



US007237318B2

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

(10) **Patent No.:** **US 7,237,318 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **METHOD FOR PRODUCING ANTENNA COMPONENTS**

(75) Inventors: **Petteri Annamaa**, Oulunsalo (FI); **Kimmo Antila**, Kiviniemi (FI); **Iikka Niemla**, Oulu (FI); **Heikki Riekk**, Oulu (FI)

(73) Assignee: **Pulse Finland Oy**, Kempele (FI)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 363 days.

(21) Appl. No.: **10/800,081**

(22) Filed: **Mar. 8, 2004**

(65) **Prior Publication Data**

US 2004/0244187 A1 Dec. 9, 2004

(30) **Foreign Application Priority Data**

Mar. 31, 2003 (FI) ..... 20030472

(51) **Int. Cl.**  
**H01P 11/00** (2006.01)

(52) **U.S. Cl.** ..... 29/600; 29/601; 343/700 MS; 343/702

(58) **Field of Classification Search** ..... 29/825, 29/832-835, 600, 601.2; 343/700 MS, 702, 343/895, 806, 746-747

See application file for complete search history.

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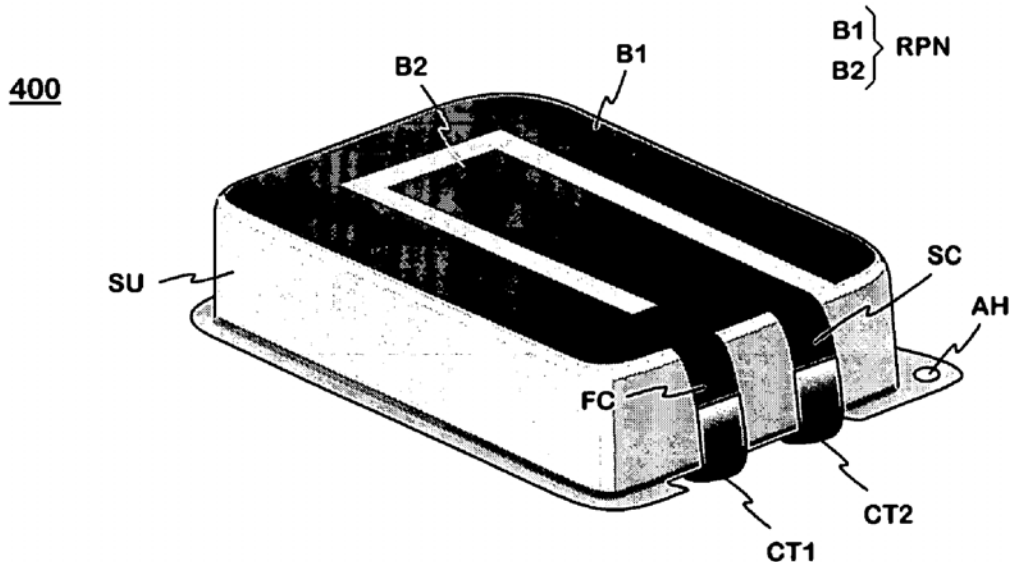
*Primary Examiner*—Minh Trinh

(74) *Attorney, Agent, or Firm*—Darby & Darby

(57) **ABSTRACT**

A method for producing internal antenna components for small radio devices. A radiator is supported by a flat-topped protrusion formed in a plastic blank—e.g., by pressing with a hot tool. The length of the protrusion sets the height of the planar antenna. The radiator and its conductors are formed by removing material from a conducting film attached to the top of the protrusion. A feed and a shorting conductor are formed as extensions of the radiator. Contacts are attached to the feed and the shorting conductor to connect the antenna component to the radio device. Elongated gaps made in the plastic blank around the edges of the protrusion can facilitate loosening of the component. A plurality of antenna components can be formed on a uniform plastic blank and placed in a common package. The method results in low manufacturing costs and quick production time.

**18 Claims, 4 Drawing Sheets**





US007239217B2

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

(10) **Patent No.:** **US 7,239,217 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **ANTENNA DUPLEXER**  
(75) Inventors: **Yuki Satoh**, Osaka (JP); **Kazushi Nishida**, Kadoma (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 109 days.

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*Primary Examiner*—Barbara Summons  
(74) *Attorney, Agent, or Firm*—RatnerPrestia

(21) Appl. No.: **11/078,107**  
(22) Filed: **Mar. 11, 2005**  
(65) **Prior Publication Data**  
US 2005/0206478 A1 Sep. 22, 2005

(57) **ABSTRACT**

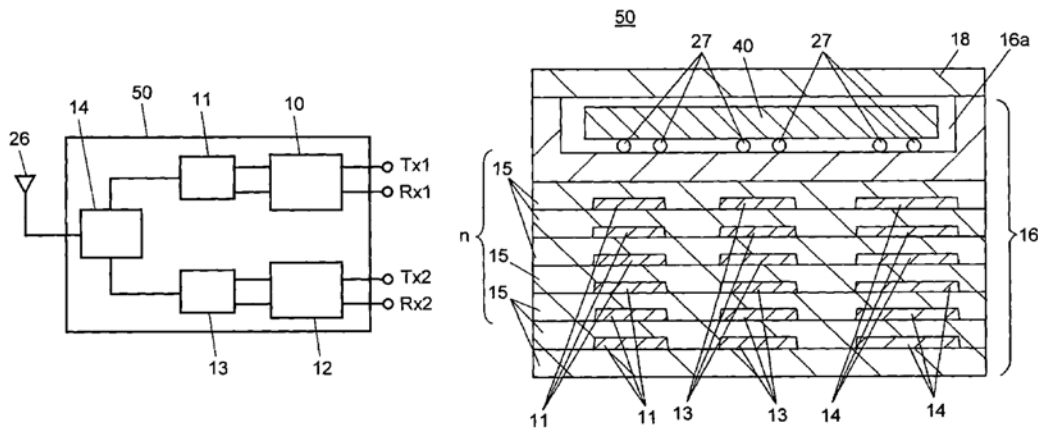
The disclosed is a downsized and power saving antenna duplexer. The antenna duplexer includes: diplexer; first surface acoustic wave filter to transmit/receive low channel frequency band signals; first phase shift circuit to match the transmission phase with the reception phase of first surface acoustic wave filter; second surface acoustic wave filter to transmit/receive high channel frequency band signals; second phase shift circuit to match the transmission phase with the reception phase of second surface acoustic wave filter. Diplexer, first phase shift circuit and second phase shift circuit are formed in a monolithic structure in package that includes surface acoustic wave filters. The configuration can provide the antenna duplexer with a compact size, a lower current consumption and a highly efficient performance.

(30) **Foreign Application Priority Data**  
Mar. 16, 2004 (JP) ..... 2004-074258

(51) **Int. Cl.**  
**H03H 9/72** (2006.01)  
(52) **U.S. Cl.** ..... **333/133; 455/78; 455/83**  
(58) **Field of Classification Search** ..... **333/133**  
See application file for complete search history.

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**3 Claims, 5 Drawing Sheets**





US007239279B2

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

(10) **Patent No.:** **US 7,239,279 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **MULTIPLE-BAND ANTENNA WITH SHARED SLOT STRUCTURE**

(75) Inventors: **Geyi Wen**, Waterloo (CA); **Perry Jarmuszewski**, Waterloo (CA); **Adrian M. Cooke**, Kitchener (CA)

(73) Assignee: **Research in Motion Limited**, Ontario (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.

(21) Appl. No.: **11/533,020**

(22) Filed: **Sep. 19, 2006**

(65) **Prior Publication Data**  
US 2007/0115189 A1 May 24, 2007

**Related U.S. Application Data**  
(63) Continuation of application No. 10/537,189, filed as application No. PCT/CA02/01943 on Dec. 6, 2002, now Pat. No. 7,151,493.

(51) **Int. Cl.**  
*H01Q 1/38* (2006.01)  
*H01Q 13/10* (2006.01)  
(52) **U.S. Cl.** ..... **343/700 MS; 343/770**  
(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 725, 770**  
See application file for complete search history.

(56) **References Cited**  
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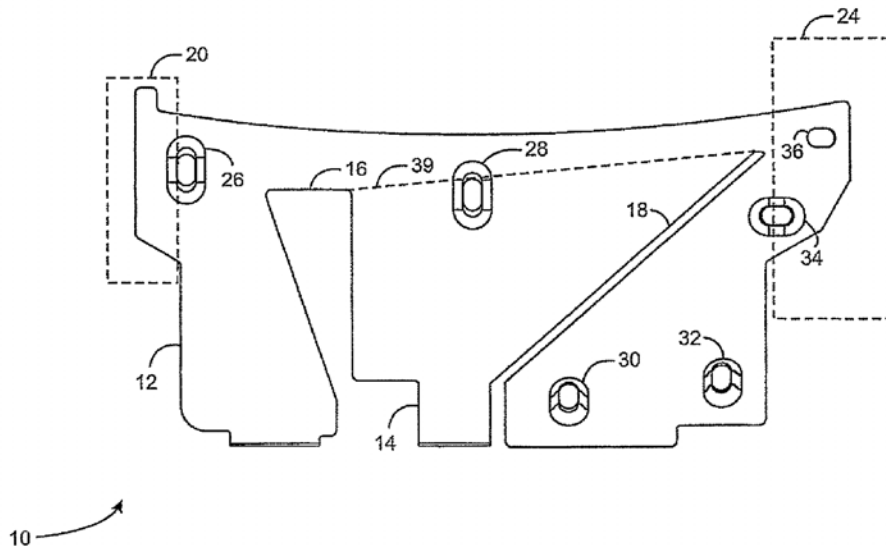
\* cited by examiner

*Primary Examiner*—Shih-Chao Chen  
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A multiple-band antenna having first and second operating frequency bands is provided. The antenna includes a first patch structure associated primarily with the first operating frequency band, a second patch structure electrically coupled to the first patch structure and associated primarily with the second operating frequency band, a first slot structure disposed between a first portion of the first patch structure and the second patch structure and associated primarily with the first operating frequency band, and a second slot structure disposed between a second portion of the first patch structure and the second patch structure and associated with both the first operating frequency band and the second operating frequency band. A mounting structure for the multiple-band antenna is also provided, and includes a first surface and a second surface opposite to and overlapping the first surface. The first and second patch structures are mounted to the first surface, and a feeding point and a ground point, respectively connected to the first and second patch structures, are mounted to the second surface.

**21 Claims, 7 Drawing Sheets**





US007239280B2

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

(10) **Patent No.:** **US 7,239,280 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

- (54) **ANTENNA COMPRISING A PLASTIC HOUSING**
- (75) Inventors: **Joachim Kordass**, Koengen (DE);  
**Günther Blickle**, Kusterdingen (DE);  
**Boris Wischniowski**, Stuttgart (DE)
- (73) Assignee: **Hirschmann Electronics GmbH & Co. KG**, Neckartenzlingen (DE)
- (\* ) 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.: **10/549,833**
- (22) PCT Filed: **Jan. 22, 2004**
- (86) PCT No.: **PCT/EP2004/000486**  
  
§ 371 (c)(1),  
(2), (4) Date: **Jun. 20, 2006**
- (87) PCT Pub. No.: **WO2004/084342**  
  
PCT Pub. Date: **Sep. 30, 2004**
- (65) **Prior Publication Data**  
US 2007/0035459 A1 Feb. 15, 2007
- (30) **Foreign Application Priority Data**  
Mar. 18, 2003 (DE) ..... 103 11 835
- (51) **Int. Cl.**  
**H01Q 1/32** (2006.01)
- (52) **U.S. Cl.** ..... **343/711; 343/713; 343/872**

(58) **Field of Classification Search** ..... 343/711,  
343/713, 872, 878  
See application file for complete search history.

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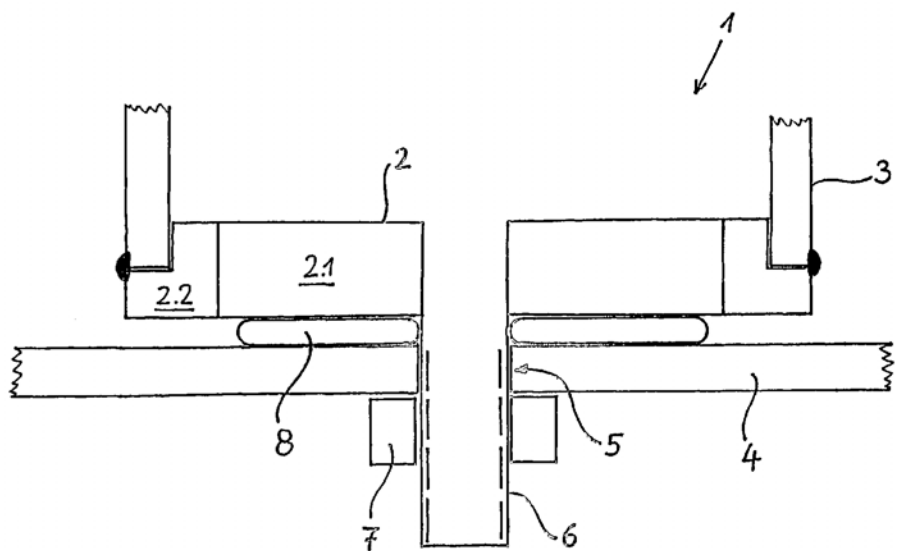
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*Primary Examiner*—Tan Ho  
(74) *Attorney, Agent, or Firm*—Alfred Wilford

(57) **ABSTRACT**  
The invention relates to a vehicle antenna (1), designed to be mounted on a vehicle surface (4). Said antenna comprises a base body (2) consisting of metal and a plastic antenna housing (3), which surrounds the antenna elements that are placed on the base body (2). According to the invention, the base body (2) has at least one sub-section (2.2) consisting of plastic and the antenna housing (3) is permanently connected to said sub-section (2.2) once the antenna elements have been mounted.

**7 Claims, 1 Drawing Sheet**





US007239281B2

(12) **United States Patent**  
**Lu**

(10) **Patent No.:** **US 7,239,281 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **FIN-SHAPED ANTENNA APPARATUS FOR VEHICLE RADIO APPLICATION**

(75) Inventor: **Yu-Sheng Lu, Pingjen (TW)**

(73) Assignees: **Yeoujyi Electronics Co., Ltd., Taoyuan (TW); Sky Year Investments Limited, Apia (WS)**

(\*) 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.: **11/099,509**

(22) Filed: **Apr. 6, 2005**

(65) **Prior Publication Data**  
US 2006/0227057 A1 Oct. 12, 2006

(51) **Int. Cl.**  
**H01Q 1/32** (2006.01)  
(52) **U.S. Cl.** ..... **343/713; 343/711; 343/712**  
(58) **Field of Classification Search** ..... **343/711-713, 343/718, 872, 705, 708**  
See application file for complete search history.

(56) **References Cited**  
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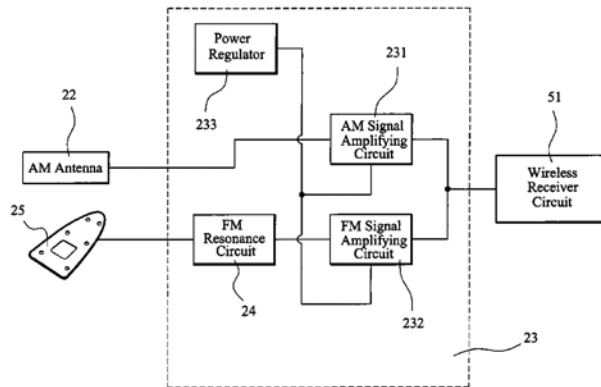
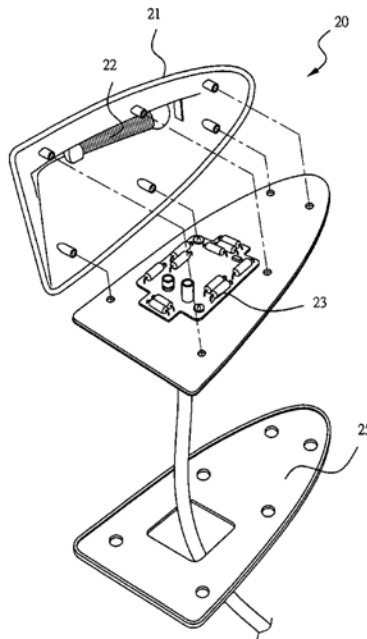
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*Primary Examiner*—Tuyet Vo  
*Assistant Examiner*—Ephrem Alemu  
(74) *Attorney, Agent, or Firm*—Rosenberg, Klein & Lee

(57) **ABSTRACT**

A fin-shaped antenna apparatus for vehicle radio application is electrically connected to a wireless receiver circuit and receives a radio signal. The fin-shaped antenna apparatus includes a fin-shaped cover, an AM antenna, a signal amplifier circuit board, an FM resonance circuit on the signal amplifier circuit board and a metal base. The AM antenna is separated with the FM resonance circuit. The FM resonance circuit comprises a plurality of inductors to form a resonance circuit and is connected to a metal base for enhancing the signal reception thereof. Therefore the signal quality for vehicle radio application is enhanced.

**7 Claims, 7 Drawing Sheets**





US007239282B2

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

(10) **Patent No.:** **US 7,239,282 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **WIRING STRUCTURE OF VEHICLE-MOUNTED ANTENNA SYSTEM**

(75) Inventors: **Tomoki Ikeda**, Tokyo (JP); **Hideaki Oshima**, Ibaraki-ken (JP); **Makoto Ueda**, Kyoto-fu (JP)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 44 days.

(21) Appl. No.: **11/159,703**

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

(65) **Prior Publication Data**  
US 2005/0285806 A1 Dec. 29, 2005

(30) **Foreign Application Priority Data**  
Jun. 25, 2004 (JP) ..... 2004-188708

(51) **Int. Cl.**  
**H01Q 1/32** (2006.01)  
(52) **U.S. Cl.** ..... **343/713**  
(58) **Field of Classification Search** ..... 343/713,  
343/711, 700 MS, 767, 905, 906  
See application file for complete search history.

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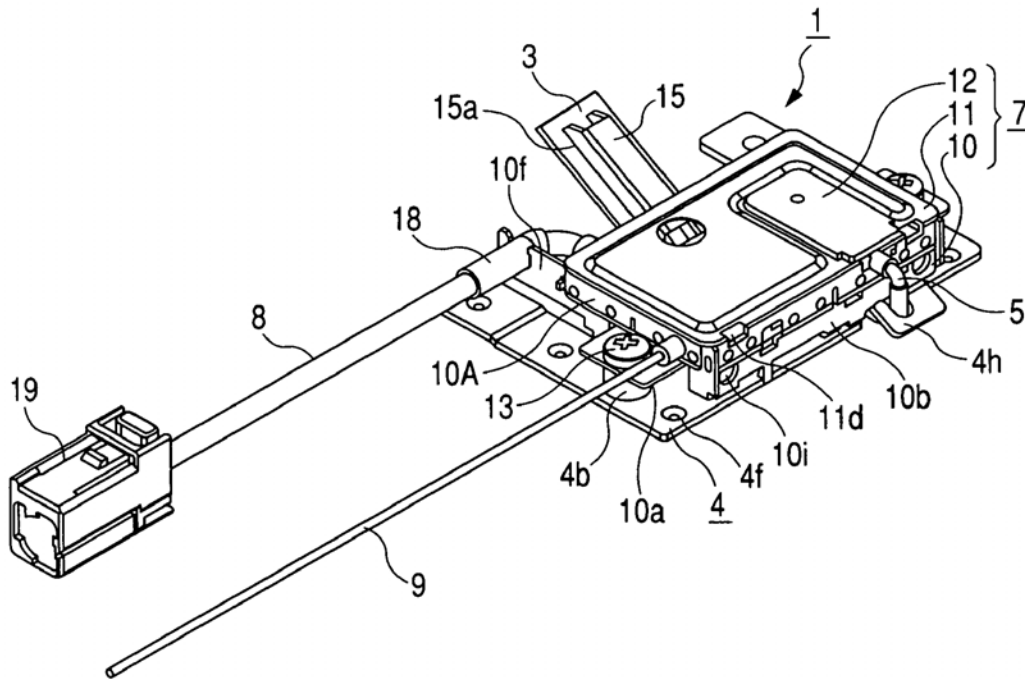
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*Primary Examiner*—Michael C. Wimer  
(74) *Attorney, Agent, or Firm*—Brinks Hofer Gilson & Lione

(57) **ABSTRACT**

A glass plate is formed with a radiating conductor. An electronic circuit unit includes a base plate soldered to the radiating conductor to be fixed to the glass plate, a frame fixed to the base plate with screws for accommodating the circuit board, and a cover crowned on the frame. The base plate is provided with a holding piece which protrudes the inside of the frame, and a hooking piece which protrudes out of frame. The cover is provided with a holding groove. A feeder line connected to the radiating conductor is inserted between the holding piece and the glass plate. The feeder line drawn out of the frame is hooked on the hooking piece, and led to the circuit board by the holding groove.

**4 Claims, 9 Drawing Sheets**





US007239283B2

(12) **United States Patent**  
**Chua**

(10) **Patent No.:** **US 7,239,283 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **ANTENNA**  
(75) Inventor: **Lye-Whatt Chua**, Surrey (GB)  
(73) Assignee: **Thales PLC**, Surrey (GB)  
(\* ) 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.: **10/944,409**  
(22) Filed: **Sep. 20, 2004**

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(30) **Foreign Application Priority Data**  
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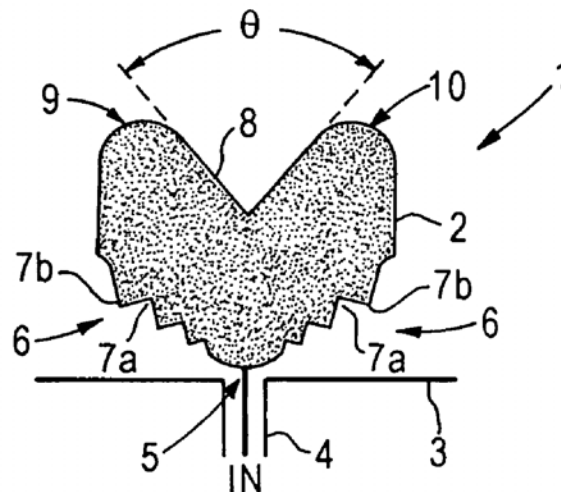
(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)  
(52) **U.S. Cl.** ..... 343/746; 343/700 MS;  
343/792.5; 343/829  
(58) **Field of Classification Search** ..... 343/700 MS,  
343/746  
See application file for complete search history.

*Primary Examiner*—Don Wong  
*Assistant Examiner*—Binh Van Ho  
(74) *Attorney, Agent, or Firm*—Lowe Hauptman & Berner, LLP

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(57) **ABSTRACT**  
There is disclosed an antenna having a tapered radiating element possessing a slow-wave structure along a tapered radiating edge thereof. The radiating element is combined with a ground plane conductor to form a monopole antenna. The slow-wave structure supports an increased antenna operating bandwidth and reduced aperture clutter by being shaped to increase the radiative rate of loss of energy from signals propagating along the slow-wave structure. A log-periodic distribution in the shaping of serrations within the slow-wave structure provides substantially frequency-independent performance across the bandwidth.

**17 Claims, 4 Drawing Sheets**





US007239288B2

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

(10) **Patent No.:** US 7,239,288 B2  
(45) **Date of Patent:** Jul. 3, 2007

(54) **ACCESS POINT ANTENNA FOR A WIRELESS LOCAL AREA NETWORK**

6,127,987 A \* 10/2000 Maruyama et al. .... 343/835

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- (75) Inventors: **Michael J. Lynch**, Merritt Island, FL (US); **Bing Chiang**, Melbourne, FL (US)
- (73) Assignee: **IPR Licensing, Inc.**, 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.

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- (21) Appl. No.: **10/953,893**
- (22) Filed: **Sep. 29, 2004**

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- (65) **Prior Publication Data**  
US 2005/0088359 A1 Apr. 28, 2005

*Primary Examiner*—Michael C. Wimer  
 (74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

**Related U.S. Application Data**

- (60) Provisional application No. 60/507,330, filed on Sep. 30, 2003.

(57) **ABSTRACT**

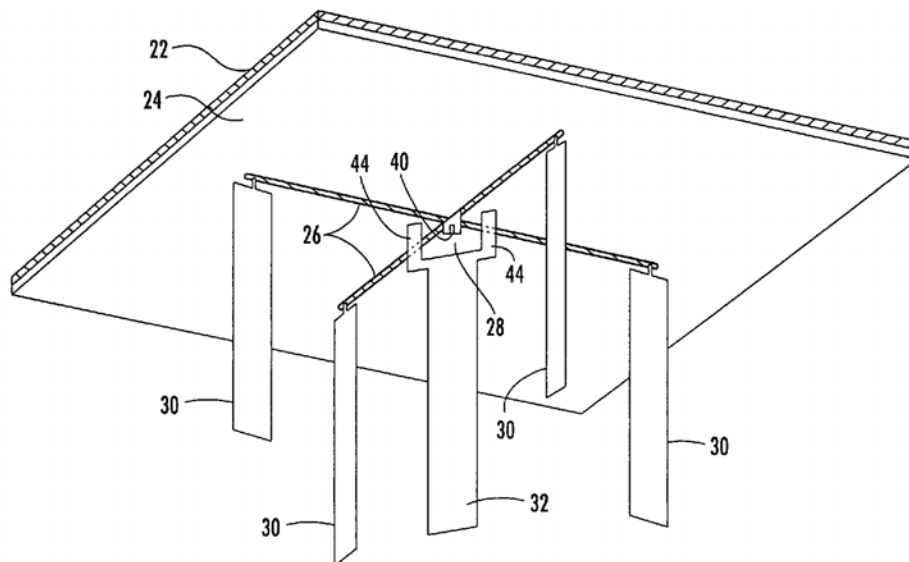
- (51) **Int. Cl.**  
**H01Q 19/10** (2006.01)
  - (52) **U.S. Cl.** ..... **343/833; 343/853**
  - (58) **Field of Classification Search** ..... 343/700 MS,  
343/833, 834, 853
- See application file for complete search history.

An access point antenna for a wireless local area network (WLAN) includes a combiner network with a feed point, a ground plane adjacent the combiner network, and a dielectric substrate adjacent the ground plane. Conductive paths are on the dielectric substrate and are coupled to the feed point. Active antenna elements extend from the dielectric substrate. Each active antenna element is coupled to a respective conductive path and is equally spaced from a common area on the dielectric substrate. A passive director antenna element extends from the dielectric substrate and is coupled to the ground plane adjacent the common area.

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**40 Claims, 6 Drawing Sheets**







US007239289B2

(12) **United States Patent**  
**Kim**

(10) **Patent No.:** **US 7,239,289 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **DEVICE AND METHOD FOR ANTENNA MATCHING IN PORTABLE WIRELESS TERMINAL WITH BUILT-IN ANTENNA**

6,862,432 B1\* 3/2005 Kim ..... 455/80  
6,985,760 B2\* 1/2006 Hosonuma ..... 455/575.3

(75) Inventor: **Kang-Sik Kim**, Suwon-si (KR)

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

KR 10-2001-0011282 2/2001

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 79 days.

\* cited by examiner

(21) Appl. No.: **11/249,064**

*Primary Examiner*—Hoang V. Nguyen  
(74) *Attorney, Agent, or Firm*—The Farrell Law Firm

(22) Filed: **Oct. 12, 2005**

(57) **ABSTRACT**

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(30) **Foreign Application Priority Data**

Oct. 12, 2004 (KR) ..... 10-2004-0081196

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

(52) **U.S. Cl.** ..... 343/860; 343/702; 455/575.3

(58) **Field of Classification Search** ..... 343/860,  
343/702; 455/575.3, 80

See application file for complete search history.

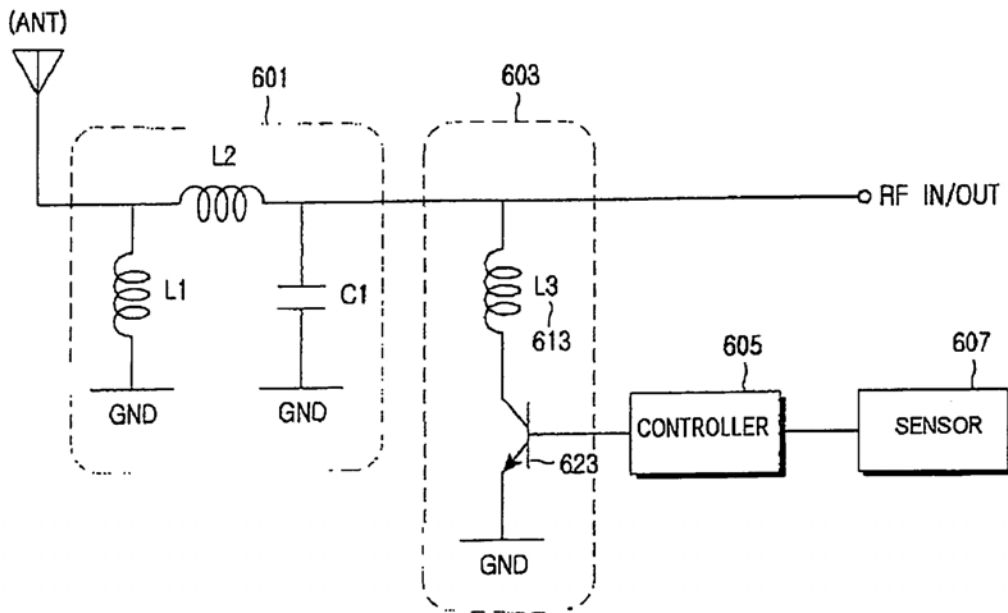
Disclosed is an antenna matching device of a folder type portable wireless terminal with a built-in antenna. In the antenna matching device, a  $\pi$ -type matching circuit is connected between an built-in antenna and a duplexer, one end of a passive element is shunted between the  $\pi$ -type matching circuit and the duplexer, and an active element opens or connects the other end of the passive element to ground according to the opening or closing of a folder of the terminal. The antenna matching device lowers antenna impedance difference between the opened and closed states of the folder, such that the terminal can constantly maintain its radiation performance, such as VSWR and resonant frequency, regardless of the opened or closed position of the folder.

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**13 Claims, 9 Drawing Sheets**





US007239290B2

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

(10) **Patent No.:** **US 7,239,290 B2**  
(45) **Date of Patent:** **Jul. 3, 2007**

(54) **SYSTEMS AND METHODS FOR A CAPACITIVELY-LOADED LOOP ANTENNA**

6,693,599 B1 \* 2/2004 Chia et al. .... 343/741  
6,697,025 B2 \* 2/2004 Koyanagi et al. .... 343/741

(75) Inventors: **Gregory Poilasne**, San Diego, CA (US); **Jorge Fabrega-Sanchez**, San Diego, CA (US); **Mete Ozkar**, San Diego, CA (US); **Vaneet Pathak**, San Diego, CA (US)

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Internet Document: Computer Translation of document DE-8814993-U 'Description' (at <http://www.freetranslation.com/view.asp>(Feb. 6, 2006)).

*Primary Examiner*—Shih-Chao Chen  
*Assistant Examiner*—Minh Dieu A

(73) Assignee: **Kyocera Wireless Corp.**, 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 198 days.

(21) Appl. No.: **10/940,935**

(22) Filed: **Sep. 14, 2004**

(65) **Prior Publication Data**

US 2006/0055618 A1 Mar. 16, 2006

(57) **ABSTRACT**

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

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

(58) **Field of Classification Search** ..... 343/724,  
343/726–728, 730, 735, 859, 860, 864, 740,  
343/741, 744–745, 747–749, 886

See application file for complete search history.

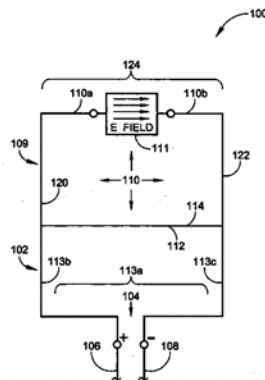
A capacitively-loaded loop antenna and corresponding radiation method have been provided. The antenna comprises a transformer loop having a balanced feed interface and a capacitively-loaded loop radiator. In one aspect, the capacitively-loaded loop radiator is a balanced radiator. In another, the transformed loop and capacitively-loaded loop radiator are physically connected. That is, the transformer loop and the capacitively-loaded loop radiator have a portion shared by both of the loop perimeters. Alternately, the loops are physically independent of each other. In one aspect, the perimeters have a rectangular shape. Other shapes such as round or oval are also possible. In another aspect, the planes formed by the transformer and capacitively-loaded loop radiator can be coplanar or non-planar, while both loops are orthogonal to a common magnetic near-field generated by the transformed loop. The radiator has a capacitively-loaded side, or capacitively loaded perimeter section, depending on the shape of the perimeter.

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**30 Claims, 9 Drawing Sheets**





US007242352B2

(12) **United States Patent**  
**Tavassoli Hozouri**

(10) **Patent No.:** **US 7,242,352 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **MULTI-BAND OR WIDE-BAND ANTENNA**

2004/0061652 A1 4/2004 Ishihara et al.  
2004/0150567 A1 8/2004 Yuanzhu  
2004/0227675 A1 11/2004 Harano

(75) Inventor: **Behzad Tavassoli Hozouri**, Santa Clara, CA (US)

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(73) Assignee: **X-Ether, Inc.**, Santa Clara, CA (US)

WO WO 03/077360 A1 9/2003  
WO WO 2004/109857 A1 12/2004

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 21 days.

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(21) Appl. No.: **10/907,606**

Guo et al., A Quarter-Wave U-Shaped Patch Antenna With Two Unequal Arms For Wideband And Dual-Frequency Operation, IEEE Transactions On Antennas And Propagation, vol. 50, No. 8, Aug. 2002.

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

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(65) **Prior Publication Data**

US 2006/0227052 A1 Oct. 12, 2006

*Primary Examiner*—Tho Phan  
*Assistant Examiner*—Chuc Tran  
(74) *Attorney, Agent, or Firm*—Raymond E. Roberts; Intellectual Property Law Offices

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

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **343/700 MS; 343/702; 343/756**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 752, 711–713, 749, 872, 767, 770, 343/725, 895**

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

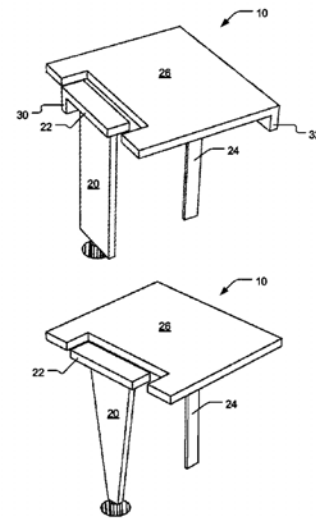
See application file for complete search history.

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- 6,977,616 B2 \* 12/2005 Yuanzhu ..... 343/700 MS
- 2001/0048391 A1 12/2001 Annamaa
- 2003/0122718 A1 7/2003 Fang et al.

**14 Claims, 6 Drawing Sheets**





US007242353B2

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

(10) **Patent No.:** **US 7,242,353 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **BRACKET-ANTENNA ASSEMBLY AND MANUFACTURING METHOD OF THE SAME**

(75) Inventors: **Chen-Ta Hung**, Tu-Chen (TW);  
**Lung-Sheng Tai**, Tu-Chen (TW);  
**Yung-Lung Ke**, Tu-chen (TW)

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

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 141 days.

(21) Appl. No.: **10/992,038**

(22) Filed: **Nov. 17, 2004**

(65) **Prior Publication Data**  
US 2005/0104788 A1 May 19, 2005

(30) **Foreign Application Priority Data**  
Nov. 18, 2003 (TW) ..... 92132256 A

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

(52) **U.S. Cl.** ..... **343/702**; 343/892; 343/853;  
343/872

(58) **Field of Classification Search** ..... 343/702,  
343/700 MS, 853, 892  
See application file for complete search history.

(56) **References Cited**  
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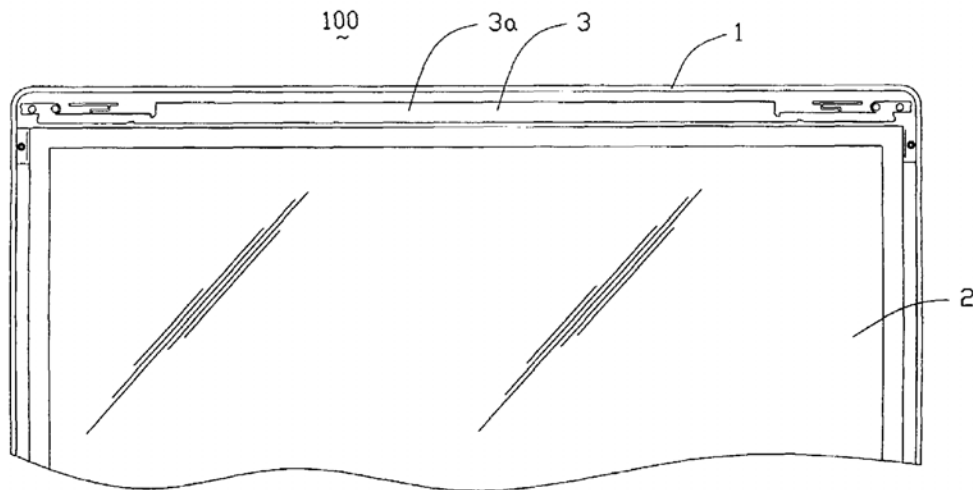
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*Primary Examiner*—Trinh Vo Dinh  
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A bracket-antenna assembly (3a) for transmitting and receiving electromagnetic waves as well as supporting a liquid crystal display of an electronic device is disclosed. The bracket-antenna assembly is formed by a side of a loop bracket (3) and includes a first antenna (41) and a second antenna (42) having the same structure with the first antenna and arranged symmetrically to the first antenna on the side of the bracket. Each of the antennas includes two inverted-F antennas operating at different frequency bands. A remained portion of the bracket acts as a grounding portion (30) of both the first and the second antennas.

**13 Claims, 10 Drawing Sheets**





US007242354B2

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

(10) **Patent No.:** **US 7,242,354 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **ANTENNA UNIT AND WIRELESS COMMUNICATION APPARATUS**

(75) Inventors: **Katsutoshi Katoh**, Tokyo-to (JP);  
**Kazuhiko Maeda**, Yokohama (JP)

(73) Assignee: **Lenovo (Singapore) Pte. Ltd.**,  
Singapore (SG)

(\* ) 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.: **11/259,697**

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

(65) **Prior Publication Data**

US 2006/0049999 A1 Mar. 9, 2006

**Related U.S. Application Data**

(63) Continuation of application No. 10/730,322, filed on Dec. 8, 2003, now Pat. No. 6,972,722.

(30) **Foreign Application Priority Data**

Mar. 3, 2003 (JP) ..... 2003-056376

(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  
See application file for complete search history.

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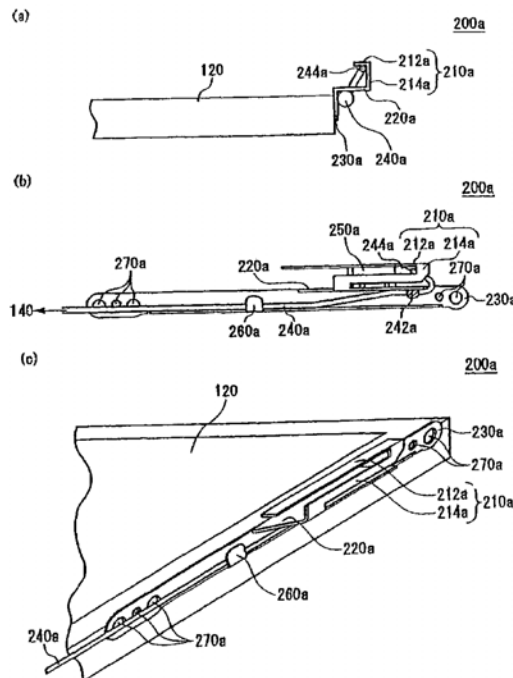
*Primary Examiner*—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Michael J. Medley; Driggs, Hogg & Fry Co., LPA

(57) **ABSTRACT**

An antenna unit is provided in a wireless communication apparatus which performs wireless communication. The antenna unit has a radio wave resonance part through which a radio wave is transmitted or received, an antenna ground part electrically connected to the radio wave resonance part, and a connection part which fixes the antenna ground part at such a position that the antenna ground part is closer to the radio wave resonance part than other ground parts of the wireless communication apparatus.

**20 Claims, 6 Drawing Sheets**





US007242355B2

(12) **United States Patent**  
**Vance**

(10) **Patent No.:** **US 7,242,355 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **FREQUENCY BAND SWITCHING OF AN ANTENNA ARRANGEMENT**

6,753,827 B2\* 6/2004 Oshiyama et al. .... 343/876

(75) Inventor: **Scott L. Vance**, Staffanstorp (SE)

\* cited by examiner

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

*Primary Examiner*—Shih-Chao Chen

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 62 days.

(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec, P.A.

(57) **ABSTRACT**

(21) Appl. No.: **11/286,903**

A portable communication device includes an antenna arrangement in its interior. The antenna arrangement comprises at least one first radiating antenna element dimensioned for radiation in a first frequency band, and a first mechanically movable extension element, movable between at least two different fixed positions and being connected to the first radiating antenna element in at least one of the positions for radiating together with the first radiating antenna element. When the extension element is being moved from one position to another, it adjusts the electrical length of the combined first radiating antenna and extension element for enhancing radiation in a second frequency band. In this way a small sized multiband antenna arrangement is provided that keeps the efficiency of the different bands high.

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

(65) **Prior Publication Data**

US 2007/0115186 A1 May 24, 2007

(51) **Int. Cl.**  
*H01Q 3/24* (2006.01)  
*H01Q 1/24* (2006.01)  
*H01Q 19/00* (2006.01)

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

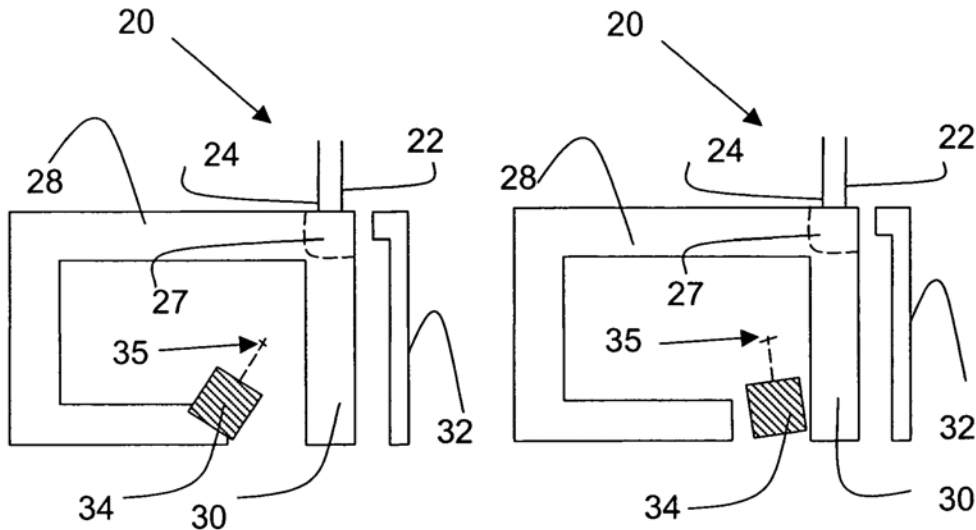
(58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 833, 876  
See application file for complete search history.

(56) **References Cited**

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**24 Claims, 3 Drawing Sheets**





US007242356B2

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

(10) **Patent No.:** **US 7,242,356 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **ANTENNA ASSEMBLY FOR USE IN A FOLDABLE MOBILE PHONE**

(75) Inventors: **Shih-Wen Lu**, Taipei Hsien (TW);  
**Hao-Chun Tung**, Chinmen Hsien (TW)

(73) Assignee: **BENQ CORPORATION** (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.: **11/355,231**

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

(65) **Prior Publication Data**

US 2006/0187128 A1 Aug. 24, 2006

(30) **Foreign Application Priority Data**

Feb. 18, 2005 (TW) ..... 94104781 A

(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, 860**

See application file for complete search history.

(56) **References Cited**

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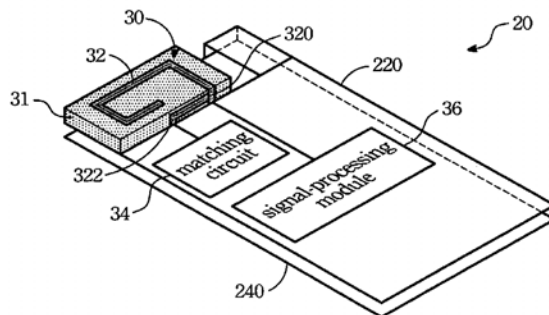
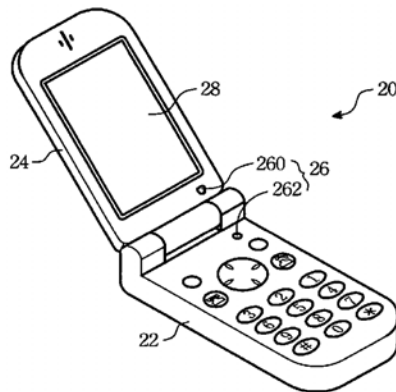
*Primary Examiner*—Tan Ho

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

(57) **ABSTRACT**

A mobile phone includes a main body, a cover member and an antenna assembly having a radiating metal strip and a matching circuit. The radiating metal strip has a feeding leg and a short-circuit leg coupled electrically to the matching circuit in such a manner that the latter provides impedance matching for the antenna assembly. A switching unit couples the cover member pivotally on the main body, and determines whether the mobile phone is in a first operating mode or a second operating mode. Either in the first or second operating mode, the antenna assembly in the mobile phone has similar characteristic by virtue of the impedance matching provided by the matching circuit.

**14 Claims, 4 Drawing Sheets**





US007242357B2

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

(10) **Patent No.:** **US 7,242,357 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **ANTENNA FOR VEHICLE**  
(75) Inventors: **Hiroyuki Fujii**, Matsusaka (JP);  
**Masashi Uemura**, Matsusaka (JP)  
(73) Assignee: **Central Glass Co., Ltd.**, Yamaguchi  
(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.: **10/549,803**  
(22) PCT Filed: **Mar. 16, 2004**  
(86) PCT No.: **PCT/JP2004/003490**  
§ 371 (c)(1),  
(2), (4) Date: **Sep. 19, 2005**

(87) PCT Pub. No.: **WO2004/084343**  
PCT Pub. Date: **Sep. 30, 2004**

(65) **Prior Publication Data**  
US 2006/0176227 A1 Aug. 10, 2006

(30) **Foreign Application Priority Data**  
Mar. 19, 2003 (JP) ..... 2003-074837  
Nov. 25, 2003 (JP) ..... 2003-394328  
Jan. 14, 2004 (JP) ..... 2004-007353  
Feb. 9, 2004 (JP) ..... 2004-032659

(51) **Int. Cl.**  
**H01Q 1/32** (2006.01)  
(52) **U.S. Cl.** ..... **343/713; 343/711**  
(58) **Field of Classification Search** ..... **343/703,**  
**343/711, 712, 704, 713**

See application file for complete search history.

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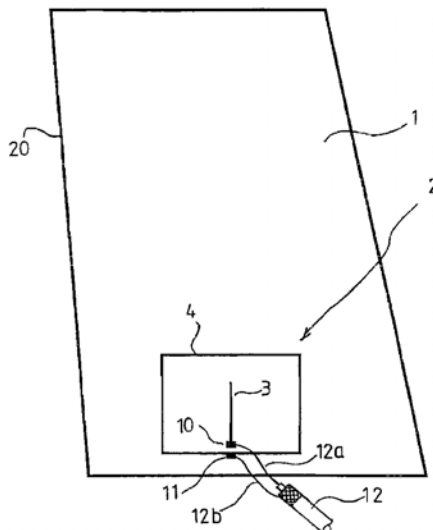
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*Primary Examiner*—Hoanganh Le  
(74) *Attorney, Agent, or Firm*—Young & Thompson

(57) **ABSTRACT**

An antenna for vehicle, i.e. a wire antenna being arranged on the surface of the window glass of an automobile or the like, comprising a first element having a length extending from a first feeding point equal to any one of 1/4, 3/4 or 5/4 of the wavelength of a transmitting/receiving radio wave, and a second closed loop element having a length extending from a second feeding point, provided in the vicinity of the first feeding point, while surrounding the first element not shorter than one wavelength of the transmitting/receiving radio wave.

**19 Claims, 17 Drawing Sheets**







US007242358B2

(12) **United States Patent**  
**Noh**

(10) **Patent No.:** **US 7,242,358 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **WIDEBAND GLASS ANTENNA FOR VEHICLE**  
(75) Inventor: **Yong-Ho Noh**, Hwaseong-si (KR)  
(73) Assignee: **Hyundai Motor Company**, Yangjae-Dong, Seocho-Ku, Seoul (KR)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 54 days.

(21) Appl. No.: **11/299,367**  
(22) Filed: **Dec. 8, 2005**

(65) **Prior Publication Data**  
US 2007/0091002 A1 Apr. 26, 2007

(30) **Foreign Application Priority Data**  
Oct. 26, 2005 (KR) ..... 10-2005-0101196

(51) **Int. Cl.**  
**H01Q 1/32** (2006.01)  
(52) **U.S. Cl.** ..... **343/713; 343/866; 343/741**  
(58) **Field of Classification Search** ..... **343/713, 343/711, 866, 741**  
See application file for complete search history.

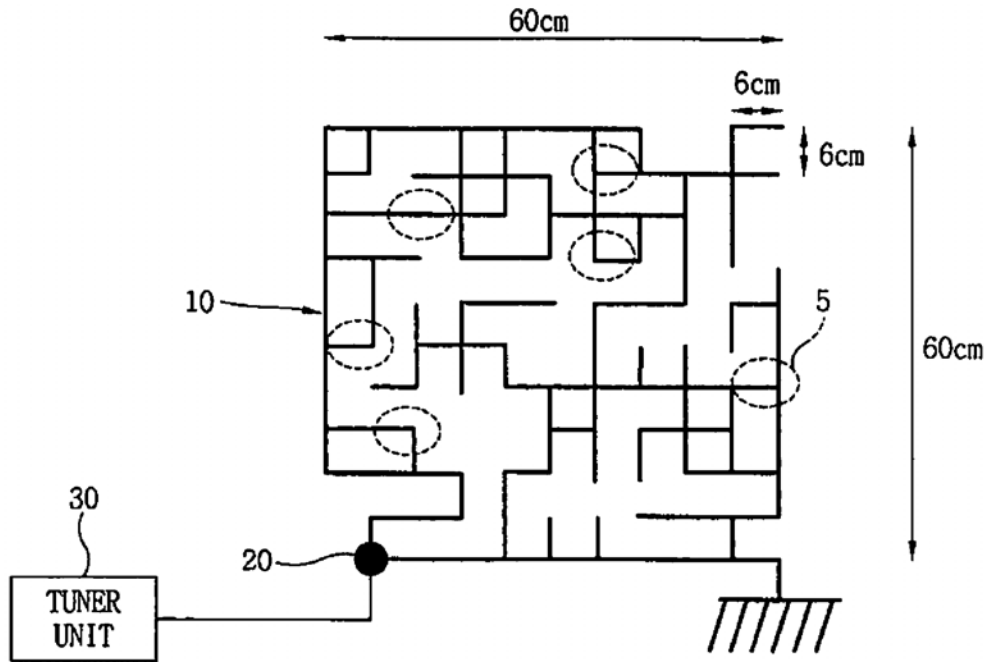
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*Primary Examiner*—Hoang V. Nguyen  
(74) *Attorney, Agent, or Firm*—Morgan Lewis & Bockius LLP

(57) **ABSTRACT**  
Disclosed herein is a wideband glass antenna for a vehicle. The wideband glass antenna includes a loop antenna and a pattern. The loop antenna has a loop antenna pattern, in which a first side is connected to a feeding point, a second side is connected to a ground, and the two sides are connected to each other. The loop antenna pattern forms a predetermined space in the loop antenna. The pattern is formed in the loop antenna and is connected by a plurality of tuning arms for expanding a frequency band of the antenna.

**8 Claims, 2 Drawing Sheets**





US007242361B2

(12) **United States Patent**  
**Kronberger**

(10) **Patent No.:** **US 7,242,361 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

- (54) **ANTENNA STRUCTURE WITH FILTER EFFECT**
- (75) Inventor: **Rainer Kronberger**, Würselen (DE)
- (73) Assignee: **Infineon Technologies AG**, Munich (DE)
- (\* ) 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*—Tan Ho

(74) *Attorney, Agent, or Firm*—Baker Botts L.L.P.

- (21) Appl. No.: **11/148,133**
- (22) Filed: **Jun. 8, 2005**
- (65) **Prior Publication Data**  
US 2006/0119530 A1 Jun. 8, 2006
- (30) **Foreign Application Priority Data**  
Jun. 8, 2004 (DE) ..... 10 2004 027 839

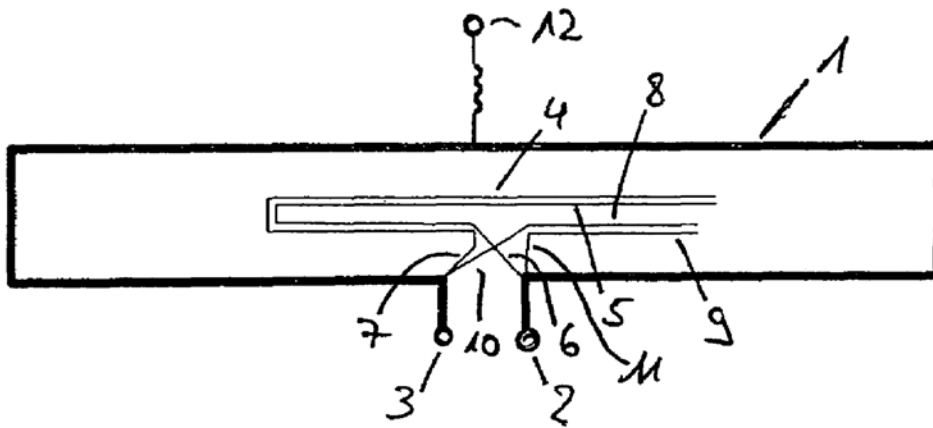
(57) **ABSTRACT**

An antenna structure for transmitting and/or receiving radio waves has a symmetrically arranged radiator element with a first connecting terminal and a second connecting terminal, said radiator element being tuned to a useful frequency. Moreover, it has at least one conductor structure connected in parallel with the radiator element. The conductor structure comprises an open-circuited first line element, which is coupled to the first connecting terminal, and an open-circuited second line element, which is coupled to the second connecting terminal. In this case, a length of the first line element and of the second line element essentially corresponds to the integral multiple of a quarter wavelength corresponding to a blocking frequency. The first line element and the second line element run parallel to one another.

- (51) **Int. Cl.**  
**H01Q 9/28** (2006.01)
- (52) **U.S. Cl.** ..... **343/795; 343/866**
- (58) **Field of Classification Search** ..... **343/795, 343/803, 741, 742, 866, 867**  
See application file for complete search history.

- (56) **References Cited**  
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**23 Claims, 2 Drawing Sheets**





US007242364B2

(12) **United States Patent**  
**Ranta**

(10) **Patent No.:** **US 7,242,364 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **DUAL-RESONANT ANTENNA**  
(75) Inventor: **Tero Ranta**, Turku (FI)  
(73) Assignee: **Nokia Corporation**, Espoo (FI)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

2006/0055606 A1\* 3/2006 Boyle ..... 343/702  
2006/0197711 A1\* 9/2006 Sekiguchi et al. .... 343/745

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*Primary Examiner*—Hoang V. Nguyen

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

(21) Appl. No.: **11/238,438**  
(22) Filed: **Sep. 29, 2005**

(65) **Prior Publication Data**  
US 2007/0069957 A1 Mar. 29, 2007

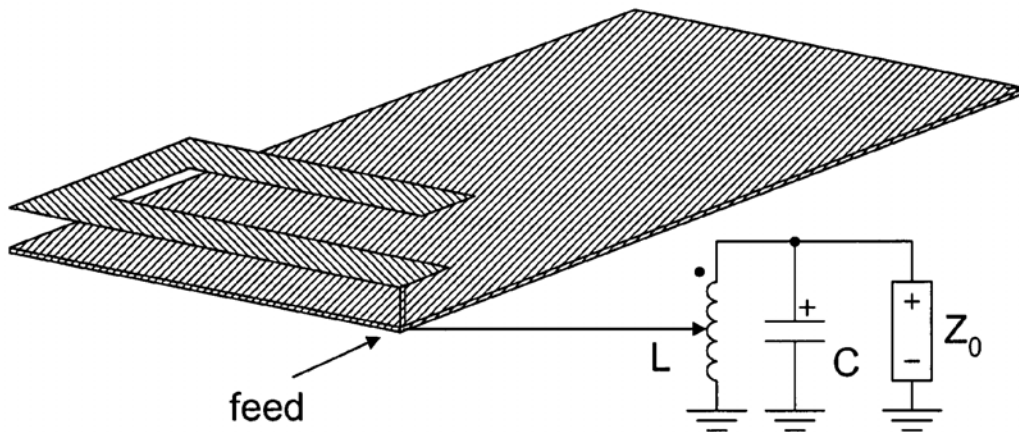
(57) **ABSTRACT**

(51) **Int. Cl.**  
**H01Q 1/50** (2006.01)  
(52) **U.S. Cl.** ..... **343/860; 343/861; 343/702**  
(58) **Field of Classification Search** ..... 343/860,  
343/861, 702  
See application file for complete search history.

A wide-band antenna comprises a series-resonant antenna and a resonant circuit. The antenna has a radiative element and a feed pin. The resonant circuit comprises an inductive element connected to the feed pin and a capacitor connected in parallel to the inductive element, which has a center tap for adjusting the impedance of the resonant circuit relative to the antenna impedance. The antenna can be a low-impedance PIFA, a helix, monopole, whip, stub or loop antenna. The wide-band antenna can be used for the low (1 GHz range) or high (2 GHz range) band. The antenna can be made to simultaneously cover both 850 & 900 bands with the ground plane small enough to be implemented in a mobile phone or the like. The center tap is either connected to the feed of the antenna or connected to an RF front-end dependent upon the impedance level of the antenna element.

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**22 Claims, 12 Drawing Sheets**





US007242366B2

(12) **United States Patent**  
**Shibata**

(10) **Patent No.:** **US 7,242,366 B2**  
(45) **Date of Patent:** **Jul. 10, 2007**

(54) **ANTENNA APPARATUS**

6,831,611 B2\* 12/2004 Ooe et al. .... 343/713

(75) Inventor: **Osamu Shibata**, Kawasaki (JP)

**FOREIGN PATENT DOCUMENTS**

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

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JP	2004-221971	8/2004

(\* ) 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.: **11/523,703**

**OTHER PUBLICATIONS**

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

International Search Report dated Nov. 15, 2005 (w/ English translation).

(65) **Prior Publication Data**

US 2007/0030210 A1 Feb. 8, 2007

Written Opinion dated Nov. 15, 2005 (w/ English translation).

**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2005/015402, filed on Aug. 25, 2005.

Ohira et al., Electronically Steerable Parasitic Array Radiator Antenna, Jan. 2004 vol. J87-C No. 1.

(30) **Foreign Application Priority Data**

Sep. 3, 2004 (JP) ..... 2004-257379

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*Primary Examiner*—Trinh Dinh

*Assistant Examiner*—Huedung Mancuso

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

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

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **343/893; 343/833**

(58) **Field of Classification Search** ..... **343/834, 893, 815, 702**  
See application file for complete search history.

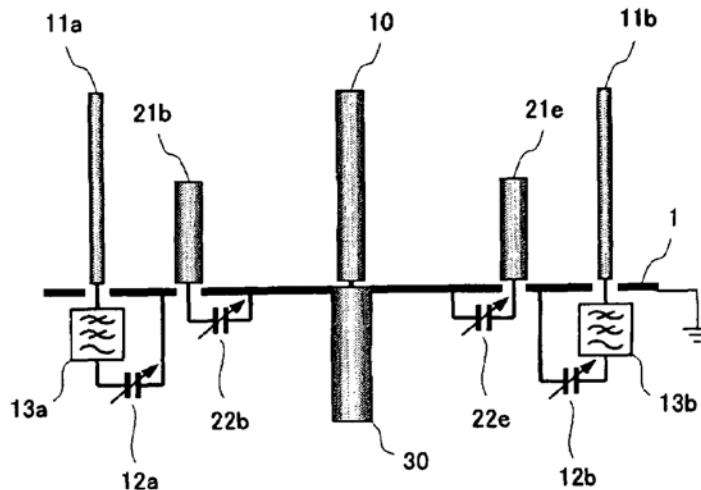
An antenna apparatus including a feed element excited by first and second wireless frequency signals, first non-feed elements for controlling directivity with respect to the first wireless frequency signal, second non-feed elements for controlling directivity with respect to the second wireless frequency signal, second variable-reactance circuits disposed between the second non-feed elements and ground, filters for passing the first frequency band and cutting off the second frequency band, which are connected to the first non-feed elements, and first variable-reactance circuits disposed between the filters and the ground.

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**19 Claims, 7 Drawing Sheets**





US007245259B2

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

(10) **Patent No.:** **US 7,245,259 B2**  
(45) **Date of Patent:** **Jul. 17, 2007**

(54) **MULTIPLE ANTENNA DIVERSITY ON MOBILE TELEPHONE HANDSETS, PDAS AND OTHER ELECTRICALLY SMALL RADIO PLATFORMS**

(75) Inventors: **Steven Puckey**, Cambridge (GB); **Steven Martin**, Cambridge (GB); **Tim John Palmer**, Cambridge (GB); **James William Kingsley**, Cambridge (GB); **Simon Phillip Kingsley**, Cambridge (GB)

(73) Assignee: **Antenova Ltd.**, Cambridge (GB)

(\*) 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.: **10/544,478**

(22) PCT Filed: **Feb. 9, 2004**

(86) PCT No.: **PCT/GB2004/000511**

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

(87) PCT Pub. No.: **WO2004/070874**

PCT Pub. Date: **Aug. 19, 2004**

(65) **Prior Publication Data**  
US 2006/0097919 A1 May 11, 2006

(30) **Foreign Application Priority Data**  
Feb. 7, 2003 (GB) ..... 0302818.0

(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.

(56) **References Cited**

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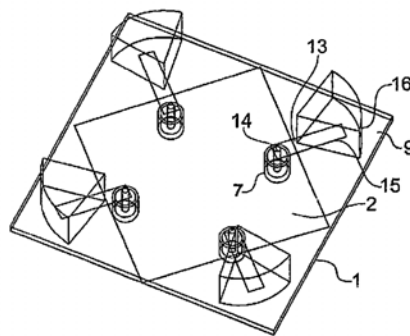
Primary Examiner—Tho Phan

(74) Attorney, Agent, or Firm—Pearl Cohen Zedek Latzer LLP

(57) **ABSTRACT**

There is disclosed an antenna device including a dielectric substrate having a first, upper surface and a second, lower surface, a conductive groundplane on the second surface or located between the first and second surfaces. At least two conductive feedlines are formed on the first surface and extend from feed points to predetermined radiating points at edge or corner parts of the first surface. The groundplane does not extend under the radiating points. The groundplane is configured as to extend between the radiating points and the feedlines are widened at the radiating points and/or are provided with discrete dielectric elements at the radiating points. The antenna device provides broadband performance and good diversity within a small space.

**19 Claims, 17 Drawing Sheets**





US007245260B2

(12) **United States Patent**  
**Chang**

(10) **Patent No.:** **US 7,245,260 B2**  
(45) **Date of Patent:** **Jul. 17, 2007**

(54) **DUAL BAND ANTENNA**

(75) Inventor: **Chun Yi Chang**, Yi Lan Hsien (TW)

(73) Assignee: **Benq Corporation**, Taoyuan, Taiwan (CN)

(\* ) 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.: **10/862,864**

(22) Filed: **Jun. 7, 2004**

(65) **Prior Publication Data**  
US 2005/0007279 A1 Jan. 13, 2005

(30) **Foreign Application Priority Data**  
Jun. 24, 2003 (TW) ..... 92117137 A

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/702; 343/895**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 895, 718, 725, 843**  
See application file for complete search history.

(56) **References Cited**

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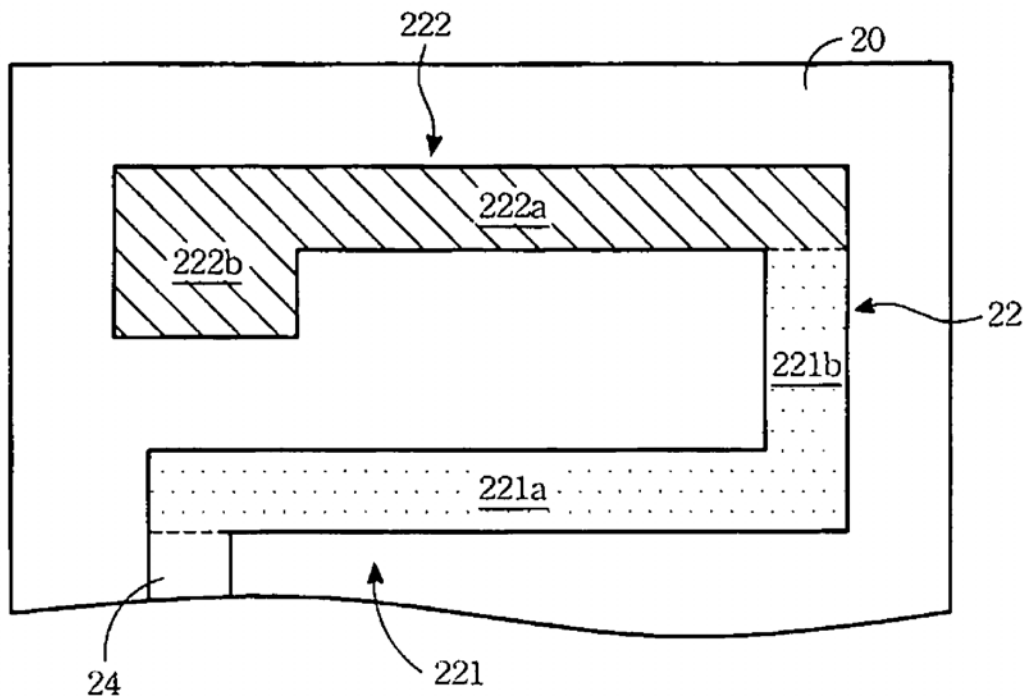
*Primary Examiner*—Hoang Nguyen  
*Assistant Examiner*—Ephrem Alemu

(74) *Attorney, Agent, or Firm*—Ladas and Parry LLP

(57) **ABSTRACT**

A dual band antenna includes a metal strip and a feeding leg. The metal strip formed on a substrate further comprises a first band portion and a second band portion, in which a tail of the first band portion is connected to the second band portion. The feeding leg extended from a head of the first band portion is led to connect with a signal processing circuit. The metal strip can be tuned to second frequency band signals, in which the first band portion is purposely tuned to first frequency band signals. Also, the second band portion has a function of adjusting frequencies of the second frequency band.

**13 Claims, 3 Drawing Sheets**





US007245263B2

(12) **United States Patent**  
**Hoshi**

(10) **Patent No.:** **US 7,245,263 B2**  
(45) **Date of Patent:** **Jul. 17, 2007**

- (54) **ANTENNA**
- (75) Inventor: **Fumikazu Hoshi**, Miyagi (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 0 days.

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- (21) Appl. No.: **11/354,708**
- (22) Filed: **Feb. 15, 2006**
- (65) **Prior Publication Data**  
US 2006/0187134 A1 Aug. 24, 2006

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*Primary Examiner*—Shih-Chao Chen  
*(74) Attorney, Agent, or Firm*—Cooper & Dunham LLP

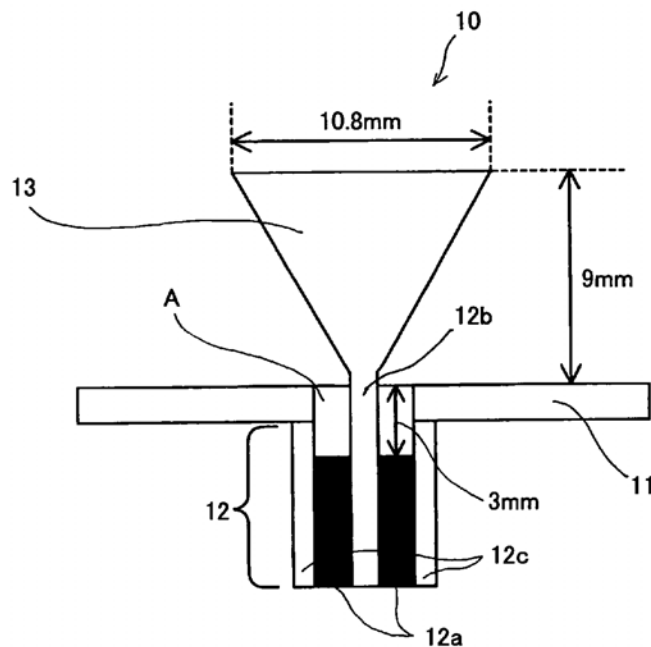
- (30) **Foreign Application Priority Data**  
Feb. 18, 2005 (JP) ..... 2005-042743
- (51) **Int. Cl.**  
*H01Q 13/00* (2006.01)  
*H01Q 9/38* (2006.01)
- (52) **U.S. Cl.** ..... 343/772; 343/830
- (58) **Field of Classification Search** ..... 343/772,  
343/773, 791, 830, 908  
See application file for complete search history.

(57) **ABSTRACT**

An antenna supplied with power by a coaxial line including an inner conductor, an outer conductor, and a dielectric provided between the inner conductor and the outer conductor is disclosed. The antenna includes an antenna part including a first conductor and a second conductor, the second conductor including a conical shape having an apex thereof opposing the first conductor; and a transition area having an effective dielectric constant different from the dielectric constant of the dielectric in the coaxial line, the transition area being provided in the end part of the coaxial line connected to the antenna.

- (56) **References Cited**  
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**17 Claims, 18 Drawing Sheets**





US007245268B2

(12) **United States Patent**  
**O'Neill, Jr. et al.**

(10) **Patent No.:** **US 7,245,268 B2**  
(45) **Date of Patent:** **Jul. 17, 2007**

(54) **QUADRIFILAR HELICAL ANTENNA**

(75) Inventors: **Gregory A. O'Neill, Jr.**, Rockledge, FL (US); **Murray Fugate**, Coral Springs, FL (US); **Young-Min Jo**, Viera, FL (US); **John C. Farrar**, Indialantic, FL (US); **Myung Sung Lee**, Seoul (KR); **Se-hyun Oh**, Seoul (KR); **Joo Mun Lee**, Kyunggi-do (KR); **Jin Hee Yoon**, Seoul (KR); **Sang Ok Choi**, Seoul (KR); **Eun Seok Han**, Seoul (KR)

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(73) Assignee: **SkyCross, Inc.**, Viera, FL (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 38 days.

(21) Appl. No.: **10/998,301**

(22) Filed: **Nov. 26, 2004**

(65) **Prior Publication Data**  
US 2006/0022891 A1 Feb. 2, 2006

**Related U.S. Application Data**

(60) Provisional application No. 60/592,011, filed on Jul. 28, 2004.

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

(52) **U.S. Cl.** ..... **343/895; 343/853; 343/702**

(58) **Field of Classification Search** ..... **343/895, 343/850, 796, 853**  
See application file for complete search history.

(56) **References Cited**

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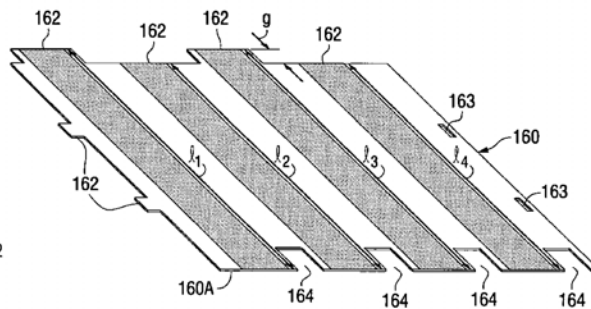
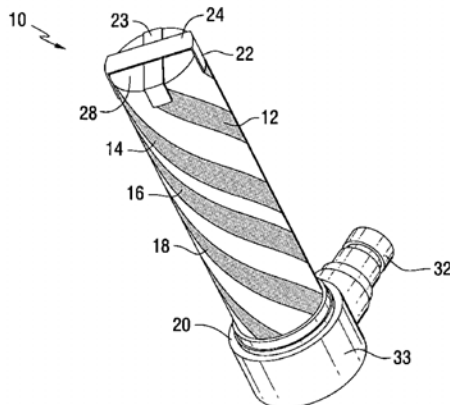
*Primary Examiner*—Trinh Vo Dinh

(74) *Attorney, Agent, or Firm*—John L. DeAngelis, Jr.; Beusse Wolter Sanks Mora & Maire, P.A.

(57) **ABSTRACT**

A quadrifilar helical antenna comprising two pairs of filars having unequal lengths and phase quadrature signals propagating thereon. A conductive H-shaped impedance matching element matches a source impedance to an antenna impedance. The impedance matching element having a feed terminal at the center thereof from which current is supplied to the two filars of each filar pair disposed about an edge of the impedance matching element and symmetric with respect to a center of the impedance matching element. The impedance matching element further comprises a reactive element for matching the antenna and source impedances.

**39 Claims, 6 Drawing Sheets**







US007248220B2

(12) **United States Patent**  
**Futamata**

(10) **Patent No.:** **US 7,248,220 B2**  
(45) **Date of Patent:** **Jul. 24, 2007**

- (54) **ANTENNA**
- (75) Inventor: **Hiromasa Futamata, Sakura (JP)**
- (73) Assignee: **Fujikura Ltd., Tokyo (JP)**
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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- (21) Appl. No.: **10/537,786**
- (22) PCT Filed: **Dec. 5, 2003**
- (86) PCT No.: **PCT/JP03/15588**

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- § 371 (c)(1), (2), (4) Date: **Jun. 6, 2005**

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

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- (65) **Prior Publication Data**  
US 2006/0119517 A1 Jun. 8, 2006

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- (30) **Foreign Application Priority Data**  
Dec. 6, 2002 (JP) ..... 2002-354986  
Mar. 20, 2003 (JP) ..... 2003-077159  
Jun. 19, 2003 (JP) ..... 2003-174823

*Primary Examiner*—Thuy V. Tran  
*Assistant Examiner*—Dieu Hien Duong  
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

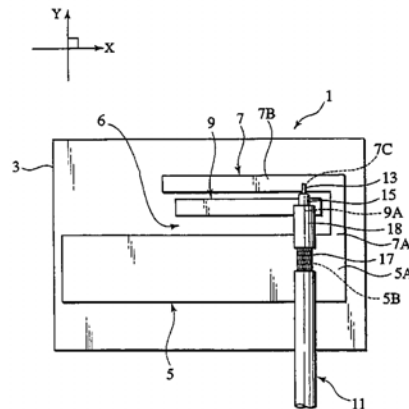
- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **343/700 MS; 343/702**
- (58) **Field of Classification Search** ..... 343/700 MS, 343/702, 767, 770  
See application file for complete search history.

(57) **ABSTRACT**

An antenna comprises a base member (3), a ground conductor (5), a first antenna element (7) and a second antenna element (9). The base member (3) is formed in a thin plate shape and made of dielectric material. The ground conductor (5) is formed of a thin-film shaped and rectangular conductor and disposed on the base member (3). The first antenna element (7) is formed of a thin-film shaped and L-shaped conductor, is disposed on the base member (3) and has one end connected to one end (5A) of the ground conductor (5). The second antenna element (9) is formed of a thin-film shaped and rectangular conductor and is disposed on the base member (3) to be isolated from the ground conductor (5) and the first antenna element (7).

- (56) **References Cited**  
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**37 Claims, 24 Drawing Sheets**





US007248221B2

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

(10) **Patent No.:** **US 7,248,221 B2**  
(45) **Date of Patent:** **Jul. 24, 2007**

(54) **RADIO TAG ANTENNA STRUCTURE FOR AN OPTICAL RECORDING MEDIUM AND A CASE FOR AN OPTICAL RECORDING MEDIUM WITH A RADIO TAG ANTENNA**

(75) Inventors: **Manabu Kai**, Kawasaki (JP); **Yasuyuki Oishi**, Kawasaki (JP); **Toru Maniwa**, Kawasaki (JP); **Hiroyuki Hayashi**, Kawasaki (JP); **Andrey Andrenko**, Kawasaki (JP)

(73) Assignee: **Fujitsu Limited**, Kawasaki (JP)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 149 days.

(21) Appl. No.: **10/999,690**

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

(65) **Prior Publication Data**  
US 2006/0012527 A1 Jan. 19, 2006

(30) **Foreign Application Priority Data**  
Jul. 13, 2004 (JP) ..... 2004-205829

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/872; 343/873**

(58) **Field of Classification Search** ..... **343/700 MS, 343/872, 873**

See application file for complete search history.

(56) **References Cited**

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*Primary Examiner*—Thuy V. Tran

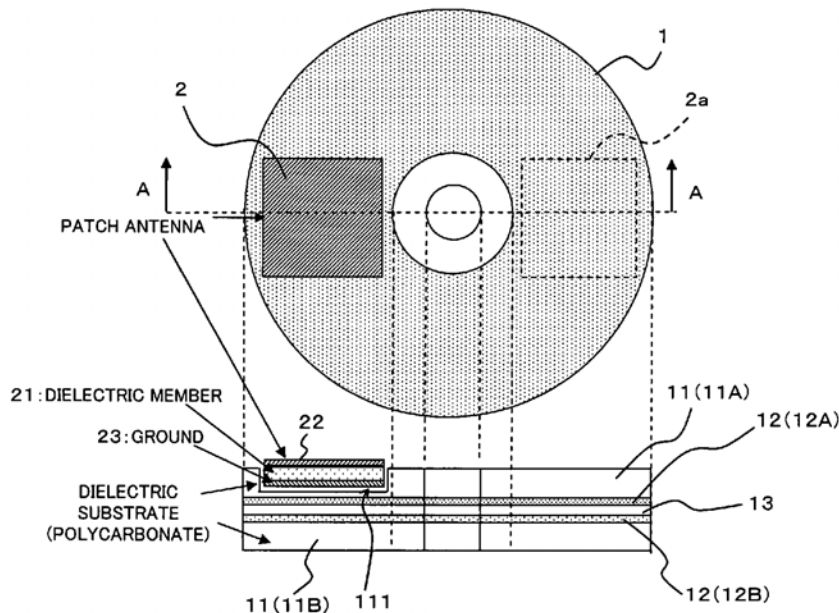
*Assistant Examiner*—Dieu Hien Duong

(74) *Attorney, Agent, or Firm*—Katten Muchin Rosenman LLP

(57) **ABSTRACT**

An antenna comprises a dielectric member, an antenna pattern formed on one surface of the dielectric member, and a ground pattern formed on the other surface of the dielectric member. A part or the whole of the antenna is implanted in a dielectric layer on the side from which a laser beam does not come in of an optical recording medium symmetrically having a metal layer reflecting the laser beam and the dielectric layer, thereby to provide a radio tag antenna structure for an optical recording medium which is simple, is small-sized, and can secure necessary reading performance.

**18 Claims, 16 Drawing Sheets**





US007248223B2

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

(10) **Patent No.:** **US 7,248,223 B2**  
(45) **Date of Patent:** **Jul. 24, 2007**

(54) **FRactal Monopole Antenna**

- (75) Inventors: **Laurent Habib**, Moshav Shapira (IL);  
**Benyamin Almog**, Beit Arie (IL)
- (73) Assignee: **Elta Systems Ltd**, Ashdod (IL)
- (\* ) 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.: **11/293,369**
- (22) Filed: **Dec. 5, 2005**

- (65) **Prior Publication Data**  
US 2007/0126637 A1 Jun. 7, 2007

- (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,  
343/846  
See application file for complete search history.

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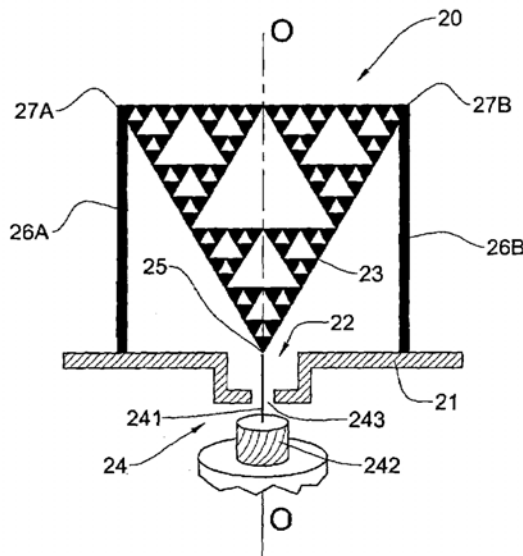
(Continued)

*Primary Examiner*—Hoang V. Nguyen  
(74) *Attorney, Agent, or Firm*—The Nath Law Group; Jerald L. Meyer; Stanley N. Protigal

(57) **ABSTRACT**

A monopole fractal antenna and a method of manufacturing thereof are described. The antenna includes a ground plane having a cavity recessed therein, a radiating arm backed by the cavity and coupled to a feeding line arranged at the cavity, and at least one pair of electrical shunts configured for connecting at least two points selected within the fractal portion of the radiating arm to the ground plane. At least a portion of the radiating arm has a fractal geometric shape. The radiating arm is extended from the cavity along an axis disposed in relation to the ground plane.

**23 Claims, 9 Drawing Sheets**





US007248224B2

(12) **United States Patent**  
**Yuanzhu**

(10) **Patent No.:** **US 7,248,224 B2**  
(45) **Date of Patent:** **Jul. 24, 2007**

(54) **ANTENNA DEVICE HAVING RADIATION CHARACTERISTICS SUITABLE FOR ULTRAWIDEBAND COMMUNICATIONS**

6,906,669 B2\* 6/2005 Sabet et al. .... 343/700 MS  
2003/0043083 A1\* 3/2003 Huang ..... 343/767  
2004/0104851 A1\* 6/2004 Kadambi et al. .... 343/700 MS

(75) Inventor: **Dou Yuanzhu**, Fukushima-ken (JP)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 34 days.

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JP 2003-133838 5/2003

(21) Appl. No.: **11/314,578**

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

Primary Examiner—Tho Phan

(65) **Prior Publication Data**

(74) Attorney, Agent, or Firm—Brinks Hofer Gilson & Lione

US 2006/0132362 A1 Jun. 22, 2006

(30) **Foreign Application Priority Data**

Dec. 22, 2004 (JP) ..... 2004-370417

(57) **ABSTRACT**

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

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

(58) **Field of Classification Search** ..... **343/700 MS, 343/725, 727, 767, 770, 895**

See application file for complete search history.

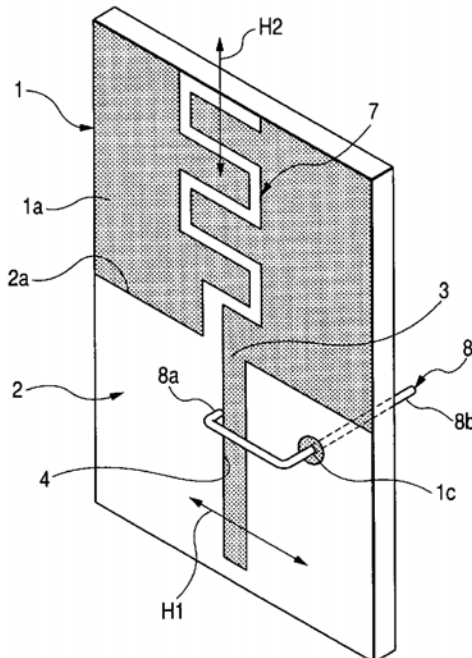
An antenna device includes a plate-shaped conductor and a radiating conductor that extends outward from an end portion of the conductor and has a length corresponding to a quarter wavelength of a first frequency. A strip-shaped slot portion formed by removing a part of the plate-shaped conductor extending inward from the end portion has a length corresponding to a quarter wavelength of a second frequency. A feed portion is perpendicular to the slot portion and crosses over the slot portion. The feed portion feeds the same signals to the slot portion and the radiating conductor.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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**12 Claims, 7 Drawing Sheets**





US007248226B2

(12) **United States Patent**  
**Yuanzhu**

(10) **Patent No.:** **US 7,248,226 B2**  
(45) **Date of Patent:** **Jul. 24, 2007**

(54) **COMPACT ANTENNA DEVICE RADIATING CIRCULARLY POLARIZED WAVE**

(75) Inventor: **Dou Yuanzhu**, Fukushima-ken (JP)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 15 days.

(21) Appl. No.: **11/337,213**

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

(65) **Prior Publication Data**

US 2006/0164314 A1 Jul. 27, 2006

(30) **Foreign Application Priority Data**

Jan. 25, 2005 (JP) ..... 2005-017137

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

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

(58) **Field of Classification Search** ..... **343/767**  
See application file for complete search history.

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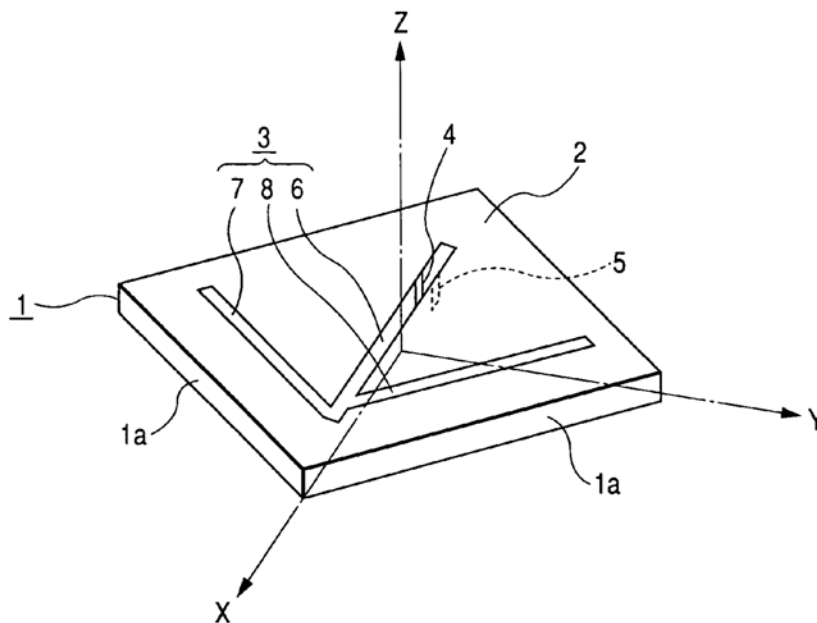
*Primary Examiner*—Trinh Vo Dinh

(74) *Attorney, Agent, or Firm*—Brinks Hofer Gilson & Lione

(57) **ABSTRACT**

In an antenna device, a radiation slot formed in a metal plate includes a main slot part on one diagonal line of the metal plate and first and second branch slot parts. The first and second branch split parts extend along two adjacent sides of the metal plate and are connected to one end of the main slot part. A power feeder line and a ground line are formed in the vicinity of another end of the main slot part. The length and relative position of each slot part is set such that the plane of polarization of an electric wave radiated from the main and first slot parts and the plane of polarization of an electric wave radiated from the main and second slot parts are orthogonal to each other and the two electric waves differ in phase by 90 degrees.

**6 Claims, 5 Drawing Sheets**





US007248227B2

(12) **United States Patent**  
**Chen**

(10) **Patent No.:** **US 7,248,227 B2**  
(45) **Date of Patent:** **Jul. 24, 2007**

- (54) **DIPOLE ANTENNA**
- (75) Inventor: **Chih-Lung Chen**, Taipei Hsien (TW)
- (73) Assignee: **Wistron NeWeb Corporation**,  
Hsi-Chih, 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 0 days.

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*Primary Examiner*—Shih-Chao Chen  
(74) *Attorney, Agent, or Firm*—Winston Hsu

- (21) Appl. No.: **11/306,903**
- (22) Filed: **Jan. 16, 2006**
- (65) **Prior Publication Data**  
US 2007/0097008 A1 May 3, 2007
- (30) **Foreign Application Priority Data**  
Nov. 3, 2005 (TW) ..... 94138585 A
- (51) **Int. Cl.**  
*H01Q 9/28* (2006.01)  
*H01Q 1/38* (2006.01)
- (52) **U.S. Cl.** ..... 343/795; 343/795; 343/700 MS
- (58) **Field of Classification Search** ..... 343/793,  
343/795, 700 MS  
See application file for complete search history.
- (56) **References Cited**

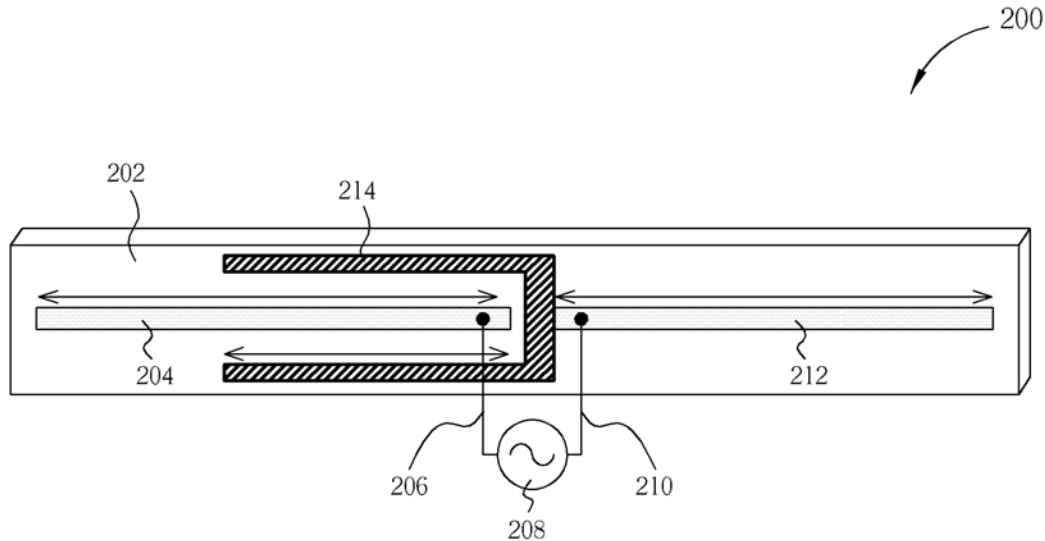
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(57) **ABSTRACT**

Disposing an additional sleeve-shaped structure, which is also called a sleeve, on a first radiator of both resonant radiators of a dipole antenna so that a cavity is formed between the additional radiator and a second resonant radiator of the dipole antenna. An effective bandwidth of the dipole antenna is increased significantly by a capacitance effect caused by the cavity so that more channels can be received by a general digital television broadband antenna while the dipole antenna is applied on the digital television broadband antenna.

**22 Claims, 6 Drawing Sheets**





US007249572B2

(12) **United States Patent**  
**Goetzl**

(10) **Patent No.:** **US 7,249,572 B2**  
(45) **Date of Patent:** **Jul. 31, 2007**

(54) **SEAL FOR PET COLLAR ANTENNA**

(56) **References Cited**

(75) Inventor: **Brent Andrew Goetzl**, Orinda, CA (US)

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(73) Assignee: **Radio Systems Corporation**, Knoxville, TN (US)

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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 21 days.

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(21) Appl. No.: **11/274,019**

*Primary Examiner*—Peter M. Poon  
*Assistant Examiner*—Willie Berry, Jr.  
(74) *Attorney, Agent, or Firm*—Pitts & Brittan, PC

(22) Filed: **Nov. 15, 2005**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2007/0107671 A1 May 17, 2007

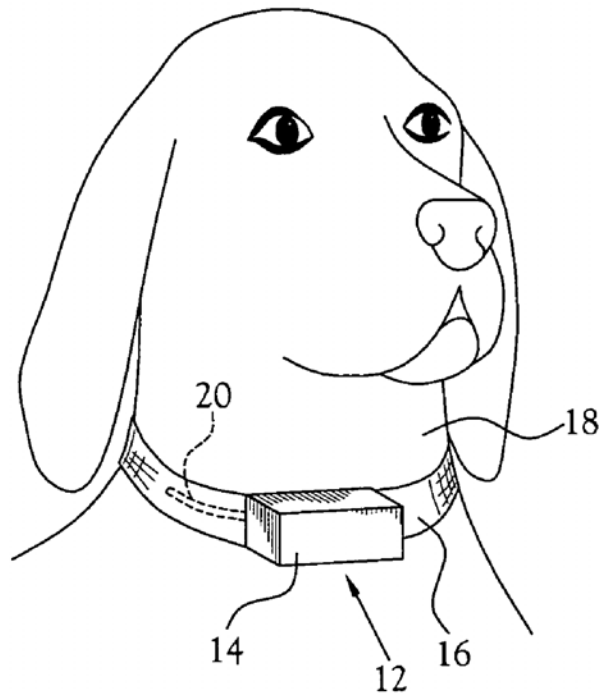
An antenna mounting for an animal collar including an O-ring and associated retainer disposed in an opening through the housing of a radio frequency receiver. The O-ring is compressed into multiple sealing locations between the circumference of the antenna and its surrounding structure to create a resilient hermetic seal between the antenna and such surrounding structure, and to resiliently suspend the antenna within the opening in the housing.

(51) **Int. Cl.**  
**A62B 35/00** (2006.01)

(52) **U.S. Cl.** ..... **119/859**; 119/719; 119/720; 119/765; 340/573.3

(58) **Field of Classification Search** ..... 119/719, 119/720, 760, 765, 859, 718, 858; 340/573.3  
See application file for complete search history.

**5 Claims, 3 Drawing Sheets**





US007250845B2

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

(10) **Patent No.:** **US 7,250,845 B2**  
(45) **Date of Patent:** **Jul. 31, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION DEVICE WITH MOVABLE ANTENNA**

(75) Inventors: **David Young**, Ambler, PA (US); **Roger Wayne Mick**, Chalfont, PA (US); **Vincent A. Turco, Jr.**, Bensalem, PA (US); **Michael Francis Walsh**, Horsham, PA (US)

(73) Assignee: **Two Technologies, Inc.**, Horsham, PA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 93 days.

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*Primary Examiner*—Thomas Mullen

(74) *Attorney, Agent, or Firm*—Woodcock Washburn LLP

(57) **ABSTRACT**

A preferred embodiment of a hand-held radio frequency identification reader includes a first casing suitable for being grasped by a user, a second casing, and a transceiver housed within one of the first and second casings. The reader also includes an antenna housed within the second casing and communicatively coupled to the transceiver for communicatively coupling the reader to a radio frequency identification tag. The second casing is movably coupled to the first casing so that the second casing can be aligned with the radio frequency identification tag to substantially maximize a read distance of the reader while the first casing is held in a substantially fixed position in relation to the radio frequency identification tag.

**31 Claims, 12 Drawing Sheets**

(21) Appl. No.: **11/035,523**

(22) Filed: **Jan. 14, 2005**

(65) **Prior Publication Data**

US 2005/0156040 A1 Jul. 21, 2005

**Related U.S. Application Data**

(60) Provisional application No. 60/536,965, filed on Jan. 16, 2004.

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

(52) **U.S. Cl.** ..... **340/5.92**; 235/385; 235/439; 340/572.7; 343/880; 455/575.7

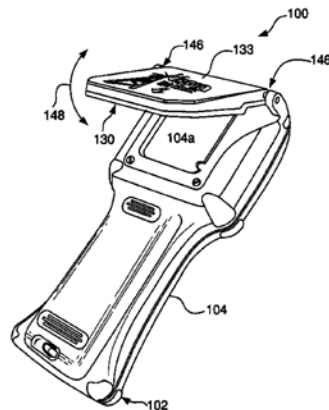
(58) **Field of Classification Search** ..... 340/572.1, 340/572.7, 572.8, 5.92; 343/880–883, 878; 235/385, 435, 439; 455/575.1, 575.3, 575.4, 455/575.7

See application file for complete search history.

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US007250910B2

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

(10) **Patent No.:** **US 7,250,910 B2**  
(45) **Date of Patent:** **Jul. 31, 2007**

(54) **ANTENNA APPARATUS UTILIZING MINUTE LOOP ANTENNA AND RADIO COMMUNICATION APPARATUS USING THE SAME ANTENNA APPARATUS**

(75) Inventors: **Yoshishige Yoshikawa**, Kashihara (JP); **Yoshio Horiike**, Shijonawate (JP); **Yoshiyuki Yokoajiro**, Yamatokooryama (JP); **Takayuki Matsumoto**, Neyagawa (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.

(21) Appl. No.: **10/544,139**

(22) PCT Filed: **Jan. 30, 2004**

(86) PCT No.: **PCT/JP2004/000890**

§ 371 (c)(1),  
(2), (4) Date: **Jan. 4, 2006**

(87) PCT Pub. No.: **WO2004/070879**

PCT Pub. Date: **Aug. 19, 2004**

(65) **Prior Publication Data**

US 2006/0114159 A1 Jun. 1, 2006

(30) **Foreign Application Priority Data**

Feb. 3, 2003	(JP)	2003-025604
Sep. 3, 2003	(JP)	2003-311503
Sep. 25, 2003	(JP)	2003-333227
Oct. 17, 2003	(JP)	2003-357699
Dec. 9, 2003	(JP)	2003-410023
Dec. 10, 2003	(JP)	2003-411463
Dec. 10, 2003	(JP)	2003-411464

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

(52) **U.S. Cl.** ..... **343/702; 343/748**

(58) **Field of Classification Search** ..... **343/702, 343/700 MS, 748, 741, 742, 866, 867**  
See application file for complete search history.

(56) **References Cited**

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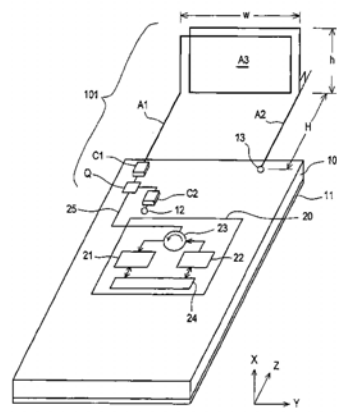
*Primary Examiner*—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Wenderoth, Lind & Ponack, L.L.P.

(57) **ABSTRACT**

An antenna apparatus includes a minute loop antenna and at least one antenna element. The minute loop antenna is provided to be electromagnetically close to a dielectric substrate including a grounding conductor, has a predetermined number N of turns and a predetermined minute length, operates as a magnetic ideal dipole when a predetermined metal plate is located closely to the antenna apparatus, and operates as a current antenna when the metal plate is located apart from the antenna apparatus. The antenna element is connected to the minute loop antenna, and operates as a current antenna. In the antenna apparatus, one end of the antenna apparatus is connected to a feeding point, and another end of the antenna apparatus is connected to the grounding conductor of the dielectric substrate.

**29 Claims, 39 Drawing Sheets**





US007250911B2

(12) **United States Patent  
Lindell**

(10) **Patent No.: US 7,250,911 B2**  
(45) **Date of Patent: Jul. 31, 2007**

- (54) **PLACING OF COMPONENTS ON AN ANTENNA ARRANGEMENT**
  - (75) Inventor: **Bo Lindell**, Lidingö (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 20 days.
  - (21) Appl. No.: **10/568,395**
  - (22) PCT Filed: **Aug. 9, 2004**
  - (86) PCT No.: **PCT/EP2004/008891**  
§ 371 (c)(1),  
(2), (4) Date: **Feb. 13, 2006**
  - (87) PCT Pub. No.: **WO2005/018044**  
PCT Pub. Date: **Feb. 24, 2005**
  - (65) **Prior Publication Data**  
US 2006/0232480 A1 Oct. 19, 2006
  - Related U.S. Application Data**
  - (60) Provisional application No. 60/497,638, filed on Aug. 25, 2003.
  - (30) **Foreign Application Priority Data**  
Aug. 18, 2003 (EP) ..... 03077636
  - (51) **Int. Cl.**  
**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**
- See application file for complete search history.

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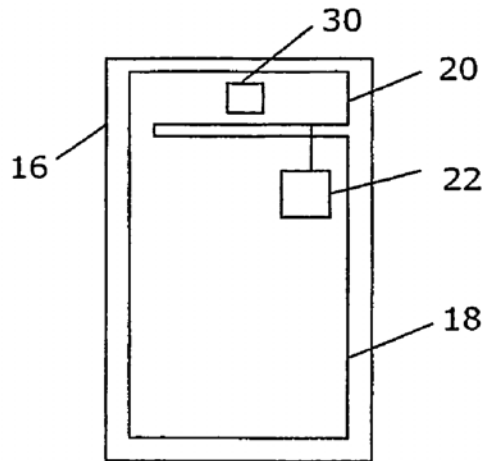
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- Primary Examiner*—Hoang V. Nguyen  
(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec, P.A.

- (57) **ABSTRACT**
- A portable communication device includes a radio circuit for feeding antenna elements, at least one component which is mildly sensitive to external radio transmission, and an antenna arrangement for sending and receiving radio traffic. The antenna arrangement includes a first antenna element located within and extending through a major portion of the device, and a second smaller antenna element connected to the first antenna element. The radio circuit is connected between the two antenna elements and the component is provided on a section of the antenna arrangement making small contributions to the antenna currents in the antenna arrangement.
- 15 Claims, 2 Drawing Sheets**





US007250913B2

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

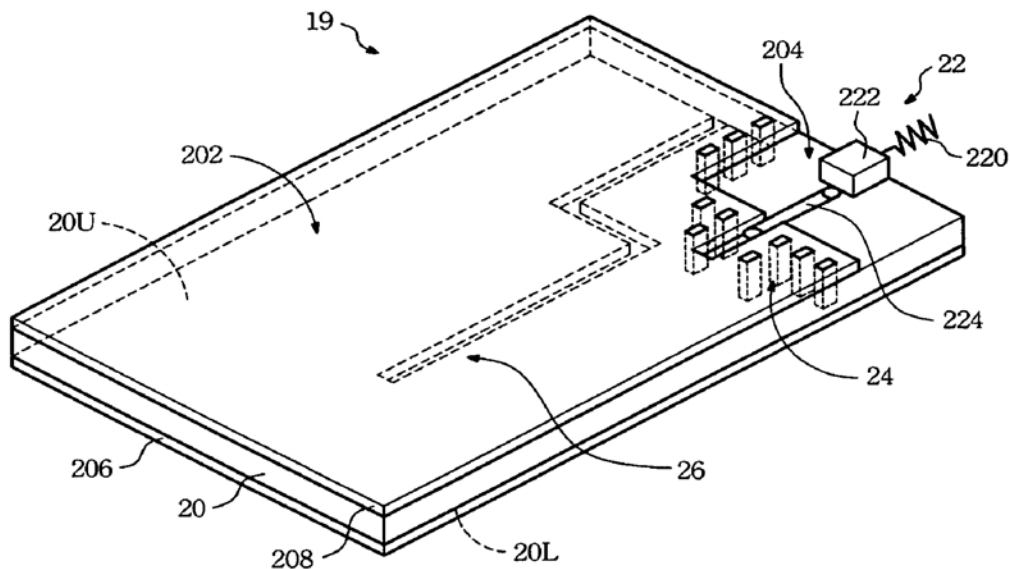
(10) **Patent No.:** **US 7,250,913 B2**  
(45) **Date of Patent:** **Jul. 31, 2007**

- (54) **ANTENNA ASSEMBLY AND METHOD FOR FABRICATING THE SAME**
- (75) Inventors: **Chih-Min Chang**, Taipei (TW);  
**Tzang-Chih Chiou**, Taipei Hsien (TW)
- (73) Assignee: **BENQ Corporation**, Taoyuan (TW)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 72 days.
- (21) Appl. No.: **11/311,676**
- (22) Filed: **Dec. 19, 2005**
- (65) **Prior Publication Data**  
US 2006/0132367 A1 Jun. 22, 2006
- (30) **Foreign Application Priority Data**  
Dec. 20, 2004 (TW) ..... 93139644 A
- (51) **Int. Cl.**  
**H01Q 1/24** (2006.01)
- (52) **U.S. Cl.** ..... **343/702**; 343/700 MS;  
343/846
- (58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 767, 829, 846  
See application file for complete search history.

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*Primary Examiner*—Tho Phan  
(74) *Attorney, Agent, or Firm*—Ladas and Parry LLP

(57) **ABSTRACT**  
An antenna assembly includes a base board having upper and lower surfaces, each of which defines a grounding domain and a dielectric domain, a first metal layer disposed on the grounding domain of the lower surface and a second metal layer disposed on the grounding domain of the upper surface, an antenna unit fabricated on the dielectric domain of the upper surface of the base board, and having an antenna body; and a plurality of conductive through holes formed through the base board for connecting electrically the first and second metal layers, thereby permitting coupled current flow generated in the second metal layer to flow into the first metal layer. A slot of predetermined length is formed through the first metal layer for enhancing effective coupled current flowing into the first metal layer.

17 Claims, 4 Drawing Sheets





US007250914B2

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

(10) **Patent No.:** **US 7,250,914 B2**  
(45) **Date of Patent:** **Jul. 31, 2007**

- (54) **COMPOSITE ANTENNA FOR A TIRE**
- (75) Inventors: **James Christopher Kish**, Akron, OH (US); **Thomas Walter Starinshak**, Wadsworth, OH (US); **Joseph Carmine Lettieri**, Stow, OH (US); **Stephen John Babbo**, Akron, OH (US)
- (73) Assignee: **The Goodyear Tire & Rubber Company**, Akron, OH (US)

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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 4 days.

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(21) Appl. No.: **10/902,981**

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

*Primary Examiner*—Trinh Vo Dinh  
(74) *Attorney, Agent, or Firm*—Richard B. O’Planick

(65) **Prior Publication Data**

US 2006/0022879 A1 Feb. 2, 2006

(57) **ABSTRACT**

- (51) **Int. Cl.**  
**H01Q 1/32** (2006.01)
  - (52) **U.S. Cl.** ..... **343/711; 343/713; 343/717**
  - (58) **Field of Classification Search** ..... **343/711, 343/717**
- See application file for complete search history.

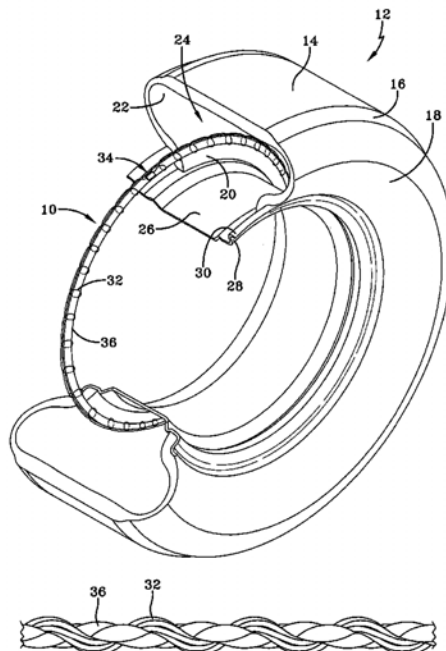
A composite antenna and method for tire monitoring systems is configured as a core composed of polymeric material and a conductive metallic layer in intimate surrounding contact with the core. The polymeric material provides elasticity to the core to enable the core to elongate when subjected to stress forces within a tire. The conductive layer is fabricated from a low impedance material and may be configured as a composite wherein an inner base metal is selected as a strength member and an outer metallic layer is applied to the base for electrical performance enhancement.

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**32 Claims, 2 Drawing Sheets**





US007250919B2

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

(10) **Patent No.:** **US 7,250,919 B2**  
(45) **Date of Patent:** **Jul. 31, 2007**

(54) **ANTENNA**  
(75) Inventors: **Kin-Lu Wong**, Kaohsiung (TW);  
**Saou-Wen Su**, Taipei (TW);  
**Chih-Hsien Wu**, Taipei (TW);  
**Chia-Lun Tang**, Miaoli (TW);  
**Shyh-Tirng Fang**, Hsinchu (TW)

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(73) Assignee: **Industrial Technology Research Institute**, 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 0 days.

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JP 2002-368532 A 12/2002

(21) Appl. No.: **10/942,925**

(22) Filed: **Sep. 17, 2004**

(65) **Prior Publication Data**  
US 2005/0237257 A1 Oct. 27, 2005

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(30) **Foreign Application Priority Data**  
Apr. 26, 2004 (TW) ..... 93111582 A

*Primary Examiner*—Don Wong  
*Assistant Examiner*—Angela M Lie  
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

(51) **Int. Cl.**  
**H01Q 1/48** (2006.01)  
**H01Q 9/28** (2006.01)

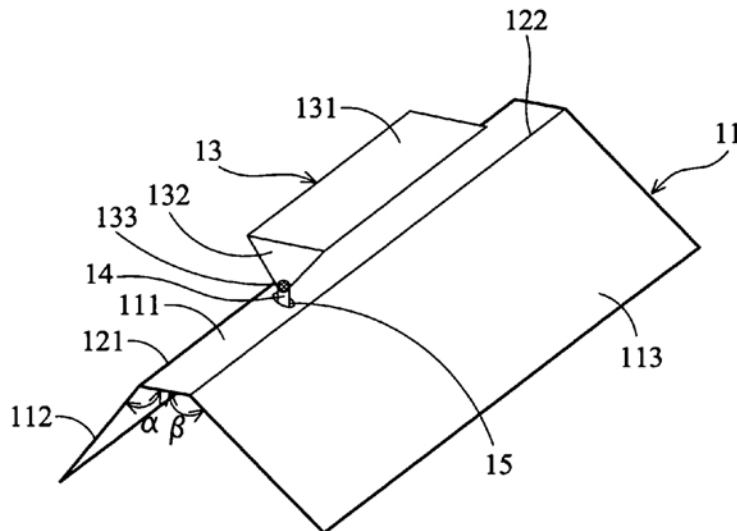
(57) **ABSTRACT**

(52) **U.S. Cl.** ..... 343/846; 343/845; 343/795  
(58) **Field of Classification Search** ..... 343/846,  
343/794, 845, 795  
See application file for complete search history.

An antenna. The antenna comprises a convex ground unit, a radiating member disposed above the ground unit and a feed member connected to the radiating member. The radiating member comprises a first sub-radiating member and a second sub-radiating member having a feed point to which the feed member is connected.

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**21 Claims, 4 Drawing Sheets**





US00D546819S

(12) **United States Design Patent** (10) **Patent No.:** **US D546,819 S**  
**Oliver** (45) **Date of Patent:** **\*\* Jul. 17, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION TAG ANTENNA ASSEMBLY**

(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)

(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/254,144**

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

(51) **LOC (8) Cl.** ..... **14-03**

(52) **U.S. Cl.** ..... **D14/230**

(58) **Field of Classification Search** ..... D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 MS, 343/700 R-705, 711-713, 741, 748, 767, 343/795, 819, 840, 846, 866, 871-908; 455/90.2, 455/90.3, 91, 128, 269, 344, 347, 562.1  
See application file for complete search history.

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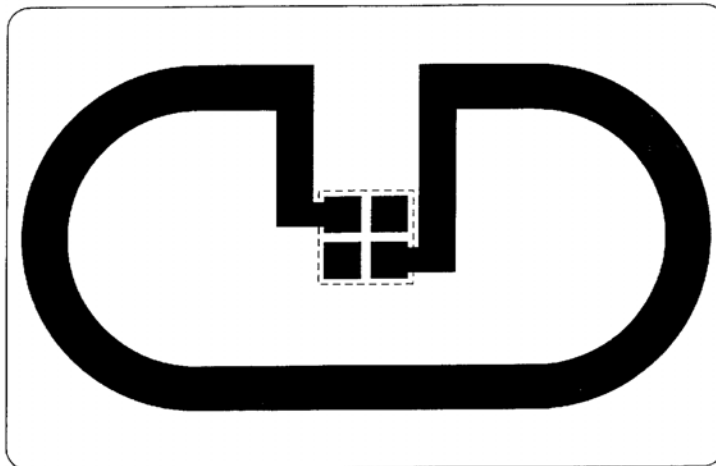
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(12) **United States Design Patent** (10) **Patent No.:** **US D546,820 S**  
**Oliver** (45) **Date of Patent:** **\*\* Jul. 17, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION TAG ANTENNA ASSEMBLY**

(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)

(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/254,157**

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

(51) **LOC (8) Cl.** ..... **14-03**

(52) **U.S. Cl.** ..... **D14/230**

(58) **Field of Classification Search** ..... D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 MS, 343/700 R-705, 711-713, 741, 748, 767, 343/795, 819, 840, 846, 866, 871-908; 455/90.2, 455/90.3, 91, 128, 269, 344, 347, 562.1  
See application file for complete search history.

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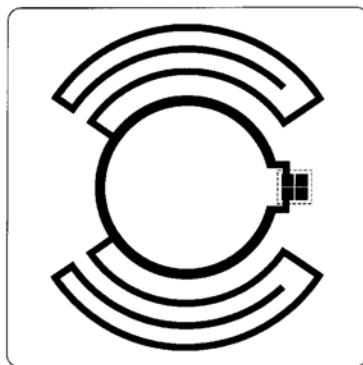
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Partial International Search for International Application No. PCT/US03/31792, date mailed Apr. 2, 2004.





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(12) **United States Design Patent** (10) **Patent No.:** **US D546,821 S**  
**Oliver** (45) **Date of Patent:** **\*\* Jul. 17, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION TAG ANTENNA ASSEMBLY**

(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)

(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/254,158**

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

(51) **LOC (8) Cl.** ..... **14-03**

(52) **U.S. Cl.** ..... **D14/230**

(58) **Field of Classification Search** ..... D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 MS, 343/700 R-705, 711-713, 741, 748, 767, 343/795, 819, 840, 846, 866, 871-908; 455/90.2, 455/90.3, 91, 128, 269, 344, 347, 562.1  
See application file for complete search history.

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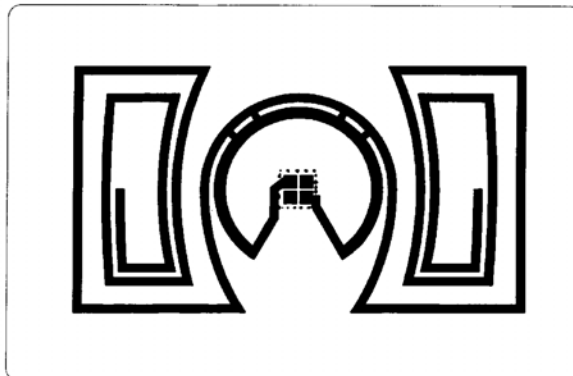
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Partial International Search for International Application No. PCT/US03/31792, date mailed Apr. 2, 2004.







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(12) **United States Design Patent** (10) **Patent No.:** **US D546,822 S**  
**Oliver** (45) **Date of Patent:** **\*\* Jul. 17, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION TAG ANTENNA ASSEMBLY**

(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)

(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/254,159**

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

(51) **LOC (8) Cl.** ..... **14-03**

(52) **U.S. Cl.** ..... **D14/230**

(58) **Field of Classification Search** ..... D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 MS, 343/700 R-705, 711-713, 741, 748, 767, 343/795, 819, 840, 846, 866, 871-908; 455/90.2, 455/90.3, 91, 128, 269, 344, 347, 562.1  
See application file for complete search history.

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Partial International Search for International Application No. PCT/US03/31792, date mailed Apr. 2, 2004.





US00D547306S

(12) **United States Design Patent** (10) **Patent No.:** **US D547,306 S**  
**Oliver** (45) **Date of Patent:** **\*\* Jul. 24, 2007**

(54) **RFID ANTENNA**  
(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)  
(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)  
(\*\*) Term: **14 Years**  
(21) Appl. No.: **29/266,524**  
(22) Filed: **Sep. 21, 2006**  
(51) **LOC (8) Cl.** ..... **14-03**  
(52) **U.S. Cl.** ..... **D14/230**  
(58) **Field of Classification Search** ..... D14/138,  
D14/230-238, 299, 358; D12/42, 43; 343/700 MS,  
343/700 R-705, 711-713, 741, 748, 767,  
343/795, 819, 840, 846, 866, 871-908; 455/90.2,  
455/90.3, 91, 128, 269, 344, 347, 562.1  
See application file for complete search history.

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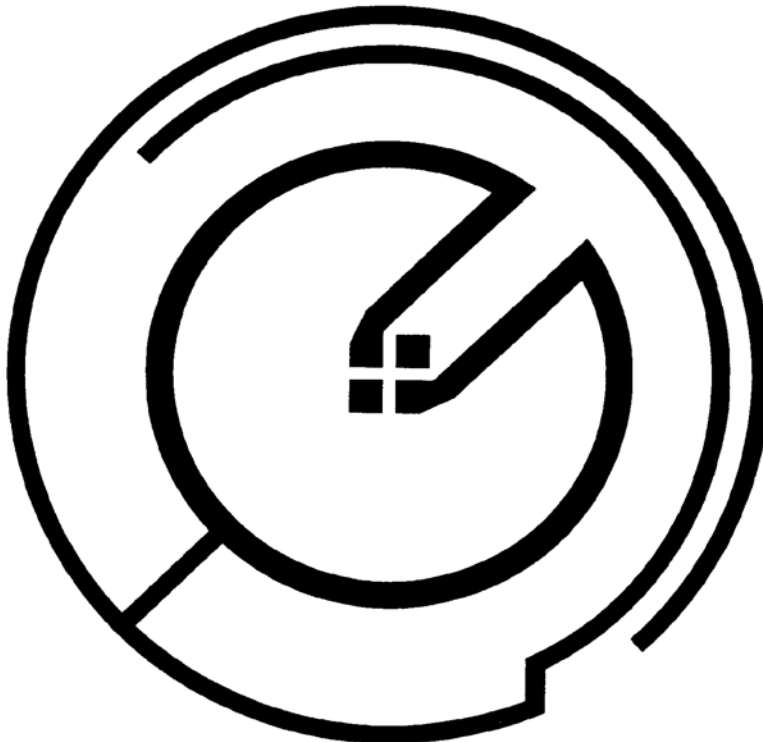
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(57) **CLAIM**  
The ornamental design for an RFID antenna, as shown and described.

**DESCRIPTION**  
FIG. 1 is a top plan view of an RFID antenna showing my new design, the bottom plan view being a mirror image thereof; and,  
FIG. 2 is a top plan view thereof in use with an RFID chip.  
The broken line showing of a square RFID chip in FIG. 2 is included for the purpose of illustrating environment and forms no part of the claimed design.

**1 Claim, 2 Drawing Sheets**





US00D547754S

(12) **United States Design Patent** (10) **Patent No.:** **US D547,754 S**  
**Oliver** (45) **Date of Patent:** **\*\* Jul. 31, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION TAG ANTENNA ASSEMBLY**

(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)

(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/254,143**

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(52) **U.S. Cl.** ..... **D14/230**

(58) **Field of Classification Search** ..... D14/138,  
D14/230-238, 299, 358; D12/42, 43; 343/700 MS,  
343/700 R-705, 711-713, 741, 748, 767,  
343/795, 819, 840, 846, 866, 871-908; 455/90.2,  
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