



US007420511B2

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

(10) **Patent No.:** **US 7,420,511 B2**
(45) **Date of Patent:** **Sep. 2, 2008**

(54) **ANTENNA FOR A PLURALITY OF BANDS**

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6,255,994 B1 * 7/2001 Saito 343/700 MS

(75) Inventors: **Tadashi Oshiyama**, Tomioka (JP);
Hirotohi Mizuno, Tomioka (JP);
Yusuke Suzuki, Tomioka (JP)

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

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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 102 days.

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(21) Appl. No.: **10/534,258**

(Continued)

(22) PCT Filed: **Nov. 10, 2003**

Primary Examiner—Douglas W. Owens

(86) PCT No.: **PCT/JP03/14250**

Assistant Examiner—Jimmy Vu

§ 371 (c)(1),
(2), (4) Date: **May 10, 2005**

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

(87) PCT Pub. No.: **WO2004/047223**

(57) **ABSTRACT**

PCT Pub. Date: **Jun. 3, 2004**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Nov. 18, 2002 (JP) 2002-333920

(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,
343/741, 744, 745, 749, 829, 846, 867, 702,
343/770-776, 820, 895

See application file for complete search history.

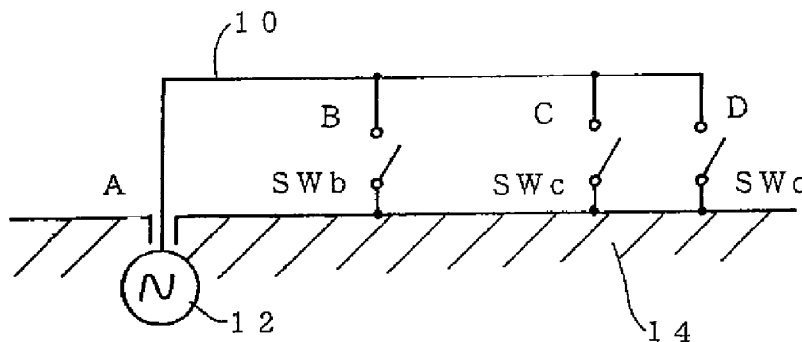
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The present invention provides an antenna for multiple bands employing a single antenna element **10**, capable of operating in multiple frequency bands, and ideal for size reduction purposes. One end **A** of an antenna element **10** is electrically connected to a feeding point **12** and intermediate points **B** and **C** and the other end thereof is electrically connected via switches **SWb**, **SWc**, and **SWd** to a ground conductor **14**. The electrical lengths of the antenna element **10** from the terminal to the intermediate points **B** and **C** plus connection lines from these points via the switches **SWb** and **SWc** to the ground conductor **14** and the electrical length from the one end **A** to the other end **D** plus a connection line from the other end via the switch **SWd** to the ground conductor **14** are set to be capable of resonating different desired frequency bands. By closing one of the switches **SWb**, **SWc**, and **SWd**, one of the desired frequencies can be selected and the antenna can resonate with that frequency. Thus, the antenna employing the single antenna element **10** can operate in multiple frequency bands.

20 Claims, 16 Drawing Sheets





US007420513B2

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

(10) **Patent No.:** **US 7,420,513 B2**
(45) **Date of Patent:** **Sep. 2, 2008**

(54) **CIRCULARLY POLARIZED ANTENNA DEVICE**

(75) Inventors: **Yukako Tsutsumi**, Yokohama (JP);
Masaki Nishio, Tokyo (JP); **Shuichi Sekine**, Yokohama (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 0 days.

(21) Appl. No.: **11/739,408**

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

(65) **Prior Publication Data**
US 2007/0285334 A1 Dec. 13, 2007

(30) **Foreign Application Priority Data**
Jun. 12, 2006 (JP) 2006-162619

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

(52) **U.S. Cl.** **343/700 MS; 343/833; 343/846**

(58) **Field of Classification Search** **343/700 MS; 343/833, 834, 846, 848**
See application file for complete search history.

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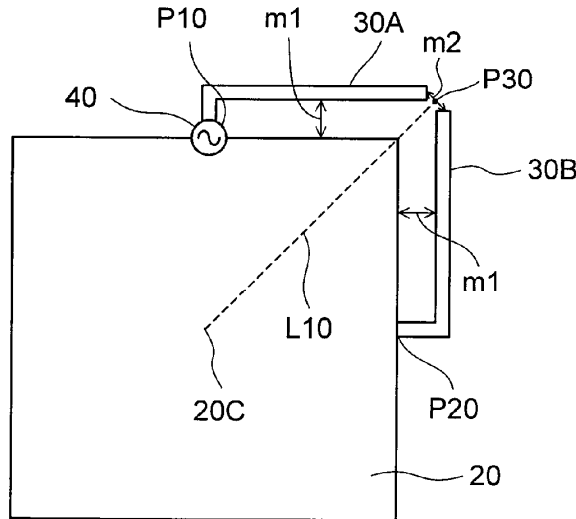
Primary Examiner—Tan Ho

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

(57) **ABSTRACT**

First and second monopole conductive elements are disposed so as to be approximately mutually perpendicular and so that respective open ends are adjacent, and with respect to a straight line that passes between open ends of the first and second monopole conductive elements and through a center of a conductive ground plane, a first conductive ground plane portion formed on a first monopole conductive element-side of the straight line among the conductive ground plane and the first monopole conductive element are formed so as to be approximately symmetrical to a second conductive ground plane portion formed on a second monopole conductive element-side of the straight line among the conductive ground plane and the second monopole conductive element.

15 Claims, 11 Drawing Sheets





US007420517B2

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

(10) **Patent No.:** **US 7,420,517 B2**
(45) **Date of Patent:** **Sep. 2, 2008**

(54) **HIGH FREQUENCY WAVE GLASS ANTENNA FOR AN AUTOMOBILE AND REAR WINDOW GLASS SHEET FOR AN AUTOMOBILE**

(75) Inventors: **Kiyoshi Oshima**, Chiyoda-ku (JP); **Osamu Kagaya**, Chiyoda-ku (JP); **Koji Ikawa**, Chiyoda-ku (JP); **Toshifumi Funatsu**, Chiyoda-ku (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.: **11/736,219**

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

(65) **Prior Publication Data**
US 2007/0247379 A1 Oct. 25, 2007

(30) **Foreign Application Priority Data**
Apr. 19, 2006 (JP) 2006-115701

(51) **Int. Cl.**
H01Q 1/32 (2006.01)

(52) **U.S. Cl.** **343/711**

(58) **Field of Classification Search** 343/711-713, 343/726, 728, 741-744, 748
See application file for complete search history.

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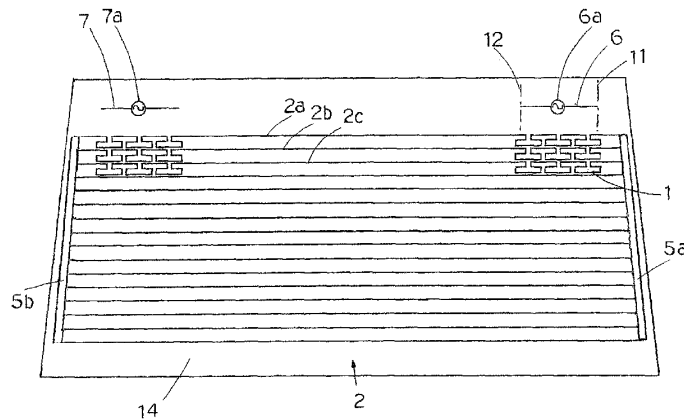
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Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

(57) **ABSTRACT**

A plurality of heating wires **2** have a plurality of detours **1** formed therein, the heating wires **2** have inlets **10** formed therein for connection with the detours **1**, and both ends of each of the inlets **10** and both ends of each of the detours **1** are connected by a pair of connection lines **9**. When a shorter one of the shortest spacing between the paired connection lines **9** and the shortest spacing between both ends of the inlets **10** is called W_e , when the maximum width of the detours **1** in a horizontal direction is called W_p , when a received frequency has a wavelength of λ_0 in the air, and when the formula of $\{(W - W_e)/2\} = L_1$ is established, the formula of $L_1 \cong 0.0053 \cdot \lambda_0$ is satisfied.

43 Claims, 11 Drawing Sheets





US007420518B2

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

(10) **Patent No.:** **US 7,420,518 B2**
(45) **Date of Patent:** **Sep. 2, 2008**

(54) **PLANAR ANTENNA WITH MATCHED IMPEDANCE AND/OR POLARIZATION**

7,227,507 B2* 6/2007 Minard et al. 343/767

(75) Inventors: **Nicolas Boisbouvier**, Rennes (FR);
Philippe Minard, Saint Medard sur Ille (FR); **Ali Louzir**, Rennes (FR)

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(73) Assignee: **Thomson Licensing**,
Boulogne-Billancourt (FR)

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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 120 days.

Japan Abstract 05267923; published Oct. 15, 1993; Kokusai Kagaku Shinko Zaldan; vol. 16, No. 038.
Dual-Loop Slot Antenna With Simple Feed; Stevenage, Herts; Electronics Letters; pp. 1218-1219; vol. 25, No. 18; Aug. 31, 1989.
Search Report dated May 11, 2005.

(21) Appl. No.: **11/287,999**

(22) Filed: **Nov. 28, 2005**

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(65) **Prior Publication Data**

US 2006/0152425 A1 Jul. 13, 2006

Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Joseph J. Laks; Robert D. Shedd; Brian J. Cromarty

(30) **Foreign Application Priority Data**

Dec. 13, 2004 (FR) 04 52948

(57) **ABSTRACT**

(51) **Int. Cl.**
H01Q 13/12 (2006.01)

(52) **U.S. Cl.** **343/769; 343/767**

(58) **Field of Classification Search** **343/767, 343/769**

See application file for complete search history.

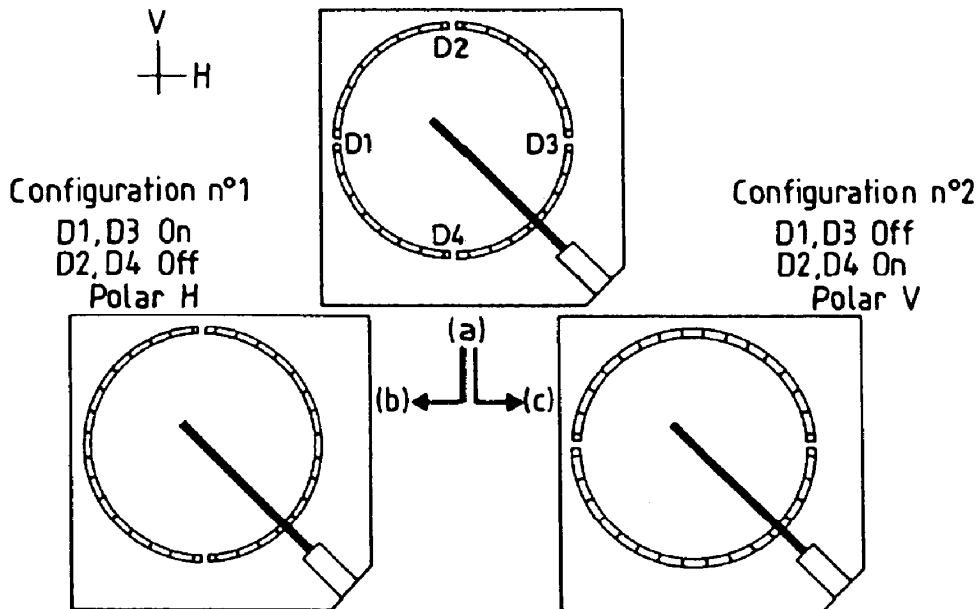
The present invention relates to a planar antenna carried by a substrate comprising a slot in the form of a closed curve dimensioned to operate at a given frequency, supplied by a feeder line intersecting the slot at a point known as an excitation point, characterized in that at least two short circuits in parallel on the slot are positioned with respect to the excitation point so as to match the impedance to the excitation point and/or the polarization of the antenna.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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6 Claims, 4 Drawing Sheets





US007420521B2

(12) **United States Patent**
Hauck

(10) **Patent No.:** **US 7,420,521 B2**
(45) **Date of Patent:** **Sep. 2, 2008**

(54) **WIDEBAND SEGMENTED DIPOLE ANTENNA**
(75) Inventor: **Bryan L. Hauck**, West Warwick, RI (US)
(73) Assignee: **Applied Radar Inc.**, North Kingstown, RI (US)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 82 days.

(21) Appl. No.: **11/650,616**
(22) Filed: **Jan. 8, 2007**

(65) **Prior Publication Data**
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(51) **Int. Cl.**
H01Q 21/00 (2006.01)
H01Q 9/16 (2006.01)
H01Q 1/32 (2006.01)
(52) **U.S. Cl.** **343/817**; 343/817; 343/818; 343/825; 343/833; 343/792
(58) **Field of Classification Search** 343/817, 343/818, 833, 834

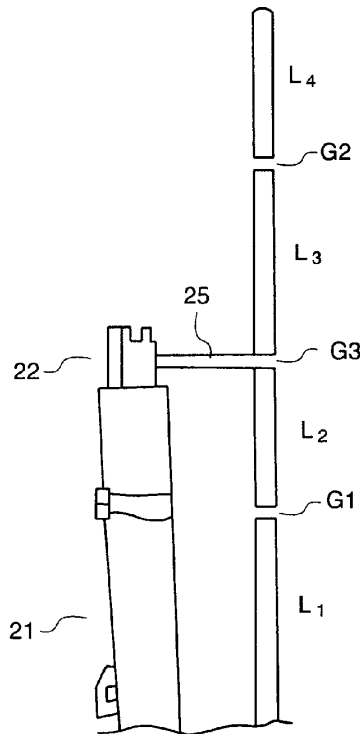
See application file for complete search history.

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Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—Maurice M. Lynch

(57) **ABSTRACT**
A wideband antenna comprised of two or more conductive segments that are parasitically coupled.

1 Claim, 4 Drawing Sheets





US007423592B2

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

(10) **Patent No.:** **US 7,423,592 B2**
(45) **Date of Patent:** **Sep. 9, 2008**

- (54) **MULTI-BAND MONOPOLE ANTENNAS FOR MOBILE COMMUNICATIONS DEVICES**
- (75) Inventors: **Jaume Anguera Pros**, Castellon (ES);
Carles Puente Baliarda, Barcelona (ES)
- (73) Assignee: **Fractus, S.A.**, Barcelona (ES)
- (*) 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.: **10/584,442**
- (22) PCT Filed: **Jan. 28, 2005**
- (86) PCT No.: **PCT/EP2005/000880**
§ 371 (c)(1),
(2), (4) Date: **Jul. 18, 2006**
- (87) PCT Pub. No.: **WO2005/076407**
PCT Pub. Date: **Aug. 18, 2005**

(65) **Prior Publication Data**
US 2007/0046548 A1 Mar. 1, 2007

- Related U.S. Application Data**
- (63) Continuation-in-part of application No. PCT/EP02/14706, filed on Dec. 22, 2002.
- (60) Provisional application No. 60/540,450, filed on Jan. 30, 2004.

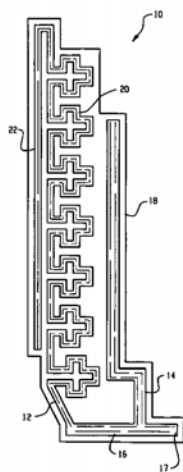
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/895; 343/702**
- (58) **Field of Classification Search** **343/700 MS, 343/895, 702**
See application file for complete search history.

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- Primary Examiner*—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Winstead PC

(57) **ABSTRACT**

Antennas for use in mobile communication devices are disclosed. The antennas disclosed can include a substrate with a base, a top, a front side and a back side; a first conductor can be located on the first side of the antenna substrate; and a second conductor can be located on the second side of the antenna substrate. The conductors can have single or multiple branches. If a conductor is a single branch it can, for example, be a spiral conductor or a conducting plate. If a conductor has multiple branches, each branch can be set up to receive a different frequency band. A conductor with multiple branches can have a linear branch and a space-filling or grid dimension branch. A conducting plate can act as a parasitic reflector plane to tune or partially tune the resonant frequency of another conductor. The first and second conductors can be electrically connected.

15 Claims, 17 Drawing Sheets





US007423593B2

(12) **United States Patent**
Puente Baliarda et al.

(10) **Patent No.:** **US 7,423,593 B2**
(45) **Date of Patent:** **Sep. 9, 2008**

- (54) **BROADSIDE HIGH-DIRECTIVITY MICROSTRIP PATCH ANTENNAS**
- (76) Inventors: **Carles Puente Baliarda**, Londres 57 4th 2nd San Cugat del Valles, Barcelona (ES) 08036; **Jaume Anguera Pros**, P. Blasco Ibanez N. 15 2nd, Vinaros (ES) 12500; **Carmen Borja Borau**, Tvra. de Dalt, 67, Barcelona (ES) 08024

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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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(21) Appl. No.: **11/186,538**

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

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(65) **Prior Publication Data**
US 2005/0285795 A1 Dec. 29, 2005

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- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
 - (52) **U.S. Cl.** **343/700 MS**
 - (58) **Field of Classification Search** **343/700 MS,**
343/833, 834
- See application file for complete search history.

Primary Examiner—Michael C Wimer

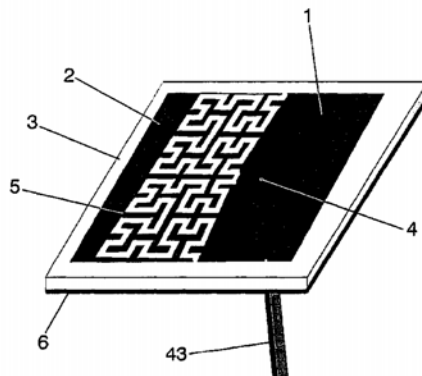
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High-directivity microstrip antennas comprising a driven patch and at least one parasitic element placed on the same plane, operate at a frequency larger than the fundamental mode of the driven patch in order to obtain a resonant frequency with a high-directivity broadside radiation pattern. The driven patch, the parasitic elements and the gaps between them may be shaped as multilevel and/or Space Filling geometries. The gap defined between the driven and parasitic patches according to the invention is used to control the resonant frequency where the high-directivity behaviour is obtained. The invention provides that with one single element it is possible to obtain the same directivity than an array of microstrip antennas operating at the fundamental mode.

28 Claims, 10 Drawing Sheets





US007423597B2

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

(10) **Patent No.:** **US 7,423,597 B2**
(45) **Date of Patent:** **Sep. 9, 2008**

(54) **DUAL BAND WLAN ANTENNA**

(75) Inventors: **James Li**, Santa Clara, CA (US); **Jing Jiang**, San Jose, CA (US)

(73) Assignee: **Marvell World Trade Ltd.**, St. Michael (BB)

(*) 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.: **11/519,979**

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

(65) **Prior Publication Data**
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Related U.S. Application Data
(60) Provisional application No. 60/771,634, filed on Feb. 9, 2006.

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/700 MS**
(58) **Field of Classification Search** **343/702, 343/700 MS, 846, 795**
See application file for complete search history.

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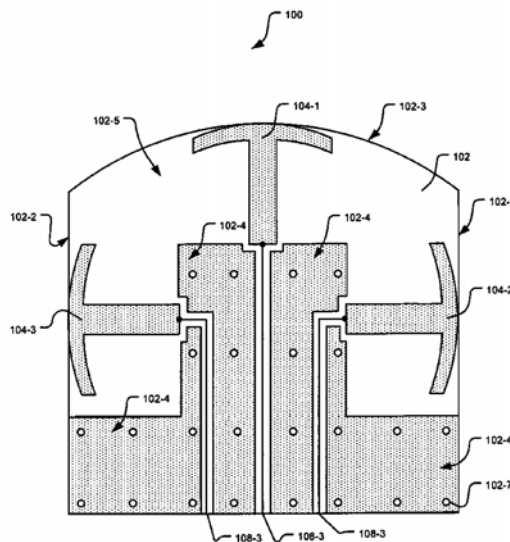
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Primary Examiner—HoangAnh T Le

(57) **ABSTRACT**

An antenna system comprises first, second, and third antennas that are arranged on a printed circuit board (PCB) and that include an arc-shaped element having a concave side and a convex side, and a conducting element that extends substantially radially from a center of the concave side.

42 Claims, 38 Drawing Sheets





US007423598B2

(12) **United States Patent**
Bit-Babik et al.

(10) **Patent No.:** **US 7,423,598 B2**
(45) **Date of Patent:** **Sep. 9, 2008**

(54) **COMMUNICATION DEVICE WITH A WIDEBAND ANTENNA**

(75) Inventors: **Giorgi G. Bit-Babik**, Sunrise, FL (US);
Carlo Dinallo, Plantation, FL (US);
Antonio Faraone, Plantation, 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.

(21) Appl. No.: **11/567,430**

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

(65) **Prior Publication Data**

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(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, 846

See application file for complete search history.

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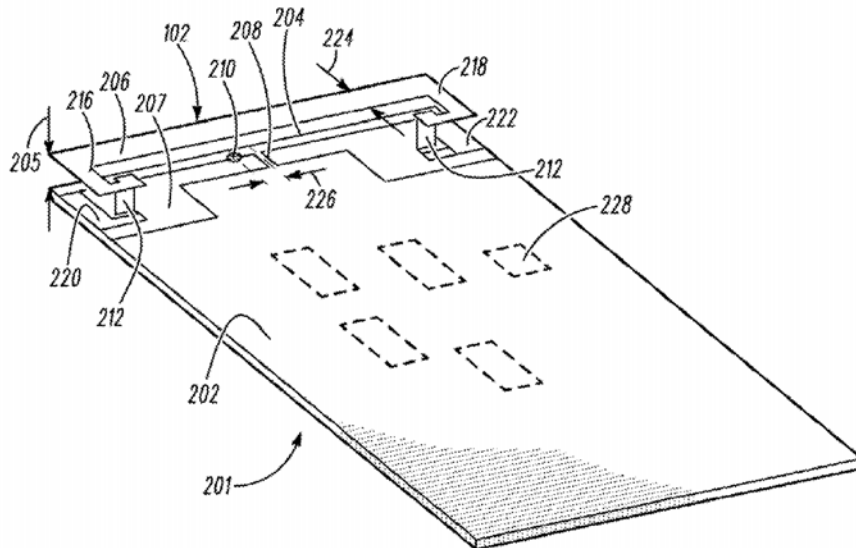
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—James Lamb; Anthony P. Curtis

(57) **ABSTRACT**

An apparatus is disclosed for a communication device (100) with a wideband antenna (102) supporting at least two common and one differential resonant modes. An apparatus that incorporates teachings of the present invention may include, for example, the communication device having an antenna (102) that includes a ground structure (202), a first elongated conductor (204) spaced from the ground structure, a second elongated conductor (206) separated from the first elongated conductor, third and fourth conductors (212) each coupled to the first and second elongated conductors forming a gap (205), a ground conductor (208) coupling the ground structure to one among the first and second elongated conductors, and a signal feed conductor (210) coupling to one among the first and second elongated conductors spaced from the ground conductor. Additional embodiments are disclosed. A -10 dB bandwidth of at least 0.5 can be realized using electrical non-congruence.

20 Claims, 4 Drawing Sheets





US007423599B2

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

(10) **Patent No.:** **US 7,423,599 B2**
(45) **Date of Patent:** **Sep. 9, 2008**

(54) **DUAL BAND WLAN ANTENNA** 2005/0062652 A1* 3/2005 Huang 343/700 MS

(75) Inventors: **James Li**, Santa Clara, CA (US); **Jing Jiang**, San Jose, CA (US)

(Continued)

(73) Assignee: **Marvell World Trade Ltd.**, St. Michael (BB)

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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.

EP 0 795 926 A2 9/1997

(21) Appl. No.: **11/581,540**

(Continued)

(22) Filed: **Oct. 16, 2006**

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(65) **Prior Publication Data**

US 2007/0182646 A1 Aug. 9, 2007

Related U.S. Application Data

(63) Continuation of application No. 11/519,979, filed on Sep. 12, 2006.

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(60) Provisional application No. 60/771,634, filed on Feb. 9, 2006.

(Continued)

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

Primary Examiner—HoangAnh T Le

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

(57) **ABSTRACT**

(58) **Field of Classification Search** 343/702, 343/700 MS, 725, 729, 846, 848

See application file for complete search history.

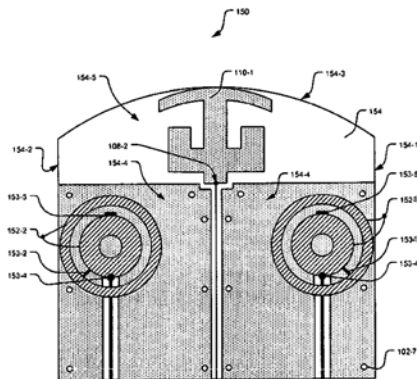
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An antenna system comprises a first antenna that is arranged on a printed circuit board (PCB) and that includes an arch-shaped element having a concave side and a convex side. A conducting element extends substantially radially from a center of the concave side. A U-shaped element has a base portion with a center that communicates with the conducting element and two side portions that extend from ends of the base portion towards the concave side. Second and third antennas are arranged on the PCB and include an inner ring and an outer ring that is concentric to the inner ring.

42 Claims, 38 Drawing Sheets





US00D576613S

(12) **United States Design Patent**
Okamura

(10) **Patent No.:** **US D576,613 S**
(45) **Date of Patent:** **** Sep. 9, 2008**

- (54) **ANTENNA**
- (75) **Inventor:** **Shinichiro Okamura, Kyoto (JP)**
- (73) **Assignee:** **Omron Corporation, Kyoto (JP)**
- (**) **Term:** **14 Years**
- (21) **Appl. No.:** **29/242,424**
- (22) **Filed:** **Nov. 10, 2005**

(30) **Foreign Application Priority Data**

May 11, 2005	(JP)	.....	2005-013423
May 11, 2005	(JP)	.....	2005-013424
May 11, 2005	(JP)	.....	2005-013425
May 11, 2005	(JP)	.....	2005-013426
May 11, 2005	(JP)	.....	2005-013427

- (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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Primary Examiner—Robert M. Spear
Assistant Examiner—John Windmuller
(74) *Attorney, Agent, or Firm*—Harness, Dickey, & Pierce, P.L.C.

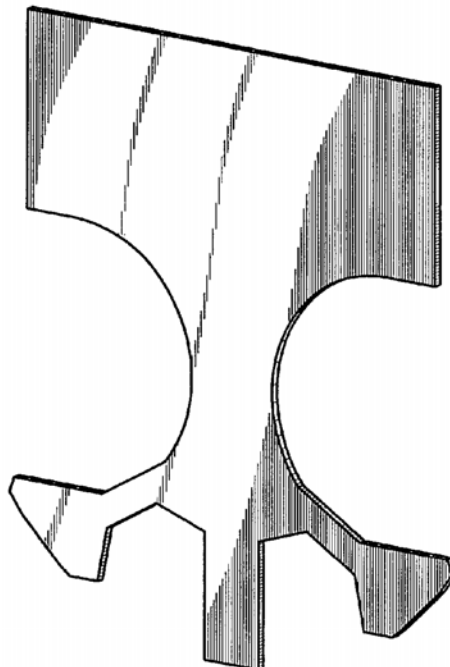
(57) **CLAIM**

The ornamental design for an antenna, as shown and described.

DESCRIPTION

FIG. 1 is a front perspective view of an embodiment of an antenna showing our new design;
 FIG. 2 is a front elevational view thereof, a rear elevational view being a same image thereof;
 FIG. 3 is a top plan view thereof;
 FIG. 4 is a bottom view thereof; and,
 FIG. 5 is a right side elevational view thereof, a left side elevational view being a same image thereof.

1 Claim, 3 Drawing Sheets





US00D576614S

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

(10) **Patent No.:** **US D576,614 S**
(45) **Date of Patent:** **** Sep. 9, 2008**

- (54) **ANTENNA**
- (75) Inventors: **Yi Ju Lee**, Tu-Cheng (TW); **An Yu Yen**, Tu-Cheng (TW)
- (73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)
- (**) Term: **14 Years**
- (21) Appl. No.: **29/290,758**
- (22) Filed: **Jan. 11, 2008**

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Primary Examiner—Louis S Zarfaz

Assistant Examiner—John Windmuller

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

(57) **CLAIM**

The ornamental design for an antenna, as shown and described.

DESCRIPTION

FIG. 1 is a perspective view of an antenna showing our new design;

FIG. 2 is a front elevational view thereof;

FIG. 3 is a rear elevational view thereof;

FIG. 4 is a left side elevational view thereof;

FIG. 5 is a right side elevational view thereof;

FIG. 6 is a top plan view thereof; and,

FIG. 7 is a bottom plan view thereof.

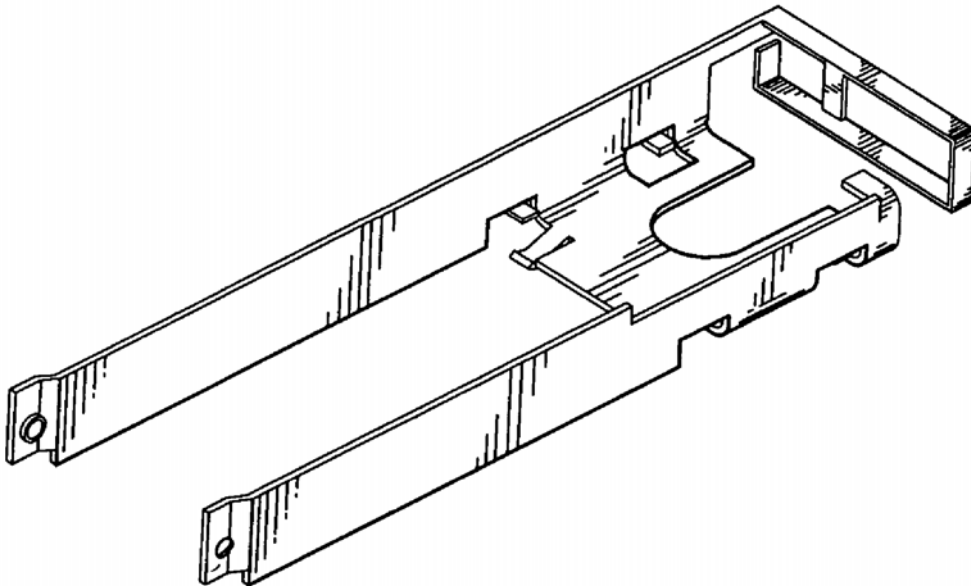
- (51) **LOC (8) CL.** **14-03**
- (52) **U.S. CL.** **D14/230**
- (58) **Field of Classification Search** D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 MS, 343/700 R-705, 711-713, 741, 748, 767, 343/795, 819, 840, 846, 866, 871-908; 455/90.2, 455/90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

(56) **References Cited**

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D531,622 S *	11/2006	Chen et al.	D14/230

1 Claim, 7 Drawing Sheets





US007425922B1

(12) **United States Patent**
Adams

(10) **Patent No.:** **US 7,425,922 B1**
(45) **Date of Patent:** **Sep. 16, 2008**

(54) **WEARABLE SMALL-SIZED PATCH**
ANTENNA FOR USE WITH A SATELLITE

(75) Inventor: **Richard C. Adams**, Chula Vista, CA
(US)

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 248 days.

(21) Appl. No.: **11/639,582**

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

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

(52) **U.S. Cl.** **343/700 MS**; 343/718

(58) **Field of Classification Search** 343/700 MS,
343/702, 718, 829, 846
See application file for complete search history.

(56) **References Cited**

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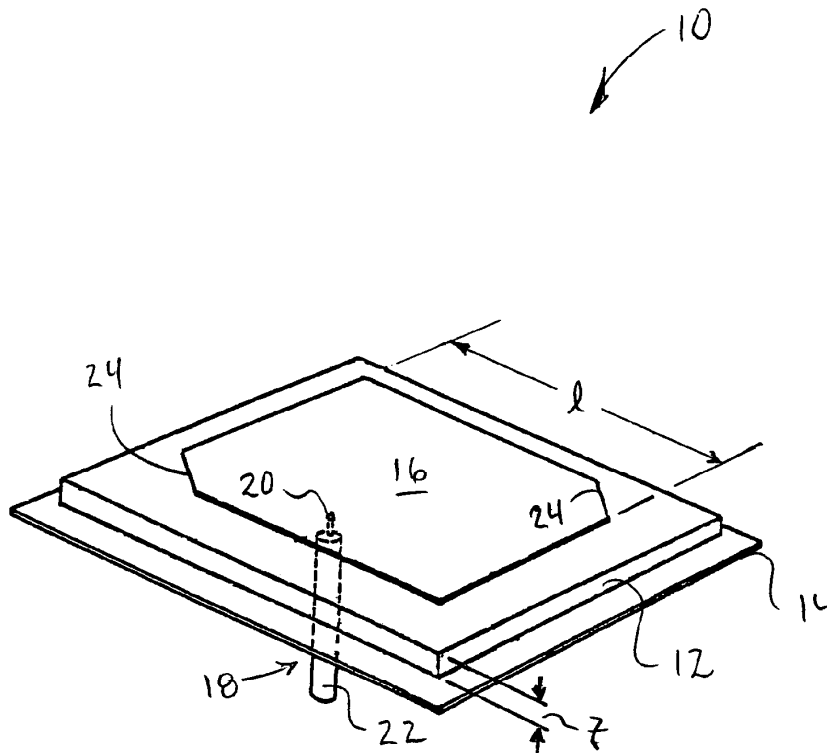
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Kyle Epele; Arthur K.
Samora; Peter A. Lipovsky

(57) **ABSTRACT**

A wearable patch antenna comprises a dielectric layer includ-
ing water; a ground plane adjacent one side of the dielectric
layer; a conductive patch element placed adjacent another
side of the dielectric layer spaced from the ground plane by
the dielectric layer; and a feed electrically connected to the
conductive patch element.

13 Claims, 1 Drawing Sheet





US007425924B2

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

(10) **Patent No.:** **US 7,425,924 B2**
(45) **Date of Patent:** **Sep. 16, 2008**

(54) **MULTI-FREQUENCY ANTENNA WITH DUAL LOOPS**

(75) Inventors: **Ming-Hsun Chung**, Taipei (TW);
Tsung-Wen Chiu, Taipei (TW); **Fu-Ren Hsiao**, Taipei (TW); **Yu-Ching Lin**,
Taipei (TW); **Chun-Ching Lan**, Taipei
(TW)

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

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

(21) Appl. No.: **11/696,190**

(22) Filed: **Apr. 4, 2007**

(65) **Prior Publication Data**
US 2007/0285321 A1 Dec. 13, 2007

(30) **Foreign Application Priority Data**
Jun. 9, 2006 (TW) 95120597 A

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

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

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

(56) **References Cited**
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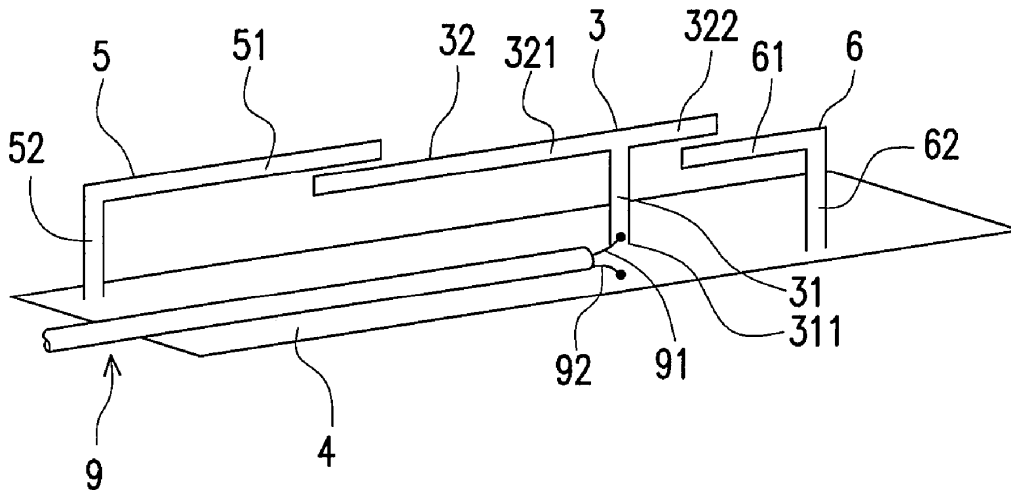
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Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Jianq Chyun IP Office

(57) **ABSTRACT**

A multi-frequency antenna with dual loops is provided. The antenna includes a T-shaped radiator having a first arm and a second arm of unequal lengths as a main body, and two grounded L-shaped radiators, so as to form dual loops. Thus, the antenna can operate in a high-frequency operation mode and a low-frequency operation mode. With the dual loops, the antenna obtains enough bandwidths at high frequency, and also meets the requirements of low frequency. More specific, the antenna meets the requirements of high-frequency systems, such as DCS/PCS/UMTS and those of low-frequency systems, such as AMPS/GSM.

13 Claims, 5 Drawing Sheets





US007425929B2

(12) **United States Patent**
Sako

(10) **Patent No.:** **US 7,425,929 B2**
(45) **Date of Patent:** **Sep. 16, 2008**

- (54) **COIL ANTENNA**
- (75) Inventor: **Yoshihiro Sako**, Nagaokakyo (JP)
- (73) Assignee: **Murata Manufacturing Co., Ltd.**,
Kyoto (JP)

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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.

(21) Appl. No.: **11/566,264**

(22) Filed: **Dec. 4, 2006**

(65) **Prior Publication Data**
US 2007/0091007 A1 Apr. 26, 2007

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2006/313205, filed on Jul. 3, 2006.

(30) **Foreign Application Priority Data**
Aug. 4, 2005 (JP) 2005-227153

- (51) **Int. Cl.**
H01Q 7/08 (2006.01)
- (52) **U.S. Cl.** **343/788; 343/787; 343/872**
- (58) **Field of Classification Search** **343/788, 343/787, 872**
See application file for complete search history.

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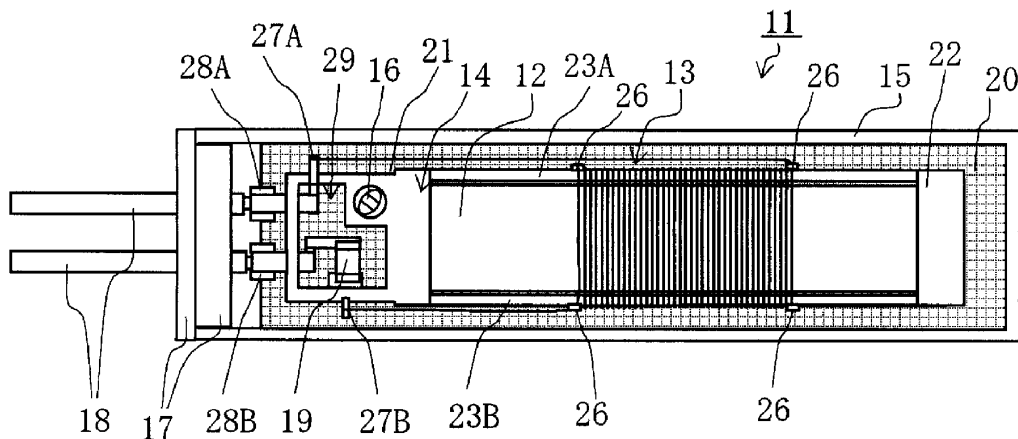
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Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Keating & Bennett, LLP

(57) **ABSTRACT**

A coil antenna includes a magnetic core and a coil wound around a bobbin which are accommodated within a case. The magnetic core and an end of the bobbin are connected to a cap. The magnetic core and an end portion of the bobbin are covered with a foamed component, and are further covered with a gel component. The foamed component is formed by a forming process, and an adhesive compound is provided between the magnetic core and the foamed component.

15 Claims, 2 Drawing Sheets





US007427955B2

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

(10) **Patent No.:** **US 7,427,955 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

(54) **DUAL POLARIZATION ANTENNA AND RFID READER EMPLOYING THE SAME**

(75) Inventors: **Won-Kyu Choi**, Gyeonggi-do (KR);
Nak-Seon Seong, Gyeonggi-do (KR);
Cheol-Sig Pyo, Daejeon (KR);
Jong-Suk Chae, Daejeon (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 241 days.

(21) Appl. No.: **11/297,182**

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

(65) **Prior Publication Data**

US 2006/0145926 A1 Jul. 6, 2006

(30) **Foreign Application Priority Data**

Dec. 8, 2004 (KR) 10-2004-0103079
Aug. 23, 2005 (KR) 10-2005-0077357

(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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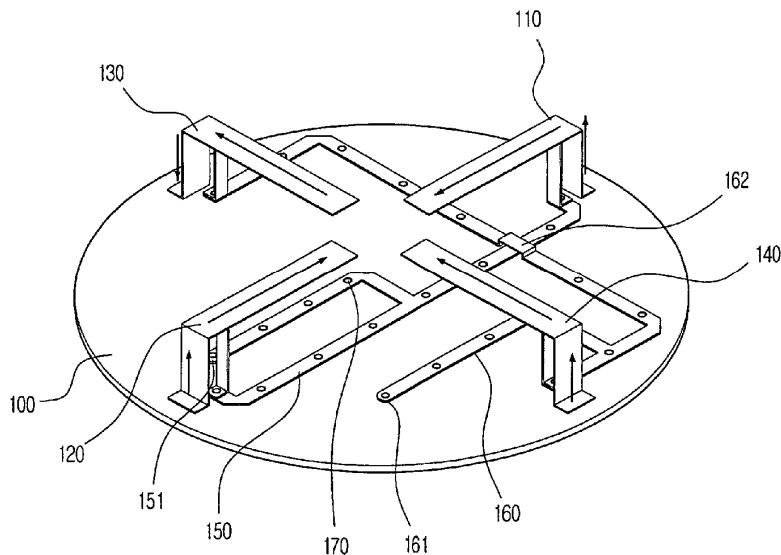
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor & Zafman

(57) **ABSTRACT**

Provided is a dual polarization antenna realized by using four inverted F-type radiators and a Radio Frequency Identification (RFID) reader employing the dual polarization antenna. The dual polarization antenna includes a ground plate and four inverted F-type radiators set up on the ground plate. Currents of the same phase are fed to the first and second inverted F-type radiators each other. Currents of an inverted phase are fed to the third and fourth inverted F-type radiators each other. The four inverted F-type radiators form an angle of 90° with one another. The first and second inverted F-type radiators radiate electric wave of vertical polarization and the third and fourth inverted F-type radiators radiate electric wave of horizontal polarization. Since the dual polarization antenna has excellent orthogonal and isolation characteristics, the antenna can extend a transmission distance between the reader and the tag and improve a communication quality.

11 Claims, 8 Drawing Sheets





US007427956B2

(12) **United States Patent**
Liao

(10) **Patent No.:** **US 7,427,956 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

- (54) **ANTENNA STRUCTURE**
- (75) Inventor: **Yen-Jang Liao**, Taoyuan Hsien (TW)
- (73) Assignee: **Speed Tech Corp.**, Taoyuan 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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- (21) Appl. No.: **11/563,543**
- (22) Filed: **Nov. 27, 2006**
- (65) **Prior Publication Data**
US 2008/0122720 A1 May 29, 2008

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Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—J.C. Patents

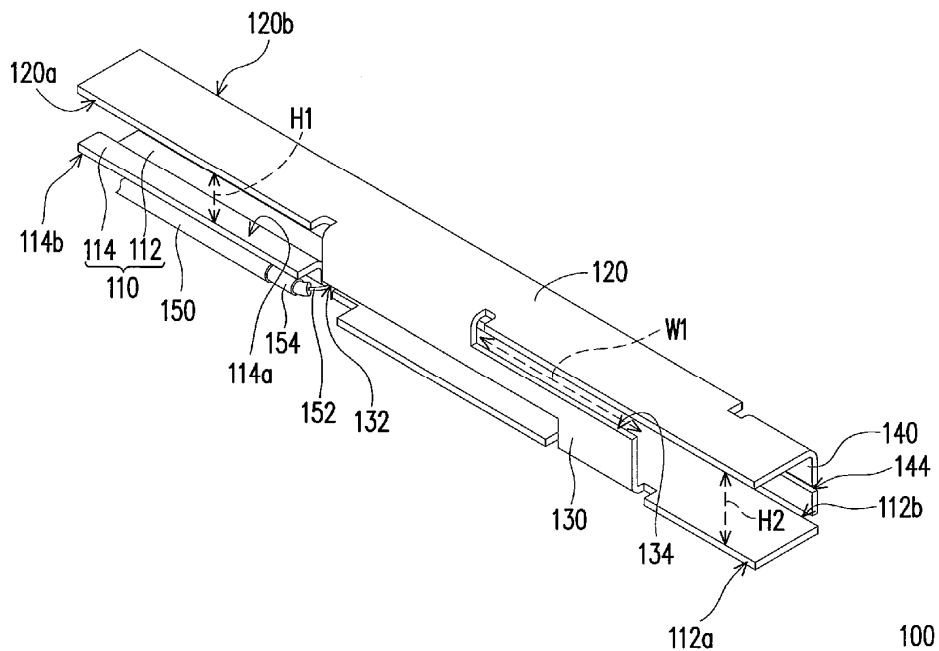
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
 - (52) **U.S. Cl.** **343/700 MS**; 343/702
 - (58) **Field of Classification Search** 343/700 MS,
343/702
- See application file for complete search history.

(57) **ABSTRACT**

An antenna structure is suitable for being embedded in an electronic device. The antenna structure includes a grounding plate, a radiating plate, and a shorting plate. The grounding plate has a body and a bending portion extending from the body. The radiating plate is disposed above the grounding plate and is extended with an auxiliary radiating plate. The gap between the bending portion and the radiating plate is less than that between the body and the radiating plate. In addition, one end of the shorting plate is connected to the grounding plate, and the other end of the shorting plate is connected to the radiating plate.

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14 Claims, 4 Drawing Sheets





US007427957B2

(12) **United States Patent**
Zeinolabedin Rafi et al.

(10) **Patent No.:** **US 7,427,957 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

- (54) **PATCH ANTENNA**
- (75) Inventors: **Gholamreza Zeinolabedin Rafi**,
Kitchener (CA); **Safieddin**
Safavi-Naeni, Waterloo (CA); **Alastair**
Malarky, Petersburg (CA)
- (73) Assignee: **Mark IV IVHS, Inc.**, Flemington, NJ
(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 22 days.

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Primary Examiner—Tan Ho

(74) Attorney, Agent, or Firm—Hanley, Flight & Zimmerman, LLC

(21) Appl. No.: **11/710,379**

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

(57) **ABSTRACT**

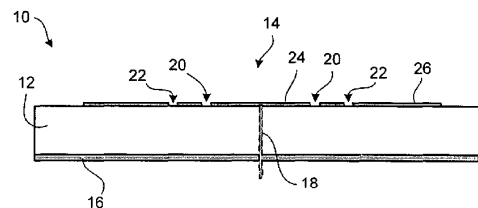
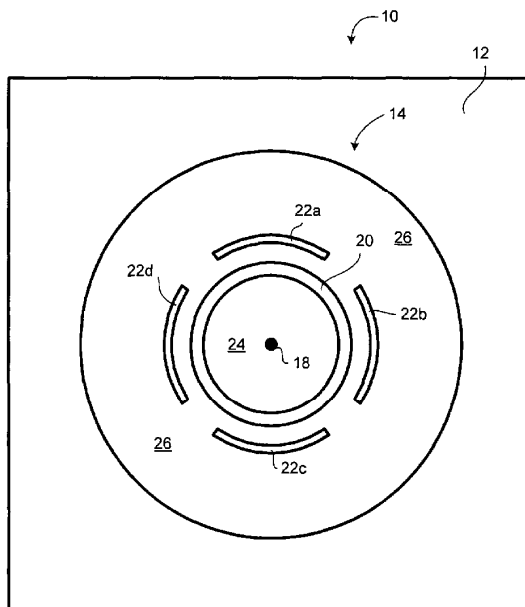
(65) **Prior Publication Data**
US 2008/0204326 A1 Aug. 28, 2008

A patch antenna for achieving a vertically-polarized radiation pattern is described. The patch antenna includes a closed-curve slot within which a signal feed point is located. Parasitic slots are disposed outside or inside the closed-curve slot. In one embodiment, the closed-curve slot is a ring slot and the parasitic slots are arc slots having a common center point with the ring slot. The antenna may further include a lower patch capable of producing a different radiation pattern with different polarization and at a different frequency band, to result in a dual-band antenna. The dual-band antenna may operate in the 5.9 GHz DSRC and 1.575 GHz GPS bands.

- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS**; 343/770
- (58) **Field of Classification Search** 343/700 MS,
343/767, 769, 770
See application file for complete search history.

- (56) **References Cited**
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23 Claims, 4 Drawing Sheets





US007427958B2

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

(10) **Patent No.:** **US 7,427,958 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

(54) **DUAL BAND ANTENNA UNIT FOR MOBILE DEVICE**

2005/0007282 A1 1/2005 Martiskainen et al. 343/702

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(75) Inventors: **Il Bae Yoon**, Suwon-si (KR); **Kee Dug Kim**, Seoul (KR); **Seong Wook Lee**, Suwon-si (KR)
(73) Assignee: **Samsung Electronics Co., Ltd.** (KR)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 5 days.

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(21) Appl. No.: **11/647,022**

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

Primary Examiner—Trinh V Dinh

(65) **Prior Publication Data**

Assistant Examiner—Dieu Hien T Duong

US 2008/0024372 A1 Jan. 31, 2008

(74) *Attorney, Agent, or Firm*—The Farrell Law Firm, P.C.

(30) **Foreign Application Priority Data**

Jul. 28, 2006 (KR) 10-2006-0071218

(57) **ABSTRACT**

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

(52) **U.S. Cl.** **343/702; 343/901**

(58) **Field of Classification Search** **343/702, 343/901**

See application file for complete search history.

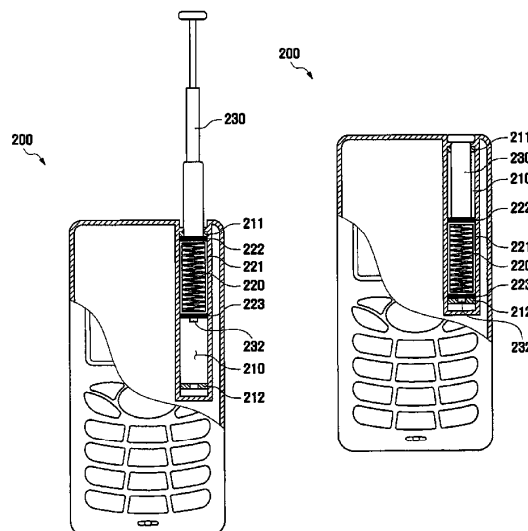
A dual band antenna unit for a mobile device may include an antenna receiving part, a first antenna part having a first contact point and a second contact point, a second antenna part, a first feed point and a second feed point. The second antenna part may be formed integrally with the first antenna part and may extend from the first antenna part. The second antenna part may be extractably and retractably mounted in the mobile device. The first antenna part and the second antenna part may have resonant frequencies of different frequency bands. When the second antenna part is extracted, the first contact point may contact the first feed point. When the second antenna part is retracted, the second contact point may contact the second feed point. The mobile device may operate in different frequency bands using a single antenna unit, thereby allowing freedom of internal design and meeting the demand for miniaturization.

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10 Claims, 4 Drawing Sheets





US007427963B2

(12) **United States Patent**
Moriya

(10) **Patent No.:** **US 7,427,963 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

(54) **ANTENNA COIL AND ANTENNA DEVICE**

(75) Inventor: **Hitoshi Moriya, Sendai (JP)**

(73) Assignee: **Sumida 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 226 days.

(21) Appl. No.: **10/575,941**

(22) PCT Filed: **Oct. 7, 2004**

(86) PCT No.: **PCT/JP2004/015187**

§ 371 (c)(1),
(2), (4) Date: **May 15, 2006**

(87) PCT Pub. No.: **WO2005/038982**

PCT Pub. Date: **Apr. 28, 2005**

(65) **Prior Publication Data**

US 2007/0075913 A1 Apr. 5, 2007

(30) **Foreign Application Priority Data**

Oct. 16, 2003 (JP) 2003-355937

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

(52) **U.S. Cl.** **343/788; 343/713**

(58) **Field of Classification Search** **343/788, 343/787, 866, 713, 895**

See application file for complete search history.

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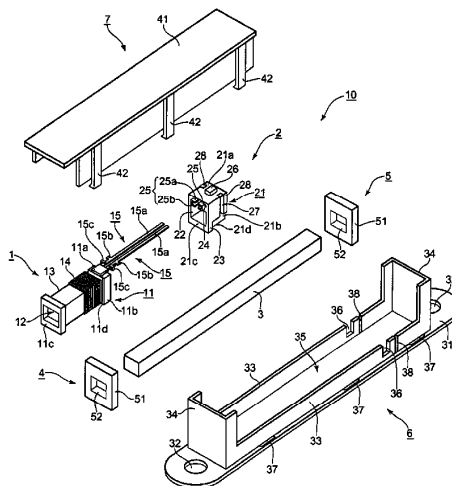
Primary Examiner—HoangAnh T Le

(74) *Attorney, Agent, or Firm*—Mark Montague; Cowan, Liebowitz & Latman, P.C.

(57) **ABSTRACT**

An antenna coil includes: a core (3) formed by shaping a magnetic material into a bar-like configuration; a bobbin (1) having a through-hole (12) into which the core (3) is to be inserted; a connection section (15) fixed to the bobbin (1) so as to extend in a length direction of the core (3) from the bobbin (1), with the core (3) inserted into the through-hole (12); a winding (14) which is wound around the bobbin (1) and whose ends are connected to the connection section (15); and a connector terminal (25) which is provided at a certain position in the length direction of the core (3), which fixes the connection section (15) in position, and which determines the position of the winding (14) in the length direction of the core (3).

8 Claims, 5 Drawing Sheets





US007427965B2

(12) **United States Patent**
Fabrega-Sanchez et al.

(10) **Patent No.:** **US 7,427,965 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

- (54) **MULTIPLE BAND CAPACITIVELY-LOADED LOOP ANTENNA**
- (75) Inventors: **Jorge Fabrega-Sanchez**, San Diego, CA (US); **Huan-Sheng Hwang**, San Diego, CA (US); **Alan Pasion**, Carlsbad, CA (US); **Gregory Poilasne**, San Diego, CA (US); **Metz Ozkar**, Raleigh, NC (US)
- (73) Assignee: **Kyocera Corporation**, Kyoto (JP)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 94 days.

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2006/0038730	A1	2/2006	Parsche	

- (21) Appl. No.: **11/674,564**
- (22) Filed: **Feb. 13, 2007**
- (65) **Prior Publication Data**
US 2007/0216598 A1 Sep. 20, 2007

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WO	WO 02/071536	9/2002

- Related U.S. Application Data**
- (63) Continuation-in-part of application No. 11/248,665, filed on Oct. 12, 2006, now Pat. No. 7,274,338.
- (51) **Int. Cl.**
H01Q 9/28 (2006.01)
- (52) **U.S. Cl.** **343/795**; 343/866; 343/895; 343/741
- (58) **Field of Classification Search** 343/700 MS, 343/702, 795, 741, 742, 866, 867, 803, 806, 343/895

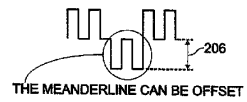
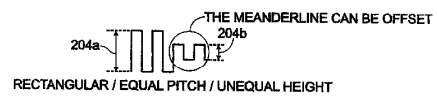
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Primary Examiner—Hoang V Nguyen

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(57) **ABSTRACT**

A multiple band capacitively-loaded magnetic dipole antenna includes a plurality of magnetic dipole radiators connected to a transformer loop where the magnetic dipole radiators include at least one capacitively-loaded magnetic dipole radiator. The transformer loop has a balanced feed interface and includes a side that provides a transformer interface of quasi loops formed by the plurality of magnetic dipole radiators. Each quasi loop has a configuration and length to maximize antenna performance within a different frequency band. The at least one capacitively-loaded magnetic dipole radiator may be formed with a meander line structure and may include an electric field bridge such as a dielectric gap, lumped element, circuit board surface-mounted, ferroelectric tunable, or a microelectromechanical system (MEMS) capacitor.

20 Claims, 14 Drawing Sheets





US007427966B2

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

(10) **Patent No.:** **US 7,427,966 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

(54) **DUAL POLARIZED ANTENNA**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Michael Boss**, Riedering (DE);
Maximilian Gottl, Frasdorf (DE);
Norbert Kreuzer, Pfaffenhofen (DE);
Jörg Langenberg, Prien am Chiemsee
(DE); **Jürgen Rumold**, Bad Endorf (DE)

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

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

(21) Appl. No.: **11/319,211**

(22) Filed: **Dec. 28, 2005**

(65) **Prior Publication Data**

US 2007/0146225 A1 Jun. 28, 2007

(51) **Int. Cl.**
H01Q 21/26 (2006.01)

(52) **U.S. Cl.** **343/797; 343/797; 343/810**

(58) **Field of Classification Search** **343/797, 343/810**

See application file for complete search history.

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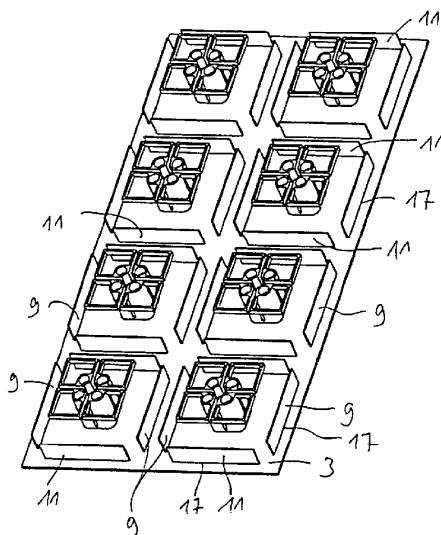
Primary Examiner—Trinh V Dinh

(74) *Attorney, Agent, or Firm*—Nixon & Vanderhye P.C.

(57) **ABSTRACT**

A dual polarized antenna with at least one dual polarized radiator device comprises a reflector (3) and longitudinal or transverse webs (9, 11) provided at least on its longitudinal side and/or on its transverse side. The improvement is distinguished by the following features: at least one longitudinal web (9) and/or at least two longitudinal webs (9) provided with respect to the radiator device (1, 1') located in between and/or at least one transverse web (11) and/or at least two transverse webs (11) provided with respect to the radiator device (1, 1') located in between are positionally changeable directly or at least indirectly by pivoting and/or bending and/or deforming and curving.

21 Claims, 20 Drawing Sheets





US007427968B2

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

(10) **Patent No.:** **US 7,427,968 B2**
(45) **Date of Patent:** **Sep. 23, 2008**

(54) **ANTENNA DEVICE HAVING ROTATABLE STRUCTURE**

(58) **Field of Classification Search** 343/715,
343/872, 882, 888, 906, 889
See application file for complete search history.

(75) Inventors: **Yat To Chan**, Chongli (TW); **Chien Te Chen**, Chongli (TW)

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(73) Assignee: **Joymax Electronics Co., Ltd.**, Chongli
Gonyeh Chu, Chongli Taoyuan Hsien
(TW)

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 288 days.

(57) **ABSTRACT**

An antenna device includes an antenna housing having a chamber and a slot formed in one end and formed between two arms and communicating with the chamber, an antenna member having a stud engaged into the slot and rotatably coupled to the antenna housing with a pivot axle and having two or more flat surfaces formed in the stud. A spring-biased follower is slidably received in the antenna housing and includes an actuator for engaging with either of the flat surfaces of the antenna member and for anchoring and retaining the antenna member to the antenna housing at selected angular positions. The antenna device includes a greatly simplified structure with a greatly reduced expense.

(21) Appl. No.: **11/448,310**

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

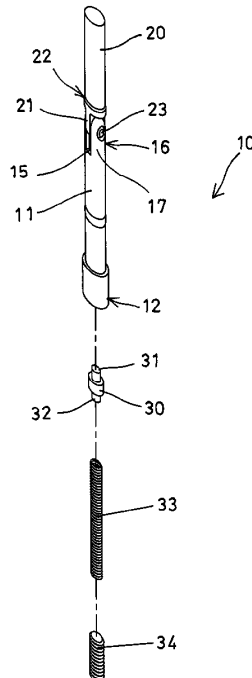
(65) **Prior Publication Data**

US 2007/0285333 A1 Dec. 13, 2007

(51) **Int. Cl.**
H01Q 3/02 (2006.01)
H01Q 1/32 (2006.01)
H01Q 1/12 (2006.01)

6 Claims, 3 Drawing Sheets

(52) **U.S. Cl.** **343/882; 343/715; 343/888**





US007429952B2

(12) **United States Patent**
Sun

(10) **Patent No.:** **US 7,429,952 B2**
(45) **Date of Patent:** **Sep. 30, 2008**

(54) **BROADBAND APERTURE COUPLED GNSS MICROSTRIP PATCH ANTENNA**

(75) Inventor: **Jia Sun**, Calgary (CA)

(73) Assignee: **Hemisphere GPS Inc.**, Calgary, Alberta (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 458 days.

(21) Appl. No.: **11/316,854**

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

(65) **Prior Publication Data**

US 2007/0146206 A1 Jun. 28, 2007

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/702, 846-848, 850-853

See application file for complete search history.

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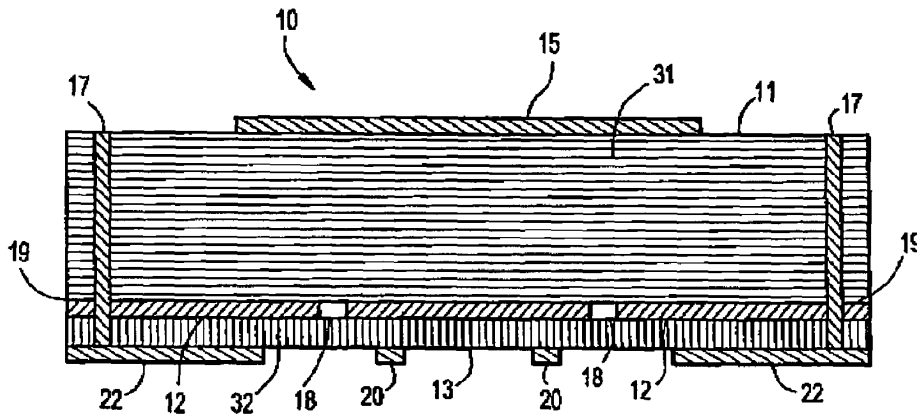
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Mark E. Brown

(57) **ABSTRACT**

A multilayer antenna structure configured to receive Global Navigation Satellite System (GNSS) and augmentation signals. The antenna includes a microstrip patch radiation element disposed at a top layer and a ground plane forming a first interior layer, the ground plane including at least two coupling apertures, and the ground plane isolated from said radiation element by a low loss dielectric. The antenna structure also includes a bottom layer, the bottom layer is isolated from the ground plane by another dielectric; at least two feed lines operably connected to a hybrid coupler disposed on the bottom layer; and an active circuit on the bottom layer, a first port of said active circuit operably connected to the hybrid coupler.

23 Claims, 6 Drawing Sheets





US007429954B2

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

(10) **Patent No.:** **US 7,429,954 B2**
(45) **Date of Patent:** **Sep. 30, 2008**

(54) **DISPLAY PANEL WITH PAIRS OF ANTENNAS**

(75) Inventors: **Paul J. Doczy**, Cypress, TX (US); **Earl W. Moore**, Cypress, TX (US); **Stacy L. Wolff**, Cypress, TX (US)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 63 days.

(21) Appl. No.: **11/229,192**

(22) Filed: **Sep. 16, 2005**

(65) **Prior Publication Data**

US 2007/0063900 A1 Mar. 22, 2007

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

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

(58) **Field of Classification Search** **343/702,**
343/906

See application file for complete search history.

(56) **References Cited**

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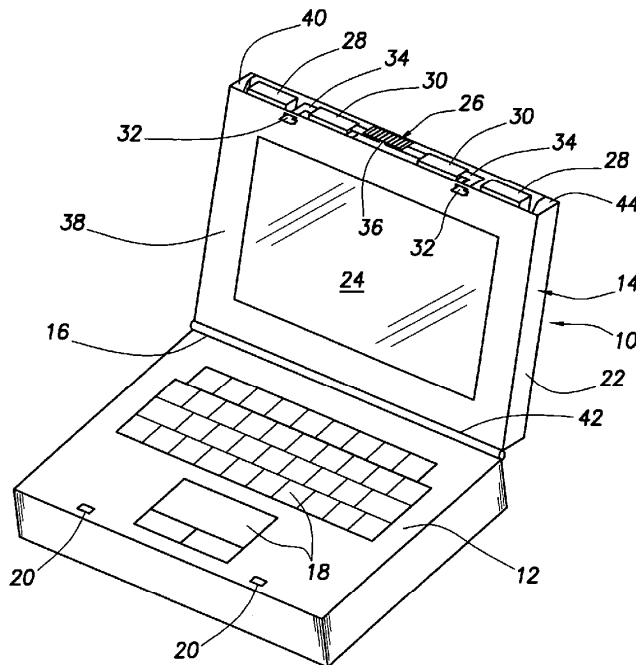
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Primary Examiner—Tho G Phan

(57) **ABSTRACT**

A portable computer display panel comprising a first and second pair of antennas disposed within a housing. A display screen is supported by the housing. A latch assembly is disposed between the display screen and an outer edge of the housing. The first pair of antennas is disposed within said housing between the display screen and the outer edge of said housing. The second pair of antennas is disposed within said housing between said display screen and the outer edge of said housing.

1 Claim, 2 Drawing Sheets





US007429955B2

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

(10) **Patent No.:** **US 7,429,955 B2**
(45) **Date of Patent:** **Sep. 30, 2008**

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Lung-Sheng Tai**, Tu-Cheng (TW);
Po-Kang Ku, Tu-Cheng (TW); **Chen-Ta Hung**, Tu-Cheng (TW); **Yun-Long Ke**, Tu-Cheng (TW); **Yao-Shien Huang**, Tu-Cheng (TW)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 67 days.

(21) Appl. No.: **11/507,834**

(22) Filed: **Aug. 22, 2006**

(65) **Prior Publication Data**
US 2007/0040750 A1 Feb. 22, 2007

(30) **Foreign Application Priority Data**
Aug. 22, 2005 (TW) 94128540 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** 343/702, 343/700 MS, 846
See application file for complete search history.

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Primary Examiner—Tan Ho

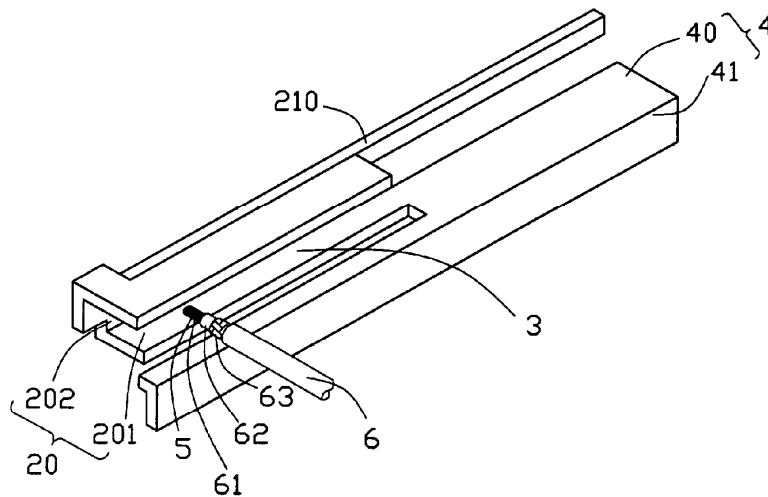
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A multi-band antenna used in an electronic device, comprising: a grounding element; a radiating element comprises a first radiating section operating at 900 MHz frequency band and a second radiating section operating at 1800 MHz frequency band; and a connecting section connecting the radiating element and the grounding element. The grounding element, the radiating element, and the connecting element locate respectively in the different plane. The whole structure of the multi-band antenna of the present invention designed combining the inner structure of the notebook or other portable electrical device. The multi-band antenna is suit to be installed in a notebook or other portable electrical device because the multi-band antenna occupies small space.

17 Claims, 9 Drawing Sheets

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US007429956B2

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

(10) **Patent No.:** **US 7,429,956 B2**
(45) **Date of Patent:** **Sep. 30, 2008**

(54) **ANTENNA**
(75) Inventors: **Cheul-hae Park**, Suwon-si (KR);
Chun-min Jung, Seoul (KR)
(73) Assignee: **Samsung Electronics Co., Ltd.**,
Suwon-si (KR)
(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
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Primary Examiner—Tho G Phan
(74) *Attorney, Agent, or Firm*—Stein, McEwen & Bui, LLP

(21) Appl. No.: **11/655,874**

(57) **ABSTRACT**

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

(65) **Prior Publication Data**
US 2008/0062051 A1 Mar. 13, 2008

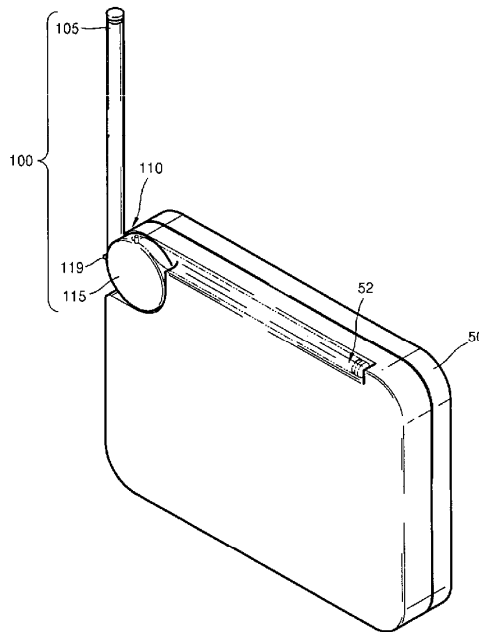
Provided is an antenna including: an antenna stick; and an antenna hinge pivotably attaching the antenna stick to an electronic device body. The antenna hinge includes: a support plate fixed to and combined with the electronic device body; a first connector connected to the antenna stick and pivotably combined with the support plate; a second connector deviating from a pivot center of the first connector and fixed in respect of the support plate; a third connector moving with the pivot of the first connector; and a spring having an elastic force varying with a distance between the second connector and the third connector. If the first connector pivots until the third connector passes a virtual first straight line connecting the pivot center of the first connector and the second connector, the first connector continuously pivots toward an identical direction due to an elastic restoring force of the spring.

(30) **Foreign Application Priority Data**
Sep. 11, 2006 (KR) 10-2006-0087468

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/882**
(58) **Field of Classification Search** **343/702;**
343/880, 882, 906
See application file for complete search history.

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20 Claims, 6 Drawing Sheets





US007429957B1

(12) **United States Patent
Tonn**

(10) **Patent No.: US 7,429,957 B1**
(45) **Date of Patent: Sep. 30, 2008**

(54) **WIDEBAND FLOATING WIRE ANTENNA
USING A DOUBLE NEGATIVE
META-MATERIAL**

(75) Inventor: **David A. Tonn**, Charlestown, RI (US)

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

(*) 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.: **11/713,832**

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

(51) **Int. Cl.**
H01Q 1/34 (2006.01)

(52) **U.S. Cl.** **343/709**

(58) **Field of Classification Search** 343/709,
343/710, 719, 701; 340/984, 985; 114/312
See application file for complete search history.

(56) **References Cited**

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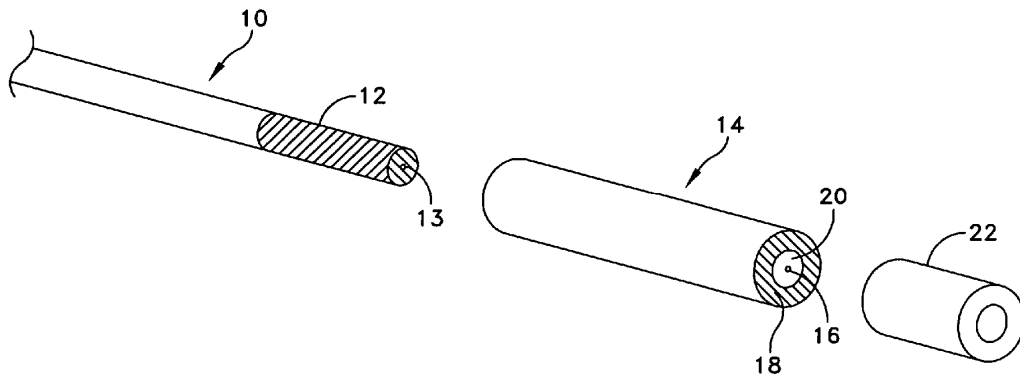
Primary Examiner—Huedung Cao Mancuso

(74) *Attorney, Agent, or Firm*—James M. Kasischke;
Jean-Paul A. Nasser; Michael P. Stanley

(57) **ABSTRACT**

A buoyant cable antenna element is taught that employs a
specific double-negative meta-material sheath with a negative
permeability. The double-negative meta-material sheath is
disposed over the insulated wire portion of the buoyant cable
antenna element. The double-negative meta-material sheath
enables a deliberate reduction in the antenna wire inductance
to a zero value at a desired critical frequency. Reducing the
antenna wire inductance to zero creates a traveling wave
structure antenna having enhanced bandwidth.

3 Claims, 1 Drawing Sheet





US007429960B2

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

(10) **Patent No.:** **US 7,429,960 B2**
(45) **Date of Patent:** **Sep. 30, 2008**

- (54) **LOG-PERIODIC ANTENNA**
- (75) Inventors: **Yasutaka Horiki**, Ypsilanti, MI (US);
Charles Reimer, Adrian, MI (US)
- (73) Assignee: **AGC Automotive Americas R & D, Inc.**, Ypsilanti, MI (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 86 days.

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Primary Examiner—Tho G Phan

(74) Attorney, Agent, or Firm—Howard & Howard Attorneys, P.C.

- (21) Appl. No.: **11/412,572**
- (22) Filed: **Apr. 27, 2006**
- (65) **Prior Publication Data**
US 2007/0252769 A1 Nov. 1, 2007

- (51) **Int. Cl.**
H01Q 11/10 (2006.01)
- (52) **U.S. Cl.** **343/792.5; 343/810**
- (58) **Field of Classification Search** **343/792.5, 343/810, 876, 877, 880**
See application file for complete search history.

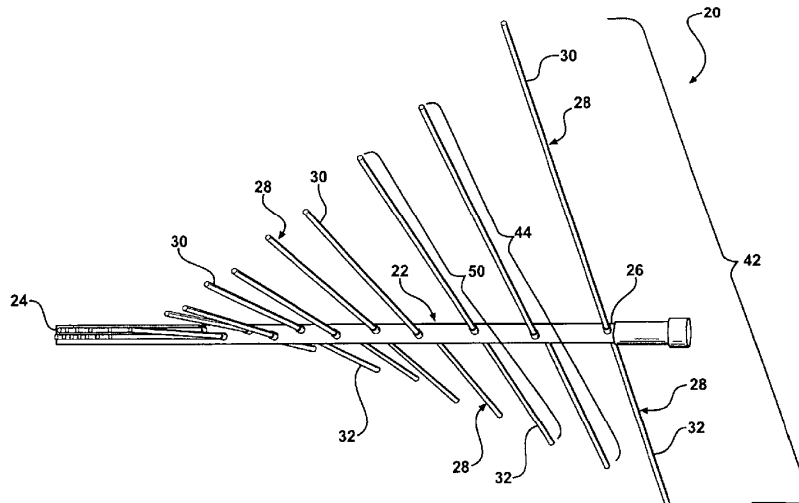
(57) **ABSTRACT**

The subject invention provides a log-periodic antenna and method for controlling multiple polarizations of the antenna per a given frequency or frequencies. The antenna includes a boom and a plurality of pairs of elements where each element of each pair of elements extends laterally from the boom in opposite directions. The plurality of pairs of elements includes a first pair of elements disposed in a first plane with the boom and a second pair of elements disposed in a second plane with the boom. The first plane extends radially from the boom at a first radial angle and the second plane extends radially from the boom at a second radial angle. The first radial angle is offset to the second radial angle. The antenna may include at least one adjustment mechanism. Each adjustment mechanism allows angular adjustment of at least one of the elements for controlling the multiple polarizations of the antenna.

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19 Claims, 8 Drawing Sheets





US007429961B2

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

(10) **Patent No.:** **US 7,429,961 B2**
(45) **Date of Patent:** ***Sep. 30, 2008**

(54) **METHOD FOR FABRICATING ANTENNA STRUCTURES HAVING ADJUSTABLE RADIATION CHARACTERISTICS**

(75) Inventors: **Daniel F. Sievenpiper**, Santa Monica, CA (US); **Hui-Pin Hsu**, Northridge, CA (US)

(73) Assignee: **GM Global Technology Operations, Inc.**, Detroit, MI (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.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/326,881**

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

(65) **Prior Publication Data**

US 2007/0159395 A1 Jul. 12, 2007

(51) **Int. Cl.**
H01Q 15/02 (2006.01)

(52) **U.S. Cl.** **343/909**; 343/700 MS

(58) **Field of Classification Search** 343/700 MS, 343/909

See application file for complete search history.

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Primary Examiner—Tho G Phan

(57) **ABSTRACT**

The radiation properties and wave guiding properties of frequency selective surfaces are used in conjunction with closely spaced antenna elements to fabricate antenna structures having adjustable radiation characteristics. The direction, magnitude, and polarization of radiation patterns for such antenna structures can be adjusted by varying the texture or patterning of layers of conducting material forming the frequency selective surfaces. The invention enables the fabrication of low profile antenna structures that can easily be conformed or integrated into complex surfaces without sacrificing antenna performance.

18 Claims, 19 Drawing Sheets

