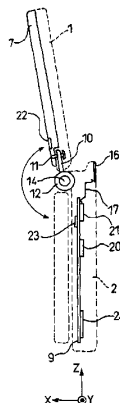
(74) *Attorney, Agent, or Firm*—Christensen O'Connor Johnson Kindness PLLC

(57) **ABSTRACT**

The present invention provides a folding type and portable wireless apparatus with a built-in antenna, particularly a portable wireless apparatus that reduces a local average SAR and improves performance of antenna.

A housing open/close detecting unit 6 detects open/close of bodies 1 and 2. When the bodies 1 and 2 are open, a first antenna 4 and a wireless circuit 24 are connected and resonant frequency of a second antenna 5 is adjusted into a first frequency bandwidth, and when the bodies 1 and 2 are closed, the resonant frequency of the second antenna 5 is adjusted into the first frequency bandwidth and a second frequency bandwidth and a wireless circuit 24 is connected. Therefore, when the bodies 1 and 2 are open, it is possible to reduce a local average SAR by separating an antenna current. Further, when the bodies 1 and 2 are closed, it is possible to obtain a high antenna gain.

3 Claims, 5 Drawing Sheets





US007737901B2

(12) **United States Patent**
Su et al.

(10) **Patent No.:** **US 7,737,901 B2**
(45) **Date of Patent:** **Jun. 15, 2010**

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Wen-Fong Su**, Tu-Cheng (TW);
Hsien-Sheng Tseng, Tu-Cheng (TW);
Shang-Jen Chen, Tu-Cheng (TW);
Lung-Shena Tai, Tu-Cheng (TW)

(73) Assignee: **Hon Hai Precision Ind. Co., Ltd**, Taipei
Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 175 days.

(21) Appl. No.: **11/824,784**

(22) Filed: **Jul. 3, 2007**

(65) **Prior Publication Data**

US 2008/0001826 A1 Jan. 3, 2008

(30) **Foreign Application Priority Data**

Jul. 3, 2006 (CN) 09 5 124096

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 13/10 (2006.01)

(52) **U.S. Cl.** **343/767**; 343/729; 343/846

(58) **Field of Classification Search** 343/700 MS,
343/702, 829, 767, 795, 846

See application file for complete search history.

(56) **References Cited**

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7,042,414 B1 5/2006 Lee

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Primary Examiner—Michael C Wimer

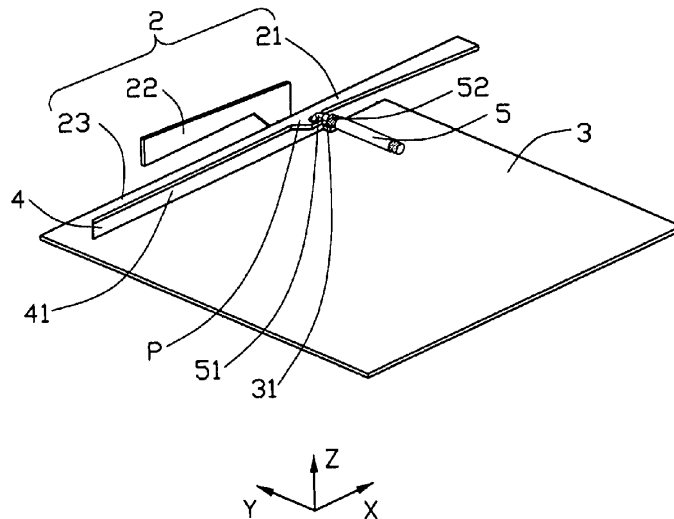
(74) *Attorney, Agent, or Firm*—Wei Te Chung; Andrew C.
Cheng; Ming Chieh Chang

(57) **ABSTRACT**

A multi-band antenna, made by an integral plate and comprises a radiating element, a grounding element, a slit formed as part of the plate, and a feeding line; wherein horizontal conductive portion of said plate are separated from each other with said slit between them and serve as the radiating element and the ground element respectively; the feeding line, comprising an inner conductor connected with the radiating element and an outer conductor connected with the grounding element; wherein said radiating element comprising at least two radiating portions defining at least one radiating arm with gradually increasing width, and at least two radiating portion cooperatively acting to achieve a Ultra Wide Band antenna.

18 Claims, 3 Drawing Sheets

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US007737905B1

(12) **United States Patent**
Meloling et al.

(10) **Patent No.:** **US 7,737,905 B1**
(45) **Date of Patent:** **Jun. 15, 2010**

(54) **BROADBAND FERRITE LOADED LOOP ANTENNA**

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(75) Inventors: **John Harold Meloling**, San Diego, CA (US); **David Carlos Dawson**, Lemon Grove, CA (US); **Peder Meyer Hansen**, San Diego, CA (US)

(73) Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, DC (US)

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Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Kyle Eppelle; J. Eric Anderson

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 183 days.

(57) **ABSTRACT**

(21) Appl. No.: **12/200,425**

A ferrite-loaded broadband loop antenna having nearly comparable transmit/receive characteristics is disclosed. The antenna contains a low loss ferrite core having a width-to-height ratio of approximately 24 and a depth-to-height ratio of approximately 6, and an antenna feed plate assembly centered about the long axis of the ferrite core, having a width-to-height ratio of approximately 6 and a width-to-depth ratio of approximately 1, and a balanced feed located at the center of the antenna feed plate assembly, positioned on the radiating side of the antenna, and a low loss center element in the ferrite core, the center element having at least one of a loss tangent and a permeability that is lower than the ferrite core, and a grounding surface coupled to the antenna feed plates.

(22) Filed: **Aug. 28, 2008**

(51) **Int. Cl.**
H01Q 7/08 (2006.01)
H01Q 1/00 (2006.01)

(52) **U.S. Cl.** **343/788; 343/787**

(58) **Field of Classification Search** **343/787, 343/788**

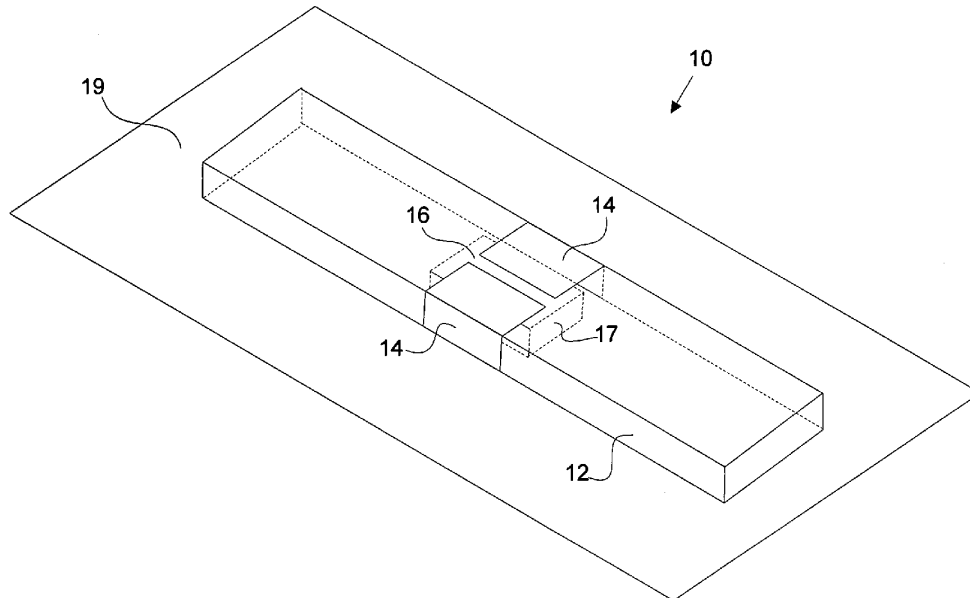
See application file for complete search history.

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20 Claims, 9 Drawing Sheets





US007737907B2

(12) **United States Patent**
Tsai et al.

(10) **Patent No.:** **US 7,737,907 B2**
(45) **Date of Patent:** **Jun. 15, 2010**

- (54) **PLANAR ANTENNA**
- (75) Inventors: **Tiao-Hsing Tsai**, Yungho (TW);
Chih-Wei Liao, Yilan Shien (TW);
Chao-Hsu Wu, Tao Yuan Shien (TW)
- (73) Assignee: **Quanta Computer Inc.** (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 31 days.
- (21) Appl. No.: **12/174,757**
- (22) Filed: **Jul. 17, 2008**
- (65) **Prior Publication Data**
US 2009/0237308 A1 Sep. 24, 2009
- (30) **Foreign Application Priority Data**
Mar. 19, 2008 (TW) 97109619 A
- (51) **Int. Cl.**
H01Q 9/30 (2006.01)
- (52) **U.S. Cl.** **343/828; 343/702; 343/829**
- (58) **Field of Classification Search** **343/700 MS, 343/702, 846, 828-830, 833**
See application file for complete search history.

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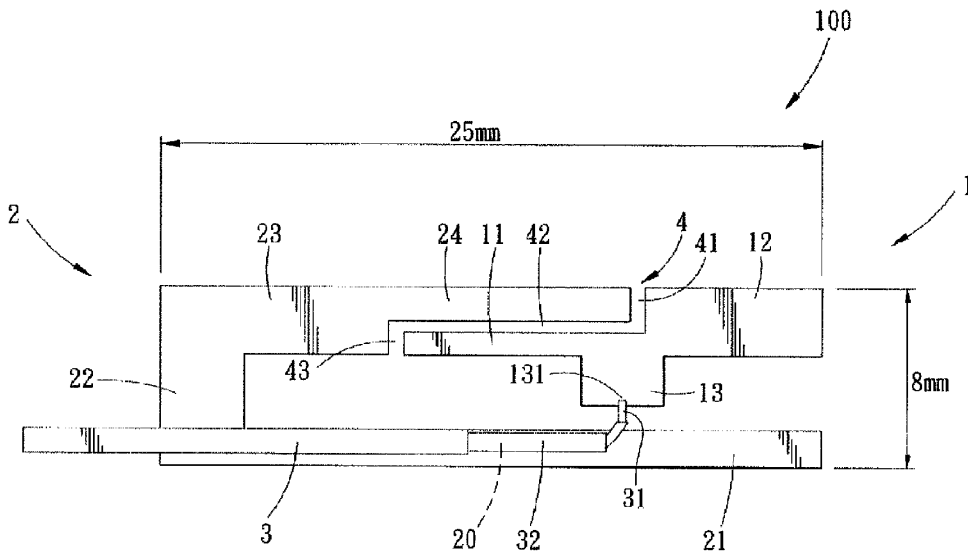
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Primary Examiner—Michael C Wimer
(74) *Attorney, Agent, or Firm*—Sunstein Kann Murphy & Timbers LLP

(57) **ABSTRACT**

An antenna includes first and second radiating elements. The first radiating element is operable in a first frequency range. The second radiating element cooperates with the first radiating element to define a slot therebetween in such a manner that the second radiating element is coupled electromagnetically to the first radiating element. The construction as such permits operation of the second radiating element in a second frequency range different from the first frequency range, and a third frequency range different from the first and second frequency ranges.

19 Claims, 7 Drawing Sheets





US007737908B2

(12) **United States Patent**
Yanagi et al.

(10) **Patent No.:** **US 7,737,908 B2**
(45) **Date of Patent:** **Jun. 15, 2010**

(54) **ANTENNA APPARATUS**

(75) Inventors: **Masahiro Yanagi**, Shinagawa (JP); **Shigemi Kurashima**, Shinagawa (JP); **Hideki Iwata**, Shinagawa (JP); **Takashi Yuba**, Shinagawa (JP); **Masahiro Kaneko**, Shinagawa (JP); **Yuriko Segawa**, Shinagawa (JP); **Takashi Arita**, Shinagawa (JP); **Toshihiro Kusagaya**, Shinagawa (JP); **Kazuhiko Ikeda**, Iiyama (JP); **Hiroshi Matsumiya**, Iiyama (JP); **Kazuo Nomura**, Iiyama (JP)

(73) Assignee: **Fujitsu Component Limited**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 335 days.

(21) Appl. No.: **11/581,376**

(22) Filed: **Oct. 17, 2006**

(65) **Prior Publication Data**
US 2007/0229360 A1 Oct. 4, 2007

(30) **Foreign Application Priority Data**
Mar. 30, 2006 (JP) 2006-094429
Sep. 6, 2006 (JP) 2006-242016

(51) **Int. Cl.**
H01Q 1/40 (2006.01)

(52) **U.S. Cl.** **343/846; 343/700 MS; 343/873**

(58) **Field of Classification Search** 343/700 MS, 343/829, 830, 846, 872, 873
See application file for complete search history.

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Primary Examiner—Tho G Phan

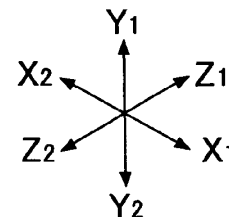
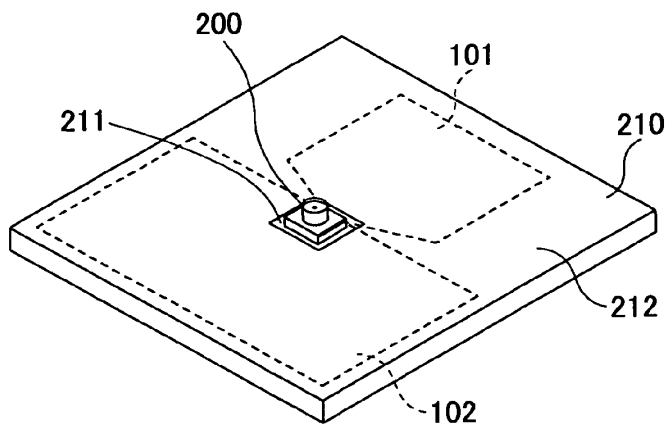
(74) *Attorney, Agent, or Firm*—Staas & Halsey LLP

(57) **ABSTRACT**

A disclosed antenna apparatus includes: a punched out antenna element made of a sheet metal; a punched out ground element made of a sheet metal, the ground element facing the antenna element; and a surface mount type coaxial connector mounted across the antenna element and the ground element.

3 Claims, 27 Drawing Sheets

100





US007737909B2

(12) **United States Patent**
Pan

(10) **Patent No.:** **US 7,737,909 B2**
(45) **Date of Patent:** **Jun. 15, 2010**

(54) **ANTENNA STRUCTURE FOR TWO OVERLAPPING FREQUENCY BANDS**

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

(73) Assignee: **Palm, Inc.**, Sunnyvale, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 493 days.

(21) Appl. No.: **10/539,665**

(22) PCT Filed: **Nov. 18, 2003**

(86) PCT No.: **PCT/DE03/03821**

§ 371 (c)(1),
(2), (4) Date: **Jun. 14, 2005**

(87) PCT Pub. No.: **WO2004/054036**

PCT Pub. Date: **Jun. 24, 2004**

(65) **Prior Publication Data**

US 2006/0152429 A1 Jul. 13, 2006

(30) **Foreign Application Priority Data**

Dec. 12, 2002 (DE) 102 58 184

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

(52) **U.S. Cl.** **343/895**; 343/700 MS

(58) **Field of Classification Search** 343/895,
343/700 MS

See application file for complete search history.

(56) **References Cited**

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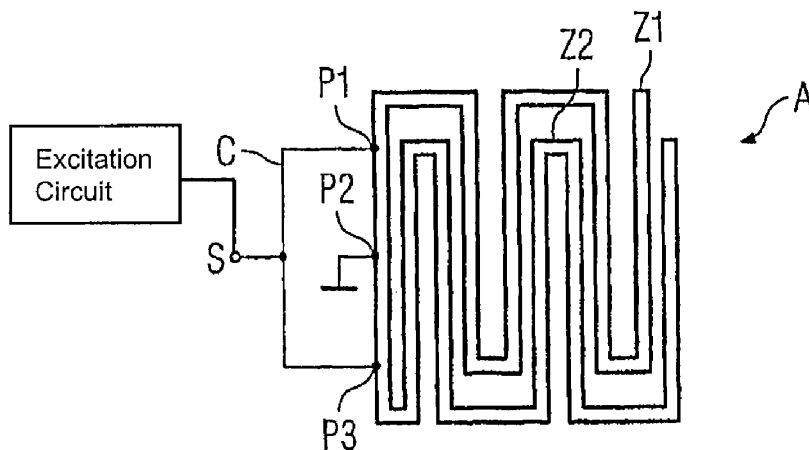
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Primary Examiner—Douglas W Owens
Assistant Examiner—Dieu Hien T Duong
(74) *Attorney, Agent, or Firm*—K&L Gates LLP

(57) **ABSTRACT**

The present disclosure relates to a substantially flat antenna structure which includes a frame earth terminal and at least one HF feed connection, which can be used for at least two frequency bands. From one foot area outwards, which includes the frame earth terminal, the antenna structure includes two antenna branches. Two distanced HF feed connections are provided in the foot area. The two antenna branches of the antenna structure are embodied in such a way that the associated frequency bands overlap.

5 Claims, 2 Drawing Sheets





US007741999B2

(12) **United States Patent**
Mierke et al.

(10) **Patent No.:** **US 7,741,999 B2**
(45) **Date of Patent:** **Jun. 22, 2010**

(54) **MULTILAYER ANTENNA OF PLANAR CONSTRUCTION**

2006/0202900 A1* 9/2006 Simile 343/792.5
2006/0238432 A1* 10/2006 Mikami et al. 343/795
2007/0216589 A1* 9/2007 Li et al. 343/713

(75) Inventors: **Frank Mierke**, Munich (DE); **Gerald Schillmeier**, Munich (DE)

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(73) Assignee: **Kathrein-Werke KG**, Rosenheim (DE)

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EP 1376758 A1 1/2004
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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 334 days.

(21) Appl. No.: **11/453,253**

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(22) Filed: **Jun. 15, 2006**

Robert E. Munson: "Conformal Microstrip Antennas and Microstrip Phased Arrays," IEEE Transactions on Antennas and Propagation, pp. 74-78 (Jan. 1974).
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(65) **Prior Publication Data**

US 2008/0122697 A1 May 29, 2008

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

(Continued)

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

Primary Examiner—Douglas W Owens

(58) **Field of Classification Search** **343/700 MS**
See application file for complete search history.

Assistant Examiner—Dieu Hien T Duong

(74) *Attorney, Agent, or Firm*—Nixon & Vanderhye PC

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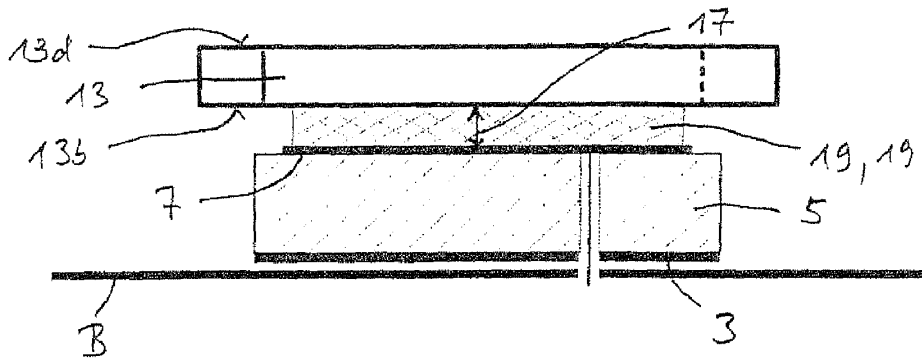
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2006/0001574 A1* 1/2006 Petros 343/702

A multilayer antenna of planar construction comprises an electrically conductive ground face and a conductive radiation face which is arranged with lateral spacing from the ground face and extends substantially parallel thereto. A dielectric carrier is arranged between the ground face and the radiation face. Above the radiation face there is a carrying means. Above the carrying means there is provided an electrically conductive patch element. The carrying means has a thickness or height which is less than the thickness or height of the patch element.

23 Claims, 5 Drawing Sheets





US007742001B2

(12) **United States Patent**
Humphrey et al.

(10) **Patent No.:** **US 7,742,001 B2**
(45) **Date of Patent:** **Jun. 22, 2010**

(54) **TWO-TIER WIDE BAND ANTENNA**

(75) Inventors: **Denver Humphrey**, Broughshane (GB);
Brian Kearns, Dublin (IE); **Bee Yen Toh**, Lisburn (GB)

(73) Assignee: **TDK Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 213 days.

(21) Appl. No.: **12/078,440**

(22) Filed: **Mar. 31, 2008**

(65) **Prior Publication Data**

US 2009/0243937 A1 Oct. 1, 2009

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/702, 846

See application file for complete search history.

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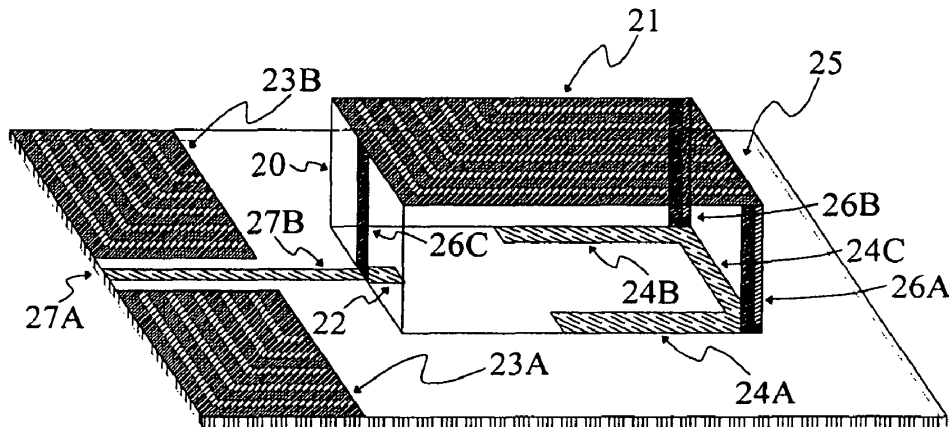
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Oliff & Berridge, PLC

(57) **ABSTRACT**

A two-tier wideband antenna comprising a chip of a dielectric material with an upper radiating structure and a lower radiating structure, the dielectric chip being mounted on an insulating carrier substrate which includes a feed-line to connect the antenna to a transceiver device. The lower radiating structure comprises two side elements which have a large aspect ratio so as to reduce the frequency of the lower band edge of the frequency response of the antenna when compared with the frequency response of a monopole patch antenna fabricated on a similar dielectric chip. The antenna of the present invention is suitable for operation over an ultra wideband, e.g. a frequency range extending from 3.1 to 10.6 GHz.

22 Claims, 6 Drawing Sheets





US007742003B2

(12) **United States Patent**
Tseng et al.

(10) **Patent No.:** **US 7,742,003 B2**
(45) **Date of Patent:** **Jun. 22, 2010**

(54) **BROADBAND ANTENNA AND AN ELECTRONIC DEVICE THEREOF**

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2005/0128151 A1	6/2005	Kwak et al.	

(75) Inventors: **Kuan-Hsueh Tseng**, Taipei Hsien (TW);
Yi-Ling Chiu, Taipei Hsien (TW)

(73) Assignee: **Wistron Neweb Corp.**, Taipei Hsien (TW)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 203 days.

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WO	WO 02/29988 A1	4/2002

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(21) Appl. No.: **12/219,086**

Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(22) Filed: **Jul. 16, 2008**

(65) **Prior Publication Data**

(57) **ABSTRACT**

US 2009/0046016 A1 Feb. 19, 2009

(30) **Foreign Application Priority Data**

A broadband antenna for wireless signal transmission of an electronic device is disclosed. The broadband antenna has a radiating element, a grounding element, a short-circuiting element and a feeding plane. The radiating element has a first radiation area and a second radiation area, the first radiation area and the second radiation area perpendicularly connected to each other substantially. The feeding plane perpendicularly connected to the second radiation area substantially, the feeding plane comprising a feeding point, a first end and a second end; wherein a distance between the feeding point and the first end is less than a distance between the feeding point and the second end. The short-circuiting element is used for connecting the first radiation area with the grounding element or connecting the feeding plane with the grounding element.

Aug. 14, 2007	(TW)	96213418 U
Jun. 13, 2008	(TW)	97210544 U

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

(52) **U.S. Cl.** **343/702; 343/700 MS**

(58) **Field of Classification Search** **343/702, 343/700 MS, 846**

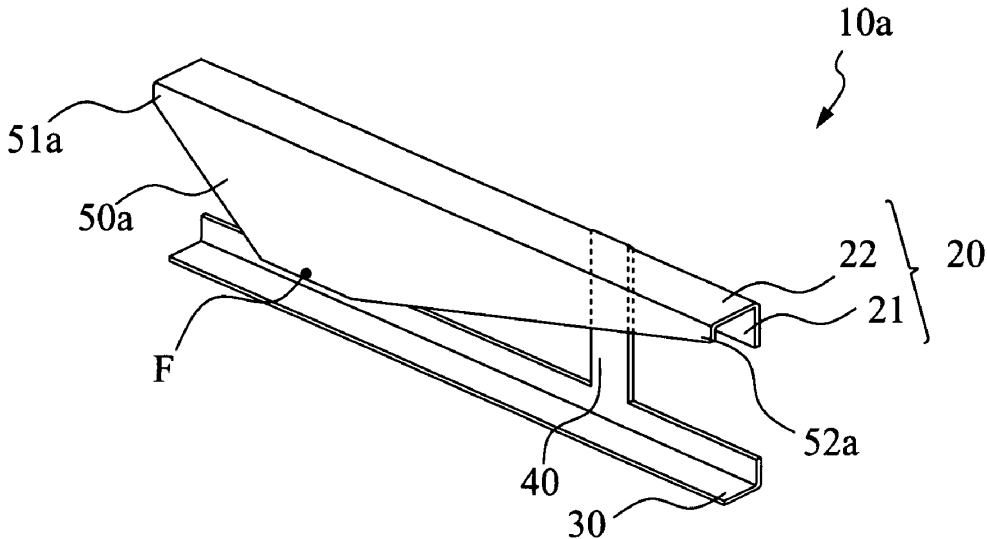
See application file for complete search history.

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20 Claims, 27 Drawing Sheets





US007742005B2

(12) **United States Patent**
Villarroel et al.

(10) **Patent No.:** **US 7,742,005 B2**
(45) **Date of Patent:** **Jun. 22, 2010**

- (54) **MULTI-BAND STRIP ANTENNA**
- (75) Inventors: **Wladimiro Villarroel**, Ypsilanti, MI (US); **Nuttawit Surittikul**, Bangkok (TH); **Qian Li**, Ann Arbor, MI (US); **Kwan-ho Lee**, Ann Arbor, MI (US)
- (73) Assignee: **AGC Automotive Americas R&D, Inc.**, Ypsilanti, MI (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 173 days.
- (21) Appl. No.: **11/965,089**
- (22) Filed: **Dec. 27, 2007**
- (65) **Prior Publication Data**
US 2008/0158074 A1 Jul. 3, 2008

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Related U.S. Application Data

- (60) Provisional application No. 60/877,455, filed on Dec. 28, 2006.

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- EP 1732160 A1 12/2006

- (51) **Int. Cl.**
H01Q 1/34 (2006.01)
- (52) **U.S. Cl.** **343/713**
- (58) **Field of Classification Search** 343/713,
343/700 MS, 765-767, 770, 702
See application file for complete search history.

Primary Examiner—Huedung Mancuso
(74) Attorney, Agent, or Firm—Howard & Howard Attorneys PLLC

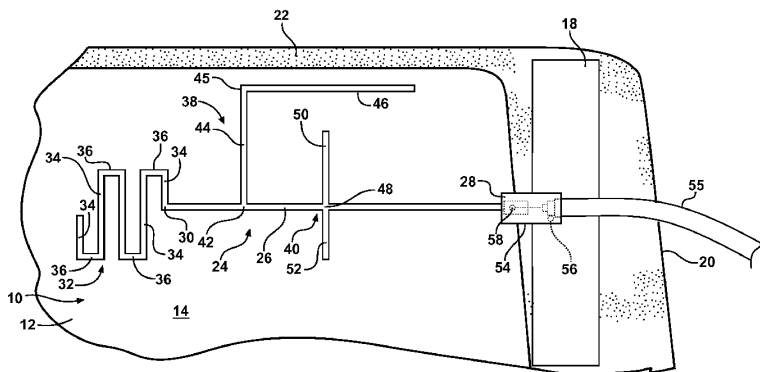
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- 5,646,637 A 7/1997 Miller
- 5,650,791 A 7/1997 Talty
- 5,659,324 A 8/1997 Taniguchi et al.

(57) **ABSTRACT**

A multi-band antenna includes a non-conductive pane, a ground plane disposed on the non-conductive pane, and a radiating strip for operating in a plurality of frequency bands. The radiating strip includes an elongated portion and a meander line portion extending away from an end of the elongated portion. The radiating strip also includes a pair of tuning stubs extending from the elongated portion.

14 Claims, 5 Drawing Sheets





US007742006B2

(12) **United States Patent**
Villarroel et al.

(10) **Patent No.:** **US 7,742,006 B2**
(45) **Date of Patent:** **Jun. 22, 2010**

- (54) **MULTI-BAND LOOP ANTENNA**
- (75) Inventors: **Wladimiro Villarroel**, Ypsilanti, MI (US); **Nuttawit Surittikul**, Bangkok (TH); **Qian Li**, Ann Arbor, MI (US); **Kwan-ho Lee**, Ann Arbor, MI (US)
- (73) Assignee: **AGC Automotive Americas R&D, Inc.**, Ypsilanti, MI (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 201 days.
- (21) Appl. No.: **11/965,125**
- (22) Filed: **Dec. 27, 2007**

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- 6,097,345 A 8/2000 Walton
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- 6,480,162 B2 11/2002 Sabet et al.
- 6,486,840 B1 11/2002 Buren

(65) **Prior Publication Data**
US 2008/0158075 A1 Jul. 3, 2008

Related U.S. Application Data
(60) Provisional application No. 60/877,548, filed on Dec. 28, 2006.

(51) **Int. Cl.**
H01Q 1/32 (2006.01)
(52) **U.S. Cl.** **343/713**
(58) **Field of Classification Search** 343/713,
343/702, 745, 700 MS, 748-750
See application file for complete search history.

- (56) **References Cited**
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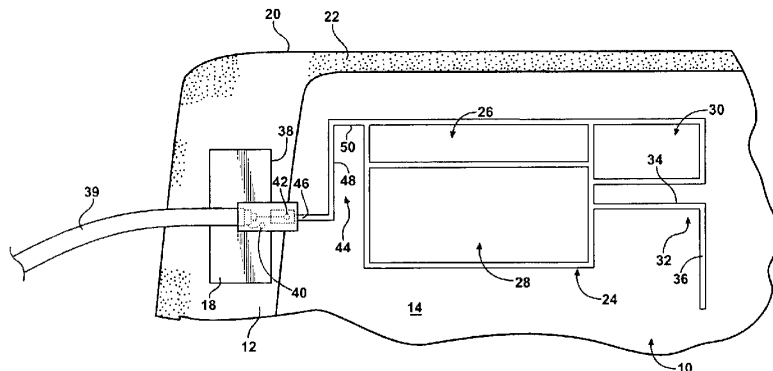
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EP 1732160 A1 12/2006

Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Howard & Howard Attorneys PLLC

(57) **ABSTRACT**

An antenna includes a non-conductive pane, a ground plane disposed on the non-conductive pane, and a radiating strip disposed on the non-conductive pane for operating in a plurality of frequency bands. The radiating strip defines a plurality of loops. A portion of a periphery of one of the loops coincides with at least a portion of a periphery of another of the loops. The radiating strip also includes at least one branch extending away from the periphery of one of the loops to allow tuning and shifting of the resonant frequencies of the antenna.

19 Claims, 6 Drawing Sheets





US007742009B2

(12) **United States Patent**
Li et al.

(10) **Patent No.:** **US 7,742,009 B2**
(45) **Date of Patent:** **Jun. 22, 2010**

(54) **ANTENNA FOR THE PLUG-IN
DUAL-INTERFACE SMART CARD**

(75) Inventors: **Yong Li**, Beijing (CN); **Xuechao Jiang**,
Beijing (CN)

(73) Assignee: **Beijing Watch Data System Co., Ltd.**,
Beijing (CN)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 102 days.

(21) Appl. No.: **11/817,234**

(22) PCT Filed: **Jul. 25, 2006**

(86) PCT No.: **PCT/CN2006/001840**

§ 371 (c)(1),
(2), (4) Date: **Oct. 3, 2008**

(87) PCT Pub. No.: **WO2007/012271**

PCT Pub. Date: **Feb. 1, 2007**

(65) **Prior Publication Data**

US 2009/0102741 A1 Apr. 23, 2009

(30) **Foreign Application Priority Data**

Jul. 29, 2005 (CN) 2005 2 0103147 U

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

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

(58) **Field of Classification Search** 343/866,
343/742, 842, 702, 787; 340/572.1, 572

See application file for complete search history.

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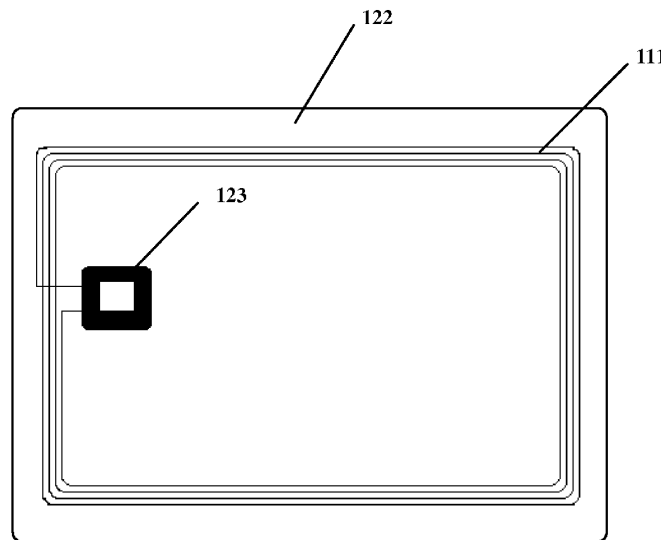
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Gibb I.P. Law Firm, LLC

(57) **ABSTRACT**

An antenna for the non-contact interface of a plug-in dual-interface smart card, wherein the plug-in smart card includes a card module and chip base, the antenna includes a substrate, antenna loop fixed on the first surface of the substrate, and the first and second pins of the antenna, wherein the substrate comprises a structure to cooperate with the card module, the first and second contact points on the second surface, and the first and second vias. The first and second contact points and structure cooperating with the card module are arranged on the substrate on the position corresponding to the contact points of the plug-in smart card. The first and second antenna pins connect with the first and second contact points via the first and second vias.

11 Claims, 7 Drawing Sheets





US007746276B2

(12) **United States Patent**
Surducan et al.

(10) **Patent No.:** **US 7,746,276 B2**
(45) **Date of Patent:** **Jun. 29, 2010**

(54) **MICROSTRIP MULTI-BAND COMPOSITE ANTENNA**

(75) Inventors: **Emanoil Surducan**, Cluj-Napoca (RO);
Daniel Iancu, Pleasantville, NY (US);
John Glossner, Carmel, NY (US)

(73) Assignee: **Sandbridge Technologies, Inc.**, White Plains, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 514 days.

(21) Appl. No.: **11/719,246**

(22) PCT Filed: **Feb. 2, 2006**

(86) PCT No.: **PCT/US2006/003564**

§ 371 (c)(1),
(2), (4) Date: **May 14, 2007**

(87) PCT Pub. No.: **WO2006/086194**

PCT Pub. Date: **Aug. 17, 2006**

(65) **Prior Publication Data**

US 2009/0079658 A1 Mar. 26, 2009

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

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

(58) **Field of Classification Search** 343/700 MS,
343/702; 333/132-133, 12
See application file for complete search history.

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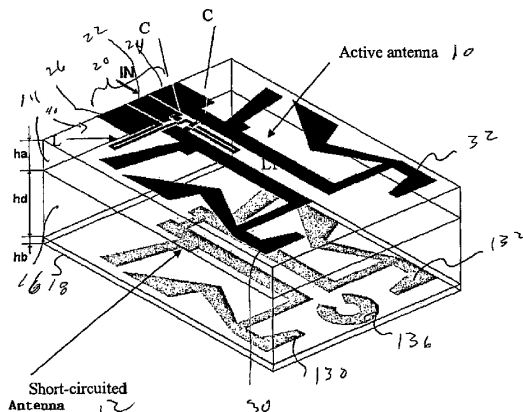
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Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Barnes & Thornburg LLP

(57) **ABSTRACT**

The multi-band antenna structure includes a first antenna having a band width about a middle frequency and a second antenna spaced and electrically isolated from the antenna. Ends of the second antenna are shorted to each other and the antenna floats electrically. The first and second antennas are planar and superimposed in parallel planes. At least two layers of dielectric material of a thickness is between the two antennas. A third layer of dielectric material of a third thickness is between the two antennas.

20 Claims, 3 Drawing Sheets





US007746277B2

(12) **United States Patent**
Huang et al.

(10) **Patent No.:** **US 7,746,277 B2**
(45) **Date of Patent:** **Jun. 29, 2010**

- (54) **PLANE SUPER WIDE BAND COUPLING ANTENNA**
- (75) Inventors: **Ching-Hsiung Huang**, Taipei County (TW); **Ming-Han Perng**, Taipei County (TW); **Chung-Ming Lin**, Taipei County (TW); **Chia-Cheng Lo**, Taipei County (TW); **Ming-Lai Chen**, Taipei County (TW)
- (73) Assignee: **Joinsoon Electronic Mfg Co. Ltd.**, Xizhi, Taipei Country (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 117 days.

(21) Appl. No.: **12/054,386**

(22) Filed: **Mar. 25, 2008**

(65) **Prior Publication Data**
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- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS**
- (58) **Field of Classification Search** **343/700 MS,**
343/702

See application file for complete search history.

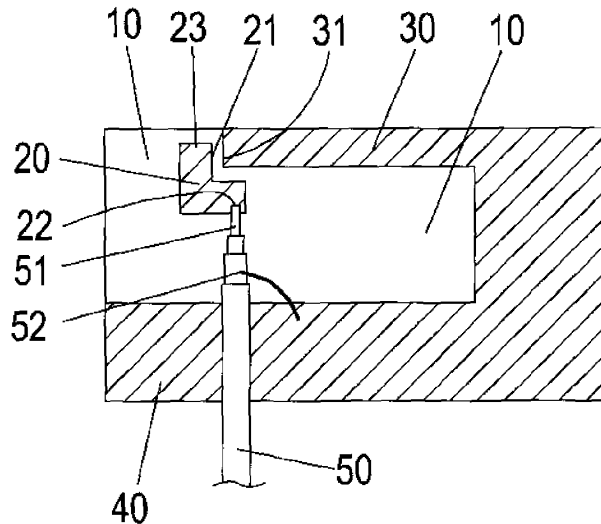
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Primary Examiner—Hoang V Nguyen

(57) **ABSTRACT**

A plane super wide band coupling antenna comprises an isolating substrate for installing with a metal thin film layer by printing; a first radiating portion being a metal thin film layer printed upon the isolating substrate; the first radiating portion having a coupling section and being extended with a feeding point; a second radiating portion being a metal thin film layer printed upon the isolating substrate; the second radiating portion extending from a ground portion on the isolating substrate and being a bended structure; the second radiating portion being formed with gaps with the first radiating portion; the ground portion being formed by a metal thin film layer; one end thereof being electrically connected to the second radiating portion; a signal feeding wire being a coaxial cable; and the main signal wire of the signal feeding wire being electrically connected to the feeding point of the first radiating portion.

5 Claims, 4 Drawing Sheets





US007746286B2

(12) **United States Patent**
Suzuki

(10) **Patent No.:** **US 7,746,286 B2**
(45) **Date of Patent:** **Jun. 29, 2010**

(54) **ANTENNA DEVICE HAVING GOOD SYMMETRY OF DIRECTIONAL CHARACTERISTICS**

2004/0108957 A1 6/2004 Umehara et al.
2005/0110692 A1 5/2005 Andersson

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(75) Inventor: **Tomotaka Suzuki**, Fukushima-ken (JP)

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(73) Assignee: **Alps Electric Co., Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **11/943,524**

European Search Report from European Application No. 07023677 dated Aug. 26, 2008.

(22) Filed: **Nov. 20, 2007**

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(65) **Prior Publication Data**

Primary Examiner—James H. Cho

Assistant Examiner—Christopher Lo

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(74) *Attorney, Agent, or Firm*—Beyer Law Group LLP

(30) **Foreign Application Priority Data**

Dec. 12, 2006 (JP) 2006-334886

(57) **ABSTRACT**

(51) **Int. Cl.**
H01Q 19/00 (2006.01)

An antenna device suitable for short distance wireless communication is provided which can have a good symmetry of directional characteristics and increase a gain at both end sides in a longitudinal direction of a ground pattern. An antenna device is formed by patterning a metal conductor on a printed substrate. The antenna device is provided with a ground pattern of a rectangular shape, a power feed element arranged adjacent to one short side portion of the ground pattern, a correction pattern that projects from the short side portion and is located lateral to the power feed element, and a parasitic radiation element extending along the short side portion at a separation position facing the short side portion of the ground pattern through the power feed element and the correction pattern. An electrical length of the parasitic radiation element is set to be approximately 1/2 of a resonant length. When power is feed, the power feed element is excited to radiate electric waves.

(52) **U.S. Cl.** **343/833**; 343/846

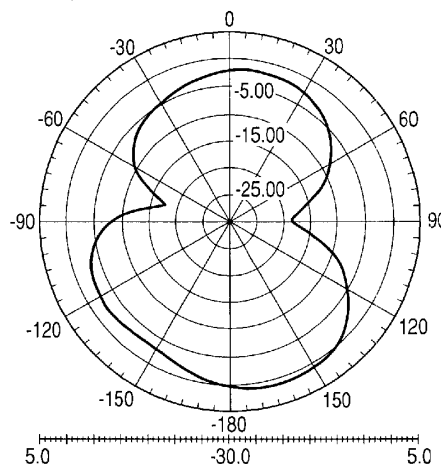
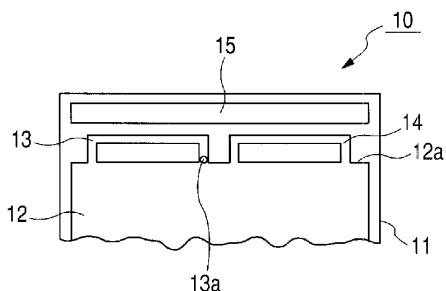
(58) **Field of Classification Search** 343/700 MS, 343/702, 725, 815, 817, 846, 833
See application file for complete search history.

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12 Claims, 5 Drawing Sheets





US007746287B2

(12) **United States Patent**
Noro

(10) **Patent No.:** **US 7,746,287 B2**
(45) **Date of Patent:** ***Jun. 29, 2010**

(54) **ANTENNA APPARATUS INCLUDING A SHIELD COVER WHICH COVERS AN AMPLIFICATION CIRCUIT, THE SHIELD COVER HAVING AN APERTURE POSITIONED TO ALLOW OBSERVATION OF AN INPUT UNIT OF THE AMPLIFICATION CIRCUIT FROM OUTSIDE OF THE SHIELD COVER**

(75) Inventor: **Junichi Noro**, Akita (JP)

(73) Assignee: **Mitsumi Electric Co., Ltd.**, Tama-shi (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 358 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/895,099**

(22) Filed: **Aug. 23, 2007**

(65) **Prior Publication Data**

US 2008/0068278 A1 Mar. 20, 2008

(30) **Foreign Application Priority Data**

Sep. 19, 2006 (JP) 2006-252292

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

(52) **U.S. Cl.** **343/841**

(58) **Field of Classification Search** 343/711, 343/712, 713, 841, 700 MS

See application file for complete search history.

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Primary Examiner—Hoang V Nguyen

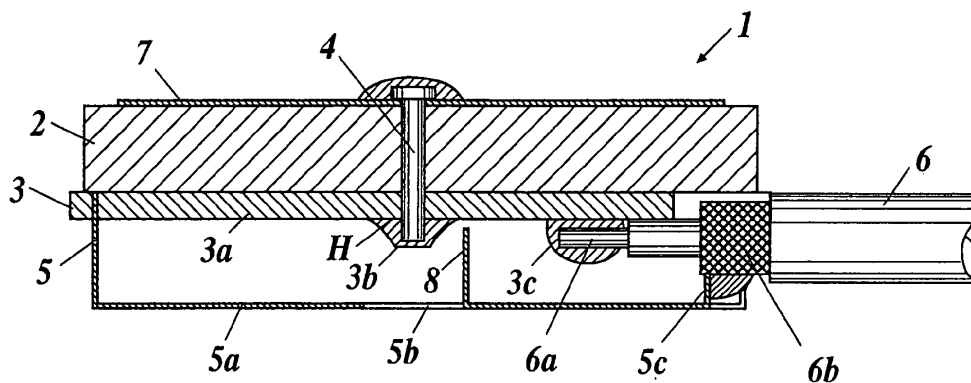
Assistant Examiner—Robert Karacsony

(74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, P.C.

(57) **ABSTRACT**

Disclosed is an antenna apparatus that includes: an antenna element including a receiving unit to receive a radio wave; a circuit board on which an amplifier circuit to amplify an input signal sent from the antenna element is formed; an input pin to connect the receiving unit with the amplifier circuit; and a shield cover to cover the amplifier circuit on the circuit board, the shield cover shielding the amplifier circuit from a disturbing wave, wherein the input pin penetrates through the circuit board and is connected to the amplifier circuit by soldering, so as to structure an input unit of the circuit, and an ascertainment aperture is provided in the shield cover, the ascertainment aperture positioned such that the input unit can be observed from outside of the shield cover.

5 Claims, 4 Drawing Sheets





US007746288B2

(12) **United States Patent**
Wang et al.

(10) **Patent No.:** **US 7,746,288 B2**
(45) **Date of Patent:** **Jun. 29, 2010**

(54) **ANTENNA FOR WWAN AND INTEGRATED ANTENNA FOR WWAN, GPS AND WLAN**

(75) Inventors: **Chi-Yueh Wang**, Kaohsiung (TW);
Cheng-Han Lee, Kaohsiung (TW);
Ching-Chia Mai, Kaohsiung (TW)

(73) Assignee: **Yageo Corporation**, Kaohsiung (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1050 days.

(21) Appl. No.: **11/437,686**

(22) Filed: **May 22, 2006**

(65) **Prior Publication Data**

US 2007/0200774 A1 Aug. 30, 2007

(30) **Foreign Application Priority Data**

Feb. 24, 2006 (TW) 95106360 A

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

(52) **U.S. Cl.** **343/846**; 343/702

(58) **Field of Classification Search** 343/700 MS,
343/702, 846

See application file for complete search history.

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Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Volentine & Whitt, PLLC

(57) **ABSTRACT**

The present invention relates to an antenna for WWAN and an integrated antenna for WWAN, WLAN, and GPS. The integrated antenna comprises a ground metal plate, a coupled WWAN antenna, a WLAN antenna, an auxiliary grounding element, and at least one supporting element. The integrated antenna of the invention can be applied to a wireless electronic device with WWAN and WLAN by utilizing the coupled WWAN antenna to induce a WWAN frequency and the WLAN antenna to induce a WLAN frequency. In addition, the ground metal plate and the auxiliary grounding element are selectively connected or not connected to a ground end of the wireless electronic device, and can be separately used to provide grounding effect. Therefore, the integrated antenna can be mounted on any part of the wireless electronic device, and can have stable electrical characteristic.

35 Claims, 10 Drawing Sheets

