



US007173564B2

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

(10) **Patent No.:** **US 7,173,564 B2**  
(45) **Date of Patent:** **Feb. 6, 2007**

(54) **ANTENNA FOR ULTRA-WIDE BAND COMMUNICATION**

(75) Inventors: **Jaе Yeong Park**, Seoul (KR); **Seok Ho Choi**, Chungcheongnam-do (KR); **Jong Kweon Park**, Daejeon (KR); **Sun Kyung Kim**, Daejeon (KR)

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

(\*) 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.: **10/894,013**

(22) Filed: **Jul. 20, 2004**

(65) **Prior Publication Data**

US 2005/0052322 A1 Mar. 10, 2005

(30) **Foreign Application Priority Data**

Jul. 21, 2003 (KR) ..... 10-2003-0049755

(51) **Int. Cl.**

**H01Q 1/38** (2006.01)

**H01Q 1/48** (2006.01)

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

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

See application file for complete search history.

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*Primary Examiner*—Hoanganh Le

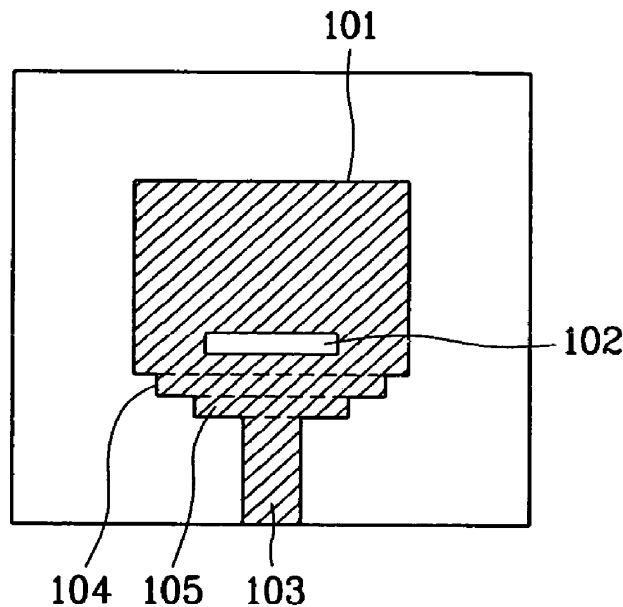
*Assistant Examiner*—Tung Le

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

**ABSTRACT**

An antenna for ultra-wide band communication is disclosed. The antenna includes a substrate, a patch formed on one side of the substrate so as to be smaller than the substrate, and being excited when an electric current is supplied through a feeder line, so as to radiate energy, and a ground area formed by removing a portion of another side of the substrate so as to obtain a wide band characteristic.

**18 Claims, 11 Drawing Sheets**





US007173566B2

(12) **United States Patent**  
**Cheng**

(10) **Patent No.:** **US 7,173,566 B2**  
(45) **Date of Patent:** **Feb. 6, 2007**

(54) **LOW-SIDELOBE DUAL-BAND AND BROADBAND FLAT ENDFIRE ANTENNA**

6,703,985 B2 \* 3/2004 Lee ..... 343/786  
2004/0017315 A1 \* 1/2004 Fang et al. .... 343/700 MS  
2006/0114166 A1 \* 6/2006 Mohammadian et al. ... 343/795

(75) Inventor: **Shih-Chieh Cheng**, Tainan County (TW)

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

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*Primary Examiner*—Tan Ho

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

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

(57) **ABSTRACT**

A low-sidelobe dual-band and broadband flat endfire antenna includes a substrate, a first radiator, a second radiator, two refraction portions, and a conductive element. The substrate has a side surface, a first surface, and a second surface. The first radiator is disposed on the first surface and has a first oblique portion, a first concave portion, and a first electrically connecting portion disposed opposite to the first concave portion. The second radiator is disposed on the second surface and has a second oblique portion, a second concave portion, and a second electrically connecting portion disposed opposite to the second concave portion. The second oblique portion is disposed opposite to the first oblique portion to form an included angle. The refraction portions are disposed on the side surface and are opposite to one another. The conductive element has a conductive body and a grounded conductor electrically connected to the first conductivity portion and the second conductivity portion, respectively.

(21) Appl. No.: **11/187,936**

(22) Filed: **Jul. 25, 2005**

(65) **Prior Publication Data**

US 2006/0170594 A1 Aug. 3, 2006

(30) **Foreign Application Priority Data**

Feb. 2, 2005 (TW) ..... 94103280 A

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

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

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 795**

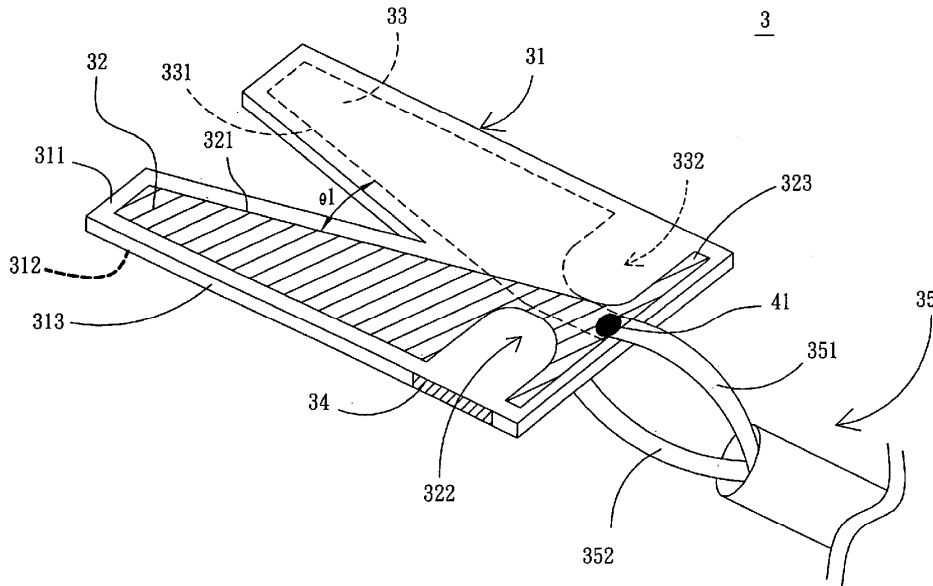
See application file for complete search history.

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**14 Claims, 6 Drawing Sheets**





US007173567B2

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

(10) **Patent No.:** **US 7,173,567 B2**  
(45) **Date of Patent:** **Feb. 6, 2007**

(54) **ANTENNA**  
(75) Inventors: **Susumu Inatsugu**, Osaka (JP);  
**Hiroataka Ishihara**, Osaka (JP); **Koichi Ogawa**, Osaka (JP); **Tomoyuki Maeda**, Hyogo (JP)  
(73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, 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.

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*Primary Examiner*—Trinh Dinh  
*Assistant Examiner*—Huedung Mancuso  
(74) *Attorney, Agent, or Firm*—RatnerPrestia

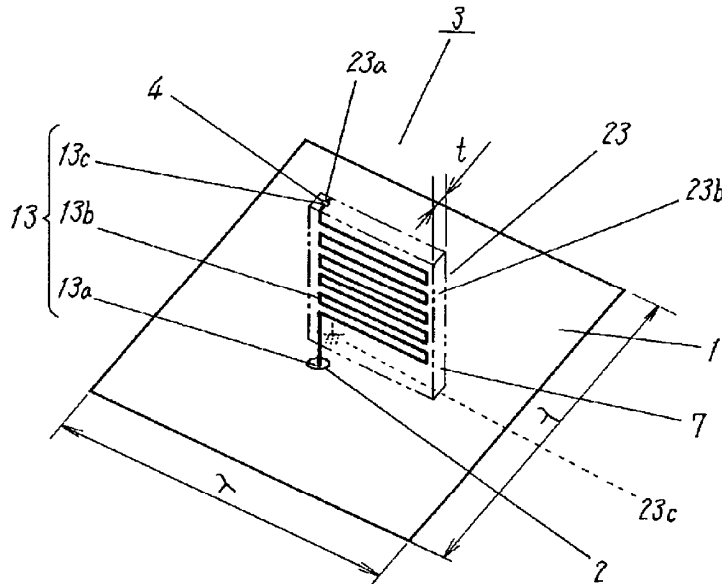
(21) Appl. No.: **10/756,982**  
(22) Filed: **Jan. 14, 2004**  
(65) **Prior Publication Data**  
US 2004/0263407 A1 Dec. 30, 2004  
(30) **Foreign Application Priority Data**  
Jan. 16, 2003 (JP) ..... 2003-007980  
(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
(52) **U.S. Cl.** ..... **343/702**  
(58) **Field of Classification Search** ..... 343/700 MS,  
343/815-818, 711-713, 702, 895, 866, 741,  
343/742  
See application file for complete search history.

(57) **ABSTRACT**

The antenna of the present invention comprises flat-plate conductive ground plane **1**, first antenna element **13** with one end **13a** connected to feeding point **2** and intermediate portion **13b** folded by a plurality of times, which is extended upward from the ground plane **1**, and second antenna element **23** with one end **23a** connected to the other end **13c** of the first antenna element **13**, with intermediate portion **23b** formed in symmetrical relation to the first antenna element **13**, and also, with the other end **23c** connected to the ground plane **1**. Thus, it is possible to obtain a small size antenna with the antenna element lowered in height.

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**8 Claims, 11 Drawing Sheets**





US007173573B2

(12) **United States Patent**  
**Wakabayashi**

(10) **Patent No.:** **US 7,173,573 B2**  
(45) **Date of Patent:** **Feb. 6, 2007**

(54) **INSERTION-PORT LOOP ANTENNA AND NON-CONTACT TYPE COMMUNICATION MEDIUM PROCESSING UNIT**

5,602,556 A \* 2/1997 Bowers ..... 343/742  
6,422,475 B1 7/2002 May  
6,525,694 B2 \* 2/2003 Jiang et al. .... 343/742  
2003/0184493 A1 \* 10/2003 Robinet et al. .... 343/867

(75) Inventor: **Naoyuki Wakabayashi**, Osaka (JP)

(73) Assignee: **Omron Corporation** (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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WO WO 9746964 12/1997

(21) Appl. No.: **10/943,881**

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(22) Filed: **Sep. 20, 2004**

*Primary Examiner*—Don Wong

*Assistant Examiner*—Angela M Lie

(65) **Prior Publication Data**

(74) *Attorney, Agent, or Firm*—Dickstein Shapiro LLP

US 2005/0062672 A1 Mar. 24, 2005

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Sep. 19, 2003 (JP) ..... 2003/327400

(51) **Int. Cl.**  
*H01Q 21/00* (2006.01)  
*H01Q 7/00* (2006.01)  
*H04B 1/38* (2006.01)

(52) **U.S. Cl.** ..... 343/867; 343/866; 455/557

(58) **Field of Classification Search** ..... 455/558,  
455/557; 343/866, 867, 870, 742, 788, 895;  
235/384, 382, 440

See application file for complete search history.

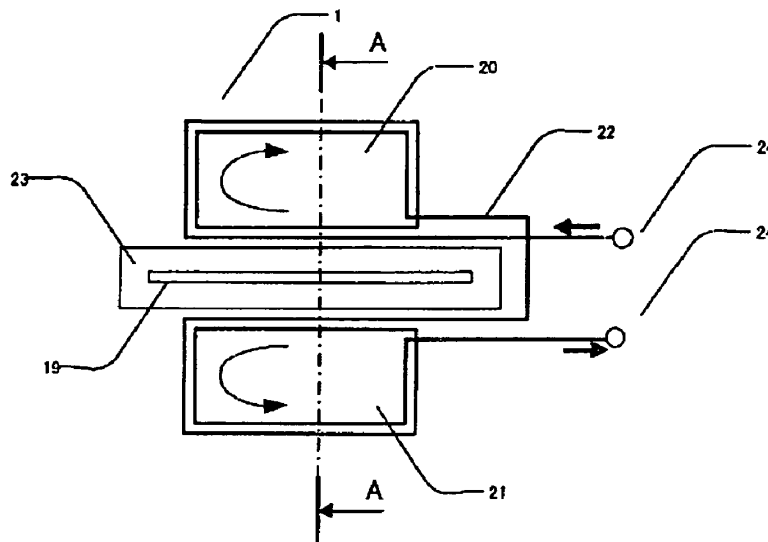
An insertion-port loop antenna has a wide communication region for a non-contact type IC card inserted into an insertion port of a card reader, etc. An insertion-port loop antenna is mounted in the vicinity of an insertion port, through which a non-contact type communication medium is inserted. The insertion-port loop antenna comprises two loops. An upper loop is arranged above a long side of the insertion port. A lower loop is arranged below the long side of the insertion port. The two loops are opposite to each other in a direction of winding. Thereby, magnetic flux is generated between the upper loop and the lower loop. The magnetic flux is generated in front of the insertion port. Therefore, it is possible to begin communication before the non-contact type IC card is inserted into the insertion port.

(56) **References Cited**

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**5 Claims, 15 Drawing Sheets**





US007176837B2

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

(10) **Patent No.:** **US 7,176,837 B2**  
(45) **Date of Patent:** **Feb. 13, 2007**

(54) **ANTENNA DEVICE**

(75) Inventors: **Ryuta Sonoda**, Yokohama (JP);  
**Fuminori Watanabe**, Yokohama (JP);  
**Koji Ikawa**, Yokohama (JP); **Kazuhiko Niwano**, Yokohama (JP)

(73) Assignee: **Asahi Glass Company, 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 0 days.

(21) Appl. No.: **11/185,785**

(22) Filed: **Jul. 21, 2005**

(65) **Prior Publication Data**  
US 2006/0022876 A1 Feb. 2, 2006

(30) **Foreign Application Priority Data**  
Jul. 28, 2004 (JP) ..... 2004-220302  
Dec. 22, 2004 (JP) ..... 2004-371952

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
(52) **U.S. Cl.** ..... **343/700 MS**  
(58) **Field of Classification Search** ..... 343/700 MS,  
343/846, 702, 830, 829, 848  
See application file for complete search history.

(56) **References Cited**  
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Do-Hoon Kwon, et al., "A Small Ceramic Chip Antenna for Ultra-Wideband Systems", UWBST & IWUWBS Conference Proceedings, TA4-3, 2004, pp. 307-311.  
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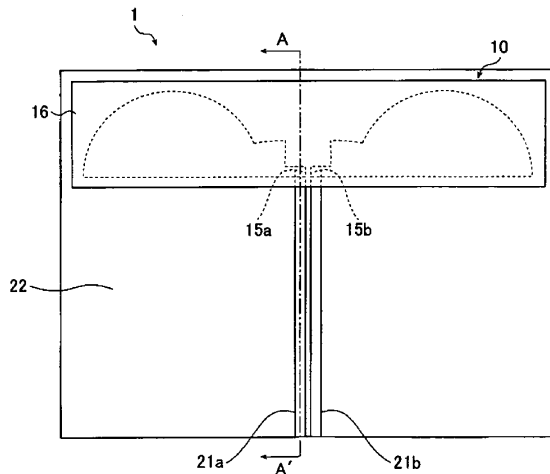
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*Primary Examiner*—Trinh Dinh  
*Assistant Examiner*—Huedung Mancuso  
(74) *Attorney, Agent, or Firm*—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

(57) **ABSTRACT**

The radiating conductor in an antenna device comprises first forming elements, second forming elements and third forming elements disposed to be coupled in one direction. The first forming elements are formed in a semi-circular shape, and the third forming elements are formed in a band-like shape and have feed points disposed therein. The first forming elements, the second forming elements and the third forming elements have respective maximum lengths gradually reduced in this order.

**26 Claims, 16 Drawing Sheets**





US007176838B1

(12) **United States Patent**  
**Kinezos**

(10) **Patent No.:** **US 7,176,838 B1**  
(45) **Date of Patent:** **Feb. 13, 2007**

- (54) **MULTI-BAND ANTENNA**
- (75) Inventor: **Christos L. Kinezos**, Sunrise, FL (US)
- (73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)
- (\* ) 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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*Primary Examiner*—Hoanganh Le

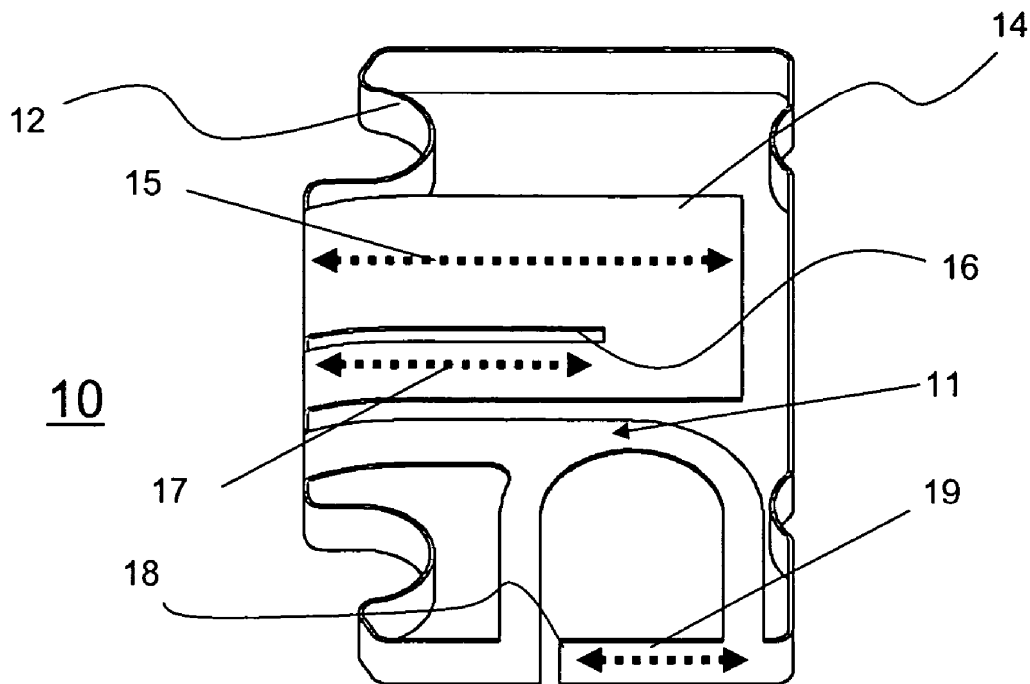
- (21) Appl. No.: **11/208,673**
- (22) Filed: **Aug. 22, 2005**
- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **343/700 MS; 343/729; 343/702; 343/767**
- (58) **Field of Classification Search** ..... **343/700 MS, 343/702, 729, 767, 741, 866, 725**  
See application file for complete search history.

(57) **ABSTRACT**

A multi-band antenna (10) includes one or more a loop portions (12) substantially defining operation in frequency ranges covering between approximately 800 MegaHertz and approximately 1.0 GigaHertz and between approximately 1.8 GigaHertz and approximately 2.0 GigaHertz, a surface plate portion (14) having a length (15) substantially defining operation in a frequency range between approximately 1.7 GigaHertz and approximately 1.9 GigaHertz, and a slot (16) within the surface plate portion having a length (17) substantially defining operation in a frequency range between 5 and 6 Gigahertz (WLAN). The antenna can further include a resonant stub (18) having a length (19) substantially defining operation in a frequency range of approximately 2.4 Gigahertz. The antenna can be a unitary radiating element having a feed element (9) and a ground port (7). Operationally, the antenna can function in 6 bands and can be independently tunable in a majority of the 6 bands.

- (56) **References Cited**  
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**20 Claims, 3 Drawing Sheets**





US007176839B2

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

(10) **Patent No.:** **US 7,176,839 B2**  
(45) **Date of Patent:** **Feb. 13, 2007**

(54) **ANTENNA UNIT**

(75) Inventors: **Shinsuke Ueda**, Shijonawate (JP);  
**Hideki Oka**, Neyagawa (JP); **Kazuhiro**  
**Matsumoto**, Hirakata (JP); **Masayuki**  
**Matsuo**, Neyagawa (JP); **Takashi**  
**Saeki**, Hirakata (JP); **Hiroshi Chujo**,  
Tsu (JP)

(73) Assignee: **Matsushita Electric Works, Ltd.**,  
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.: **10/536,981**

(22) PCT Filed: **Oct. 25, 2004**

(86) PCT No.: **PCT/JP2004/015782**

§ 371 (c)(1),  
(2), (4) Date: **May 31, 2005**

(87) PCT Pub. No.: **WO2005/078971**

PCT Pub. Date: **Aug. 25, 2005**

(65) **Prior Publication Data**

US 2006/0007046 A1 Jan. 12, 2006

(30) **Foreign Application Priority Data**

Feb. 17, 2004 (JP) ..... 2004-040308

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

(52) **U.S. Cl.** ..... **343/702; 343/702; 343/841;**  
**343/872; 455/90.3; 455/575.5**

(58) **Field of Classification Search** ..... 343/702,  
343/841, 872; 455/90.3, 575.5  
See application file for complete search history.

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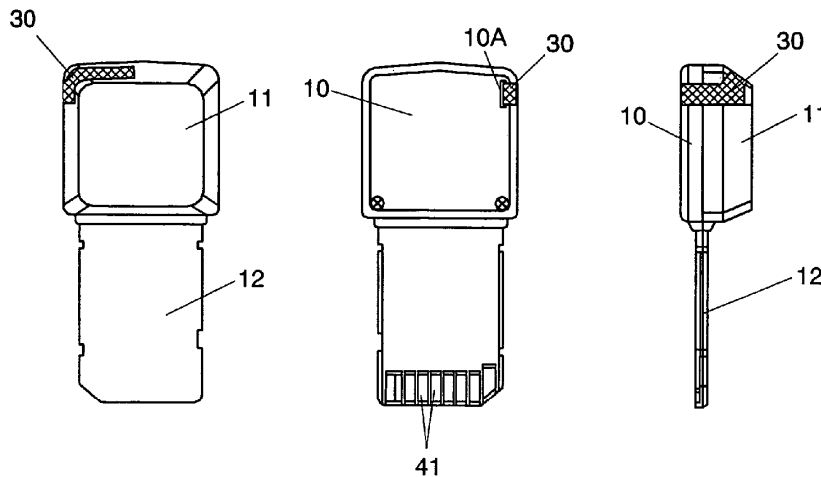
*Primary Examiner*—Hoang V. Nguyen  
*Assistant Examiner*—Dieu Hien Duong

(74) *Attorney, Agent, or Firm*—Rader, Fishman & Grauer  
PLLC

(57) **ABSTRACT**

This antenna unit is adapted to be connected to an electronic  
device for transmitting a received radio signal to the elec-  
tronic device. The antenna unit comprises a noise canceller  
for canceling noise generated in the electronic device and  
transmitted to the antenna unit through a ground line. The  
noise canceller is a conductive stub piece one end of which  
is electrically connected to an electromagnetic shield of the  
antenna unit and the other end of which is a free end. The  
stub piece has a length of about ¼ of a wavelength of the  
radio signal.

**17 Claims, 25 Drawing Sheets**





US007176841B2

(12) **United States Patent**  
**Fukuda**

(10) **Patent No.:** **US 7,176,841 B2**  
(45) **Date of Patent:** **Feb. 13, 2007**

(54) **ANTENNA DEVICE AND RADIO COMMUNICATION APPARATUS USING THE ANTENNA DEVICE**

7,043,269 B2\* 5/2006 Ono et al. .... 455/558

**FOREIGN PATENT DOCUMENTS**

(75) Inventor: **Junichi Fukuda**, Tokyo (JP)  
(73) Assignee: **NEC 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 69 days.

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(21) Appl. No.: **11/006,559**  
(22) Filed: **Dec. 8, 2004**  
(65) **Prior Publication Data**  
US 2005/0128155 A1 Jun. 16, 2005  
(30) **Foreign Application Priority Data**  
Dec. 11, 2003 (JP) ..... 2003-413219

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*Primary Examiner*—Tuyet Vo  
*Assistant Examiner*—Jimmy Vu  
(74) *Attorney, Agent, or Firm*—Whitham, Curtis, Christofferson & Cook, PC

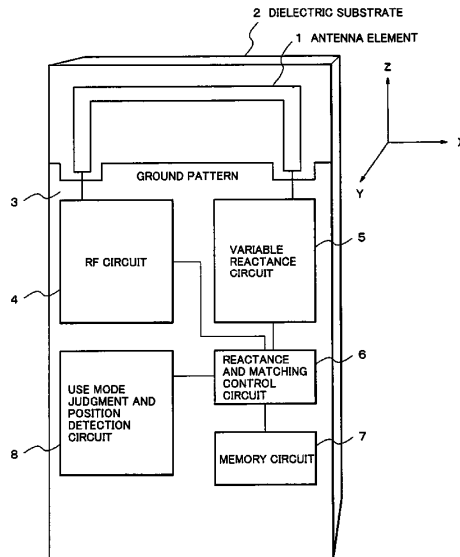
(57) **ABSTRACT**

(51) **Int. Cl.**  
**H01Q 9/00** (2006.01)  
(52) **U.S. Cl.** ..... **343/745; 343/860**  
(58) **Field of Classification Search** ..... 343/747,  
343/806, 860, 745, 750; 455/193, 558, 557;  
342/357.1  
See application file for complete search history.

An electrical signal is fed from one terminal of an antenna element, and the other terminal thereof is terminated by a variable reactance circuit. A reactance value of the variable reactance circuit is changed according to use state of a device to optimally set its directivity. Matching conditions at an electricity feeding point are controlled to match an impedance of the electricity feeding point which fluctuates according to the value of the variable reactance circuit. With the above construction, there are provided an antenna device that is downsized, can control its directivity, and does not deteriorate a communication quality depending on a use state, and a radio communication apparatus provided with the antenna device.

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**16 Claims, 7 Drawing Sheets**







US007176843B2

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

(10) **Patent No.:** **US 7,176,843 B2**  
(45) **Date of Patent:** **Feb. 13, 2007**

- (54) **WIDEBAND ANTENNA AND COMMUNICATION APPARATUS HAVING THE ANTENNA**
- (75) Inventors: **Hiroshi Shimasaki**, Ome (JP); **Satoshi Mizoguchi**, Ome (JP); **Masao Teshima**, Kunitachi (JP)
- (73) Assignee: **Kabushiki Kaisha Toshiba**, Tokyo (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 128 days.
- (21) Appl. No.: **11/092,161**
- (22) Filed: **Mar. 28, 2005**

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*Primary Examiner*—Hoang V. Nguyen  
*Assistant Examiner*—Ephrem Alemu  
(74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, PC

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US 2006/0017643 A1 Jan. 26, 2006
- (30) **Foreign Application Priority Data**  
Jul. 12, 2004 (JP) ..... 2004-205042  
Jan. 11, 2005 (JP) ..... 2005-004196  
Feb. 22, 2005 (JP) ..... 2005-045783

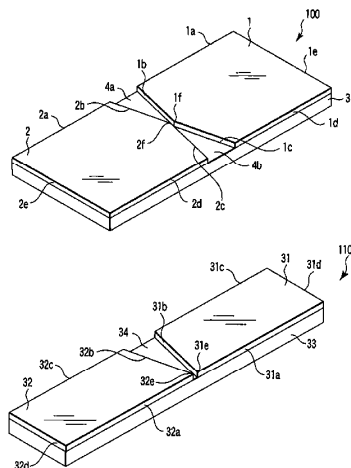
(57) **ABSTRACT**

A wideband antenna in which a first and second conductive element are arranged so that a notch is formed between the first and second conductive element, wherein the first and second conductive element have shapes satisfying two conditions (i) a sum of the lengths of sides facing the notch and a first side terminating at one edge of a wider opening of the notch, these sides pertaining to the first conductive element, and the lengths of sides facing the notch and a second side terminating at one edge of the wider opening, these sides pertaining to the second conductive element, is approximately half of a first wavelength, and (ii) a sum of the lengths of sides pertaining to the first conductive element and facing the notch, and the lengths of sides pertaining to the second conductive element and facing the notch is approximately half of a second wavelength.

- (51) **Int. Cl.**  
**H01Q 9/28** (2006.01)
- (52) **U.S. Cl.** ..... **343/795**; 343/700 MS; 343/702
- (58) **Field of Classification Search** ..... 343/795, 343/793, 700 MS, 702, 820, 821  
See application file for complete search history.

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**24 Claims, 69 Drawing Sheets**





US007177236B2

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

(10) **Patent No.:** **US 7,177,236 B2**  
(45) **Date of Patent:** **Feb. 13, 2007**

(54) **OPTICAL DISC HEAD INCLUDING A BOWTIE GRATING ANTENNA AND SLIDER FOR OPTICAL FOCUSING, AND METHOD FOR MAKING**

5,581,267 A \* 12/1996 Matsui et al. .... 343/837  
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6,396,789 B1 \* 5/2002 Guerra et al. .... 369/112.01  
6,407,708 B1 6/2002 Jasper, Jr.

(75) Inventors: **John Harchanko**, New Market, AL (US); **Michele Banish**, Huntsville, AL (US)

(73) Assignee: **MEMS Optical, Inc.**, Huntsville, AL (US)

(Continued)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 274 days.

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WO WO 99/64929 A1 12/1999

(21) Appl. No.: **10/318,189**

(22) Filed: **Dec. 13, 2002**

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(65) **Prior Publication Data**  
US 2003/0210637 A1 Nov. 13, 2003

Grossman, E. Ed., "Lithographic Antennas For Submillimeter and Infrared Frequencies", EMC-A Global Concern. IEEE1995 International Symposium on Electromagnetic Compatibility. Atlanta, Aug. 14, 1995, International Symposium on Electromagnetic Compatibility, New York, IEEE, US, Aug. 14, 1995, pp. 102-107.

**Related U.S. Application Data**

(Continued)

(60) Provisional application No. 60/346,615, filed on Jan. 10, 2002, provisional application No. 60/339,103, filed on Dec. 13, 2001.

*Primary Examiner*—Wayne Young  
*Assistant Examiner*—Michael V. Battaglia  
(74) *Attorney, Agent, or Firm*—McGrath, Geissler, Olds & Richardson, PLLC

(51) **Int. Cl.**  
**G11B 7/18** (2006.01)

(52) **U.S. Cl.** ..... **369/13.33**; 369/112.04;  
369/13.29; 343/756; 343/763

(57) **ABSTRACT**

(58) **Field of Classification Search** ..... 369/13.33,  
369/112.04, 112.17, 13.29, 13.3; 363/756,  
363/793; 343/756, 793  
See application file for complete search history.

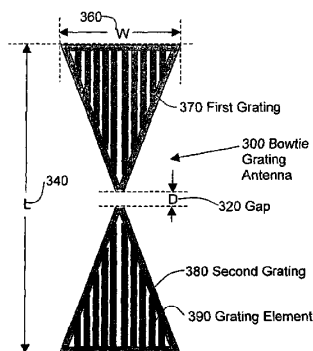
A slider system have been developed to aid in the spacing between read/write heads and the storage medium, and a grating antenna amplifier has been developed to improve illumination spot size and polarization characteristics. The grating antenna can be attached to a grayscale slider to obtain a distance between the illumination spot and antenna that lies in the near field region.

(56) **References Cited**

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**23 Claims, 8 Drawing Sheets**



GRATING ANTENNA PREFERRED EMBODIMENT



US007180448B2

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

(10) **Patent No.:** **US 7,180,448 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **PLANAR INVERTED F ANTENNA AND METHOD OF MAKING THE SAME**

(75) Inventors: **Shanmuganthan Suganthan**, Watford (GB); **Vladimir Stojilkovic**, Aylesbury (GB)

(73) Assignee: **Centurion Wireless Technologies, Inc.**, Lincoln, NE (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 129 days.

(21) Appl. No.: **10/667,933**

(22) Filed: **Sep. 22, 2003**

(65) **Prior Publication Data**  
US 2005/0062655 A1 Mar. 24, 2005

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
(52) **U.S. Cl.** ..... **343/700 MS; 343/702**  
(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 846**  
See application file for complete search history.

(56) **References Cited**

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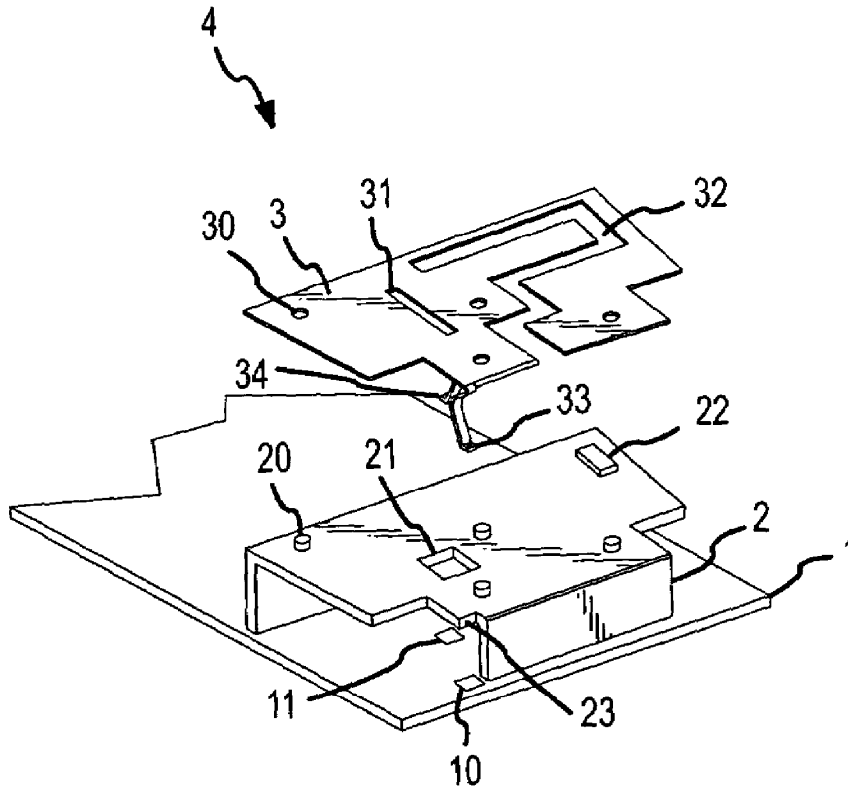
*Primary Examiner*—Michael C. Wimer

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

(57) **ABSTRACT**

A planar inverted F antenna having a radiating patch and a carrier is described. The radiating patch includes a blank, a first connector and a second connector. The first connector is formed from the blank material and provides a cutout region within the periphery of the radiating patch.

**21 Claims, 2 Drawing Sheets**





US007180449B2

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

(10) **Patent No.:** **US 7,180,449 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

- (54) **ANTENNA WITH FILTER**
- (75) Inventors: **Jia-Haur Liang**, Kaohsiung (TW);  
**Ting-Yi Tsai**, Taipei (TW)
- (73) Assignee: **Accton 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.
- (21) Appl. No.: **10/986,087**
- (22) Filed: **Nov. 12, 2004**
- (65) **Prior Publication Data**  
US 2006/0012526 A1 Jan. 19, 2006
- (30) **Foreign Application Priority Data**  
Jul. 13, 2004 (TW) ..... 93120836 A
- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **343/700 MS**; 343/795;  
343/850

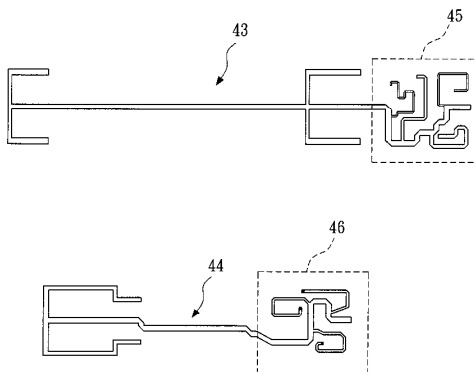
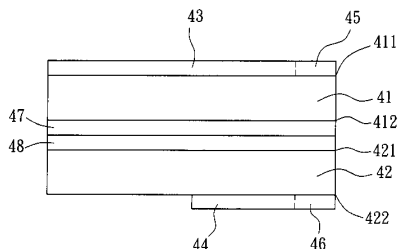
(58) **Field of Classification Search** ..... 343/700 MS,  
343/795, 850; 333/204  
See application file for complete search history.

- (56) **References Cited**  
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*Primary Examiner*—Michael C. Wimer  
(74) *Attorney, Agent, or Firm*—Troxell Law Office, PLLC

(57) **ABSTRACT**  
The present invention discloses an antenna with a filter,  
which comprises a substrate; an antenna device, a filter and  
a feed end. The antenna device is printed on the substrate;  
the filter is coupled to the antenna device; the feed end is  
coupled to the filter. The filter and the antenna device are  
radiating members printed on the substrate.

**10 Claims, 10 Drawing Sheets**





US007180453B2

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

(10) **Patent No.:** **US 7,180,453 B2**  
(45) **Date of Patent:** **\*Feb. 20, 2007**

(54) **ANTENNA FOR PORTABLE CELLULAR TELEPHONE**

(75) Inventors: **Yoshinobu Nakagawa**, Osaka (JP); **Koji Sako**, Okayama (JP); **Masaaki Yamabayashi**, Tsuyama (JP); **Kazumine Koshi**, Tsuyama (JP); **Naoyuki Takagi**, Joyo (JP)

(73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, 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.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/063,520**

(22) Filed: **Feb. 23, 2005**

(65) **Prior Publication Data**  
US 2005/0225488 A1 Oct. 13, 2005

(30) **Foreign Application Priority Data**  
Apr. 9, 2004 (JP) ..... 2004-115284  
May 27, 2004 (JP) ..... 2004-157396

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

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

(58) **Field of Classification Search** ..... 343/702,  
343/745, 749, 725  
See application file for complete search history.

(56) **References Cited**

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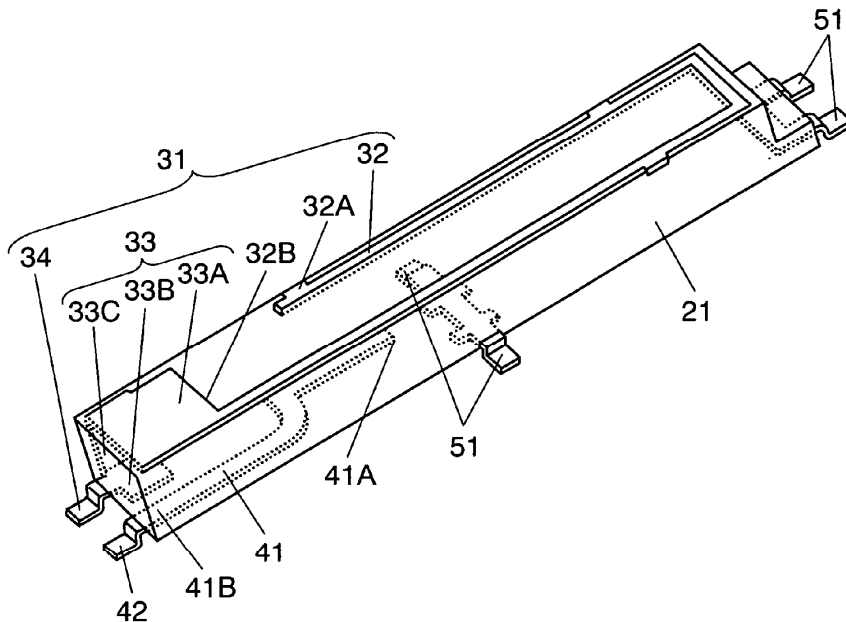
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*Primary Examiner*—Trinh Dinh  
*Assistant Examiner*—Huedung Mancuso  
(74) *Attorney, Agent, or Firm*—RatnerPrestia

(57) **ABSTRACT**

An antenna for portable cellular telephone can adjust each of multiple antenna elements efficiently and independently to a predetermined resonance frequency. A first antenna element and second antenna element are mounted on and anchored to one common base. Terminals for feeding power to the first antenna element and the second antenna element are provided respectively. The terminals are coupled to matching circuits. This structure facilitates separate and efficient adjustment of resonance frequency of the first antenna element and the second antenna element.

**5 Claims, 9 Drawing Sheets**





US007180455B2

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

(10) **Patent No.:** **US 7,180,455 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **BROADBAND INTERNAL ANTENNA**

(75) Inventors: **Sae Won Oh**, Kyungki-do (KR); **Chul Ho Kim**, Kyungki-do (KR); **Hyun Hak Kim**, Kyungki-do (KR); **Tae Sung Kim**, Seoul (KR); **Young Deg Kim**, Kyungki-do (KR); **Gi Tae Do**, Kyungki-do (KR)

(73) Assignee: **Samsung Electro-Mechanics Co., Ltd.**, Kyungki-do (KR)

(\* ) 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.: **11/091,987**

(22) Filed: **Mar. 29, 2005**

(65) **Prior Publication Data**

US 2006/0077115 A1 Apr. 13, 2006

(30) **Foreign Application Priority Data**

Oct. 13, 2004 (KR) ..... 10-2004-0081860

(51) **Int. Cl.**

**H01Q 21/00** (2006.01)  
**H01Q 1/36** (2006.01)

(52) **U.S. Cl.** ..... **343/725; 343/702; 343/895**

(58) **Field of Classification Search** ..... **343/725, 343/728, 895, 702**  
See application file for complete search history.

(56) **References Cited**

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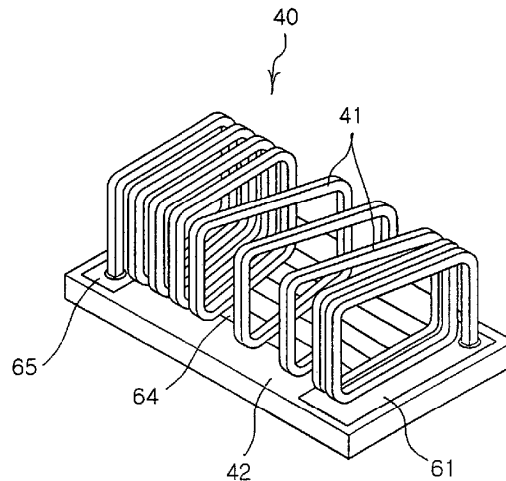
*Primary Examiner*—Hoang V. Nguyen  
*Assistant Examiner*—Ephrem Alemu

(74) *Attorney, Agent, or Firm*—Volpe And Koenig, P.C.

(57) **ABSTRACT**

A broadband internal antenna includes a first radiator having a radiation part with one or more coils having different pitch intervals connected in series to each other, and a second radiator having at least one conductive strip line arranged parallel to a longitudinal direction of the first radiator. The antenna further includes a connection part to which an end of the at least one conductive strip line is connected, to which a first end of the first radiator is attached and in which a part for supplying current to the antenna and a part for grounding the antenna are formed, and an attachment pad to which a second end of the first radiator is attached and from which current is drawn. Current flowing through the first radiator and current flowing through the strip lines form current paths in different directions to set a certain broadband using mutual Electromagnetic (EM) coupling.

**11 Claims, 18 Drawing Sheets**





US007180458B2

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

(10) **Patent No.:** **US 7,180,458 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **ANTENNA AND INFORMATION COMMUNICATION APPARATUS USING THE ANTENNA**

(75) Inventors: **Fumikazu Hoshi**, Miyagi (JP);  
**Takakuni Minewaki**, Kanagawa (JP)

(73) Assignee: **Ricoh Company, 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 36 days.

(21) Appl. No.: **11/178,679**

(22) Filed: **Jul. 11, 2005**

(65) **Prior Publication Data**  
US 2006/0012528 A1 Jan. 19, 2006

(30) **Foreign Application Priority Data**  
Jul. 13, 2004 (JP) ..... 2004-206124  
Feb. 28, 2005 (JP) ..... 2005-053142

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

(52) **U.S. Cl.** ..... **343/772; 343/773**

(58) **Field of Classification Search** ..... **343/772, 343/773, 846**

See application file for complete search history.

(56) **References Cited**

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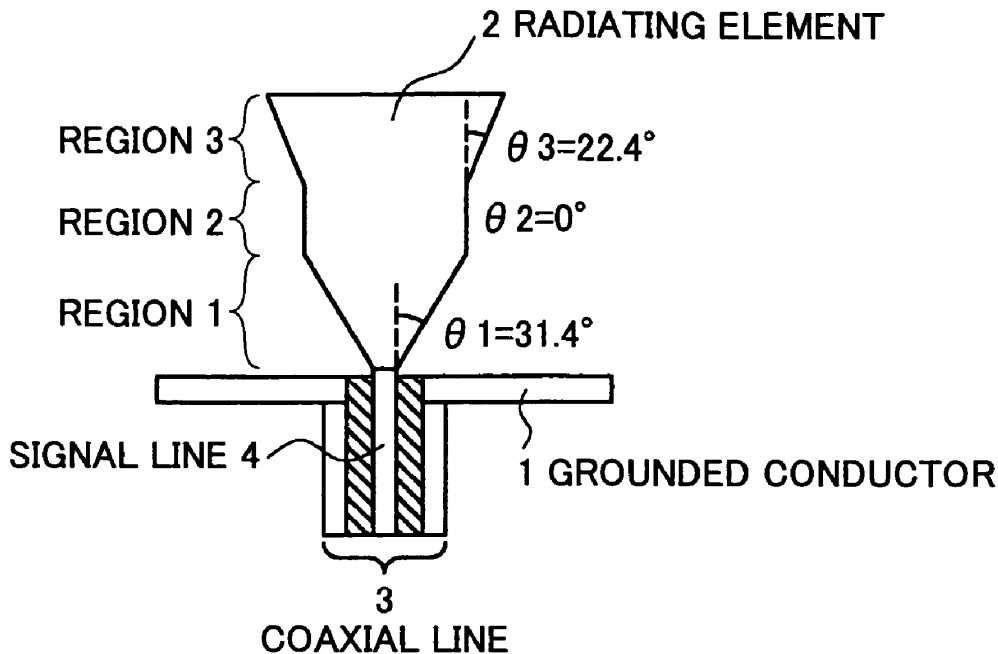
*Primary Examiner*—Hoang V. Nguyen

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

(57) **ABSTRACT**

An antenna including a grounded conductor and a radiating element having a diameter that increases from the top to the bottom in which the top of the radiating element is opposed to the grounded conductor is disclosed. The radiating element of the antenna includes three regions positioned from the top to the bottom, each region having an angle between a side of the radiating element in the region and a center axis of the radiating element, wherein the angles of the three regions satisfy relationship:  $\theta 1 > \theta 2$  and  $\theta 2 < \theta 3$  when the angles are indicated by  $\theta 1$ ,  $\theta 2$  and  $\theta 3$  respectively from the top to the bottom.

**19 Claims, 18 Drawing Sheets**





US007180461B2

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

(10) **Patent No.:** **US 7,180,461 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **WIDEBAND OMNIDIRECTIONAL ANTENNA**

(75) Inventors: **Anthanasios G. Petropoulos**, Lowell, MA (US); **Jarrett Morrow**, Bow, NH (US)  
(73) Assignee: **Cushcraft Corporation**, Manchester, NH (US)  
(\* ) 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.: **11/190,649**

(22) Filed: **Jul. 27, 2005**

(65) **Prior Publication Data**

US 2006/0082515 A1 Apr. 20, 2006

**Related U.S. Application Data**

(60) Provisional application No. 60/619,469, filed on Oct. 15, 2004.

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

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

(58) **Field of Classification Search** ..... **343/700 MS, 343/793, 795, 797**

See application file for complete search history.

(56) **References Cited**

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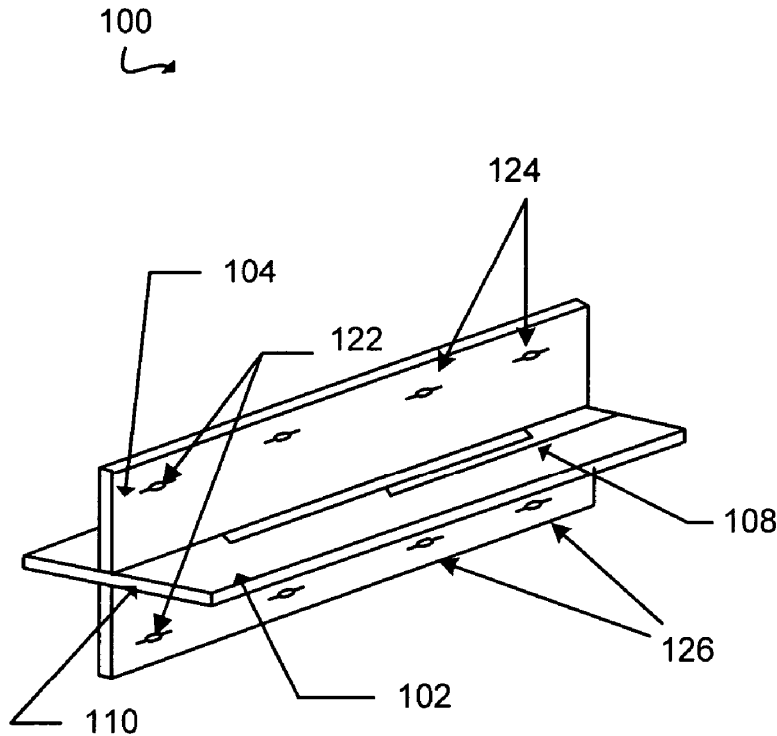
*Primary Examiner*—Tan Ho

(74) *Attorney, Agent, or Firm*—Hayes Soloway PC

(57) **ABSTRACT**

An omnidirectional antenna and method of producing the omnidirectional antenna is provided. Generally, the antenna has a first board with a ground plane on a first side of the first board and a second board with one or more dipole antennas located next to a first edge of the second board and one or more dipole antennas located next to a second edge opposite the first edge. The second board is located approximately perpendicular to the first board and approximately centered about the first board.

**14 Claims, 13 Drawing Sheets**







US007180462B2

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

(10) **Patent No.:** **US 7,180,462 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

- (54) **UHF BROADBAND ANTENNA**
- (75) Inventors: **Atsushi Kaneko, Saitama (JP); Shuji Hagiwara, Saitama (JP); Mikihiro Matsuura, Saitama (JP)**
- (73) Assignee: **Yagi Antenna Inc., Saitama (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.

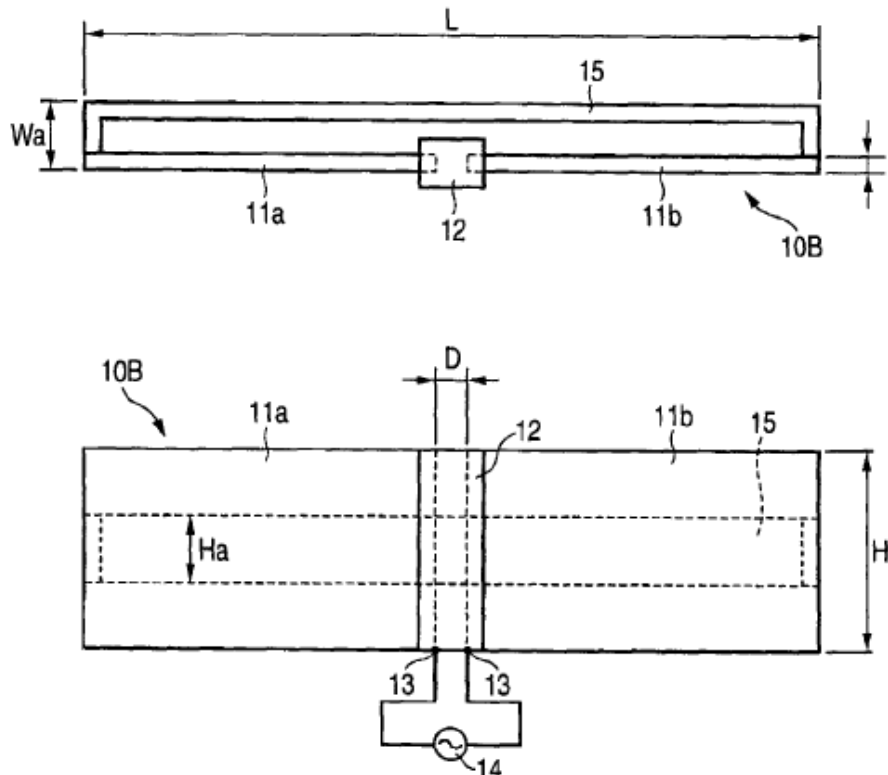
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- (21) Appl. No.: **11/043,140**
- (22) Filed: **Jan. 27, 2005**
- (65) **Prior Publication Data**  
US 2005/0162333 A1 Jul. 28, 2005

- FOREIGN PATENT DOCUMENTS
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- \* cited by examiner
- Primary Examiner*—Hoang V. Nguyen
- (74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

- (30) **Foreign Application Priority Data**
  - Jan. 27, 2004 (JP) ..... P2004-018592
  - Jul. 30, 2004 (JP) ..... P2004-223940
  - (51) **Int. Cl.**  
**H01Q 9/26** (2006.01)
  - (52) **U.S. Cl.** ..... **343/803; 343/793**
  - (58) **Field of Classification Search** ..... 343/795,  
343/803, 818, 793
- See application file for complete search history.

- (57) **ABSTRACT**
- In a UHF broadband antenna, a pair of dipole elements are provided. Each of the dipole elements is shaped into a rectangular plate. A power feeding point is provided on each of the dipole elements
- 6 Claims, 30 Drawing Sheets**





US007180463B2

(12) **United States Patent**  
**Chung**

(10) **Patent No.:** **US 7,180,463 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **DUAL-BAND ANTENNA**  
(75) Inventor: **Cho-Ju Chung, Tu-Cheng (TW)**  
(73) Assignee: **Hon Hai Precision Industry Co., Ltd. (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 0 days.

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CN 2600926 Y 1/2004

(21) Appl. No.: **10/955,620**

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(22) Filed: **Sep. 30, 2004**

*Primary Examiner*—Michael C. Wimer  
(74) *Attorney, Agent, or Firm*—Morris Manning & Martin; Tim Tingkang Xia, Esq.

(65) **Prior Publication Data**

(57) **ABSTRACT**

US 2005/0285802 A1 Dec. 29, 2005

(30) **Foreign Application Priority Data**

A dual-band antenna includes a ground point, a feeding element, a first radiation element, a second radiation element, and an impedance element. The ground point is electronically connected to the first radiation element and the second radiation element. The first radiation element is electronically connected to the feeding element via a first feeding point, and the second radiation element is electronically connected to the feeding element via a second feeding point. The first radiation element includes a head and a neck. A width of the neck decreases from the head toward the first feeding point. The impedance element extends from the neck and through the first feeding point. The dual-band antenna further includes a support element that is connected to the ground point.

Jun. 25, 2004 (TW) ..... 93210028 U

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

(52) **U.S. Cl.** ..... **343/824; 343/752; 343/826**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 846, 752, 824, 826**

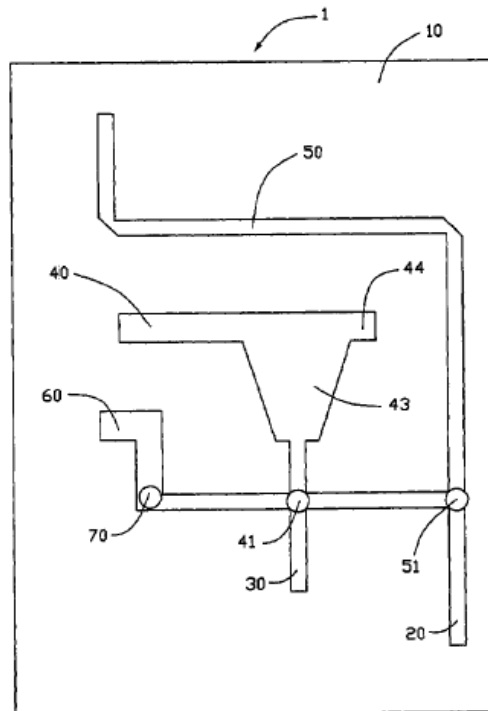
See application file for complete search history.

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**10 Claims, 6 Drawing Sheets**





US007180465B2

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

(10) **Patent No.:** **US 7,180,465 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **COMPACT SMART ANTENNA FOR WIRELESS APPLICATIONS AND ASSOCIATED METHODS**

(75) Inventors: **Michael J. Lynch**, Merritt Island, FL (US); **Thomas Liu**, Melbourne, FL (US); **Bing A. Chiang**, Melbourne, FL (US); **Govind R. Kadambi**, Melbourne, FL (US)

(73) Assignee: **InterDigital Technology Corporation**, Wilmington, DE (US)

(\* ) 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.: **11/201,789**

(22) Filed: **Aug. 11, 2005**

(65) **Prior Publication Data**  
US 2006/0044205 A1 Mar. 2, 2006

**Related U.S. Application Data**

(60) Provisional application No. 60/601,740, filed on Aug. 13, 2004, provisional application No. 60/601,482, filed on Aug. 13, 2004.

(51) **Int. Cl.**  
*H01Q 1/24* (2006.01)  
*H01Q 9/38* (2006.01)  
*H01Q 19/00* (2006.01)  
*H01Q 1/50* (2006.01)

(52) **U.S. Cl.** ..... **343/833**; 343/702; 343/829; 343/850

(58) **Field of Classification Search** ..... 343/702, 343/829, 833, 834, 850  
See application file for complete search history.

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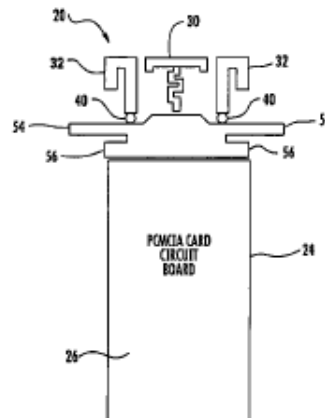
*Primary Examiner*—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A smart antenna includes an active antenna element, a passive antenna element laterally adjacent the active antenna element, and an impedance element selectively connectable to the passive antenna element for antenna beam steering. A ground plane includes a center portion adjacent the active antenna element, and first and second arms extending outwardly from the center portion. The first arm is connected to the impedance element, and the second arm is laterally adjacent the first arm.

**35 Claims, 7 Drawing Sheets**





US007180466B2

(12) **United States Patent**  
**Kuroda**

(10) **Patent No.:** **US 7,180,466 B2**

(45) **Date of Patent:** **Feb. 20, 2007**

(54) **UNBALANCED ANTENNA**

(75) Inventor: **Shinichi Kuroda**, Tokyo (JP)

(73) Assignee: **Sony 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 98 days.

(21) Appl. No.: **10/498,518**

(22) PCT Filed: **Oct. 15, 2003**

(86) PCT No.: **PCT/JP03/13185**

§ 371 (c)(1),  
(2), (4) Date: **Jan. 24, 2005**

(87) PCT Pub. No.: **WO2004/038860**

PCT Pub. Date: **May 6, 2004**

(65) **Prior Publication Data**

US 2006/0214869 A1 Sep. 28, 2006

(30) **Foreign Application Priority Data**

Oct. 23, 2002 (JP) ..... 2002-307910

(51) **Int. Cl.**

**H01Q 1/38** (2006.01)

**H01Q 21/00** (2006.01)

(52) **U.S. Cl.** ..... **343/846; 343/700 MS; 343/773**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 846, 848, 773**

See application file for complete search history.

(56) **References Cited**

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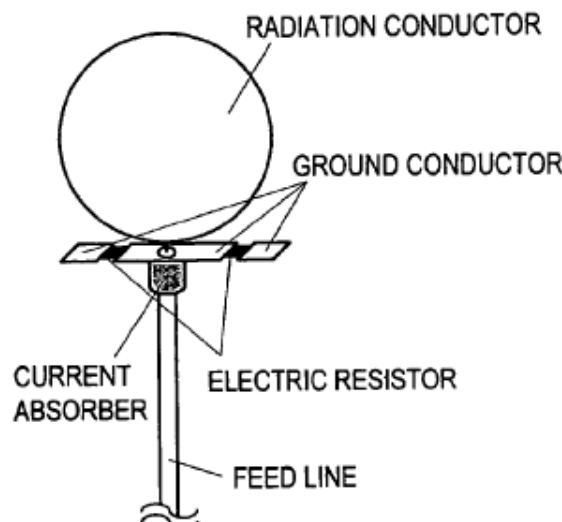
*Primary Examiner*—Tan Ho

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

(57) **ABSTRACT**

An unbalanced antenna having a radiation conductor and a ground conductor provided with a predetermined gap therebetween is provided. At least a predetermined part of the ground conductor, the predetermined part being opposed to the radiation conductor, is left so that it keeps functioning as a pole for forming a near electromagnetic-field distribution together with the radiation conductor opposed to the ground conductor. Further, a part of the reduced ground conductor, the part being near an end at a predetermined distance from the feed section, includes a conductor having low conductivity for obtaining impedance matching. Where the ground conductor is significantly reduced, mode mismatch inevitably occurs. Therefore, at least one part of an external conductor of a coaxial feed line connected to the feed section is covered by a current absorber, so as to forcefully reduce a leakage current. Subsequently, the ground conductor can be reduced and the antenna characteristic can be maintained.

**27 Claims, 16 Drawing Sheets**





US007180472B2

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

(10) **Patent No.:** **US 7,180,472 B2**  
(45) **Date of Patent:** **Feb. 20, 2007**

(54) **QUADRIFILAR HELICAL ANTENNA**

(75) Inventors: **Korkut Yegin**, Grand Blanc, MI (US);  
**Daniel G. Morris**, Ovid, MI (US);  
**William R. Livengood**, Grand Blanc,  
MI (US)

(73) Assignee: **Delphi Technologies, Inc.**, Troy, MI  
(US)

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 22 days.

(21) Appl. No.: **10/999,385**

(22) Filed: **Nov. 30, 2004**

(65) **Prior Publication Data**

US 2005/0264468 A1 Dec. 1, 2005

**Related U.S. Application Data**

(60) Provisional application No. 60/574,520, filed on May  
26, 2004.

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

(52) **U.S. Cl.** ..... **343/895; 343/725; 343/701**

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

See application file for complete search history.

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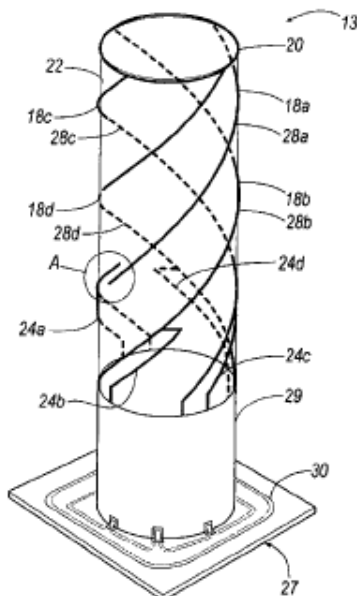
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*Primary Examiner*—Binh V. Ho  
(74) *Attorney, Agent, or Firm*—Jimmy L. Funke

(57) **ABSTRACT**

An antenna having a plurality of elongated conductors is  
disclosed. The elongated conductors have a substantially  
straight portion and a substantially helical portion.

**15 Claims, 3 Drawing Sheets**





US007183976B2

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

(10) **Patent No.:** **US 7,183,976 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **COMPACT INVERTED-F ANTENNA**

(75) Inventors: **Ke-Li Wu**, Hong Kong (HK); **Yong Huang**, Shaanxi (CN); **Wai-Cheung Tang**, Mannheim (CA)

(73) Assignees: **Mark IV Industries Corp.**, Mississauga (CA); **Chinese University of Hong Kong**, Hong Kong (HK)

(\*) 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.: **10/895,783**

(22) Filed: **Jul. 21, 2004**

(65) **Prior Publication Data**  
US 2006/0017628 A1 Jan. 26, 2006

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

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

(58) **Field of Classification Search** ..... **343/702, 343/700 MS, 895**  
See application file for complete search history.

(56) **References Cited**

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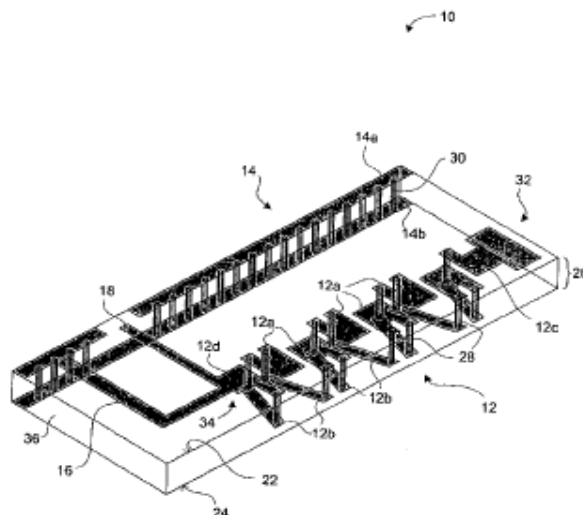
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*Primary Examiner*—Hoanganh Le  
*Assistant Examiner*—Tung Le  
(74) *Attorney, Agent, or Firm*—Pyle & Piontek

(57) **ABSTRACT**

A compact inverted-F antenna having a radiator arm formed from portions disposed in two parallel spaced apart planes and connected together electrically to form a folded meander-line topology. The planes may be defined by the surfaces of a dielectric substrate and the radiator arm may be formed from upper and lower conductive traces printed on either side of the dielectric substrate and interconnected serially through filled via holes. The antenna includes a ground plane parallel to and spaced apart from the radiator arm. The ground plane may be a grid conductive wall formed from filled via holes through the dielectric substrate.

**21 Claims, 5 Drawing Sheets**





US007183977B2

(12) **United States Patent**  
**Suh**

(10) **Patent No.:** **US 7,183,977 B2**

(45) **Date of Patent:** **Feb. 27, 2007**

(54) **ANTENNAS FOR MULTICARRIER COMMUNICATIONS AND MULTICARRIER TRANSCEIVER**

(75) Inventor: **Seong-Youp Suh**, San Jose, CA (US)

(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 216 days.

(21) Appl. No.: **10/954,018**

(22) Filed: **Sep. 28, 2004**

(65) **Prior Publication Data**

US 2006/0071858 A1 Apr. 6, 2006

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

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

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 767, 795, 829, 846, 845**  
See application file for complete search history.

(56) **References Cited**

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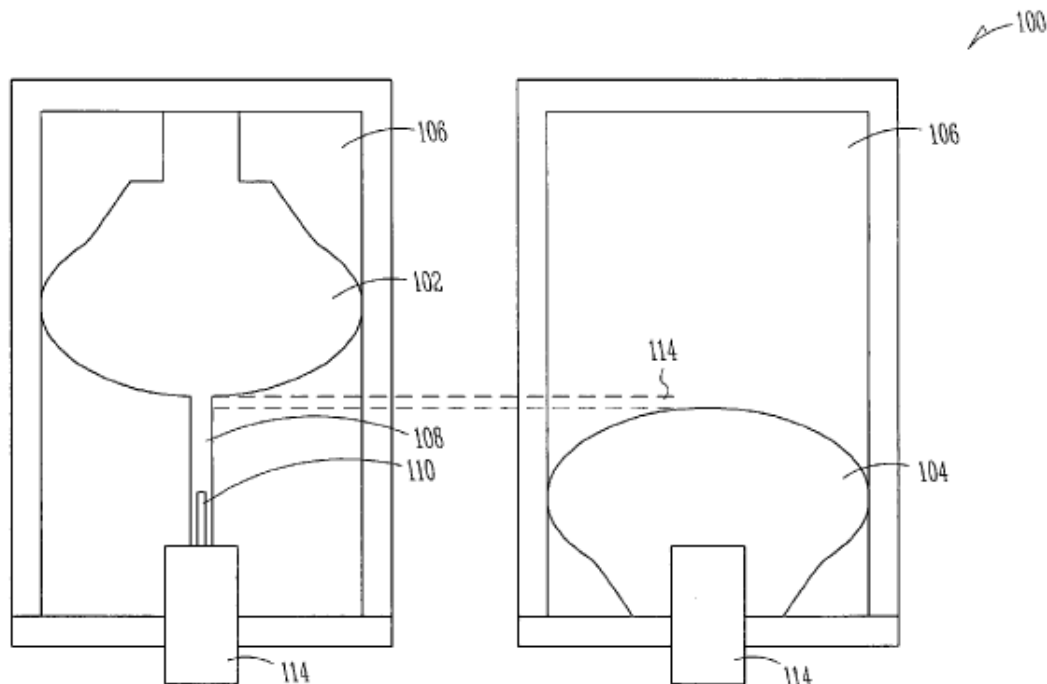
*Primary Examiner*—Michael C. Wimer

(74) *Attorney, Agent, or Firm*—Schwegman, Lundberg, Woessner & Kluth, P.A.

(57) **ABSTRACT**

Small and compact antennas are suitable for use in portable wireless communication devices, including wireless local area network (WLANs) devices.

**18 Claims, 9 Drawing Sheets**





US007183978B1

(12) **United States Patent**  
**Azar**

(10) **Patent No.:** **US 7,183,978 B1**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **WIDEBAND OMNIDIRECTIONAL ANTENNA**

(75) Inventor: **Tony Azar**, Melville, NY (US)

(73) Assignee: **BAE Systems Information and Electronic Systems Integration Inc.**, Nashua, NH (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 81 days.

(21) Appl. No.: **11/074,133**

(22) Filed: **Mar. 7, 2005**

(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, 343/773, 846, 829, 830**

See application file for complete search history.

(56) **References Cited**

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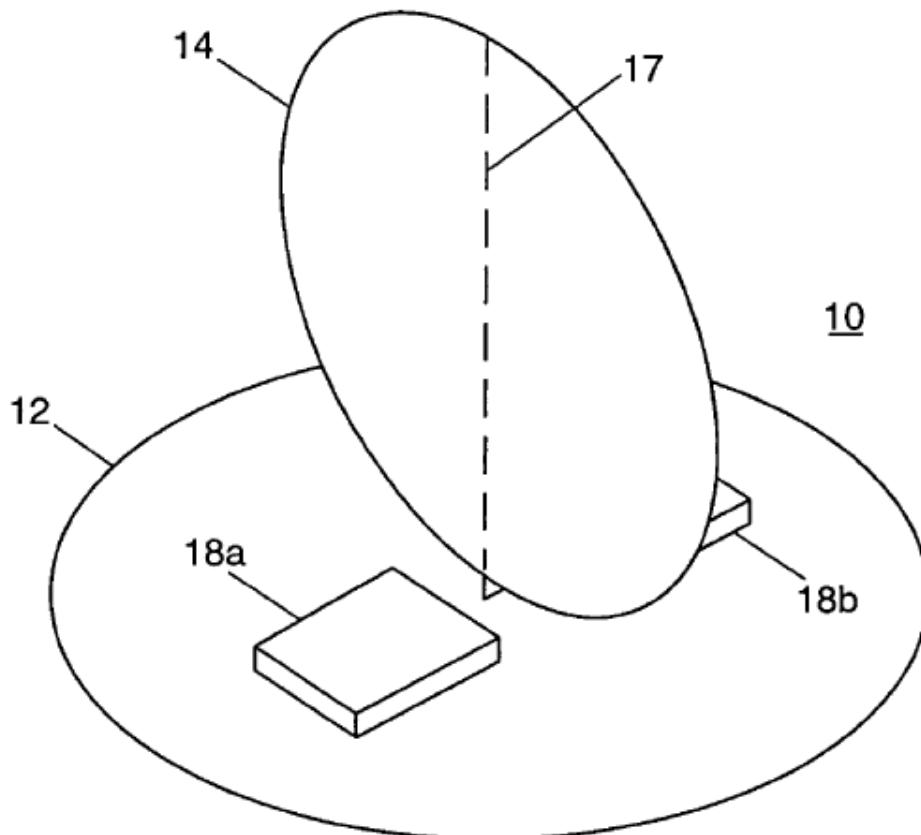
*Primary Examiner*—Hoang V. Nguyen

(74) *Attorney, Agent, or Firm*—Kenneth P. Robinson

(57) **ABSTRACT**

A compact antenna includes a disk-type radiating element normal to a ground plane section. Each face of the radiating element may have a third-dimensional characteristic (e.g., a convex outer surface.) Dielectric material may be positioned on the ground plane forward of each face of the radiating element. In other configurations, the third-dimensional characteristic and dielectric material features may be used separately in antennas arranged to provide omnidirectional performance over a wide frequency bandwidth. An input/output port may be provided by a coaxial-type connector coupled to the radiating element.

**14 Claims, 5 Drawing Sheets**







US007183979B1

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

(10) **Patent No.:** **US 7,183,979 B1**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **DUAL-BAND PATCH ANTENNA WITH SLOT STRUCTURE**

6,346,914 B1\* 2/2002 Annamaa ..... 343/700 MS  
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2003/0193438 A1\* 10/2003 Yoon ..... 343/702

(75) Inventors: **I-Ru Liu**, Taipei (TW); **Hong-Kun Tyan**, Taoyuan Hsien (TW)

(73) Assignee: **Accton Technology Corporation**, Hsinchu (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 9 days.

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

(21) Appl. No.: **11/209,813**

(57) **ABSTRACT**

(22) Filed: **Aug. 24, 2005**

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

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/846, 848, 702, 767, 770  
See application file for complete search history.

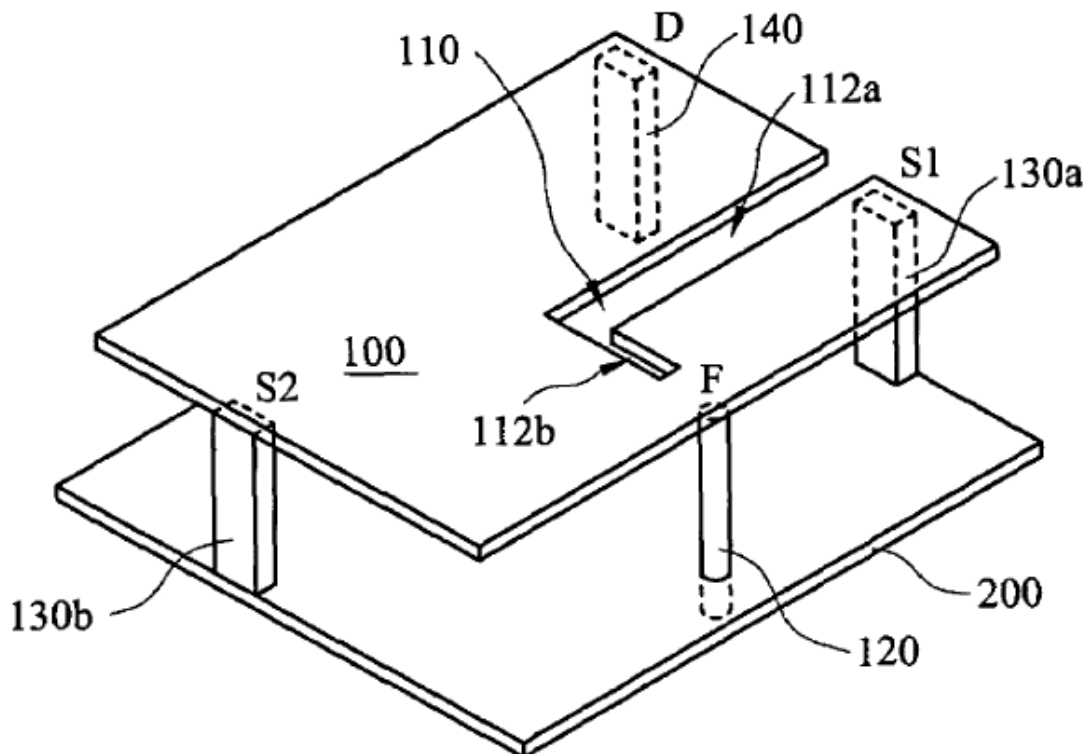
A dual-band patch antenna with a slot structure is disclosed. The dual-band patch antenna comprises a metal-work antenna including a rectangular (patch) radiator on which an L-shaped slot structure is formed; two shorting strips and vertically shorted to a conductive ground plane formed on a base board; and a feeding means inserted into the base board. When the dual-band patch antenna is operated at about 2.45 GHz and about 5.4 GHz, good radiation pattern and antenna gain are obtained for being applicable to IEEE802.11b/g/a/j or Bluetooth specifications.

(56) **References Cited**

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6,252,552 B1\* 6/2001 Tarvas et al. .... 343/700 MS

**17 Claims, 9 Drawing Sheets**





US007183980B2

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

(10) **Patent No.:** **US 7,183,980 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **INVERTED-F ANTENNA**

(75) Inventors: **Ping-Cheng Chang**, Taipei (TW);  
**Wen-Fa Lin**, Taipei (TW); **Tsung-Wen Chiu**, Taipei (TW); **Fu-Ren Hsiao**, Taipei (TW)

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2003/0122722 A1 \* 7/2003 Sugiyama et al. .... 343/767  
2004/0085245 A1 \* 5/2004 Miyata et al. .... 343/700 MS

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

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*Primary Examiner*—Tan Ho

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

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

(57) **ABSTRACT**

(21) Appl. No.: **11/211,539**

(22) Filed: **Aug. 26, 2005**

(65) **Prior Publication Data**

US 2006/0187121 A1 Aug. 24, 2006

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

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

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

See application file for complete search history.

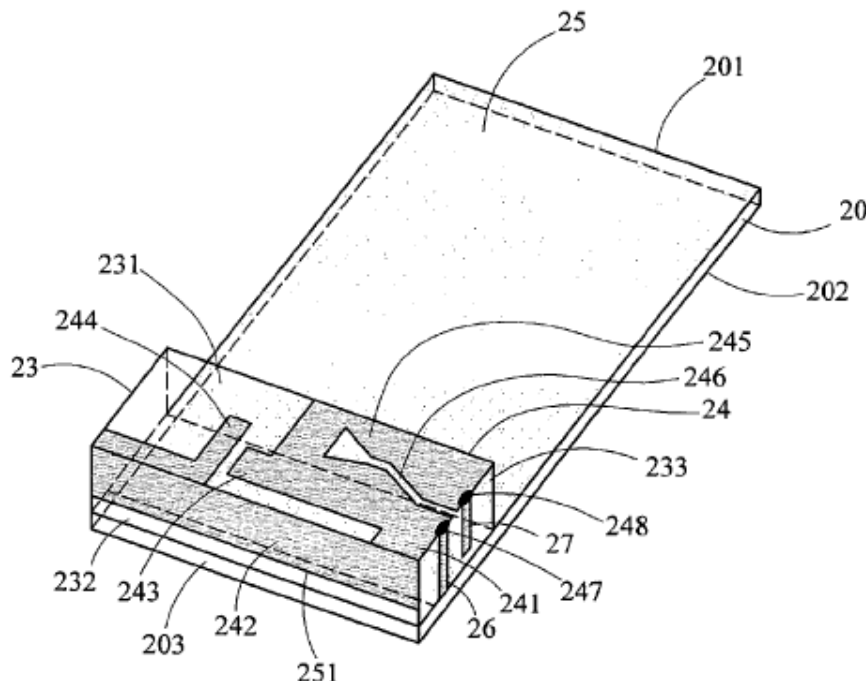
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6,448,932 B1 \* 9/2002 Stoiljkovic et al. .. 343/700 MS

An inverted-F antenna comprises a microwave plate, a dielectric substrate, a radiating metal sheet, a ground surface, a shorting metal strip, and a feeding metal strip. The radiating metal sheet comprises a connecting metal sheet, first, second, and third child radiating metal sheets, a matching metal sheet, a slot, a shorting point, and a feeding point. The first child radiating metal sheet is for forming a low frequency operating mode. The second child radiating metal sheet is for forming a high frequency operating mode. The third child radiating metal sheet is for adjusting operating frequency and bandwidth of the second operating mode. The slot, the shorting point, and the feeding point are for adjusting impedance matching. The grounding surface is for increasing the operating bandwidth of the low frequency operating mode. The shorting metal sheet and the feeding metal sheet are for grounding the antenna and signal transmission.

**10 Claims, 2 Drawing Sheets**





US007183981B1

(12) **United States Patent**  
**Chao**

(10) **Patent No.:** **US 7,183,981 B1**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **MONOPOLE ANTENNA**

(75) Inventor: **Wen-Shin Chao**, Taichung (TW)

(73) Assignee: **Arcadyan Technology Corporation**,  
Hsinchu (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 36 days.

*Primary Examiner*—Tho Phan  
(74) *Attorney, Agent, or Firm*—Rosenberg, Klein & Lee

(21) Appl. No.: **11/217,372**

(57) **ABSTRACT**

(22) Filed: **Sep. 2, 2005**

(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, 829, 846**

See application file for complete search history.

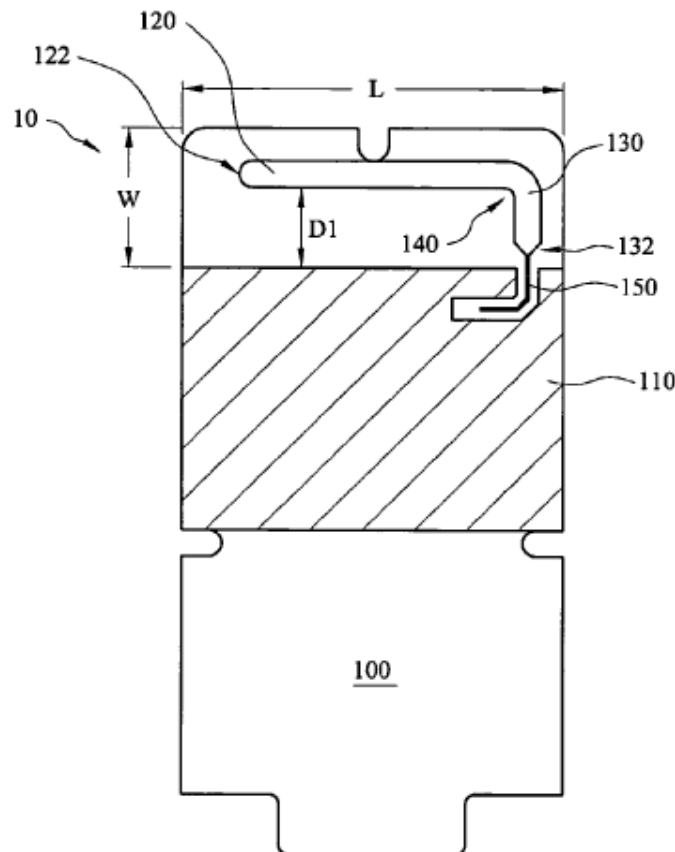
A monopole antenna is disclosed. The monopole antenna comprises a base board, a first substantially L-shaped conductor, a first ground plane, a second substantially L-shaped conductor, a second ground plane and a feeding strip, and the monopole antenna further has a plurality of evenly-distributed through holes penetrating the base board from the first substantially L-shaped conductor to the second substantially L-shaped conductor. When the monopole antenna is operated at about 2.4–2.5 GHz, good radiation patterns and antenna gain are obtained for being applicable to IEEE802.11b/g specifications.

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**20 Claims, 8 Drawing Sheets**





US007183984B2

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

(10) **Patent No.:** **US 7,183,984 B2**  
(45) **Date of Patent:** **\*Feb. 27, 2007**

(54) **MULTIPLE-ELEMENT ANTENNA WITH PARASITIC COUPLER**

(75) Inventors: **Perry Jarmuszewski**, Waterloo (CA); **Yihong Qi**, Waterloo (CA); **Ying Tong Man**, Kitchener (CA)

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

(\* ) 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.: **11/122,455**

(22) Filed: **May 5, 2005**

(65) **Prior Publication Data**

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**Related U.S. Application Data**

(63) Continuation of application No. 10/462,440, filed on Jun. 16, 2003, now Pat. No. 6,891,506.

(60) Provisional application No. 60/390,491, filed on Jun. 21, 2002.

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

(52) **U.S. Cl.** ..... **343/702; 343/803; 343/833; 455/575.7**

(58) **Field of Classification Search** ..... **343/702, 343/803, 833, 834, 700 MS, 795; 455/575.7**  
See application file for complete search history.

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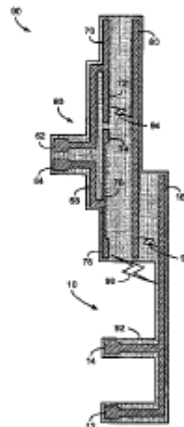
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(57) **ABSTRACT**

A multiple-element antenna for a multi-band wireless mobile communication device is provided. The multiple-element antenna includes a first antenna element, a second antenna element positioned adjacent the first antenna element, and a parasitic coupler positioned adjacent the first antenna element and the second antenna element. In one embodiment, the first and second antenna elements have respective first and second operating frequency bands, and electromagnetically couple with each other and with the parasitic coupler when the multiple-element antenna is operating in the first or second operating frequency band. The first and second antenna elements are configured to be connected to first and second transceivers in a wireless mobile communication device in an alternate embodiment.

**29 Claims, 6 Drawing Sheets**





US007183985B2

(12) **United States Patent**  
**Tseng**

(10) **Patent No.:** **US 7,183,985 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

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

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(73) Assignee: **Universal Scientific Industrial Co.,  
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(\* ) Notice: Subject to any disclaimer, the term of this  
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U.S.C. 154(b) by 12 days.

(21) Appl. No.: **11/176,317**

(22) Filed: **Jul. 8, 2005**

(65) **Prior Publication Data**

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

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

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

See application file for complete search history.

(56) **References Cited**

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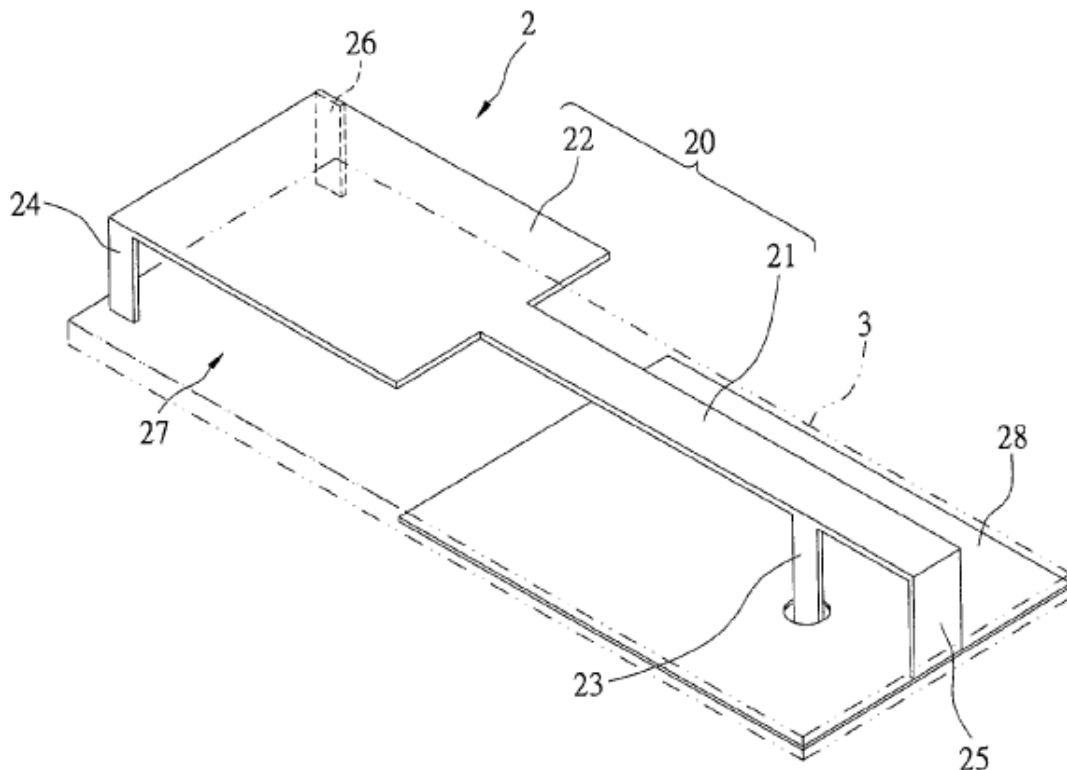
*Primary Examiner*—Hoang V. Nguyen

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

(57) **ABSTRACT**

A planar inverted-F antenna has advantages of easy manufacture, a stable structure and automatic assembly. The antenna is fixed onto a PCB and has a grounding element that is made of conductive material and is plate-shaped, a radiation element formed from a plate-shaped metal plate, a signal link element and at least one supporting leg. The radiation element has a grounding leg that electrically connects with the grounding element. The signal link element electrically connects with the radiation element to a circuit for wireless signal transmission and reception. The at least one supporting leg is downwardly bent from an edge of the radiation element far from the grounding leg and is fixed onto the PCB. The supporting leg and the grounding leg support the radiation element together.

**6 Claims, 8 Drawing Sheets**





US007183991B2

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

(10) **Patent No.:** **US 7,183,991 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **MULTIPLE FLARED ANTENNA HORN WITH ENHANCED APERTURE EFFICIENCY**

(75) Inventors: **Arun K. Bhattacharyya**, El Segundo, CA (US); **James Sor**, Los Angeles, CA (US)

(73) Assignee: **Northrop Grumman Corporation**, Los Angeles, CA (US)

(\*) 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.: **11/003,901**

(22) Filed: **Dec. 3, 2004**

(65) **Prior Publication Data**

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

(52) **U.S. Cl.** ..... **343/786; 343/772**

(58) **Field of Classification Search** ..... **343/786, 343/772, 783**

See application file for complete search history.

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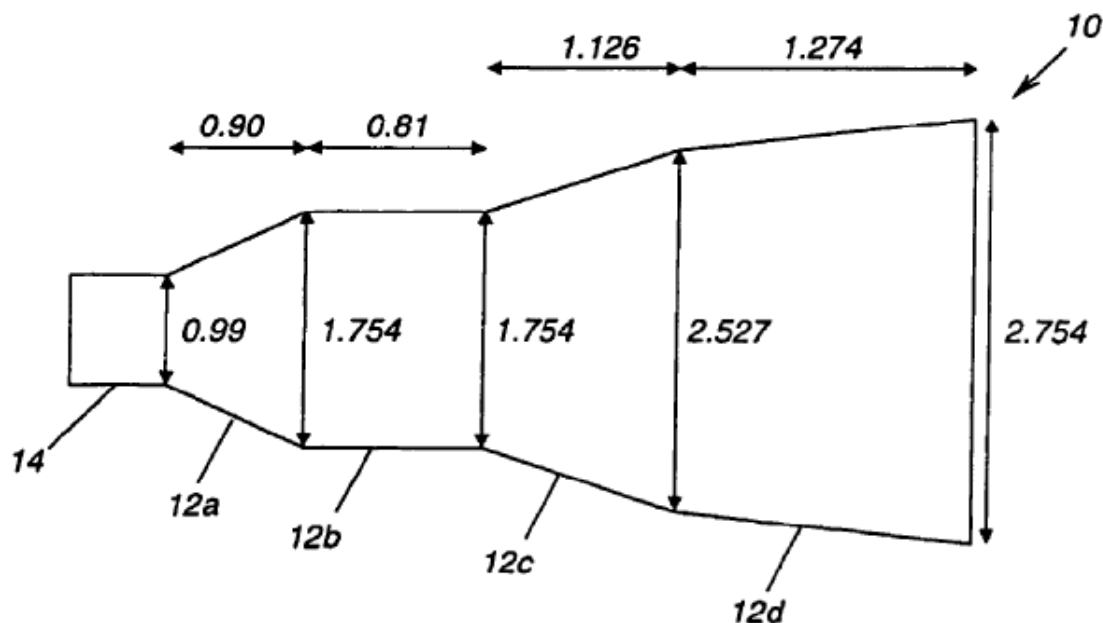
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*Primary Examiner*—Hoanganh Le  
(74) *Attorney, Agent, or Firm*—Carmen B. Patti & Assoc., LLC

(57) **ABSTRACT**

An antenna horn having multiple flared sections with their slopes and lengths selected to enhance desirable electromagnetic modes and to suppress undesirable modes at the horn aperture, thereby increasing the aperture efficiency and antenna gain.

**20 Claims, 3 Drawing Sheets**





US007183992B2

(12) **United States Patent**  
**Hung**

(10) **Patent No.:** **US 7,183,992 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **ULTRA-WIDEBAND V-UHF ANTENNA**

(75) Inventor: **Frédéric Ngo Bui Hung**, Franconville (FR)

(73) Assignee: **Thales**, Neuilly sur Seine (FR)

(\*) 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.: **11/059,309**

(22) Filed: **Feb. 17, 2005**

(65) **Prior Publication Data**

US 2005/0253768 A1 Nov. 17, 2005

(30) **Foreign Application Priority Data**

Feb. 27, 2004 (FR) ..... 04 02039

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

(52) **U.S. Cl.** ..... **343/790**

(58) **Field of Classification Search** ..... **343/790, 343/791, 792, 793, 817, 818, 800**  
See application file for complete search history.

(56) **References Cited**

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*Primary Examiner*—Trinh Dinh

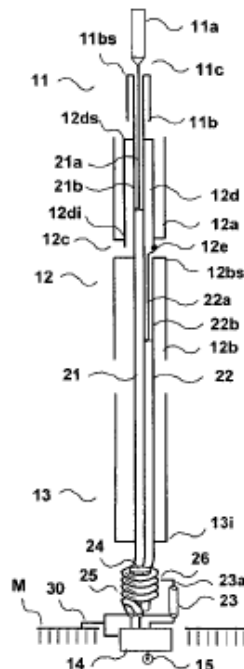
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(74) *Attorney, Agent, or Firm*—Lowe Hauptman & Berner, LLP

(57) **ABSTRACT**

A wideband antenna system is capable of radiating or receiving radio-frequency signals in a given frequency band, comprising at least two substantially collinear radiating elements, wherein each element radiates in one frequency band, a first radiating element working in the [F<sub>hinf</sub>, F<sub>hsup</sub>] frequency band, a second radiating element working in the [F<sub>minf</sub>, F<sub>msup</sub>] frequency band. At the hinge frequencies, these two elements participate in the radiation.

**8 Claims, 4 Drawing Sheets**





US007183993B2

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

(10) **Patent No.:** **US 7,183,993 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **DIPOLE ANTENNA**

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**Shu-Chen Yang**, Tu-Chen (TW);  
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(73) Assignee: **Hon Hai Precision Ind. Co., Ltd.**,  
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(21) Appl. No.: **11/026,149**

(22) Filed: **Dec. 29, 2004**

(65) **Prior Publication Data**  
US 2005/0231437 A1 Oct. 20, 2005

(30) **Foreign Application Priority Data**  
Apr. 16, 2004 (TW) ..... 93110611 A

(51) **Int. Cl.**  
**H01Q 9/28** (2006.01)  
(52) **U.S. Cl.** ..... **343/795; 343/797**  
(58) **Field of Classification Search** ..... **343/795, 343/797**  
See application file for complete search history.

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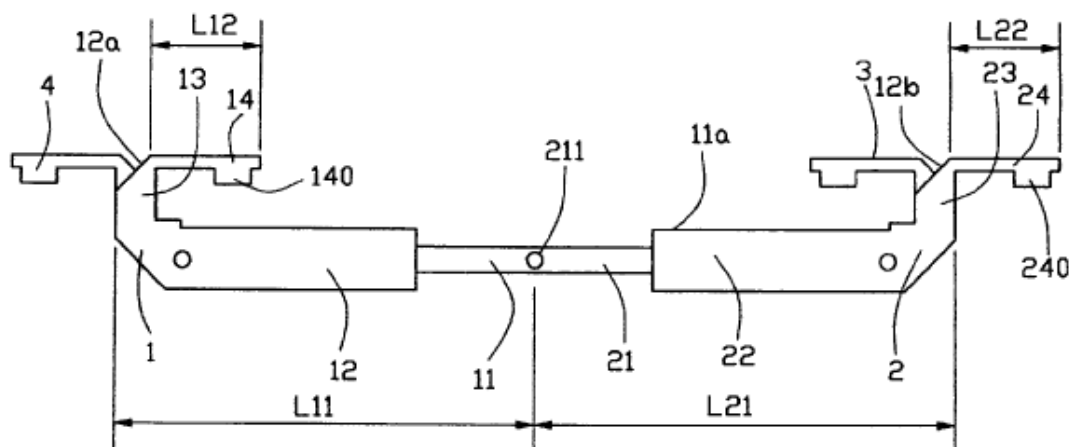
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*Primary Examiner*—Tho Phan  
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A dual-band antenna for communication device includes a first dipole antenna, a second dipole antenna and a coaxial feed line. The first dipole antenna includes a first radiating element disposed at a first plane and a first ground portion disposed at a second plane. The second dipole antenna includes a second radiating element disposed at a first plane and a second ground portion disposed at a second plane. The feed line includes an inner conductor electrically connecting to the first and second radiating elements and an outer conductor electrically connecting to the first and second ground portions. The first and second radiating elements both further include a compensating portion for improving radiating patterns of the first and second dipole antennas and a broadband portion for increasing frequency bands of the first and second dipole antennas.

**19 Claims, 9 Drawing Sheets**







US007183994B2

(12) **United States Patent**  
**Weigand**

(10) **Patent No.:** **US 7,183,994 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **COMPACT ANTENNA WITH DIRECTED RADIATION PATTERN**

(75) Inventor: **Steven Weigand**, Santa Clara, CA (US)

(73) Assignee: **WJ Communications, Inc.**, San Jose, CA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 24 days.

(21) Appl. No.: **11/173,574**

(22) Filed: **Jul. 1, 2005**

(65) **Prior Publication Data**

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**Related U.S. Application Data**

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(52) **U.S. Cl.** ..... **343/795; 343/702; 343/700 MS**

(58) **Field of Classification Search** ..... **343/700 MS, 343/795, 793, 796, 806, 803, 820, 821, 822, 343/702**

See application file for complete search history.

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*Primary Examiner*—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Morgan Lewis & Bockius LLP

(57) **ABSTRACT**

The present invention includes a balanced compact antenna, conforming to the envelope restrictions appropriate to a PC-card form factor, with maximum radiation intensity along a long axis of the card. The inventive antenna configuration employs an inductive shorting bar to match an "M"-shaped bent dipole antenna to a differential feed. The combination of horizontal cross-members and large vertical downward legs ensures radiation predominantly in a broadside direction while keeping the dimensions of the antenna sufficiently compact to fit within the PC-card envelope.

**20 Claims, 31 Drawing Sheets**

