



US007768460B2

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

(10) **Patent No.:** **US 7,768,460 B2**

(45) **Date of Patent:** **Aug. 3, 2010**

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Wen-Chieh Yang**, Tu-Cheng (TW);
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(73) Assignee: **Cheng Uei Precision Industry Co.,
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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 110 days.

(21) Appl. No.: **12/178,945**

(22) Filed: **Jul. 24, 2008**

(65) **Prior Publication Data**

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/818, 846, 866

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,050,010 B2 * 5/2006 Wang et al. 343/702

7,119,748 B2 * 10/2006 Autti 343/702

7,319,432 B2 * 1/2008 Andersson 343/702

2008/0180333 A1 * 7/2008 Martiskainen et al. 343/722

* cited by examiner

Primary Examiner—Shih-Chao Chen

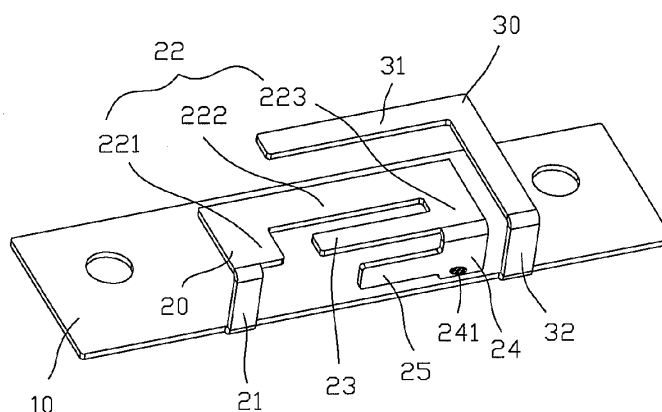
(74) *Attorney, Agent, or Firm*—Muncy, Geissler, Olds &
Lowe, PLLC

(57) **ABSTRACT**

A multi-band antenna has a grounding plate, a radiating element and a parasitic element. The radiating element has a level radiating portion disposed a predetermined distance away from the grounding plate and a first connecting portion connecting the level radiating portion with the grounding plate. The parasitic element has a substantially L-shaped parasitic portion away from the grounding plate and a second connecting portion disposed at the same side of the grounding plate with the first connecting portion to connect a free end of the L-shaped parasitic portion with the grounding plate. The L-shaped parasitic portion is substantially at the same plane with and spatially fences the level radiating portion to define a substantially L-shaped space. The multi-band antenna has simple structure and small size to be assembled in the limited space of notebook.

5 Claims, 2 Drawing Sheets

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

(10) **Patent No.:** **US 7,768,461 B2**
(45) **Date of Patent:** ***Aug. 3, 2010**

(54) **ANTENNA DEVICE WITH INSERT-MOLDED ANTENNA PATTERN**

(75) Inventors: **Yu-Chiang Cheng**, Taipei (TW);
Ping-Cheng Chang, Chaozhou Town (TW); **Cheng-Zing Chou**, Xinying (TW)

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

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/878,667**

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

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 11/404,814, filed on Apr. 17, 2006.

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/40 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/873; 343/700 MS

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,339,533 B2 * 3/2008 Kurashima et al. 343/702
2002/0075186 A1 * 6/2002 Hamada et al. 343/700 MS
2002/0089456 A1 * 7/2002 Hamada 343/702

2003/0181227 A1 9/2003 Toshiyuki
2004/0051670 A1 3/2004 Sato
2005/0001767 A1 1/2005 Wulff et al.
2005/0093752 A1 5/2005 Cheng et al.
2005/0146475 A1 7/2005 Bettner et al.
2007/0216582 A1 * 9/2007 Cheng et al. 343/702

FOREIGN PATENT DOCUMENTS

JP 58087818 A 5/1983

OTHER PUBLICATIONS

Y.Q. Wang et al, "Polymer Modification by Ion Implantation: Electrical Conductivity and Applications," Desk Reference of Functional Polymers Syntheses and Applications, American Chemical Society, pp. 387-404, Washington DC, 1997.

Y.Q. Wang et al, "Polymer Modification by Ion Implantation: Ion Bombardment and Characterization," Desk Reference of Functional Polymers Syntheses and Applications, American Chemical Society, pp. 371-385, Washington DC, 1997.

Ryan E. Griedd et al, "Electrical and Optical Behavior of Ion-Implanted and Ion-Beam Mixed Polymers," SPIE vol. 3413, pp. 27-36, Quebec, Canada, Jul. 1998.

Y.Q. Wang et al, "Ion Beam Modification and Analysis of Metal/Polymer bi-layer thin films," Nuclear Instruments and Methods in Physics Research, B 219-220, pp. 798-803, 2004 Elsevier B.V.

* cited by examiner

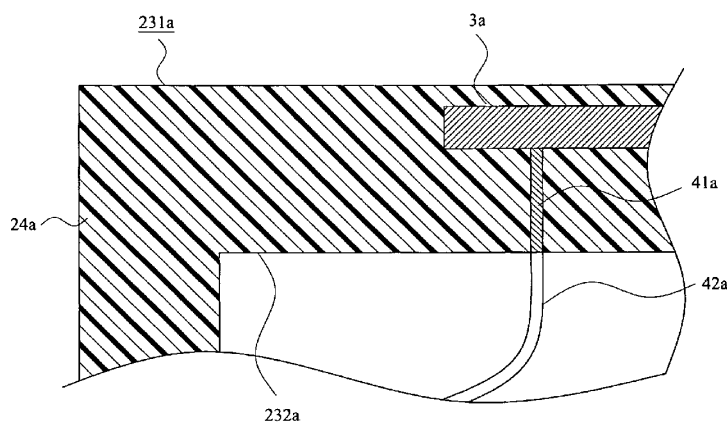
Primary Examiner—Trinh V Dinh

(74) *Attorney, Agent, or Firm*—Quintero Law Office

(57) **ABSTRACT**

Disclosed is an antenna device for transceiving a wireless signal with an insert-molded antenna pattern embedded inside a casing of an electronic device. The insert-molded antenna pattern is connected to an antenna module of a motherboard of the electronic device in order to feed the wireless signal transceived by the insert-molded antenna pattern through an antenna signal feeding line connected to the insert-molded antenna pattern and the antenna module, or by an antenna coupling element coupled with the insert-molded antenna pattern.

6 Claims, 15 Drawing Sheets



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

(10) **Patent No.:** **US 7,768,462 B2**
(45) **Date of Patent:** **Aug. 3, 2010**

(54) **MULTIBAND ANTENNA FOR HANDHELD ELECTRONIC DEVICES**

2004/0145521 A1 7/2004 Hebron et al.

(75) Inventors: **Zhijun Zhang**, Santa Clara, CA (US);
Robert W. Schlub, Campbell, CA (US);
Robert J. Hill, Salinas, CA (US);
Ruben Caballero, San Jose, CA (US)

(Continued)

FOREIGN PATENT DOCUMENTS

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

EP 1 351 334 A 10/2003

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 372 days.

(Continued)

OTHER PUBLICATIONS

(21) Appl. No.: **11/895,053**

Hill et al. U.S. Appl. No. 11/650,187, filed Jan. 4, 2007.

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

(Continued)

(65) **Prior Publication Data**

US 2009/0051604 A1 Feb. 26, 2009

Primary Examiner—Hoang V Nguyen

Assistant Examiner—Robert Karacsony

(74) *Attorney, Agent, or Firm*—Treyz Law Group; G. Victor Treyz; David C. Kellogg

(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, 767**
See application file for complete search history.

(57) **ABSTRACT**

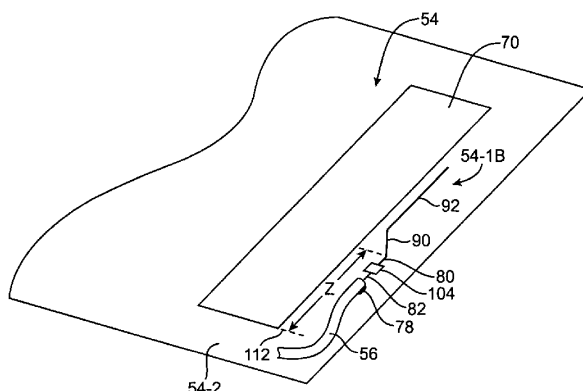
A handheld electronic device is provided that contain wireless communications circuitry. The wireless communications circuitry may include antenna structures. A first antenna may handle first and second communications bands. A second antenna may handle additional communications bands. The first and second antennas may be located at opposite ends of the handheld electronic device. Conductive structures in the handheld electronic device may form an antenna ground plane. The antenna ground plane may have portions defining an antenna slot. An L-shaped antenna resonating element may be located adjacent to the slot. In the first communications band, the L-shaped antenna resonating element may serve as a non-radiating coupling stub that excites the antenna slot. In the second communications band, the L-shaped antenna resonating element may transmit and receive radio-frequency signals.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,140,966 A * 10/2000 Pankinaho 343/700 MS
6,348,894 B1 * 2/2002 Lahti 343/702
6,670,923 B1 12/2003 Kadambi et al.
6,741,214 B1 5/2004 Kadambi et al.
6,747,601 B2 6/2004 Boyle
6,856,294 B2 2/2005 Kadambi et al.
6,980,154 B2 12/2005 Vance et al.
7,027,838 B2 4/2006 Zhou et al.
7,116,267 B2 10/2006 Schuster et al.
7,119,747 B2 10/2006 Lin et al.
2003/0107518 A1 6/2003 Li et al.
2004/0017318 A1 1/2004 Annabi et al.
2004/0058723 A1 * 3/2004 Mikkola et al. 455/575.7

20 Claims, 15 Drawing Sheets



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US007768464B2

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

(10) **Patent No.:** **US 7,768,464 B2**

(45) **Date of Patent:** **Aug. 3, 2010**

(54) **ANTENNA DEVICE**

(75) Inventors: **Yi Ju Lee**, Tu-Cheng (TW); **An Yu Yen**,
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 172 days.

(21) Appl. No.: **12/222,131**

(22) Filed: **Aug. 4, 2008**

(65) **Prior Publication Data**

US 2010/0026591 A1 Feb. 4, 2010

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,246,371 B1 * 6/2001 Kurz et al. 343/702

6,563,466 B2 * 5/2003 Sadler et al. 343/702
6,734,825 B1 * 5/2004 Guo et al. 343/700 MS
7,230,574 B2 * 6/2007 Johnson 343/702
7,256,743 B2 * 8/2007 Korva 343/702
7,466,272 B1 * 12/2008 Su et al. 343/700 MS
2010/0060525 A1 * 3/2010 Yang et al. 343/700 MS

* cited by examiner

Primary Examiner—Tho G Phan

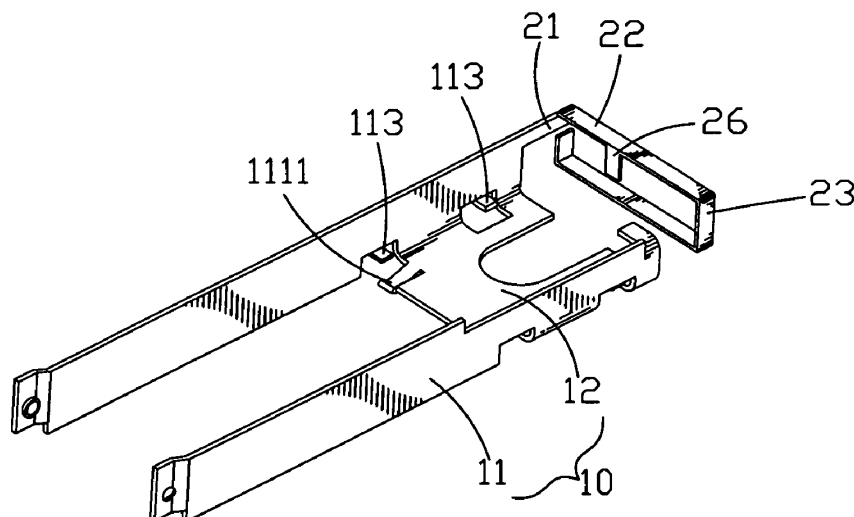
(74) *Attorney, Agent, or Firm*—Rosenberg, Klein & Lee

(57) **ABSTRACT**

An antenna device includes a supporting body and an antenna. The supporting body has two arms and a connecting portion disposed between and connecting the two arms. The antenna has a grounding portion extending from one end of one of the arms. A free end of the grounding portion perpendicularly extends toward the other arm to form a first radiating strip, and a second radiating strip, a third radiating strip and a fourth radiating strip are respectively integrally formed in turn. The first, second, third and fourth radiating strips together define substantially a rectangular shape. A feed-in portion extends from the first radiating strip. The grounding portion connects the supporting body functioning as a ground of the antenna, which increases the area of the grounding for the antenna and enhances the performance of signal transmitting and receiving of the antenna device.

6 Claims, 6 Drawing Sheets

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

(10) **Patent No.:** **US 7,768,466 B2**
(45) **Date of Patent:** **Aug. 3, 2010**

(54) **MULTIBAND FOLDED LOOP ANTENNA**

(75) Inventors: **Yun-Wen Chi**, Taipei County (TW);
Kin-Lu Wong, Kaohsiung (TW)

(73) Assignee: **Acer Incorporated**, 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 218 days.

(21) Appl. No.: **12/213,166**

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

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Apr. 9, 2008 (TW) 97112916 A

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

(52) **U.S. Cl.** **343/741; 343/700 MS**

(58) **Field of Classification Search** **343/700 MS, 343/702, 741, 866, 860**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,680,708 B2 * 1/2004 Yamaki 343/741

7,242,364 B2 7/2007 Ranta
7,256,744 B2 * 8/2007 Qi et al. 343/702
2007/0268191 A1 * 11/2007 Ishizuka et al. 343/702
2009/0273530 A1 * 11/2009 Chi et al. 343/741

* cited by examiner

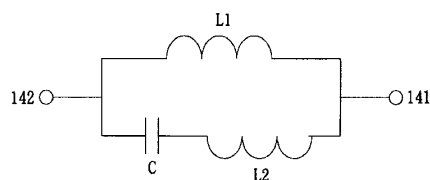
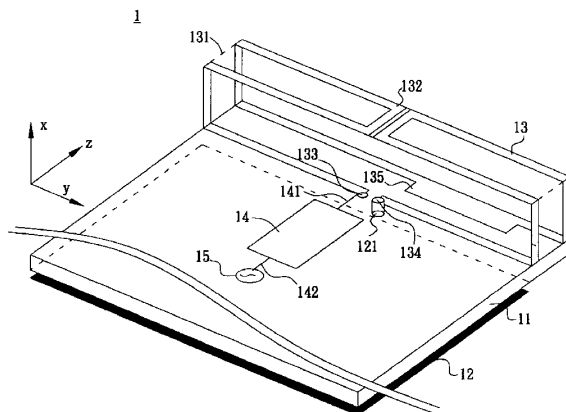
Primary Examiner—Tan Ho

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

(57) **ABSTRACT**

The present invention relates to a multiband folded loop antenna comprising a dielectric substrate, a ground plane, a radiating portion and a matching circuit. The ground plane is located on the dielectric substrate and has a grounding point. The radiating portion comprises a supporter, a loop strip, and a tuning patch. The loop strip has a length about a half-wavelength of the central frequency of the antenna's first resonant mode. The loop strip has a feeding end and a grounding end, with the grounding end electrically connected to the grounding point on the ground plane. The loop strip is folded into a three-dimensional structure and is supported by the supporter. The tuning patch is electrically connected to the loop strip. The matching circuit is located on the dielectric substrate with one terminal electrically connected to the feeding end of the loop strip and another terminal to a signal source.

15 Claims, 15 Drawing Sheets



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US007768470B2

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

(10) **Patent No.:** **US 7,768,470 B2**
(45) **Date of Patent:** **Aug. 3, 2010**

(54) **ULTRA WIDEBAND ANTENNA**

(75) Inventors: **Xiang-Hong Qin**, Shenzhen (CN);
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(73) Assignees: **Hong Fu Jin Precision Industry**
(ShenZhen) Co., Ltd., Shenzhen,
Guangdong Province (CN); **Hon Hai**
Precision Industry Co., Ltd., Tu-Cheng,
Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
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(21) Appl. No.: **11/847,357**

(22) Filed: **Aug. 30, 2007**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Mar. 8, 2007 (CN) 2007 1 0200260

(51) **Int. Cl.**

H01Q 13/10 (2006.01)

(52) **U.S. Cl.** **343/767**; 343/700 MS;
343/770; 343/795; 343/846

(58) **Field of Classification Search** 343/700 MS,
343/767, 769, 829, 846, 770, 795
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,042,401 B2 * 5/2006 Park et al. 343/700 MS
7,061,442 B1 * 6/2006 Tang et al. 343/767
7,116,276 B2 * 10/2006 Lee 343/700 MS
7,132,985 B2 * 11/2006 Lin 343/700 MS

7,173,564 B2 * 2/2007 Park et al. 343/700 MS
7,176,837 B2 * 2/2007 Sonoda et al. 343/700 MS
7,365,686 B2 * 4/2008 Sakama et al. 343/700 MS
7,471,256 B2 * 12/2008 Kwon et al. 343/795
7,518,559 B2 * 4/2009 Yun et al. 343/702
7,545,339 B2 * 6/2009 Ratni et al. 343/830
7,557,755 B2 * 7/2009 Han et al. 343/700 MS
2002/0135525 A1 * 9/2002 Ikegaya et al. 343/767
2007/0290941 A1 * 12/2007 Brown et al. 343/842

FOREIGN PATENT DOCUMENTS

TW M299358 10/2006

OTHER PUBLICATIONS

5.2GHz notched ultra-wideband antenna using slot-type SRR, Elec-
tronics Letters vol. 42, Issue 6, Mar. 16, 2006, pp. 315-316.
Folded-notch dual band ultra-wideband, Antennas and Propagation
Society International Symposium, 2005IEEE vol. 1B, 2005, pp. 520-
523.

* cited by examiner

Primary Examiner—Douglas W Owens

Assistant Examiner—Chuc D Tran

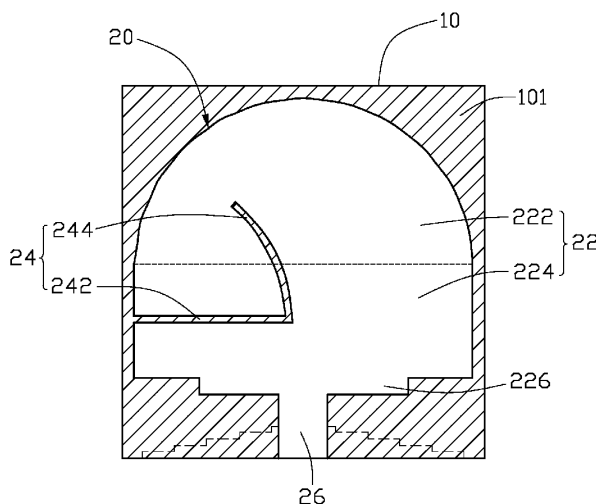
(74) *Attorney, Agent, or Firm*—Frank R. Niranjan

(57)

ABSTRACT

An ultra wideband antenna (20) is disposed on a substrate (10). The substrate includes a first surface (101) and a second surface (102). The ultra wideband antenna includes a radiation body (22), a feeding portion (26), and a grounded portion (28). The radiation body disposed on the first surface is used for transceiving electromagnetic signals. The radiation body includes a semicircle-shaped metal portion (222) and a rect-angle-shaped metal portion (224) and defines a slot (24) starting at an edge therein. The feeding portion is electronically connected to the radiation body for feeding signals to the radiation body. The grounded portion is disposed on the second surface.

13 Claims, 5 Drawing Sheets



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US007773036B2

(12) **United States Patent**
Tsai

(10) **Patent No.:** **US 7,773,036 B2**

(45) **Date of Patent:** **Aug. 10, 2010**

(54) **ANTENNA STRUCTURE**

(75) Inventor: **Hsiao-Ming Tsai**, Taipei (TW)

(73) Assignee: **ASUSTek Computer Inc.**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 189 days.

(21) Appl. No.: **12/183,014**

(22) Filed: **Jul. 30, 2008**

(65) **Prior Publication Data**

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(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/702; 343/846**

(58) **Field of Classification Search** **343/700 MS, 343/702, 846, 850, 873**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,853,335 B1 * 2/2005 Yeh 343/700 MS

6,956,530 B2 * 10/2005 Kadambi et al. 343/702
7,541,980 B2 * 6/2009 Shih 343/700 MS
2004/0201528 A1 10/2004 Lee et al.
2004/0246188 A1 12/2004 Egashira

FOREIGN PATENT DOCUMENTS

CN 2682470 Y 3/2005
CN 1913224 A 2/2007
JP 2004096314 A 3/2004
JP 2007088975 A 4/2007

* cited by examiner

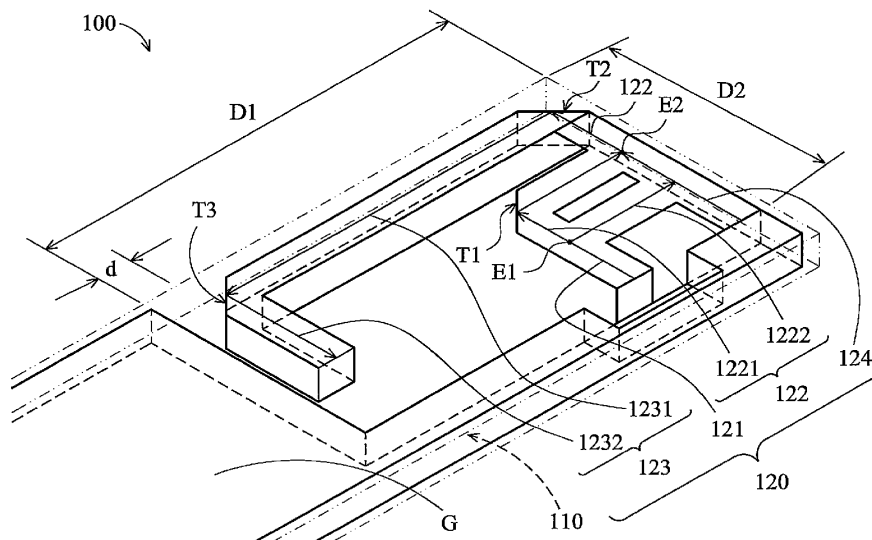
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Quintero Law Office

(57) **ABSTRACT**

An antenna structure includes a circuit board with a ground surface and a printed antenna. The printed antenna includes a signal feed-in portion, a first radiating unit connected to the signal feed-in portion and a second radiating unit connected to the first radiating unit and has a plurality of printed layers. The first radiating unit diverges and forms a first radiating element having a first turning portion and a second radiating element at a first end, and the first radiating element and the second radiating element are combined at a second end. The second radiating unit includes a third radiating element, a fourth radiating element, a second turning portion located between the third radiating element and the second end and a third turning portion located between the third radiating element and the fourth radiating element. A distance is formed between the fourth radiating element and the ground surface.

9 Claims, 2 Drawing Sheets



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US007773038B2

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

(10) **Patent No.:** **US 7,773,038 B2**
(45) **Date of Patent:** **Aug. 10, 2010**

(54) **ELECTRONIC DEVICES WITH ANTENNA SENSORS**

(75) Inventors: **Brett William Degner**, Menlo Park, CA (US); **Chris Ligtenberg**, San Carlos, CA (US); **Douglas Blake Kough**, San Jose, CA (US); **Paul Andrew Gojenola**, San Jose, CA (US)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 192 days.

(21) Appl. No.: **12/061,210**

(22) Filed: **Apr. 2, 2008**

(65) **Prior Publication Data**

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H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/702; 343/894**

(58) **Field of Classification Search** **343/702, 343/760, 894; 455/90.3**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,913,174 A 6/1999 Casarez et al.

5,983,119 A 11/1999 Martin et al.
6,259,409 B1 7/2001 Fulton et al.
6,262,684 B1 * 7/2001 Stewart et al. 343/702
6,297,778 B1 * 10/2001 Phillips et al. 343/702
7,312,758 B2 * 12/2007 Seybold 343/702
2005/0093762 A1 5/2005 Pick

* cited by examiner

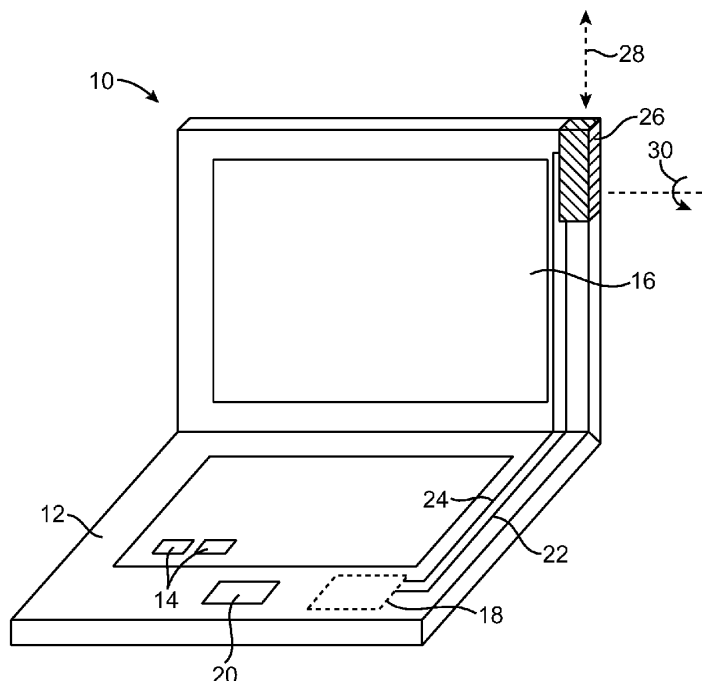
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—Treyz Law Group; G. Victor Treyz; David C. Kellogg

(57) **ABSTRACT**

Electronic devices may be provided with sensors for determining the presence and position of extendable and removable antennas. The antennas may extend by rotating about an axis, by reciprocating along their length, or by flexing from a retracted position to an extended position. The electronic device may determine when a removable antenna is attached or detached using signals from the sensors. The electronic device may determine the extent to which an antenna has been extended using signals from the sensors. The electronic device may control the operation of a radio-frequency transceiver that is coupled to the antenna based on signals from the sensors. The electronic device may turn the transceiver off when the antenna is retracted or removed. When the antenna is partially extended, the electronic device may place the transceiver in a low-power mode or place a dual-band transceiver into a single-band mode.

21 Claims, 13 Drawing Sheets



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US007773039B2

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

(10) **Patent No.:** **US 7,773,039 B2**
(45) **Date of Patent:** **Aug. 10, 2010**

(54) **HIGH FREQUENCY WAVE ANTENNA FOR AN AUTOMOBILE**

(75) Inventors: **Kenichiro Shimo**, Chiyoda-ku (JP);
Kazuyoshi Noda, Chiyoda-ku (JP);
Takuji Hayashi, Chiyoda-ku (JP)

(73) Assignee: **Asahi Glass Company, Limited**, Tokyo (JP)

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(22) Filed: **Jul. 8, 2008**

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(30) **Foreign Application Priority Data**

Jul. 9, 2007 (JP) 2007-179706

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H01Q 1/32 (2006.01)
H01Q 1/02 (2006.01)

(52) **U.S. Cl.** **343/713; 343/704**

(58) **Field of Classification Search** **343/704, 343/713**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,095,228 A 6/1978 Meinke et al.

7,420,517 B2 9/2008 Oshima et al.
2006/0152421 A1 7/2006 Baranski
2007/0109207 A1 5/2007 Mondadori et al.
2007/0247379 A1 10/2007 Oshima et al.

FOREIGN PATENT DOCUMENTS

EP 1 763 105 A1 3/2007
JP 2003-347812 12/2003
JP 2007-295536 11/2007
WO WO 2006/001486 A1 1/2006

OTHER PUBLICATIONS

U.S. Appl. No. 12/251,570, filed Oct. 15, 2008, Shimo, et al.

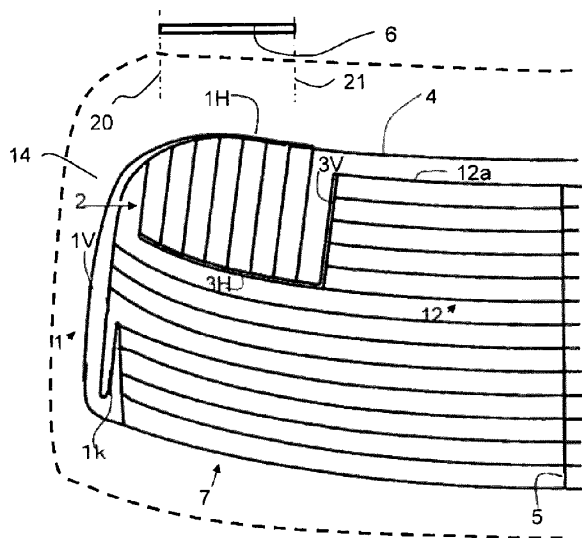
Primary Examiner—Michael C Wimer

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

(57) **ABSTRACT**

A high frequency wave antenna for an automobile is provided, which improves antenna gain of an antenna conductor provided in a spoiler. A defogger is provided on a rear window glass plate 14, a part of a plurality of heater wires extend in a horizontal direction, a spoiler including an antenna conductor 6 embedded therein is provided above the rear window glass plate 14, at least one of a plurality of bus bars has a bus bar horizontal portion 1H extending in a horizontal direction, the bus bar horizontal portion 1H is provided in an upper region of the rear window glass plate 14, and a plurality of vertical heater wires 2 extending in a vertical direction from the bus bar horizontal portion 1H, are provided.

19 Claims, 8 Drawing Sheets



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US007773040B2

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

(10) **Patent No.:** **US 7,773,040 B2**
(45) **Date of Patent:** **Aug. 10, 2010**

(54) **DUAL-BAND F-SLOT PATCH ANTENNA**

(75) Inventors: **Qinjiang Rao**, Waterloo (CA); **Geyi Wen**, Waterloo (CA); **Dong Wang**, Waterloo (CA); **Mark Pecan**, Waterloo (CA)

(73) Assignee: **Research In Motion Limited**, Waterloo, Ontario

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 456 days.

(21) Appl. No.: **11/688,043**

(22) Filed: **Mar. 19, 2007**

(65) **Prior Publication Data**

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(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/38 (2006.01)

H01Q 13/10 (2006.01)

(52) **U.S. CL.** **343/729; 343/700 MS; 343/702; 343/767**

(58) **Field of Classification Search** **343/700 MS, 343/767, 702, 729**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,023,387 B2 4/2006 Wen et al.
2006/0145927 A1 7/2006 Choi

FOREIGN PATENT DOCUMENTS

EP 0929121 A1 7/1999

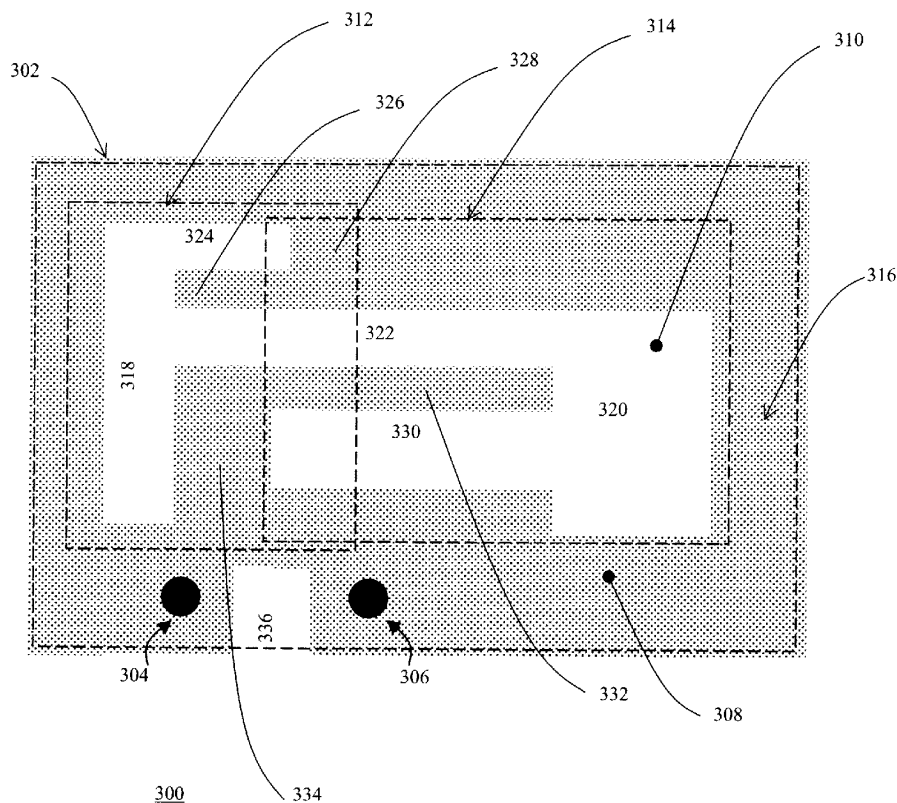
Primary Examiner—Michael C Wimer

(74) Attorney, Agent, or Firm—Heenan Blaikie LLP

(57) **ABSTRACT**

A dual-band antenna includes a planar conductive layer comprising a conductive region and a central non-conductive region. The conductive region and the non-conductive region together define a pair of interconnected F-slot structures, and a loop strip structure coupled to and disposed around the F-slot patch slot antenna structures.

20 Claims, 8 Drawing Sheets



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US007773041B2

(12) **United States Patent**
Wang

(10) **Patent No.:** **US 7,773,041 B2**
(45) **Date of Patent:** **Aug. 10, 2010**

(54) **ANTENNA SYSTEM**

(75) Inventor: **Shu-Li Wang**, Santa Clara, CA (US)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 827 days.

(21) Appl. No.: **11/486,223**

(22) Filed: **Jul. 12, 2006**

(65) **Prior Publication Data**

US 2008/0012774 A1 Jan. 17, 2008

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

(52) **U.S. Cl.** **343/741; 343/702; 343/866**

(58) **Field of Classification Search** **343/702, 343/741, 742, 866**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,445,123 A 4/1984 Wright
5,113,196 A * 5/1992 Ponce de Leon et al. 343/744
5,227,805 A * 7/1993 King et al. 343/702
5,469,178 A * 11/1995 Nguyen et al. 343/702
6,121,935 A 9/2000 Reece et al.

6,400,321 B1 6/2002 Fenwick et al.
6,603,430 B1 8/2003 Hill et al.
6,697,025 B2 2/2004 Koyanagi et al.
6,812,902 B2 11/2004 Rossman et al.
6,867,738 B2 3/2005 Birnbaum et al.
6,909,401 B2 * 6/2005 Rutfors et al. 343/702
6,924,773 B1 8/2005 Paratte

OTHER PUBLICATIONS

H. Nakano et al., "Low-Profile Inverted-F Antenna with Parasitic Elements on an Infinite Ground Plane", IEE Proceedings online No. 19982067, IEE Proc.-Microw. Antennas Propag., vol. 145, No. 4, Aug. 1998, pp. 321-325.

Constantine A. Balanis, "Linear Elements Near or on Infinite Perfect Conductors", Antenna Theory, Third Edition, Copyright 2005, Published by John Wiley & Sons, Hoboken, New Jersey, pp. 184-187, complete reference total p. 12.

Hishashi Morishita et al., "A Balance-Fed Loop Antenna System for Handset", Paper: Special Section on Multi-Dimensional Mobile Information Networks, IEICE Trans. Fundamentals, vol. E82-A, No. 7, Jul. 1999, pp. 1138-1143.

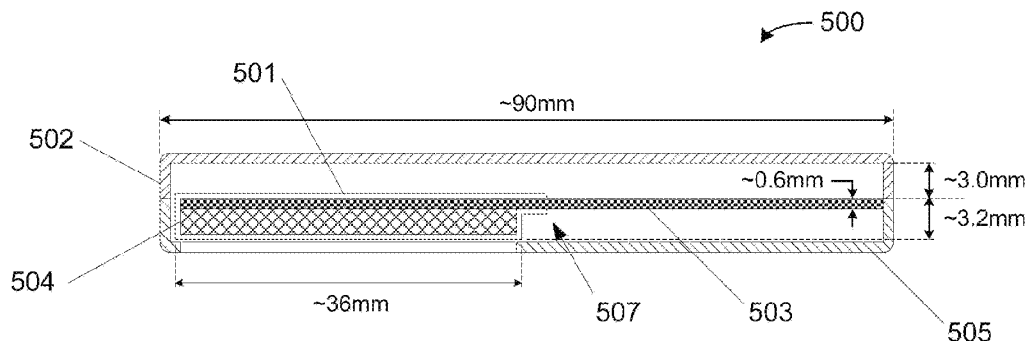
* cited by examiner

Primary Examiner—Tan Ho

(57) **ABSTRACT**

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

12 Claims, 12 Drawing Sheets



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US007773044B2

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

(10) **Patent No.:** **US 7,773,044 B2**

(45) **Date of Patent:** **Aug. 10, 2010**

(54) **METHOD FOR ENHANCING AN ANTENNA PERFORMANCE, ANTENNA, AND APPARATUS**

(75) Inventors: **Markku Oksanen**, Helsinki (FI); **Pekka Ikonen**, Helsinki (FI); **Markku Heino**, Espoo (FI); **Eira Seppälä**, Helsinki (FI); **Reijo Lehtiniemi**, Helsinki (FI)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 220 days.

(21) Appl. No.: **12/109,778**

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

(65) **Prior Publication Data**

US 2009/0267854 A1 Oct. 29, 2009

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

(52) **U.S. Cl.** **343/787; 343/700 MS**

(58) **Field of Classification Search** **343/787, 343/700 MS, 702**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,877,516 A 10/1989 Schram
6,114,962 A * 9/2000 Wiklof et al. 340/572.8
6,329,959 B1 12/2001 Varadan et al.
6,437,747 B1 8/2002 Stojiljkovic et al.

6,842,140 B2 1/2005 Killen et al.
2002/0005805 A1 * 1/2002 Ogura et al. 343/700 R
2004/0164907 A1 8/2004 Killen et al.
2006/0125703 A1 6/2006 Ma et al.

FOREIGN PATENT DOCUMENTS

EP 1580841 9/2005

OTHER PUBLICATIONS

J. Ollikainen; "Design and Implementation Techniques of Wideband Mobile Communications Antennas;" Ph.D. Dissertation, TKK Helsinki University of Technology; Nov. 8, 2004; whole document.
R. Jones; "RF-MEMS Enable Tunable Antennas—Antenna design for mobile applications is becoming increasingly complex, requiring the flexibility of MEMS technology to meet the convergence of new features and applications;" retrieved from the Internet on Apr. 28, 2008; <http://www.semiconductor.net/article/CA6436113.html>; whole document.

O. Kivekäs, et al; "Frequency-tunable internal antenna for mobile phones;" Proc. 13th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 2002), Lisbon, Portugal, Sep. 15-18, 2002; pp. 1882-1887.

* cited by examiner

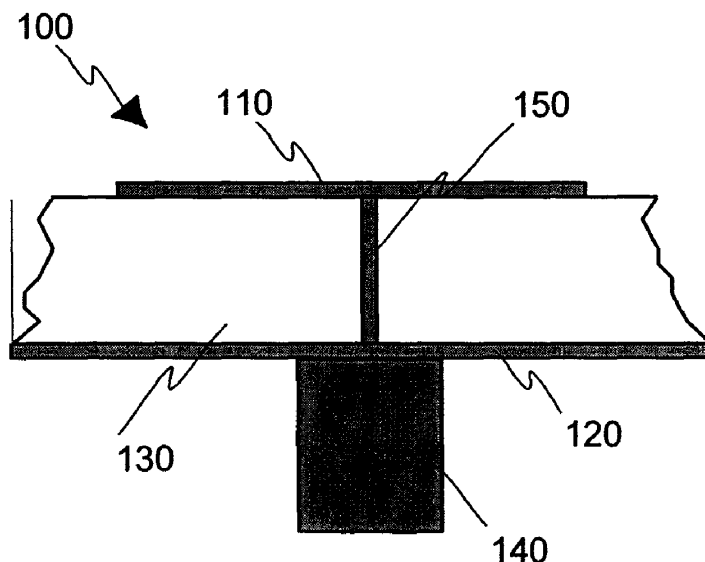
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Alfred A. Fressola; Ware, Fressola, Van Der Sluys & Adolphson, LLP

(57) **ABSTRACT**

The invention relates to a method for enhancing an antenna performance, wherein the property of the antenna substrate is modified by using an ultrasonic field. The invention also relates to an antenna comprising the modified antenna substrate, and to an apparatus comprising the modified antenna substrate.

24 Claims, 3 Drawing Sheets



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US007773046B2

(12) **United States Patent**
Shigemoto

(10) **Patent No.:** **US 7,773,046 B2**
(45) **Date of Patent:** **Aug. 10, 2010**

(54) **ANTENNA DEVICE**

(75) Inventor: **Hideki Shigemoto**, Osaka (JP)

(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 0 days.

(21) Appl. No.: **11/878,690**

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

(65) **Prior Publication Data**

US 2008/0030423 A1 Feb. 7, 2008

(30) **Foreign Application Priority Data**

Aug. 1, 2006 (JP) 2006-209663

(51) **Int. Cl.**

H01Q 1/22 (2006.01)

H01Q 1/42 (2006.01)

(52) **U.S. Cl.** **343/872**

(58) **Field of Classification Search** 343/702, 343/872, 906, 895, 873; 439/578, 916
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,573,840 A * 4/1971 Gouillou et al. 343/895

3,596,273 A * 7/1971 Francis et al. 343/793
3,781,899 A * 12/1973 Lockwood 343/880
4,435,713 A * 3/1984 Gasparaitis et al. 343/702
4,935,747 A * 6/1990 Yuichi et al. 343/895
6,133,884 A * 10/2000 Talvitie et al. 343/702

FOREIGN PATENT DOCUMENTS

JP 2001-345615 12/2001

* cited by examiner

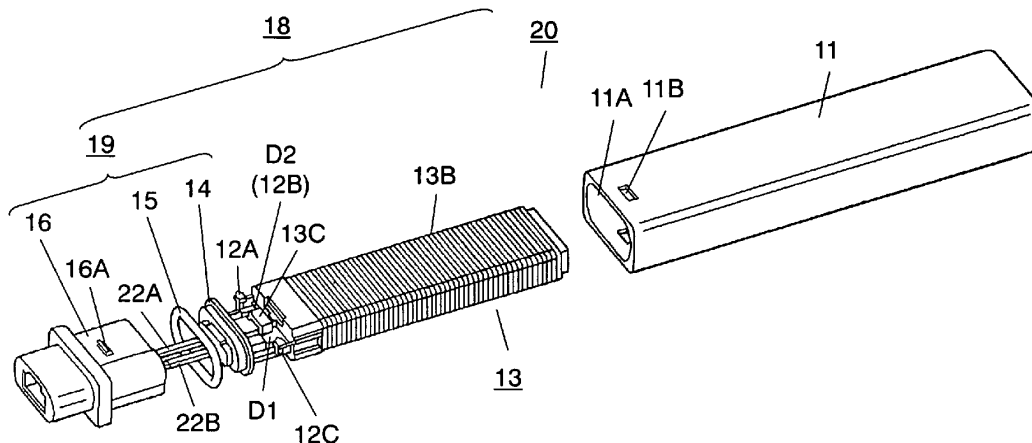
Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—McDermott Will & Emery LLP

(57) **ABSTRACT**

The present invention provides an antenna device that is easy to manufacture by doing away with the wiring section. The antenna device includes an antenna member housed inside a nearly tubular case and a terminal body electrically connected to the antenna member for taking out electrical signal to outside, and the antenna member is sealed inside the case. The antenna device also has a housing for sealing the antenna member inside the case for engaging with a connector to be coupled, and a plugging member having an O-ring and a terminal stage fit into a nearly integral unit.

6 Claims, 5 Drawing Sheets



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US007773047B2

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

(10) **Patent No.:** **US 7,773,047 B2**
(45) **Date of Patent:** **Aug. 10, 2010**

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

(75) Inventors: **Toshiyuki Horikoshi**, Hitachi (JP);
Masahiko Kobayashi, Hitachi (JP);
Seigi Aoyama, Kitaibaraki (JP); **Hiroshi Yamanobe**, Hitachi (JP); **Shinsuke Murano**, Kasama (JP)

(73) Assignee: **Hitachi Cable, 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 726 days.

(21) Appl. No.: **11/523,734**

(22) Filed: **Sep. 20, 2006**

(65) **Prior Publication Data**

US 2007/0069971 A1 Mar. 29, 2007

(30) **Foreign Application Priority Data**

Sep. 21, 2005 (JP) 2005-274011

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

(52) **U.S. Cl.** **343/873; 343/895**

(58) **Field of Classification Search** **343/873, 343/895, 897**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,999,639 A 3/1991 Frazita et al.
6,034,650 A 3/2000 Kuramoto

6,173,898 B1 * 1/2001 Mande 235/488
6,316,104 B1 11/2001 Kumakura
6,517,005 B1 * 2/2003 Ayala 235/492
6,917,345 B2 * 7/2005 Hamada et al. 343/895
6,924,777 B2 * 8/2005 Reasoner et al. 343/866
7,492,326 B1 * 2/2009 Bodlovic et al. 343/873

FOREIGN PATENT DOCUMENTS

CN 1193826 A 9/1998
CN 1272127 A 11/2000
JP 2000-76398 3/2000
JP 2001-101371 4/2001
JP 2001-102745 4/2001

OTHER PUBLICATIONS

Chinese Office Action dated Mar. 1, 2010 (with English translation).

* cited by examiner

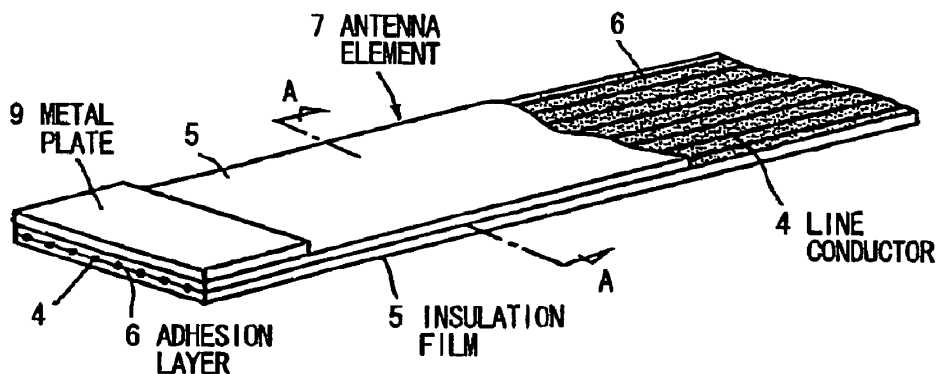
Primary Examiner—Tan Ho

(74) Attorney, Agent, or Firm—McGinn IP Law Group, PLLC

(57) **ABSTRACT**

An antenna having an antenna element bent in a predetermined shape. The antenna element has a plurality of line conductors that are arranged in parallel and are sandwiched by two insulation films. A method of making an antenna has the steps of: arranging in parallel a plurality of line conductors, each of which having a width of 0.04 mm or less, at intervals of 10 times or more the width of each of the line conductors; discharging continuously the plurality of line conductors such that visibility of the line conductors is reduced; and sandwiching continuously the discharged line conductors by planar transparent insulation films with a sticking or adhesion layer to have an antenna element.

17 Claims, 4 Drawing Sheets



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US007777677B2

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

(10) **Patent No.:** **US 7,777,677 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

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

(75) Inventors: **Akihiro Bungo**, Tokyo (JP); **Takao Yokoshima**, Tokyo (JP); **Shinsuke Yukimoto**, Kumagaya (JP); **Toshiaki Edamatsu**, Chichibu-gun (JP)

(73) Assignee: **Mitsubishi Material 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 320 days.

(21) Appl. No.: **10/596,812**

(22) PCT Filed: **Dec. 24, 2004**

(86) PCT No.: **PCT/JP2004/019337**

§ 371 (c)(1),

(2), (4) Date: **Jul. 19, 2007**

(87) PCT Pub. No.: **WO2005/064743**

PCT Pub. Date: **Jul. 14, 2005**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Dec. 25, 2003	(JP)	2003-430022
Mar. 12, 2004	(JP)	2004-070875
Mar. 12, 2004	(JP)	2004-071513
Aug. 4, 2004	(JP)	2004-228157
Aug. 31, 2004	(JP)	2004-252435
Oct. 18, 2004	(JP)	2004-302924

(51) **Int. Cl.**

H01Q 1/38 (2006.01)
H01Q 1/36 (2006.01)

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

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

2001/0002823 A1 6/2001 Ying
2001/0043159 A1 11/2001 Masuda et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 1178561 2/2002

(Continued)

OTHER PUBLICATIONS

International Search Report for PCT/JP2004/019337 mailed Apr. 12, 2005.

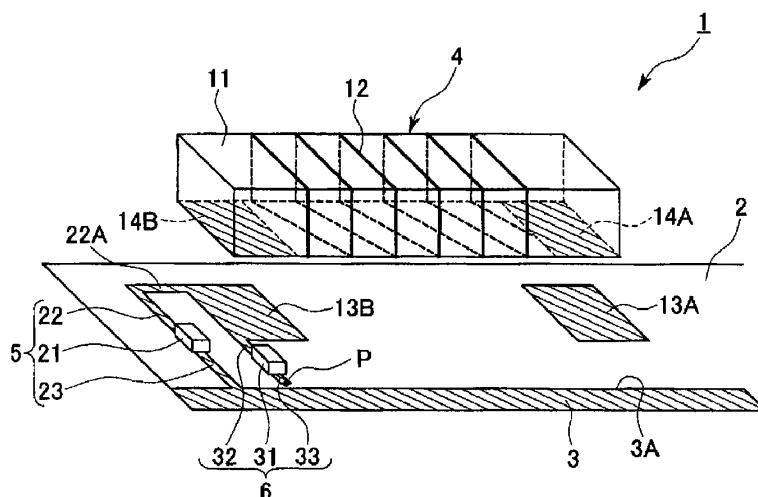
Primary Examiner—Trinh V Dinh

(74) Attorney, Agent, or Firm—Leason Ellis LLP.

(57) **ABSTRACT**

There is provided an antenna device including a substrate, an earth section which is disposed on a portion of the substrate, a feed point which is disposed on the substrate, a loading section disposed on the substrate and constructed with a line-shaped conductor pattern which is formed in a longitudinal direction of an elementary body made of a dielectric material, an inductor section which connects one end of the conductor pattern to the earth section, and a feed point which feeds a current to a connection point of the one end of the conductor pattern and the inductor section, wherein a longitudinal direction of the loading section is arranged to be parallel to an edge side of the earth section.

8 Claims, 28 Drawing Sheets



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US007777682B2

(12) **United States Patent**
Yagi

(10) **Patent No.:** **US 7,777,682 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

(54) **PLANE CIRCULAR POLARIZATION
ANTENNA AND ELECTRONIC APPARATUS**

(75) Inventor: **Shigeru Yagi**, Tokyo (JP)

(73) Assignee: **Casio Computer 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.

(21) Appl. No.: **12/011,952**

(22) Filed: **Jan. 30, 2008**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jan. 31, 2007 (JP) 2007-021301

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

(52) **U.S. Cl.** **343/725; 343/702; 343/767**

(58) **Field of Classification Search** **343/702, 343/725, 767**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,248,224 B2 7/2007 Yuanzhu
7,375,686 B2* 5/2008 Ku et al. 343/700 MS
7,389,129 B2 6/2008 Shoji
2004/0137971 A1 7/2004 Shoji
2004/0217916 A1* 11/2004 Quintero Illera et al. 343/895
2005/0200556 A1* 9/2005 Lin et al. 343/904
2006/0001590 A1* 1/2006 Hung et al. 343/846

2006/0132362 A1 6/2006 Yuanzhu
2006/0208950 A1 9/2006 Tago
2007/0103367 A1* 5/2007 Wang 343/700 MS
2007/0268190 A1* 11/2007 Huynh 343/702

FOREIGN PATENT DOCUMENTS

JP 2004-072605 A 3/2004
JP 2004-159029 A 6/2004
JP 3622959 B2 12/2004
JP 3656610 B2 3/2005
JP 2005-286915 A 10/2005
JP 2006-180150 A 7/2006
JP 3830358 B2 7/2006
JP 2006-529070 A 12/2006
WO WO2004/097980 A1 11/2004

OTHER PUBLICATIONS

Japanese Office Action (and English translation thereof) dated Oct. 21, 2008, issued in a counterpart Japanese Application.

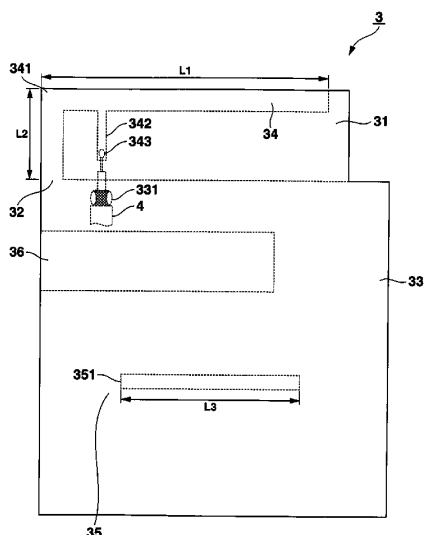
* cited by examiner

Primary Examiner—Vibol Tan
Assistant Examiner—Dylan White
(74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, P.C.

(57) **ABSTRACT**

According to an embodiment, a plane circular polarization antenna comprises a flat insulating substrate and a conductor provided on the flat insulating substrate. The conductor comprises an inverted F antenna including a feeding point, a ground portion, the ground portion including a slot antenna including a slot, and a short-circuiting portion provided in a part of an area between the inverted F antenna and the slot antenna.

8 Claims, 13 Drawing Sheets



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US007777684B2

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

(10) **Patent No.:** **US 7,777,684 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

(54) **MULTI-BAND SLOT-STRIP ANTENNA**

(75) Inventors: **Qinjiang Rao**, Waterloo (CA); **Geyi Wen**, Waterloo (CA); **Mark Pecan**, Waterloo (CA)

(73) Assignee: **Research In Motion Limited**, Waterloo, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 462 days.

(21) Appl. No.: **11/688,052**

(22) Filed: **Mar. 19, 2007**

(65) **Prior Publication Data**

US 2008/0231532 A1 Sep. 25, 2008

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/767, 770

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,677,909 B2 1/2004 Sun et al.

7,006,048 B2 2/2006 Chang

2004/0085244 A1 5/2004 Kadambi et al.

2007/0040745 A1 2/2007 Chen et al.

2007/0040747 A1 2/2007 Kinezos

FOREIGN PATENT DOCUMENTS

EP 0923156 A1 6/1999

EP 1304765 A2 4/2003

WO 2004049501 A1 6/2004

OTHER PUBLICATIONS

Kadambi G R et al: "Applications of annular and L-shaped slot in PIFA design" IEEE Antennas and Propagation Society International Symposium, 2003 Digest, APS. Columbus, OH, Jun. 22-27, 2003, New York, NY: IEEE, US, vol. 4 of 4, Jun. 22, 2003, p. 86, XP010747200; ISBN: 0-7803-7846-6, the whole document.

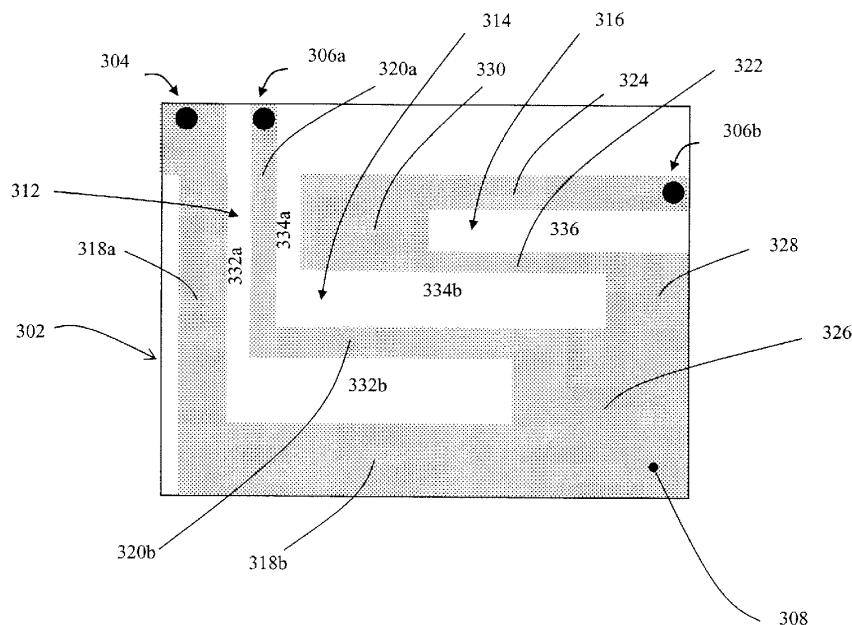
Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Heenan Blaikie LLP

(57) **ABSTRACT**

A multi-band antenna includes a planar conductive layer that comprises a conductive region and a non-conductive region. The conductive region and the non-conductive region together define a first slot-strip structure, a second slot-strip structure coupled to the first slot-strip structure, and a third slot-strip structure coupled to the second slot-strip structure. The first slot-strip structure includes a signal feed portion. The second slot-strip structure includes a first signal grounding portion. The third slot-strip structure includes a second signal grounding portion.

20 Claims, 8 Drawing Sheets



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US007777685B2

(12) **United States Patent**
Stuart

(10) **Patent No.:** **US 7,777,685 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

(54) **SMALL SPHERICAL ANTENNAS**

(75) Inventor: **Howard R. Stuart**, Glen Ridge, NJ (US)

(73) Assignee: **Alcatel-Lucent USA Inc.**, Murray Hill, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 587 days.

(21) Appl. No.: **11/540,442**

(22) Filed: **Sep. 29, 2006**

(65) **Prior Publication Data**

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

(52) **U.S. Cl.** **343/795**; 343/814; 343/742;
343/867

(58) **Field of Classification Search** 343/700 MS,
343/795, 741, 742, 866, 867, 810, 797, 814
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,307,108 A * 2/1967 Induni 455/128

6,215,455 B1 *	4/2001	D'Angelo et al.	343/842
6,593,895 B2 *	7/2003	Nesic et al.	343/795
6,791,432 B2 *	9/2004	Smith et al.	333/99 S
6,801,173 B2 *	10/2004	Wiltshire	343/787
7,009,565 B2 *	3/2006	Pidwerbetsky et al.	343/700 MS
7,015,865 B2 *	3/2006	Isaacs et al.	343/757
7,205,941 B2 *	4/2007	Wang et al.	343/700 MS
2006/0109540 A1 *	5/2006	Kueks et al.	359/321
2007/0024399 A1 *	2/2007	Antolin et al.	333/205

* cited by examiner

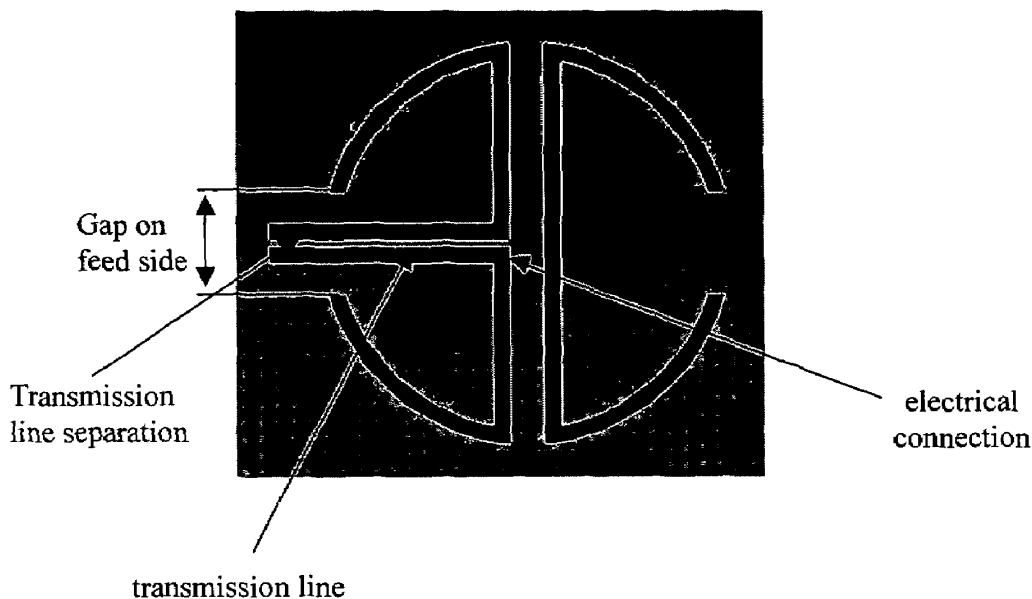
Primary Examiner—HoangAnh T Le

(74) *Attorney, Agent, or Firm*—Martin I. Finston

(57) **ABSTRACT**

An antenna is provided for operating within the electrically small antenna regime (i.e., $ka \approx 0.5$), and having bandwidth performance quite close to fundamental limits. The antenna of the invention, in various embodiments, is based upon spherical resonator structures that are characterized by a performance factor (Q/Q_{chu}) close to 1.5. The antenna combines a resonator structure determined according to the method of the invention with an appropriate transmission line feeding arrangement, such that the resonator effectively couples the transmission line mode to the radiating spherical harmonic mode in an impedance-matched manner.

19 Claims, 10 Drawing Sheets



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US007777686B2

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

(10) **Patent No.:** **US 7,777,686 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

(54) **MULTI-LAYER ISOLATED MAGNETIC
DIPOLE ANTENNA**

(75) Inventors: **Laurent Desclos**, San Diego, CA (US);
Jeffrey Shamblin, San Marcos, CA
(US); **Sebastian Rowson**, San Diego,
CA (US); **Rowland Jones**, Carlsbad, CA
(US); **Young Cha**, San Diego, CA (US)

(73) Assignee: **Ethertronics, Inc.**, San Diego, CA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 235 days.

(21) Appl. No.: **12/059,346**

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

(65) **Prior Publication Data**

US 2009/0243951 A1 Oct. 1, 2009

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

(52) **U.S. Cl.** **343/795**; 343/787; 343/846

(58) **Field of Classification Search** 343/767,
343/787, 795, 829, 846, 700 MS
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,587,524 A 5/1986 Hall

5,940,036 A * 8/1999 Oliver et al. 343/700 MS
7,084,828 B2 8/2006 Rawnick
7,215,292 B2 * 5/2007 McLean 343/725
7,388,550 B2 * 6/2008 McLean 343/725
2006/0220966 A1 10/2006 Sarychev
2007/0120740 A1 5/2007 Iellici
2007/0229376 A1 * 10/2007 Desclos et al. 343/718
2009/0224991 A1 * 9/2009 Rowson et al. 343/747

* cited by examiner

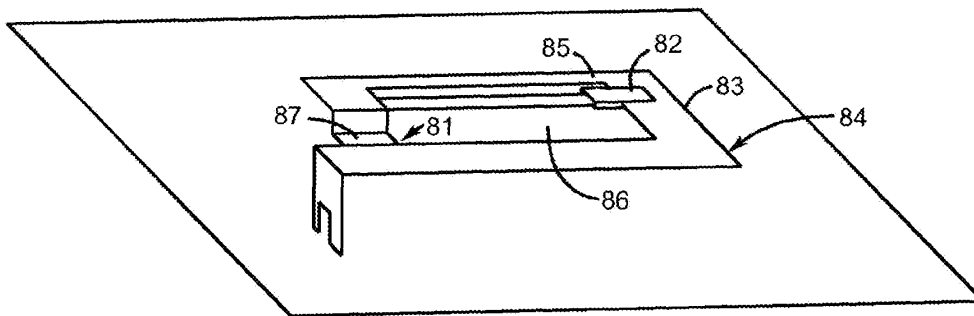
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Joshua S. Schoonover;
Coastal Patent, LLC

(57) **ABSTRACT**

A multi-layer isolated magnetic dipole (IMD) with improved bandwidth and efficiency characteristics to be used in wireless communications and other applicable systems. The multi-layer IMD antenna comprises an IMD element positioned above a ground plane, a conductive element positioned above a ground plane and coupled to the first portion having one or more slot regions being defined between the IMD element and the conductive element and one or more capacitive elements positioned across the one or more slot regions. The range of frequencies covered to be determined by the shape, size, and number of elements in the physical configuration of the components.

20 Claims, 10 Drawing Sheets



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US007777688B2

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

(10) **Patent No.:** **US 7,777,688 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

(54) **POLARIZATION SWITCHING ANTENNA
DEVICE**

(56) **References Cited**

U.S. PATENT DOCUMENTS

(75) Inventors: **Kazuya Tani**, Osaka (JP); **Yoshio
Koyanagi**, Kanagawa (JP); **Hiroshi
Haruki**, Kanagawa (JP)

6,759,991	B2 *	7/2004	Boyle	343/702
7,038,631	B2 *	5/2006	Jecko et al.	343/767
7,106,259	B2 *	9/2006	Tseng et al.	343/702
7,443,344	B2 *	10/2008	Boyle	343/700 MS

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

FOREIGN PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 498 days.

JP	08-154012	6/1996
JP	11-088246	3/1999
JP	2000-077934	3/2000
JP	2001-326514	11/2001
JP	2001-332930	11/2001
JP	2003-158468	5/2003
JP	2004-140815	5/2004
WO	03/094290	11/2003

(21) Appl. No.: **11/721,566**

(22) PCT Filed: **Aug. 16, 2005**

(86) PCT No.: **PCT/JP2005/014947**

§ 371 (c)(1),

(2), (4) Date: **Jun. 13, 2007**

* cited by examiner

Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Pearne & Gordon LLP

(87) PCT Pub. No.: **WO2006/064590**

PCT Pub. Date: **Jun. 22, 2006**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2009/0251383 A1 Oct. 8, 2009

(30) **Foreign Application Priority Data**

Dec. 16, 2004 (JP) 2004-363844

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

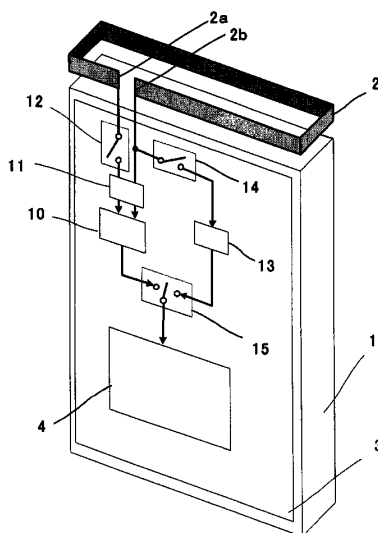
(52) **U.S. Cl.** **343/852**

(58) **Field of Classification Search** 343/753,
343/702, 745, 737, 852

See application file for complete search history.

A polarization switching antenna device capable of switching a polarization without increase of an antenna installing space and also handling a variety of frequency bands is provided. A connection state of one end of a loop antenna element arranged on a side surface of a case is switched. Thus, the polarization characteristic is switched by switching selectively whether the antenna element should constitute a loop antenna or a linear antenna. Matching circuits suitable for respective characteristics are provided. The loop antenna can be fed in terms of a balanced feeding. A balanced feeding and an unbalanced feeding can be switched.

9 Claims, 9 Drawing Sheets



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US007782257B2

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

(10) **Patent No.:** **US 7,782,257 B2**
(45) **Date of Patent:** **Aug. 24, 2010**

(54) **MULTI-BAND INTERNAL ANTENNA OF SYMMETRY STRUCTURE HAVING STUB**

(75) Inventors: **Byung-Chan Kim**, Daejeon (KR); **Jae-Ick Choi**, Daejeon (KR); **Byung-Je Lee**, Seoul (KR); **Byung-Woon Jung**, Seoul (KR); **Han-Phil Rhyu**, Seoul (KR); **Byung-Gil Yu**, Seoul (KR)

(73) Assignee: **Electronics and Telecommunications Research Institute**, Daejeon (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 536 days.

(21) Appl. No.: **11/718,087**

(22) PCT Filed: **Jul. 4, 2005**

(86) PCT No.: **PCT/KR2005/002116**

§ 371 (c)(1),
(2), (4) Date: **Apr. 26, 2007**

(87) PCT Pub. No.: **WO2006/049382**

PCT Pub. Date: **May 11, 2006**

(65) **Prior Publication Data**

US 2009/0135077 A1 May 28, 2009

(30) **Foreign Application Priority Data**

Nov. 5, 2004 (KR) 10-2004-0089854

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

(52) **U.S. Cl.** **343/700 MS; 343/843; 343/870; 343/831**

(58) **Field of Classification Search** 343/700 MS, 343/831, 870, 843
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,407,710 B2	6/2002	Keilen et al.	
6,542,123 B1 *	4/2003	Chen	343/700 MS
6,683,571 B2	1/2004	Ghosh et al.	
6,806,834 B2	10/2004	Yoon	
2003/0112185 A1 *	6/2003	Fang et al.	343/700 MS
2004/0095281 A1	5/2004	Poilasne et al.	
2004/0178958 A1	9/2004	Kadambi et al.	

FOREIGN PATENT DOCUMENTS

KR	1020030064219 A	7/2003
KR	1020030084243 A	11/2003
KR	1020040054107 A	6/2004
WO	WO 9638352	12/1996

* cited by examiner

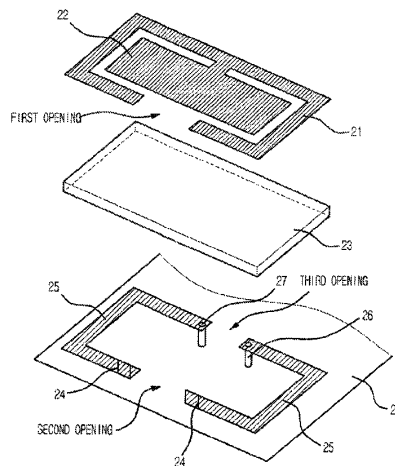
Primary Examiner—Douglas W Owens

Assistant Examiner—Dieu Hien T Duong

(57) **ABSTRACT**

A multi-band internal antenna includes a top patch defining a first loop that defines a space therein and a first opening; a stub provided within the space defined by the first loop; a bottom patch provided below the top patch and having a first section and a second section connected to a feeder part and a shorting part, respectively, the bottom patch defining a second loop and second and third openings, the second and third openings being provided on opposing sides of the second loop so that the first and second sections of the bottom patch are separated from each other; and a first connecting part and a second connecting part connecting a first portion and a second portion of the top patch, respectively, to the first section and the second section of the bottom patch to transmit a signal from the bottom patch to the top patch.

9 Claims, 8 Drawing Sheets



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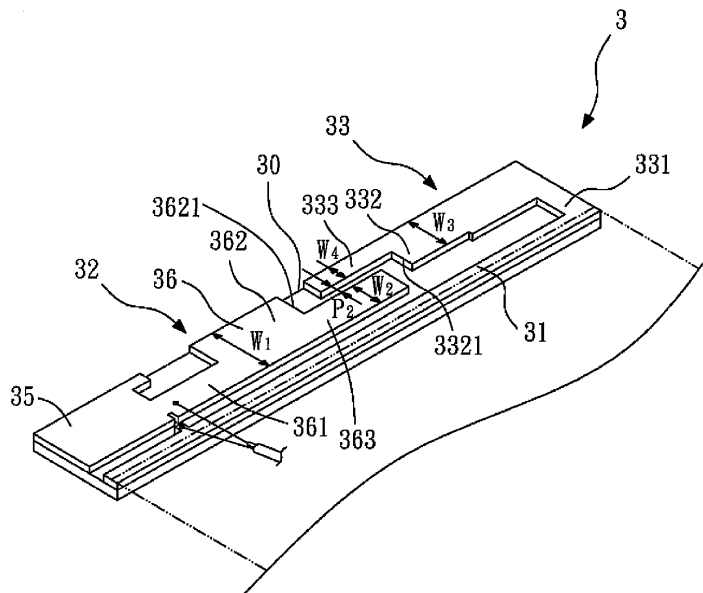


(12) **United States Patent**
Lee et al.

- (54) **INTEGRATED ANTENNA FOR WORLDWIDE INTEROPERABILITY FOR MICROWAVE ACCESS (WIMAX) AND WLAN**

- | | | | | |
|--------------|------|---------|-------------------|------------|
| 2004/0233109 | A1 * | 11/2004 | Ying et al. | 343/700 MS |
| 2005/0110692 | A1 * | 5/2005 | Andersson | 343/702 |
| 2007/0109202 | A1 * | 5/2007 | Vance | 343/702 |
| 2007/0210969 | A1 * | 9/2007 | Vance | 343/702 |
| 2007/0285321 | A1 * | 12/2007 | Chung et al. | 343/702 |

An integrated antenna for worldwide interoperability for microwave access (WiMax) and wireless local area network (WLAN), includes a substrate, a grounding metal strip, and first and second radiating metal strips. The first radiating metal strip is disposed on the substrate and is not connected to the grounding metal strip. The first radiating metal strip has a first portion and a second portion on two ends thereof. The first and second portions are used to induce first and second resonance modes, respectively. The second radiating metal strip is disposed on the substrate and is connected to the grounding metal strip. The second radiating metal strip is not connected to the first radiating metal strip. The energy is coupled from the second radiating metal strip to the first radiating metal strip to induce a third resonance mode. The antenna is adapted to the frequencies of WiMax and WLAN.





US007782260B2

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

(10) **Patent No.:** **US 7,782,260 B2**

(45) **Date of Patent:** **Aug. 24, 2010**

(54) **PLANAR ANTENNA**

(75) Inventors: **Tiao-Hsing Tsai**, Taipei Shien (TW);
Chih-Wei Liao, Yilan Shien (TW);
Chao-Hsu Wu, Tao Yuan Shien (TW);
Chieh-Ping Chiu, Yunlin Shien (TW)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 174 days.

(21) Appl. No.: **12/199,143**

(22) Filed: **Aug. 27, 2008**

(65) **Prior Publication Data**

US 2009/0256755 A1 Oct. 15, 2009

(30) **Foreign Application Priority Data**

Apr. 10, 2008 (TW) 97112991 A

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,937,193 B2 * 8/2005 Hendler et al. 343/700 MS
7,289,068 B2 * 10/2007 Fujio et al. 343/700 MS

* cited by examiner

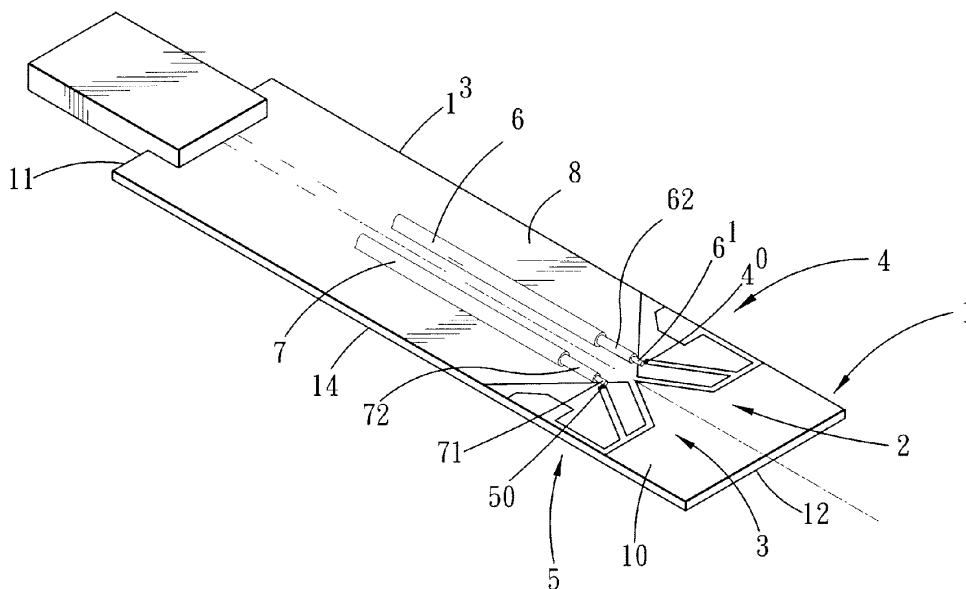
Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Stephen A. Bent; Foley & Lardner LLP

(57) **ABSTRACT**

An antenna includes a dielectric substrate, a grounding plane, first and second grounding elements, and first and second radiating elements. The grounding plane is formed on the dielectric substrate. The first and second grounding elements are formed on the dielectric substrate, have a curved shape and a size that are identical, and are connected to the grounding plane. The first and second radiating elements are formed on the dielectric substrate, have a curved shape and a size that are identical, are operable in the same frequency range, and are connected to the first and second grounding elements, respectively.

15 Claims, 10 Drawing Sheets



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US007782261B2

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

(10) **Patent No.:** **US 7,782,261 B2**

(45) **Date of Patent:** **Aug. 24, 2010**

(54) **ANTENNA ARRANGEMENT**

(75) Inventors: **Rongbang-Thomas An**, Beijing (CN);
Lu Youyuan, Beijing (CN); **Liu Shu**,
Beijing (CN)

(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 339 days.

(21) Appl. No.: **11/642,342**

(22) Filed: **Dec. 20, 2006**

(65) **Prior Publication Data**

US 2008/0150828 A1 Jun. 26, 2008

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

(52) **U.S. Cl.** **343/702; 343/860**

(58) **Field of Classification Search** **343/702**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,011,518 A * 1/2000 Yamagishi et al. 343/713
6,147,652 A * 11/2000 Sekine 343/702
6,307,525 B1 10/2001 Bateman et al. 343/853
6,774,850 B2 * 8/2004 Chen 343/700 MS
2002/0118075 A1 * 8/2002 Ohwada et al. 333/32

2003/0142022 A1 7/2003 Ollikainen et al. 343/702
2004/0075614 A1 4/2004 Dakeya et al. 343/745
2005/0190107 A1 * 9/2005 Takagi et al. 343/702
2006/0176226 A1 * 8/2006 Moon et al. 343/702
2007/0099589 A1 5/2007 Kawai 455/269
2008/0055173 A1 3/2008 Chominski 343/741
2008/0252536 A1 * 10/2008 Anguera et al. 343/702

FOREIGN PATENT DOCUMENTS

EP 0 469 779 A2 2/1992
EP 0 821 429 A2 1/1998
EP 1 720 216 A1 11/2006

OTHER PUBLICATIONS

Matthae, G.; Young, L.; Jones, E. M. T. "Microwave Filters, Impedance-Matching Networks, and Coupling Structures", pp. 681-713, McGraw-Hill 1964, pp. 681-713.
Wagner, R., "Double Stub Matching", pp. 1-8, Aug. 14, 2007, Retrieve from internet (Sep. 30, 2009) URL: <http://cnx.org/content/m1066/latest/>, Fig. 1; pp. 1-8.

* cited by examiner

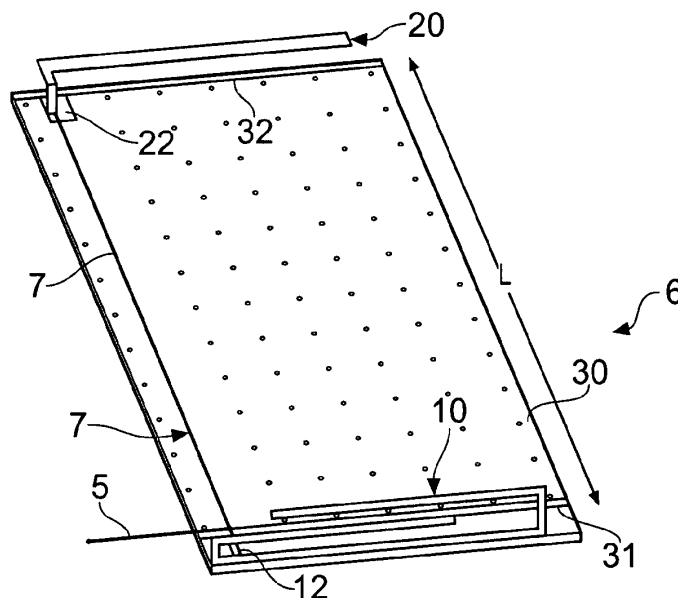
Primary Examiner—Trinh V Dinh

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

(57) **ABSTRACT**

An antenna arrangement including a first antenna element having a first feed for connection to radio frequency circuitry; and a second antenna element, separate to the first antenna element, having a second feed connected to the first feed.

22 Claims, 3 Drawing Sheets



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US007782269B2

(12) **United States Patent**
Soler Castany et al.

(10) **Patent No.:** **US 7,782,269 B2**

(45) **Date of Patent:** **Aug. 24, 2010**

(54) **ANTENNA STRUCTURE FOR A WIRELESS
DEVICE WITH A GROUND PLANE SHAPED
AS A LOOP**

5,363,114 A 11/1994 Shoemaker

(Continued)

(75) Inventors: **Jordi Soler Castany**, Barcelona (ES);
Carles Puente Baliarda, Barcelona (ES)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **Fractus, S.A.**, Barcelona (ES)

DE 10345230 A1 4/2005

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 580 days.

(Continued)

OTHER PUBLICATIONS

(21) Appl. No.: **11/719,151**

(22) PCT Filed: **Nov. 14, 2005**

(86) PCT No.: **PCT/EP2005/055959**

§ 371 (c)(1),
(2), (4) Date: **Jun. 13, 2007**

Chiou, Designs of compact microstrip antennas with a slotted ground
plane, Antennas and propagation society international symposium,
Jul. 2001.

Huang, Dielectric resonator antenna on a slotted ground plane, IEEE
Antennas and Propagation Society International Symposium and
USCN/URSI National Radio Science Meeting, Jul. 2001.

Hossa, Improvement of compact terminal antenna performance by
incorporating open-end slots in ground plane, Microwave and Wire-
less Components Letters, Jun. 2004, vol. 14, No. 6.

(Continued)

(87) PCT Pub. No.: **WO2006/051113**

PCT Pub. Date: **May 18, 2006**

Primary Examiner—Tan Ho

(74) Attorney, Agent, or Firm—Kenyon & Kenyon LLP

(65) **Prior Publication Data**

US 2007/0252773 A1 Nov. 1, 2007

(57) **ABSTRACT**

Related U.S. Application Data

(60) Provisional application No. 60/627,653, filed on Nov.
12, 2004.

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

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

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

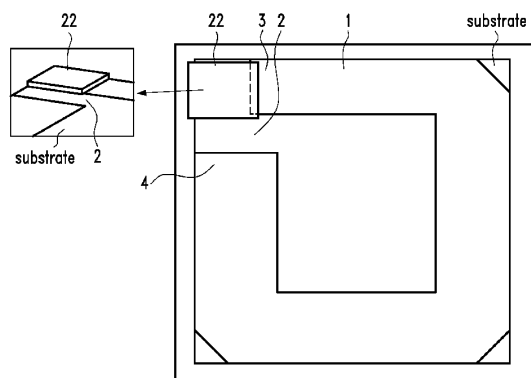
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,843,468 A 6/1989 Drewery

40 Claims, 21 Drawing Sheets



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US007782270B2

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

(10) **Patent No.:** **US 7,782,270 B2**

(45) **Date of Patent:** **Aug. 24, 2010**

(54) **PLANAR INVERTED-F ANTENNA WITH
EXTENDED GROUNDING PLANE**

(75) Inventors: **Shyh-Jong Chung**, Hsinchu (TW);
Ching-Wei Ling, Sinhua Township,
Tainan County (TW); **Yu-Chiang
Cheng**, Taipei (TW)

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
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(21) Appl. No.: **12/153,738**

(22) Filed: **May 23, 2008**

(65) **Prior Publication Data**

US 2009/0115664 A1 May 7, 2009

(30) **Foreign Application Priority Data**

Nov. 5, 2007 (TW) 96141721 A

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 9/38 (2006.01)

(52) **U.S. Cl.** **343/846; 343/830**

(58) **Field of Classification Search** **343/700 MS,**
343/702, 846, 828-830, 848

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,844,853 B2 *	1/2005	Tai et al.	343/700 MS
7,113,133 B2 *	9/2006	Chen et al.	343/700 MS
2003/0234742 A1	12/2003	Tai et al.	
2004/0012528 A1	1/2004	Dai et al.	
2005/0134509 A1	6/2005	Lin	
2007/0109200 A1	5/2007	Su	

* cited by examiner

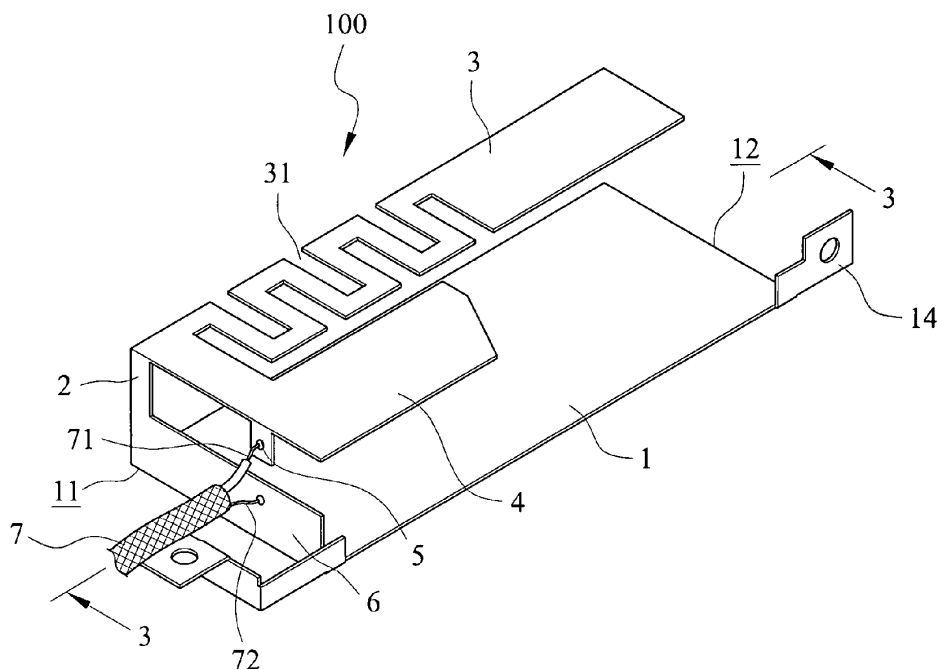
Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Quintero Law Office, PC

(57) **ABSTRACT**

Disclosed is a planar inverted-F antenna with an extended grounding plane. The planar inverted-F antenna has a grounding metal plate having a selected side edge on which the extended grounding plane is formed and has a predetermined height. At least one antenna signal radiating plate is connected to the grounding metal plate by a short-circuit piece and is substantially parallel to and spaced from the grounding metal plate by a distance. A feeding point extends from the antenna signal radiating plate in a direction toward the grounding metal plate and corresponds to the extended grounding plane with a predetermined gap therebetween. With the arrangement of the extended grounding plane, the impedance matching of the antenna is improved and the impedance bandwidth of the antenna is increased.

16 Claims, 7 Drawing Sheets



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US007782272B2

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

(10) **Patent No.:** **US 7,782,272 B2**

(45) **Date of Patent:** **Aug. 24, 2010**

(54) **ANTENNA APPARATUS**

(56) **References Cited**

(75) Inventors: **Junichi Noro**, Akita (JP); **Takao Kato**, Oga (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 119 days.

(21) Appl. No.: **11/901,473**

(22) Filed: **Sep. 17, 2007**

(65) **Prior Publication Data**

US 2008/0074328 A1 Mar. 27, 2008

(30) **Foreign Application Priority Data**

Sep. 21, 2006 (JP) 2006-255920

(51) **Int. Cl.**

H01Q 1/36 (2006.01)

H01Q 1/30 (2006.01)

H01Q 1/42 (2006.01)

H01Q 1/12 (2006.01)

(52) **U.S. Cl.** **343/895**; 343/872; 343/878; 343/900

(58) **Field of Classification Search** 343/895, 343/878, 880, 882, 888, 892, 900

See application file for complete search history.

U.S. PATENT DOCUMENTS

5,198,831 A *	3/1993	Burrell et al.	343/895
5,202,652 A *	4/1993	Tabuchi et al.	333/193
5,986,616 A *	11/1999	Edvardsson	343/853
6,421,029 B1 *	7/2002	Tanabe	343/895
6,531,986 B2 *	3/2003	Saito	343/702
6,653,987 B1 *	11/2003	Lamensdorf et al.	343/895
7,173,576 B2 *	2/2007	O'Neill et al.	343/895

FOREIGN PATENT DOCUMENTS

JP	2001-339227 A	12/2001
JP	2003-037430 A	2/2003

* cited by examiner

Primary Examiner—Douglas W Owens

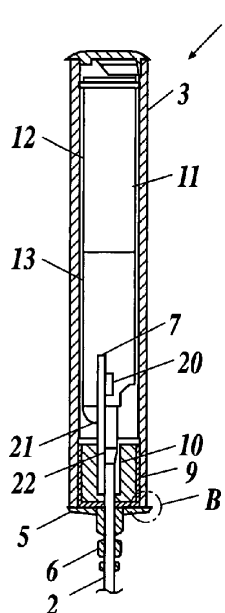
Assistant Examiner—Jennifer F Hu

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

(57) **ABSTRACT**

An antenna apparatus includes: an antenna element; and a substrate on which a low noise amplifier is mounted and on which the antenna element is disposed, wherein the substrate comprises: an input unit for inputting an electric signal into the low noise amplifier from an output terminal formed at a lower part of the antenna element; an output unit for outputting the electric signal to a transmission unit connected to a signal processing unit for processing the electric signal from the antenna element; and a signal blocking unit provided between the input unit and the output unit.

5 Claims, 8 Drawing Sheets



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US007786938B2

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

(10) **Patent No.:** **US 7,786,938 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **ANTENNA, COMPONENT AND METHODS**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Juha Sorvala**, Oulu (FI); **Petteri Annamaa**, Oulunsalo (FI); **Kimmo Koskiniemi**, Oulu (FI)

DE 101 50 149 A1 4/2003

(73) Assignee: **Pulse Finland OY** (FI)

(Continued)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 483 days.

OTHER PUBLICATIONS

(21) Appl. No.: **11/648,429**

(22) Filed: **Dec. 28, 2006**

"A Novel Approach of a Planar Multi-Band Hybrid Series Feed Network for Use in Antenna Systems Operating at Millimeter Wave Frequencies," by M.W. Elsallal and B.L. Hauck, Rockwell Collins, Inc., pp. 15-24, walsall@rockwellcollins.com and blhauck@rockwellcollins.com.

(65) **Prior Publication Data**

(Continued)

US 2007/0171131 A1 Jul. 26, 2007

Related U.S. Application Data

Primary Examiner—Tho G Phan

(74) Attorney, Agent, or Firm—Gazdzinski & Associates, PC

(63) Continuation of application No. PCT/FI2005/050247, filed on Jun. 28, 2005.

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Jun. 28, 2004 (FI) 20040892
Aug. 18, 2004 (FI) 20041088
Mar. 16, 2005 (FI) PCT/FI05/50089

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

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

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

See application file for complete search history.

(56) **References Cited**

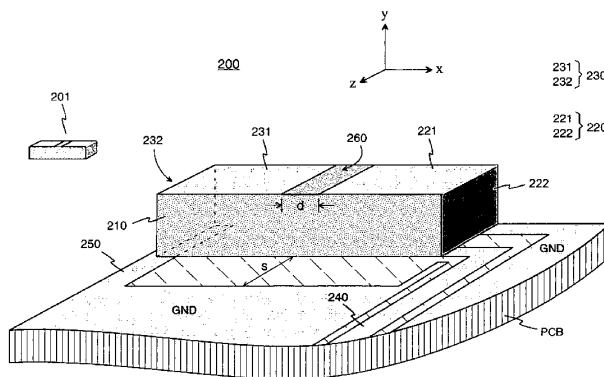
U.S. PATENT DOCUMENTS

4,069,483 A 1/1978 Kaloj
5,278,528 A 1/1994 Turunen
5,382,959 A 1/1995 Pett et al.

An antenna component (and antenna) with a dielectric substrate and a plurality of radiating antenna elements on the surface of the substrate. In one embodiment, the plurality comprises two (2) elements, each of them covering one of the opposite heads and part of the upper surface of the device. The upper surface between the elements comprises a slot. The lower edge of one of the antenna elements is galvanically coupled to the antenna feed conductor on a circuit board, and at another point to the ground plane, while the lower edge of the opposite antenna element, or the parasitic element, is galvanically coupled only to the ground plane. The parasitic element obtains its feed through the electromagnetic coupling over the slot, and both elements resonate at the operating frequency. Omni-directionality is also achieved. Losses associated with the substrate are low due to the simple field image in the substrate.

(Continued)

51 Claims, 5 Drawing Sheets



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US007786940B2

(12) **United States Patent**
Hirano

(10) **Patent No.:** **US 7,786,940 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **ANTENNA STRUCTURE AND WIRELESS COMMUNICATION DEVICE INCLUDING THE SAME**

(75) Inventor: **Satoru Hirano**, Nomi-gun (JP)

(73) Assignee: **Murata Manufacturing Co., Ltd.**, Kyoto (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 496 days.

(21) Appl. No.: **11/873,633**

(22) Filed: **Oct. 17, 2007**

(65) **Prior Publication Data**

US 2009/0303144 A1 Dec. 10, 2009

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2005/012680, filed on Jul. 8, 2005.

(30) **Foreign Application Priority Data**

May 11, 2005 (JP) 2005-138725

(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, 750, 846, 848**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,177,908 B1 1/2001 Kawahata et al.

6,614,398 B2 * 9/2003 Kushihi et al. 343/700 MS
6,653,986 B2 11/2003 Watada et al.
6,700,543 B2 * 3/2004 Konishi et al. 343/700 MS
7,136,020 B2 * 11/2006 Yamaki 343/702
2002/0101382 A1 * 8/2002 Konishi et al. 343/702

FOREIGN PATENT DOCUMENTS

JP 3-22416 U 3/1991
JP 4-114205 U 10/1992
JP 05-299927 A 11/1993
JP 08-222016 A 8/1996
JP 10-173426 A 6/1998
JP 2001-332924 A 11/2001
JP 2005-005985 A 1/2005

OTHER PUBLICATIONS

Official communication issued in the International Application No. PCT/JP2005/012680, mailed on Aug. 23, 2005.

Official communication issued in the counterpart Japanese Application No. JP 2007-505312, mailed on Apr. 17, 2007.

* cited by examiner

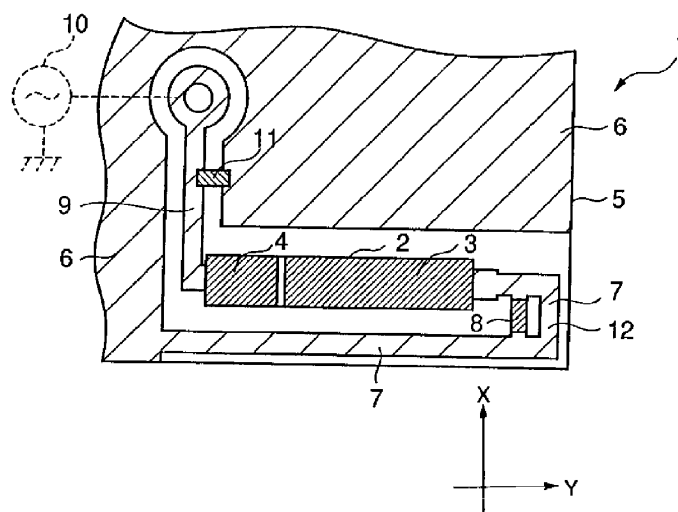
Primary Examiner—HoangAnh T Le

(74) *Attorney, Agent, or Firm*—Keating & Bennett, LLP

(57) **ABSTRACT**

A capacitive-power-feeding-type radiating electrode is provided on a dielectric substrate, and the dielectric substrate is provided in a non-ground region of a circuit board. In the non-ground region of the circuit board, a ground line electrically connecting the radiating electrode with a ground electrode of the circuit board is provided. The ground line is shaped so as to have at least one turnback portion. On the ground line, a resonant-frequency adjusting element is arranged so as to shortcut a portion of the ground line. The resonant-frequency adjusting element has a capacitance or inductance so as to adjust a resonant frequency of an antenna structure to a predetermined resonant frequency.

3 Claims, 5 Drawing Sheets



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US007786941B2

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

(10) **Patent No.:** **US 7,786,941 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **ANTENNA MODULE**

7,136,025 B2 * 11/2006 Lin et al. 343/770
7,289,071 B2 * 10/2007 Hung et al. 343/702

(75) Inventors: **Yi-Wei Tseng**, Taipei County (TW);
Tsung-Wen Chiu, Taipei County (TW);
Fu-Ren Hsiao, Taipei County (TW);
Sheng-Chih Lin, Taipei County (TW)

* cited by examiner

(73) Assignee: **Advanced Connectek, Inc.**, Taipei
County (TW)

Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Schmeiser, Olsen & Watts
LLP

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 176 days.

(57) **ABSTRACT**

(21) Appl. No.: **12/182,806**

(22) Filed: **Jul. 30, 2008**

(65) **Prior Publication Data**

US 2009/0040113 A1 Feb. 12, 2009

(30) **Foreign Application Priority Data**

Aug. 10, 2007 (TW) 96129646 A

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/38 (2006.01)

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

(58) **Field of Classification Search** **343/702,**
343/700 MS, 846, 830

See application file for complete search history.

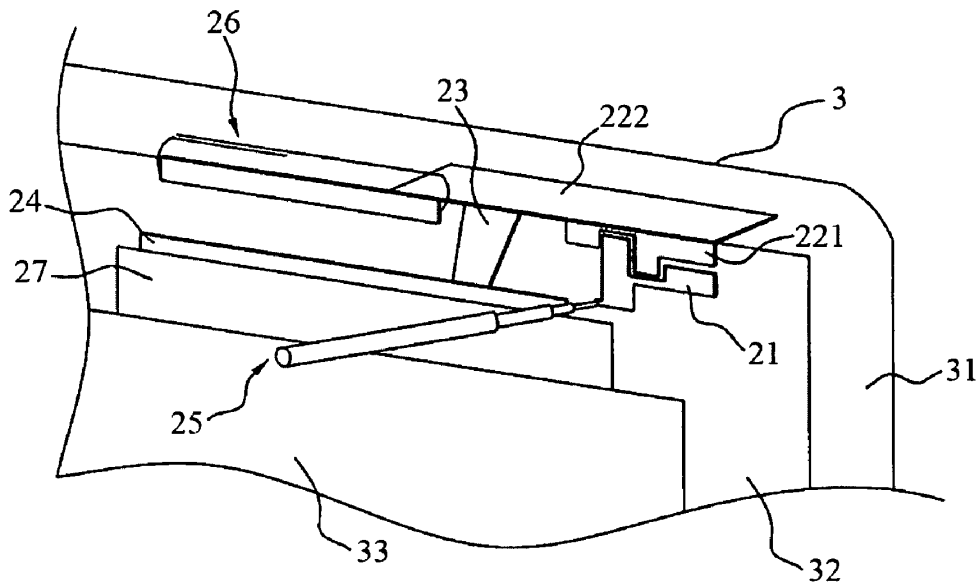
(56) **References Cited**

U.S. PATENT DOCUMENTS

7,050,010 B2 * 5/2006 Wang et al. 343/702

An antenna module is provided. The antenna module comprises a first radiation conductor, a second radiation conductor, a short-circuit element (s/c element), a ground plane, a feed-in cable and a spurious radiation conductor. One terminal of the second radiation conductor is near the first radiation conductor with a gap. One terminal of the s/c element is connected to the second radiation conductor and the other side of the s/c element is connected to the ground plane. The feed-in cable comprises a centre conductor and an external conductor, wherein the centre conductor is connected to the first radiation conductor and the external conductor is connected to the ground plane. The spurious radiation conductor is connected to the second radiation conductor. The second radiation conductor comprises a spurious radiation plate, a first radiation piece and a second radiation piece within the two sides of the second radiation conductor. The first radiation piece and a second radiation piece are in parallel and a gap is conducted between the first radiation piece and the second radiation piece.

10 Claims, 3 Drawing Sheets



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US007786942B2

(12) **United States Patent**
Chen

(10) **Patent No.:** **US 7,786,942 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **HYBRID DUAL DIPOLE SINGLE SLOT
ANTENNA FOR MIMO COMMUNICATION
SYSTEMS**

(76) Inventor: **Mexx Chen**, 584 Ruei Guang Road,
NeiHu District 11492, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 105 days.

(21) Appl. No.: **11/969,243**

(22) Filed: **Jan. 4, 2008**

(65) **Prior Publication Data**

US 2009/0174617 A1 Jul. 9, 2009

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

(52) **U.S. Cl.** **343/727**

(58) **Field of Classification Search** 343/725-727,
343/767

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,176,356 A * 11/1979 Foster et al. 342/367

4,814,777 A * 3/1989 Monser 343/727
7,358,912 B1 * 4/2008 Kish et al. 343/725
2004/0027304 A1 * 2/2004 Chiang et al. 343/810
2004/0070543 A1 * 4/2004 Masaki 343/702
2005/0042988 A1 * 2/2005 Hoek et al. 455/69
2007/0135167 A1 * 6/2007 Liu 455/562.1
2009/0096699 A1 * 4/2009 Chiu et al. 343/797

* cited by examiner

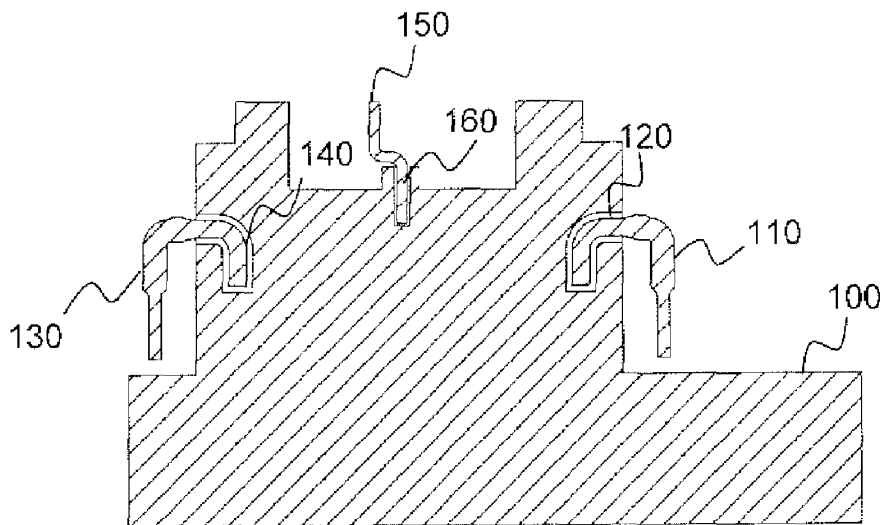
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Martin Fleit; Paul D. Bianco;
Fleit Gibbons Gutman Bongini & Bianco PL

(57) **ABSTRACT**

An antenna arrangement implemented within a printed circuit board (PCB) having three metal co planar layers, for use in multiple input multiple output (MIMO) communication systems. The antenna arrangement comprises a first dipole antenna and second dipole antenna, substantially symmetrical to the first dipole antenna a slot antenna positioned substantially between the first and the second dipole antennas. The antenna arrangement is implemented in three coplanar metal layers. The antennas are used for MIMO communication systems, specifically complying with IEEE 802.11n and are shaped such that their combined radiation pattern exhibits a substantially omni directional radiation pattern.

16 Claims, 5 Drawing Sheets



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US007786943B2

(12) **United States Patent**
Deguchi

(10) **Patent No.:** **US 7,786,943 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

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

(75) Inventor: **Futoshi Deguchi**, Fukuoka (JP)

(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 119 days.

(21) Appl. No.: **12/179,095**

(22) Filed: **Jul. 24, 2008**

(65) **Prior Publication Data**

US 2009/0027285 A1 Jan. 29, 2009

(30) **Foreign Application Priority Data**

Jul. 27, 2007 (JP) 2007-195390

(51) **Int. Cl.**

H01Q 11/12 (2006.01)

H01Q 19/10 (2006.01)

H01Q 1/36 (2006.01)

(52) **U.S. Cl.** **343/742**; 343/818; 343/895

(58) **Field of Classification Search** 343/742,
343/818, 866, 895; 340/572.7

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,173,567	B2 *	2/2007	Inatsugu et al.	343/702
7,474,272	B2 *	1/2009	Lamoureux et al.	343/895
2005/0134515	A1 *	6/2005	Copeland et al.	343/788
2007/0159333	A1	7/2007	Deguchi	

FOREIGN PATENT DOCUMENTS

JP	2007-043535	A	2/2007
JP	2007-164479	A	6/2007

OTHER PUBLICATIONS

English language Abstract of JP 2007-164479 A, Jun. 28, 2007.
English language Abstract of JP 2007-043535 A, Feb. 15, 2007.

* cited by examiner

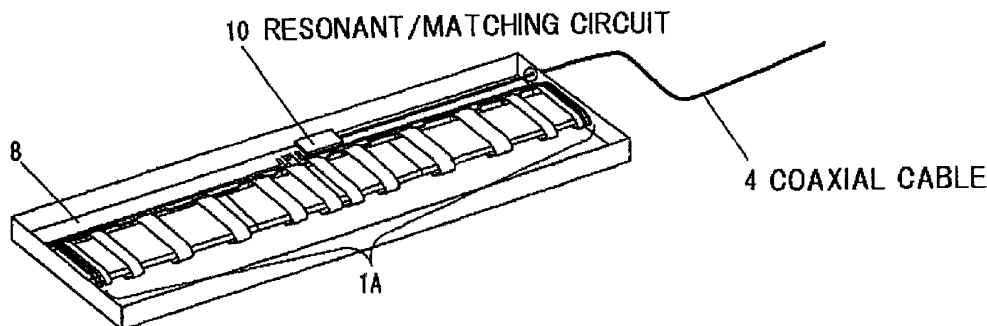
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Greenblum & Bernstein
P.L.C.

(57) **ABSTRACT**

An antenna device includes: a substrate; first and a second antenna units which are wound coaxially on a surface of the substrate, and include a plurality of antenna elements; and a feeder which feeds power only to the first antenna unit. A separation distance between the antenna elements in each of the first and second antenna units is substantially the same.

17 Claims, 5 Drawing Sheets



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US007786949B2

(12) **United States Patent**
Kato

(10) **Patent No.:** **US 7,786,949 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **ANTENNA**

(75) Inventor: **Noboru Kato**, Moriyama (JP)

(73) Assignee: **Murata Manufacturing Co., Ltd.**,
Kyoto (JP)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 323 days.

(21) Appl. No.: **11/928,502**

(22) Filed: **Oct. 30, 2007**

(65) **Prior Publication Data**

US 2008/0122724 A1 May 29, 2008

Related U.S. Application Data

(63) Continuation of application No. 11/688,290, filed on
Mar. 20, 2007, now Pat. No. 7,629,942.

(60) Provisional application No. 60/745,884, filed on Apr.
28, 2006.

(30) **Foreign Application Priority Data**

Apr. 14, 2006	(JP)	2006-112352
Sep. 20, 2006	(JP)	2006-254153
Nov. 17, 2006	(JP)	2006-311546

(51) **Int. Cl.**

H01Q 1/50 (2006.01)

H01Q 7/00 (2006.01)

H01Q 21/00 (2006.01)

(52) **U.S. Cl.** **343/860; 343/748; 343/867**

(58) **Field of Classification Search** **343/748,**
343/860, 862, 867, 895

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,364,564 A	1/1968	Kurtz et al.
4,794,397 A	12/1988	Ohe et al.
5,232,765 A	8/1993	Yano et al.
5,253,969 A	10/1993	Richert
5,337,063 A	8/1994	Takahira
5,374,937 A	12/1994	Tsunekawa et al.
5,399,060 A	3/1995	Richert
5,491,483 A	2/1996	D'Hont
5,757,074 A	5/1998	Matloubian et al.
5,903,239 A	5/1999	Takahashi et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 977 145 A2 2/2000

(Continued)

OTHER PUBLICATIONS

Official communication issued in Japanese Application No. 2007-
531524, mailed on Sep. 11, 2007.

(Continued)

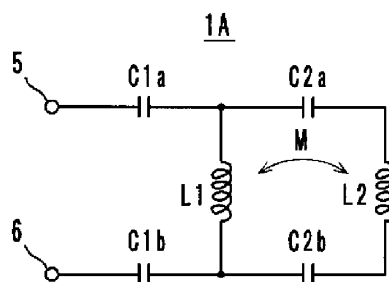
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Keating & Bennett, LLP

(57) **ABSTRACT**

An antenna includes inductance elements that are magnetically coupled together, an LC series resonant circuit that includes one of the inductance elements and capacitance elements, and an LC series resonant circuit that includes another of the inductance elements and capacitance elements. The plurality of LC series resonant circuits are used to radiate radio waves and are used as inductances of a matching circuit that matches an impedance when a power supply side is viewed from power supply terminals and a radiation impedance of free space.

20 Claims, 22 Drawing Sheets



L1
Q: 100
F: 0.915GHz
M: 1

L2
Q: 100
F: 0.915GHz
M: 1



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US007786950B2

(12) **United States Patent**
Ohashi

(10) **Patent No.:** **US 7,786,950 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **LOOP ANTENNA AND LOOP ANTENNA
MANUFACTURING METHOD**

7,573,432 B1 * 8/2009 Eydelman et al. 343/792

(75) Inventor: **Chie Ohashi**, Tokyo (JP)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **Tyco Electronics AMP K.K.**,
Kanagawa-Ken (JP)

JP	54-49839 U	4/1979
JP	57-128214 U	8/1982
JP	57-186802	11/1982
JP	58-140612 U	9/1983
JP	02-186606	7/1990

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 182 days.

(Continued)

(21) Appl. No.: **12/203,499**

OTHER PUBLICATIONS

(22) Filed: **Sep. 3, 2008**

Japanese Office Action dated Jun. 30, 2009, for corresponding Japanese Patent Application No. 2007-228028.

(65) **Prior Publication Data**

US 2009/0058743 A1 Mar. 5, 2009

Primary Examiner—Hoang V Nguyen

(30) **Foreign Application Priority Data**

Sep. 3, 2007 (JP) 2007-228028

(74) Attorney, Agent, or Firm—Barley Snyder LLC

(57) **ABSTRACT**

- (51) **Int. Cl.**
H01Q 7/00 (2006.01)
H01Q 11/12 (2006.01)
H01Q 21/00 (2006.01)
- (52) **U.S. Cl.** **343/870**; 343/741; 343/742;
343/866; 343/867
- (58) **Field of Classification Search** 343/741,
343/742, 866, 867, 870
See application file for complete search history.

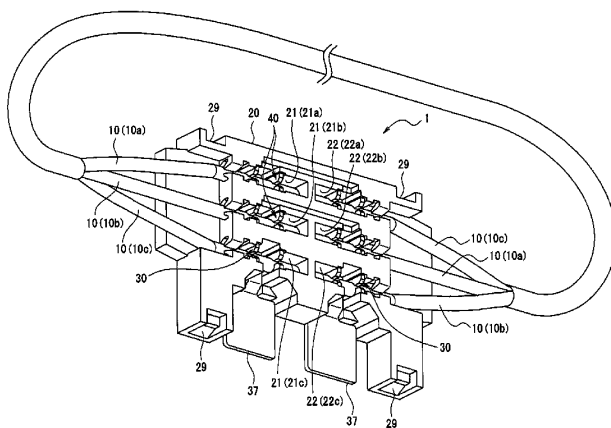
A loop antenna is disclosed which can prevent the occurrence of variance in the loop length of the installed loop antenna element, and a method for manufacturing the loop antenna. The loop antenna comprises electrical wires constituting the antenna element and a housing that holds the electrical wires. Furthermore, the housing is formed with first guide grooves that guide the first end portions of the electrical wires and that have wall surfaces against which the tip ends on the side of the first end portions of the electrical wires abut, and second guide grooves that guide the second end portions of the electrical wires and that have wall surfaces against which the tip ends on the side of the second end portions of the electrical wires abut. Moreover, crimp parts with which the end portions of the electrical wires are connected by crimping are provided inside the respective guide grooves. In addition, a pair of contact parts that make contact with external terminals are respectively connected to the crimp parts.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,936,011 A	6/1990	Berry et al.
5,655,888 A	8/1997	Yumoto
5,846,098 A	12/1998	Shiga et al.
6,772,505 B1	8/2004	Logan et al.
7,129,905 B2 *	10/2006	Morioka 343/866
7,345,644 B2 *	3/2008	Morioka et al. 343/866

4 Claims, 6 Drawing Sheets



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US007787920B2

(12) **United States Patent**
Körner

(10) **Patent No.:** **US 7,787,920 B2**
(45) **Date of Patent:** **Aug. 31, 2010**

(54) **DIPOLE ANTENNA FOR A PORTABLE COMMUNICATION DEVICE**

(75) Inventor: **Hans Peter Körner**, Lund (SE)

(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 657 days.

(21) Appl. No.: **11/738,708**

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

(65) **Prior Publication Data**

US 2008/0261538 A1 Oct. 23, 2008

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

(52) **U.S. Cl.** **455/575.5**; 455/553.1; 455/560

(58) **Field of Classification Search** 455/554.1,
455/554.2, 575.5, 575.7

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,718,157 B1 * 4/2004 Choi 455/3.01
7,151,955 B2 12/2006 Huber et al.
2006/0166719 A1 * 7/2006 Arad et al. 455/575.2

FOREIGN PATENT DOCUMENTS

JP 2004-364149 12/2004

WO 99/54956 10/1999
WO 03/026342 A2 3/2003
WO 03/067702 A2 8/2003
WO 2005/122326 A1 12/2005
WO 2007/039071 A2 4/2007

OTHER PUBLICATIONS

International Search Report for PCT/EP2007/061340, mailed Feb. 7, 2008, 3 pages.

* cited by examiner

Primary Examiner—Nay A Maung

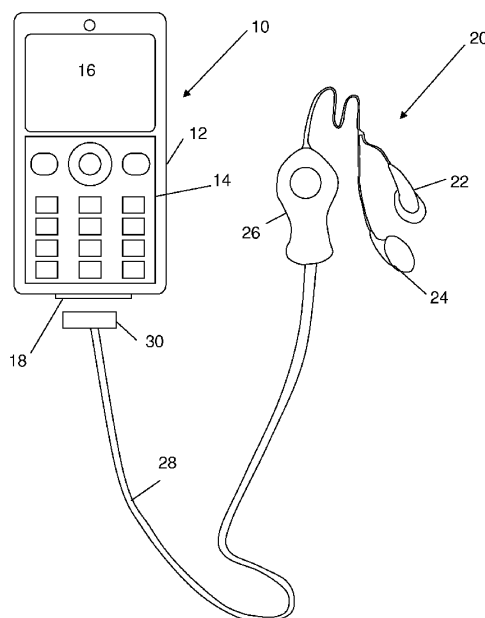
Assistant Examiner—Angelica M Perez

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

(57) **ABSTRACT**

The present invention relates to a portable communication device arrangement comprising a main unit and an auxiliary unit. The main unit includes an electrical interface to an auxiliary unit, a ground plane dimensioned for antenna operation at a multiple of a quarter of a wavelength of a desired frequency, and a radio communication unit connected to the ground plane and to the electrical interface. The auxiliary unit comprises at least one electrical conductor to be connected to the electrical interface and including a first radio frequency trap, where the distance between the first radio frequency trap and an end of the conductor that is to be connected to the electrical interface corresponds to an odd multiple of a quarter of a wavelength of the desired frequency. The invention provides a good antenna through reuse of elements already provided in relation to a portable communication device.

11 Claims, 2 Drawing Sheets



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