



US007352326B2

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

(10) **Patent No.:** **US 7,352,326 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **MULTIBAND PLANAR ANTENNA**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Heikki Korva**, Tupos (FI); **Petra Ollitervo**, London (GB)

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WO WO-03/094290 A1 11/2003

(73) Assignee: **LK Products 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 175 days.

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(21) Appl. No.: **10/595,607**

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(22) PCT Filed: **Sep. 21, 2004**

*Primary Examiner*—Shih-Chao Chen  
(74) *Attorney, Agent, or Firm*—Darby & Darby P.C.

(86) PCT No.: **PCT/FI2004/000554**

§ 371 (c)(1),  
(2), (4) Date: **Apr. 28, 2006**

(87) PCT Pub. No.: **WO2005/043674**

(57) **ABSTRACT**

PCT Pub. Date: **May 12, 2005**

A multiband planar antenna intended for small-sized radio devices and a radio device. The basic structure of the antenna is a two-resonance PIFA, the radiating plane (320) of which has a structural part (321) corresponding to the lowest operating band and a structural part (322) corresponding to the upper operating band. In addition, a loop resonator (323) operating as a radiator is formed in the radiating plane. The ground conductor (325) of the feed line of the loop is at the same time the short-circuit conductor of the PIFA. The second conductor (326) of the feed line is connected to the opposite end of the loop, and it operates as the feed conductor of the PIFA. At the same time the structural part (321) of the radiating plane that corresponds to the lowest operating band is located between the loop and the structural part of the PIFA that corresponds to the upper operating band, in order to reduce interference between them. The resonance frequency of the loop radiator is arranged on the upper operating band of the antenna, for example. Thus the loop improves the matching of the antenna on the upper operating band and the matching and efficiency on the lowest operating band as well. This is based on additional inductance caused by the loop conductor (323) that functions as a part of the feed conductor of the PIFA.

(65) **Prior Publication Data**

US 2007/0132641 A1 Jun. 14, 2007

(30) **Foreign Application Priority Data**

Oct. 31, 2003 (FI) ..... 20031584

(51) **Int. Cl.**

**H01Q 1/38** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 21/00** (2006.01)

(52) **U.S. Cl.** ..... **343/700 MS; 343/702; 343/728**

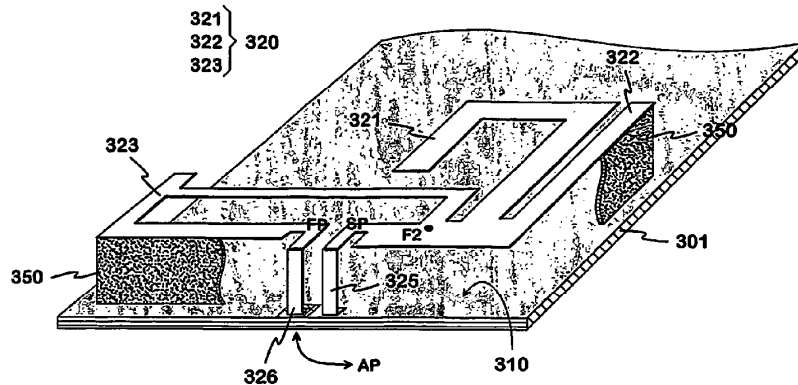
(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 728, 846, 873**  
See application file for complete search history.

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**9 Claims, 4 Drawing Sheets**





US007352327B2

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

(10) **Patent No.:** **US 7,352,327 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **WIRELESS APPARATUS CAPABLE OF CONTROLLING RADIATION PATTERNS OF ANTENNA**

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(75) Inventors: **Shih-Huang Yeh**, Tou-Liu (TW);  
**Zih-Hao Lu**, Taichung Hsien (TW);  
**Chia-Lun Tang**, Miao-Li Hsien (TW)

(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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(21) Appl. No.: **11/221,148**

*Primary Examiner*—Tho Phan

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2006/0250310 A1 Nov. 9, 2006

A wireless apparatus capable of controlling radiation patterns and directions of antenna is provided. It comprises an antenna element, a ground plane, an antenna feed-point, and at least one slot or slit formed on the ground plane. The inclusion of such slots or slits in the wireless apparatus improves the radiation directivity of antenna, and greatly enhances the antenna gain on the horizontal plane. It also resolves the problems caused by shift of radiation patterns of antenna and the poor antenna gains for a conventional antenna apparatus. The wireless apparatus of the present invention has the advantages of simple structure and easy fabrication. The invention can be applied to various kinds of antennas, such as monopole antenna, shorted-monopole antenna, dipole antenna, loop antenna, and planar inverted-F antenna, etc.

(30) **Foreign Application Priority Data**

May 5, 2005 (TW) ..... 94114506 A

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

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

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

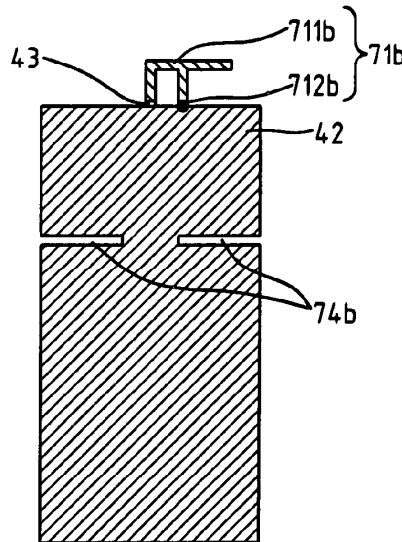
See application file for complete search history.

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**11 Claims, 9 Drawing Sheets**





US007352328B2

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

(10) **Patent No.:** **US 7,352,328 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **FLAT-PLATE MIMO ARRAY ANTENNA WITH ISOLATION ELEMENT**

(75) Inventors: **Young-min Moon**, Seoul (KR);  
**Young-eil Kim**, Suwon-si (KR);  
**Se-hyun Park**, Suwon-si (KR);  
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(73) Assignee: **Samsung Electronics Co., Ltd.**,  
Suwon-si (KR)

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

(21) Appl. No.: **11/441,206**

(22) Filed: **May 26, 2006**

(65) **Prior Publication Data**

US 2007/0069960 A1 Mar. 29, 2007

(30) **Foreign Application Priority Data**

Sep. 27, 2005 (KR) ..... 10-2005-0089925

(51) **Int. Cl.**

**H01Q 1/38** (2006.01)

**H01Q 21/00** (2006.01)

**H01Q 1/52** (2006.01)

(52) **U.S. Cl.** ..... **343/700 MS; 343/817;**  
343/841

(58) **Field of Classification Search** ..... 343/700 MS,  
343/841, 844, 853, 817, 818

See application file for complete search history.

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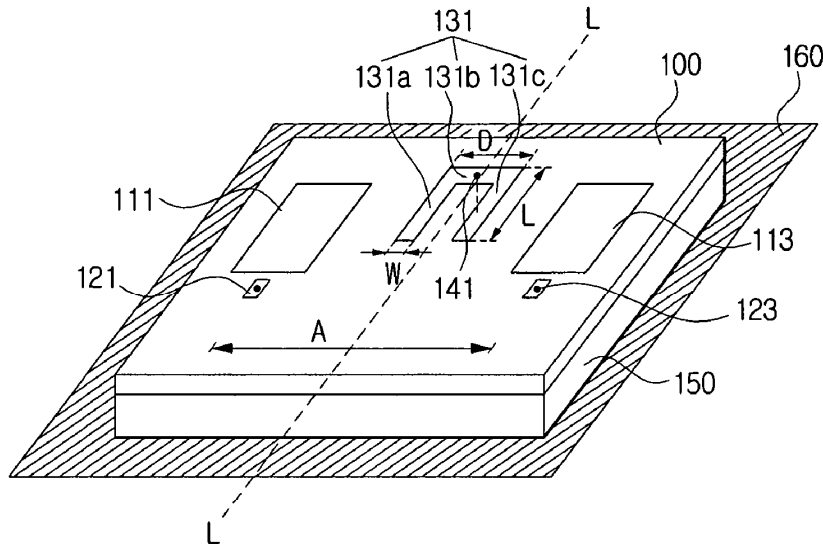
*Primary Examiner*—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

A flat-plate MIMO array antenna includes a substrate, a plurality of antenna elements disposed on the substrate, and at least one isolation element interposed between a plurality of antenna elements on the substrate and connected to a ground. Mutual interference between the antenna elements is prevented by the isolation element formed between the antenna elements, thereby preventing the distortion of the radiation pattern. Also, since the isolation element is grounded to the ground surface, the isolation element operates as a parasitic antenna, thereby increasing the output gain.

**20 Claims, 8 Drawing Sheets**





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

(10) **Patent No.:** **US 7,352,329 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

- (54) **MULTI-BAND ANTENNA WITH BROADBAND FUNCTION**
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**Ching-Feng Tseng**, Hsin-Tien (TW);  
**Yun-Fan Bai**, Hsin-Tien (TW);  
**An-Chia Chen**, Hsin-Tien (TW);  
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- (73) Assignee: **Advance Connectek, Inc.**, Hsin-Tien,  
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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.: **11/604,617**
- (22) Filed: **Nov. 27, 2006**
- (65) **Prior Publication Data**  
US 2007/0171130 A1 Jul. 26, 2007
- (30) **Foreign Application Priority Data**  
Jan. 20, 2006 (TW) ..... 95102140 A
- (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, 846, 848**  
See application file for complete search history.

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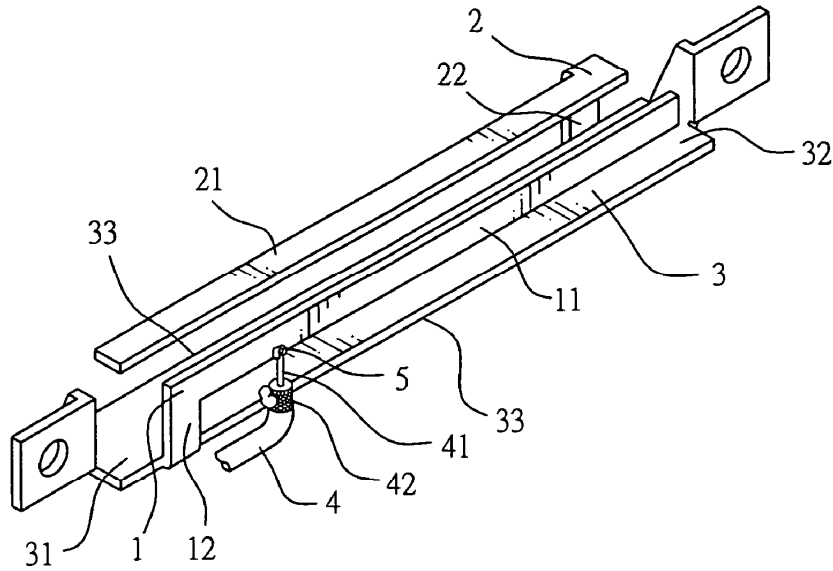
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*Primary Examiner*—Tan Ho  
(74) *Attorney, Agent, or Firm*—Jackson Walker, LLP

(57) **ABSTRACT**

A multi-band antenna with the broadband function is based upon a planar inverted-F antenna with two conductive arms and a ground. The two conductive arms extend from the ground near the two opposite ends of the ground. Two radiation plates of the two conductive arms extend toward each other. The multi-band antenna has a sufficient large band at high frequencies. Since the conductive arms are disposed close to the two ends of the ground, operations of bending the two conductive arms or soldering a feed wires are simpler and have a higher yield.

**8 Claims, 3 Drawing Sheets**





US007352330B2

(12) **United States Patent**  
**Komine**

(10) **Patent No.:** **US 7,352,330 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **PORTABLE TERMINAL INCLUDING ANTENNA**

(75) Inventor: **Yasushi Komine**, Tokyo (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.: **11/094,246**

(22) Filed: **Mar. 31, 2005**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Oct. 28, 2004 (JP) ..... 2004-314175

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

(52) **U.S. Cl.** ..... **343/702; 343/700 MS; 455/575.3; 455/575.7**

(58) **Field of Classification Search** ..... **343/702, 343/720, 866, 700 MS; 455/575.5, 575.7**  
See application file for complete search history.

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*Primary Examiner*—Douglas W. Owens

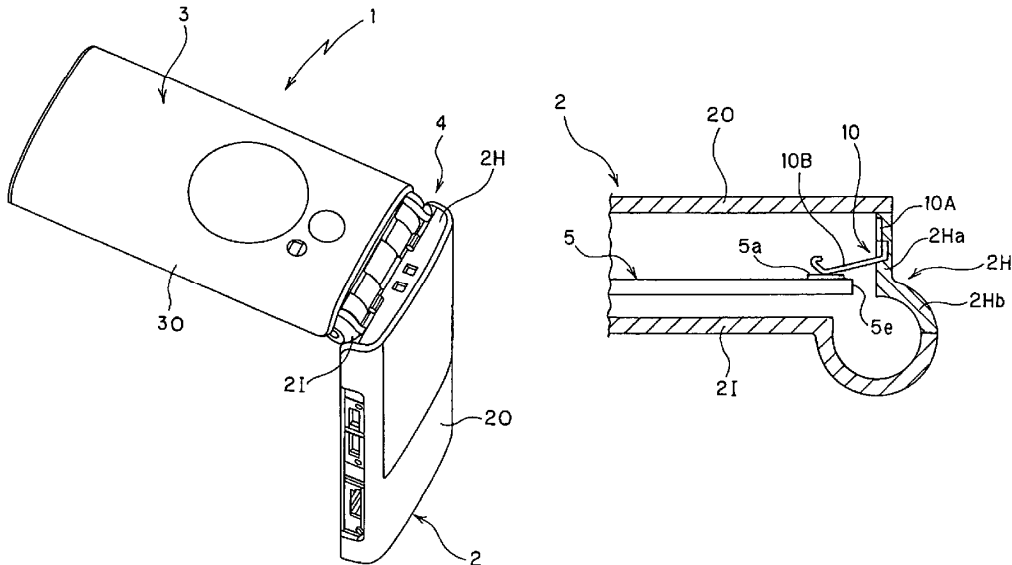
*Assistant Examiner*—Ephrem Alemu

(74) *Attorney, Agent, or Firm*—Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.

(57) **ABSTRACT**

A portable terminal, which has an antenna disposed within a housing accommodating a circuit board, capable of securing a clearance between the antenna and parts of the circuit board, etc. within the housing without increasing the size of the housing, whereby the antenna performance can be prevented from degrading when transmitting or receiving, in which the antenna is insert-molded integrally with the housing accommodating the circuit board within it.

**10 Claims, 8 Drawing Sheets**





US007352331B2

(12) **United States Patent**  
**Quagliaro**

(10) **Patent No.:** **US 7,352,331 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **SPACE TELECOMMUNICATIONS  
INTEGRATED ANTENNA SYSTEM FOR  
MOBILE TERRESTRIAL STATIONS  
(SATCOMS)**

(75) Inventor: **Gilles Quagliaro**, Corneilles en Parisis (FR)

(73) Assignee: **Thales** (FR)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 206 days.

(21) Appl. No.: **11/235,530**

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

(65) **Prior Publication Data**

US 2006/0071867 A1 Apr. 6, 2006

(30) **Foreign Application Priority Data**

Sep. 28, 2004 (FR) ..... 04 10268

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

(52) **U.S. Cl.** ..... **343/705; 343/700 MS**

(58) **Field of Classification Search** ..... **343/700 MS, 343/713, 705, 708**

See application file for complete search history.

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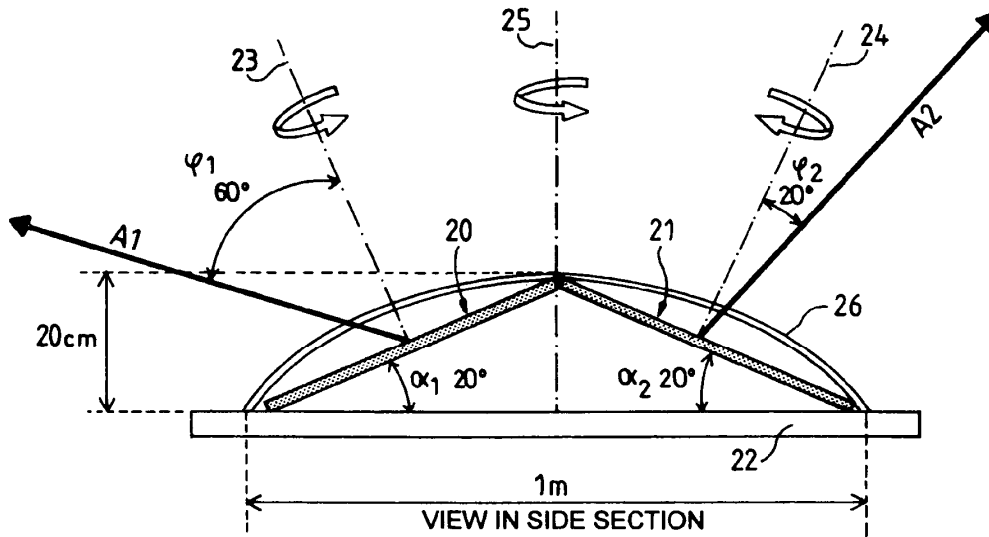
*Primary Examiner*—Hoanganh Le

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

(57) **ABSTRACT**

An integrated antenna system for telecommunications comprises at least one substantially flat and circular antenna provided with a rotation axis coinciding with its axis, the antenna being fixedly joined to a support itself comprising a rotation axis. The rotation axis of the antenna is inclined by an angle  $\theta$  relative to the rotation axis of the antenna support and the antenna beam forms an angle  $\phi$  relative to the rotation axis of the antenna.

**8 Claims, 2 Drawing Sheets**





US007352333B2

(12) **United States Patent**  
**McCorkle**

(10) **Patent No.:** **US 7,352,333 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **FREQUENCY-NOTCHING ANTENNA**

(75) Inventor: **John W. McCorkle**, Vienna, VA (US)

(73) Assignee: **Freescal Semiconductor, Inc.**, Austin, TX (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

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*Primary Examiner*—Huedung Mancuso

(21) Appl. No.: **11/237,751**

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

(65) **Prior Publication Data**

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

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

(58) **Field of Classification Search** ..... 343/767, 343/700 MS, 769, 829, 830, 846, 848  
See application file for complete search history.

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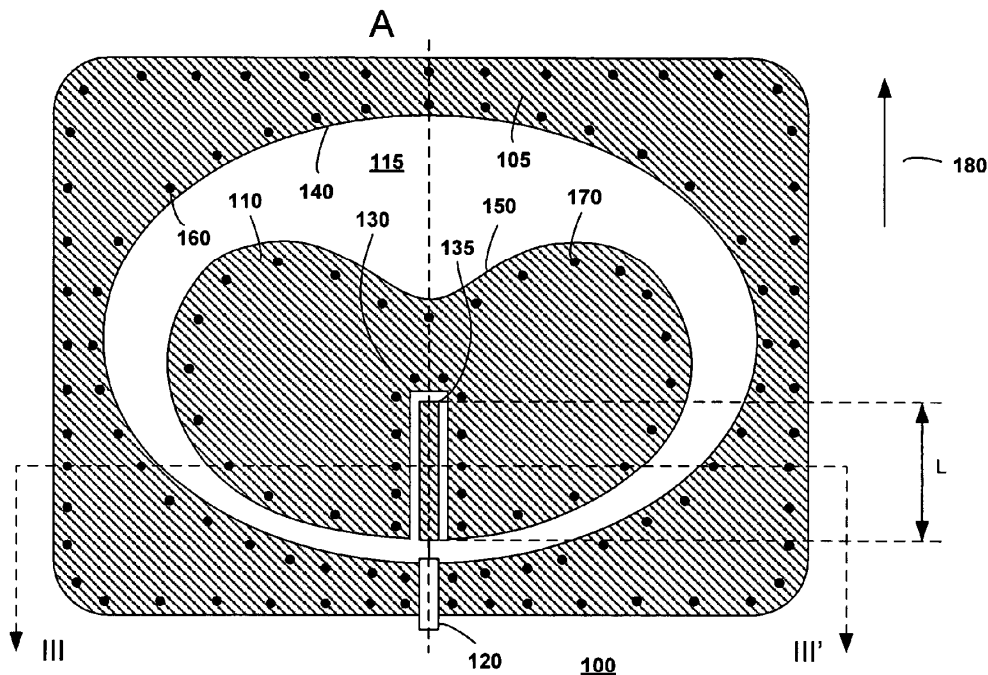
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(57) **ABSTRACT**

An antenna (100) is provided. The antenna includes: a first ground element (105); a first driven element (110) formed from a planar piece of conductive material, the first driven element being configured to transmit and receive wireless signals, the first driven element including a physical slot (130); a conductive line (135) formed in the physical slot such that the conductive line is separated from the first driven element by a gap (G) filled with non-conductive material, the conductive line having a line impedance that is a function of an effective line width of the conductive line, and an effective gap width of a gap between the conductive line and the first driven element; and a signal line (120) configured to send and receive signals to and from the conductive line.

**30 Claims, 9 Drawing Sheets**





US007352334B2

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

(10) **Patent No.:** **US 7,352,334 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **WIDEBAND ANTENNA**  
(75) Inventors: **Shinichi Kuroda**, Tokyo (JP); **Hisato Asai**, Tokyo (JP); **Tomoya Yamaura**, Tokyo (JP)

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

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JP	2002-298105	10/2002

(21) Appl. No.: **11/488,678**

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

(65) **Prior Publication Data**  
US 2006/0262019 A1 Nov. 23, 2006

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**Related U.S. Application Data**

(62) Division of application No. 10/498,813, filed as application No. PCT/JP03/13487 on Oct. 22, 2003, now Pat. No. 7,132,993.

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

(30) **Foreign Application Priority Data**

Oct. 23, 2002	(JP)	.....	2002-307908
Oct. 23, 2002	(JP)	.....	2002-307909
Oct. 30, 2002	(JP)	.....	2002-315381
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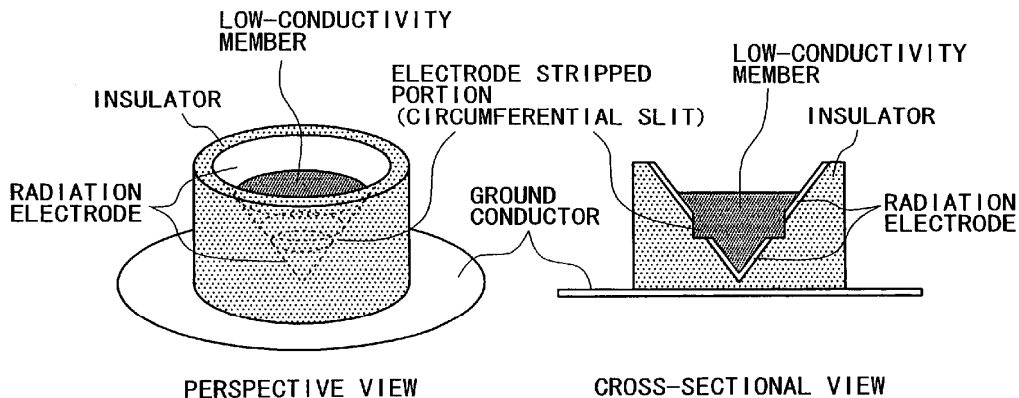
(57) **ABSTRACT**

A monoconical antenna comprises: a substantially conical concavity formed in one end face of a dielectric; a radiation electrode provided on the surface of the concavity; and a ground conductor provided in proximity to and substantially in parallel with the other end face opposite the one end face of the dielectric. The monoconical antenna is so constituted that electrical signals are fed to between the near vertex region of the radiation electrode and the region of the ground conductor. The half-cone angle  $\alpha$  of the substantially conical concavity formed in the one end face of the dielectric is determined by a predetermined rule corresponding to relative dielectric constant  $\epsilon_r$ . Thus, the quality of wideband characteristics inherent in the monoconical antenna can be sufficiently maintained, and further size reduction can be accomplished by dielectric loading.

(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)  
(52) **U.S. Cl.** ..... **343/772; 343/786**  
(58) **Field of Classification Search** ..... **343/772, 343/773, 786**  
See application file for complete search history.

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**10 Claims, 26 Drawing Sheets**







US007352335B2

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

(10) **Patent No.:** **US 7,352,335 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **RADAR APPARATUS HAVING ARRAYED HORN ANTENNA PARTS COMMUNICATED WITH WAVEGUIDE**

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6,950,073 B2 *	9/2005	Clymer et al.	343/713

(75) Inventors: **Naofumi Inomata**, Kawasaki (JP);  
**Takahisa Ishida**, Utsunomiya (JP);  
**Masahito Shingyoji**, Sakado (JP);  
**Hiroyuki Ando**, Kawagoe (JP)

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(73) Assignees: **Honda Elesys Co., Ltd.**, Yokohama (JP); **Honda Motor Co., Ltd.**, Tokyo (JP)

JP 2005-020525 A 1/2005

(\* ) 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*—Arent Fox LLP.

(21) Appl. No.: **11/605,255**

(57) **ABSTRACT**

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

(65) **Prior Publication Data**

US 2007/0139287 A1 Jun. 21, 2007

(30) **Foreign Application Priority Data**

Dec. 20, 2005 (JP) ..... 2005-366547

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

(52) **U.S. Cl.** ..... **343/786; 343/713**

(58) **Field of Classification Search** ..... **343/713, 343/771, 786**

See application file for complete search history.

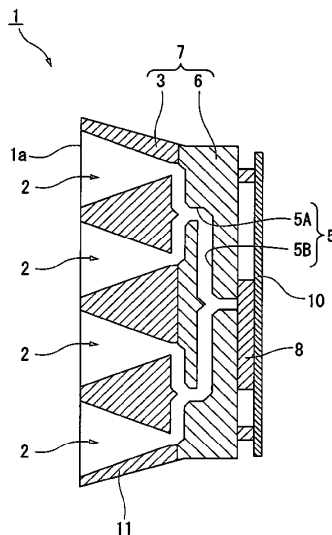
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A horn antenna part of a radar apparatus is made of a heat emitting material and includes: an antenna body part having a plurality of horn parts arranged in an array form, wherein each horn part is open toward a front surface of the apparatus, and has a diameter which gradually increases toward the front surface; and a feeder part including a waveguide which communicates with the horn parts, wherein the feeder part is connected to the antenna body part. The radar apparatus also includes: a wireless part for generating a high-frequency signal supplied to the feeder part, and converting a reflected high-frequency signal to a medium-frequency signal; and a circuit part for controlling the high-frequency signal and processing the medium-frequency signal. At least one of the wireless part and the circuit part is arranged in a manner such that it contacts the feeder part.

**8 Claims, 3 Drawing Sheets**





US007352336B1

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

(10) **Patent No.:** **US 7,352,336 B1**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **DIRECTIVE LINEARLY POLARIZED MONOPOLE ANTENNA**

6,326,922 B1\* 12/2001 Hegendoerfer ..... 343/700 MS  
2007/0001924 A1\* 1/2007 Hirabayashi ..... 343/893

(75) Inventors: **Erik Lier**, Newtown, PA (US);  
**Bernard F Lindinger**, Elkins Park, PA (US)

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*Primary Examiner*—Shih-Chao Chen  
(74) *Attorney, Agent, or Firm*—McDermott Will & Emery LLP

(73) Assignee: **Lockheed Martin Corporation**, Bethesda, MD (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.

(57) **ABSTRACT**

A directive monopole antenna element with good RF performance (e.g., directivity and cross-polarization) and a low assembly cost is provided. The directive monopole antenna includes a dielectric support structure and one or more conductive directors coupled to the support structure. Each of the conductive directors is disposed parallel to every other conductive director and in a first plane of the support structure. The directive monopole antenna further includes a conductor coupled to an end of the support structure. The conductor has a feed probe section disposed in the first plane perpendicular to the one or more conductive directors and extending beyond the end of the support structure. The conductor further has a bent section disposed in the first plane parallel to the one or more conductive directors. The feed probe section and the bent section are electrically coupled. The directive monopole antenna element may be fed by a waveguide or a coaxial feed line.

(21) Appl. No.: **11/652,608**

(22) Filed: **Jan. 12, 2007**

(51) **Int. Cl.**  
**H01Q 9/28** (2006.01)  
**H01Q 19/30** (2006.01)  
**H01Q 9/38** (2006.01)

(52) **U.S. Cl.** ..... **343/795; 343/819; 343/830**

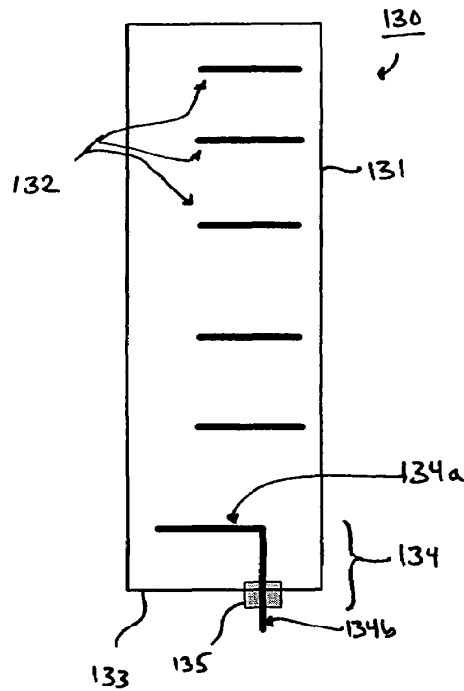
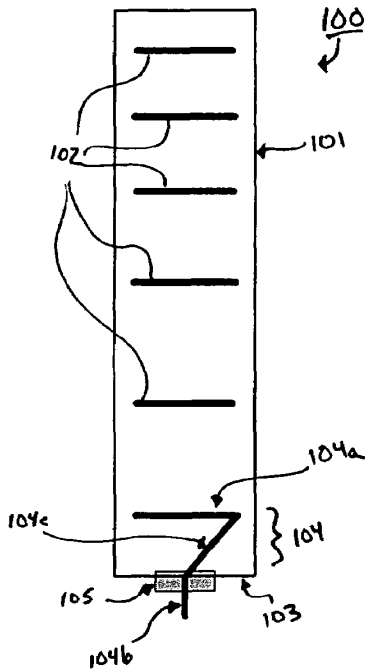
(58) **Field of Classification Search** ..... **343/795; 343/819, 818, 829, 830**  
See application file for complete search history.

(56) **References Cited**

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**22 Claims, 9 Drawing Sheets**





US007352337B2

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

(10) **Patent No.:** **US 7,352,337 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

- (54) **PORTABLE SDARS-RECEIVING DEVICE WITH INTEGRATED AUDIO WIRE AND ANTENNA**
- (75) Inventors: **Korkut Yegin**, Grand Blanc, MI (US);  
**Daniel G. Morris**, Ovid, MI (US);  
**William R. Livengood**, Grand Blanc, MI (US)
- (73) Assignee: **Delphi Technologies, Inc.**, Troy, MI (US)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 117 days.

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(21) Appl. No.: **11/437,160**

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(22) Filed: **May 19, 2006**

GB 962100 6/1964

(65) **Prior Publication Data**

US 2006/0238435 A1 Oct. 26, 2006

**Related U.S. Application Data**

- (62) Division of application No. 10/999,385, filed on Nov. 30, 2004, now Pat. No. 7,180,472.
- (60) Provisional application No. 60/574,520, filed on May 26, 2004.

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

- (51) **Int. Cl.**  
*H01Q 1/36* (2006.01)  
*H01Q 1/24* (2006.01)
- (52) **U.S. Cl.** ..... **343/895; 343/702**
- (58) **Field of Classification Search** ..... **343/702, 343/895**

(57) **ABSTRACT**

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

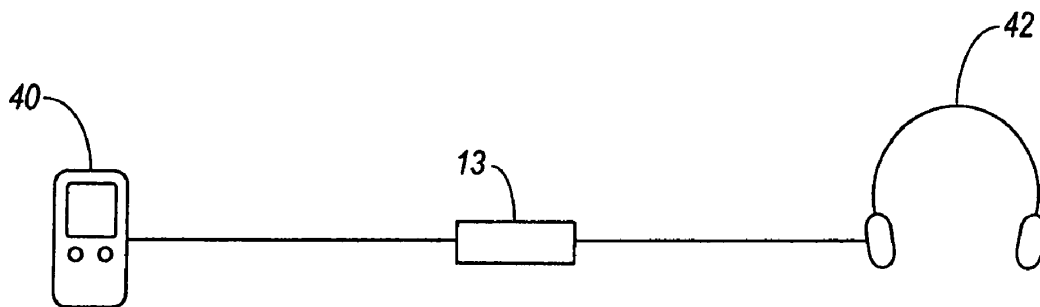
See application file for complete search history.

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**19 Claims, 3 Drawing Sheets**





US007352338B2

(12) **United States Patent**  
**Chenoweth**

(10) **Patent No.:** **US 7,352,338 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **WIDEBAND ANTENNA WITH REDUCED DIELECTRIC LOSS**

(75) Inventor: **John P. Chenoweth**, Coral Springs, 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 574 days.

(21) Appl. No.: **10/896,274**

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

(65) **Prior Publication Data**

US 2006/0030363 A1 Feb. 9, 2006

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

(52) **U.S. Cl.** ..... **343/897; 343/895**

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

See application file for complete search history.

(56) **References Cited**

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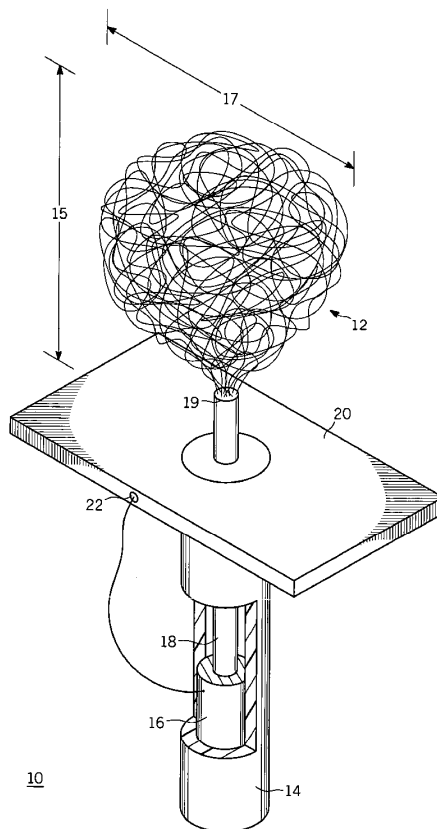
*Primary Examiner*—Hoang Nguyen

*Assistant Examiner*—Robert Karacsony

(57) **ABSTRACT**

A wideband antenna (10) includes a plurality of conductive strands (12) randomly interconnected and further coupled to a feedpoint (19) and a sheath (52) structurally retaining the plurality of conductive strands. The sheath can be a thin dielectric coating and the plurality of conductive strands can each be taller than one-quarter wavelength. The wideband antenna can have low dielectric losses while maintaining a multi-octave bandwidth. Air can be used as a dielectric between the plurality of conductive strands.

**18 Claims, 2 Drawing Sheets**





US007353013B2

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

(10) **Patent No.:** **US 7,353,013 B2**  
(45) **Date of Patent:** **Apr. 1, 2008**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE WITH POLARIZATION DIVERSITY WIRELESS LOCAL AREA NETWORK (LAN) ANTENNA AND RELATED METHODS**

(75) Inventors: **Yihong Qi**, Waterloo (CA); **Ying Tong Man**, Kitchener (CA); **Perry Jarmuszewski**, Waterloo (CA); **Adrian 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 262 days.

(21) Appl. No.: **10/924,276**

(22) Filed: **Aug. 23, 2004**

(65) **Prior Publication Data**

US 2006/0040622 A1 Feb. 23, 2006

(51) **Int. Cl.**  
**H04B 7/04** (2006.01)  
**H01Q 1/38** (2006.01)

(52) **U.S. Cl.** ..... **455/278.1**; 455/272; 455/101; 343/702; 343/700 MS

(58) **Field of Classification Search** ..... 455/552.1, 455/101, 272, 278.1, 269; 343/700 MS, 343/702, 725, 893

See application file for complete search history.

(56) **References Cited**

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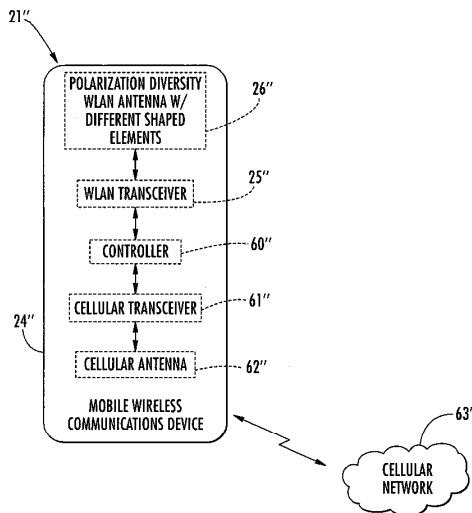
*Primary Examiner*—Blane J. Jackson

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

(57) **ABSTRACT**

A mobile wireless LAN communications device may include a portable, handheld housing, and a wireless LAN transceiver carried by the housing. A polarization diversity wireless LAN antenna may be included for cooperating with the wireless LAN transceiver to communicate over a wireless LAN. The polarization diversity wireless LAN antenna may include a first antenna element coupled to the wireless LAN transceiver having a first shape and a first polarization, and a second antenna element coupled to the wireless LAN transceiver having a second shape different from the first shape. The second antenna element may also have a second polarization different from the first polarization.

**26 Claims, 5 Drawing Sheets**





US007355270B2

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

(10) **Patent No.:** **US 7,355,270 B2**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **SEMICONDUCTOR CHIP WITH COIL ANTENNA AND COMMUNICATION SYSTEM**

(75) Inventors: **Takehiko Hasebe**, Yokohama (JP); **Yasushi Goto**, Tokyo (JP); **Kouichi Uesaka**, Yokohama (JP); **Yoshiaki Yazawa**, Tokyo (JP); **Makoto Torigoe**, Yokohama (JP)

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(73) Assignee: **Hitachi, 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 281 days.

(21) Appl. No.: **11/030,058**

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

(65) **Prior Publication Data**  
US 2005/0173532 A1 Aug. 11, 2005

(30) **Foreign Application Priority Data**  
Feb. 10, 2004 (JP) ..... 2004-033293

(51) **Int. Cl.**  
**H01L 23/02** (2006.01)  
(52) **U.S. Cl.** ..... **257/679; 257/684; 257/728**  
(58) **Field of Classification Search** ..... **257/679, 257/684, 728**  
See application file for complete search history.

(56) **References Cited**  
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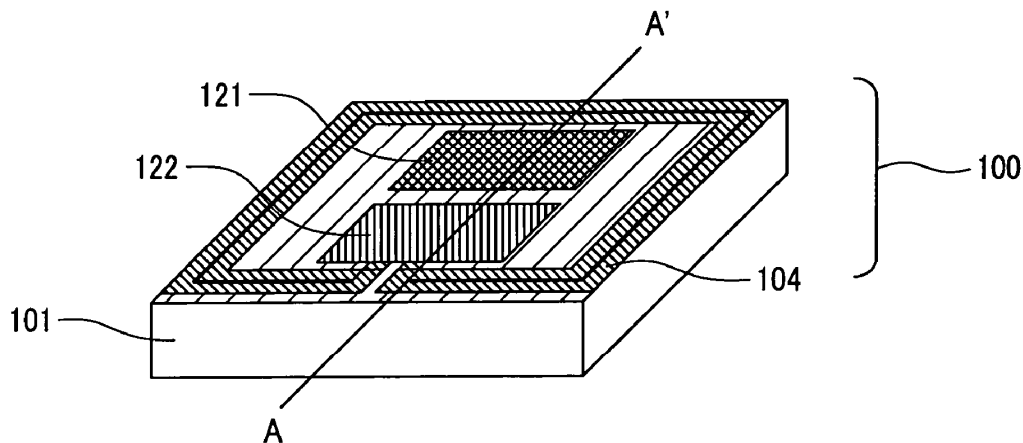
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*Primary Examiner*—Douglas M. Menz  
(74) *Attorney, Agent, or Firm*—Antonelli, Terry, Stout & Kraus, LLP.

(57) **ABSTRACT**

The present invention intends to prevent the communication distance from becoming shorter with a reduction in size of a coil antenna to the chip size and with a consequent decrease of an induced voltage. According to the present invention there is provided a semiconductor chip having a coil antenna and a circuit surface and adapted to transmit and receive signals by radio to and from an external device. The semiconductor chip has a configuration for increasing an electromagnetic coupling coefficient between the coil antenna and the external device. According to a concrete example thereof, a magnetic material is disposed, the coil antenna is formed by a stacked structure comprising plural conductor layers and insulating layers superimposed one on another, or the coil antenna is disposed outside an external form of a circuit of the semiconductor chip.

**6 Claims, 19 Drawing Sheets**





US00735552B2

(12) **United States Patent**  
**Kwon**

(10) **Patent No.:** **US 7,355,552 B2**  
(45) **Date of Patent:** **\*Apr. 8, 2008**

- (54) **CHARACTER PATTERN ANTENNA**
- (75) Inventor: **Jae-Yong Kwon**, Seoul (KR)
- (73) Assignee: **LG Electronics Inc.**, Seoul (KR)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 212 days.  
  
This patent is subject to a terminal disclaimer.

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*Primary Examiner*—Tan Ho  
(74) *Attorney, Agent, or Firm*—Lee, hong, Degerman, Kang & Schmadeka

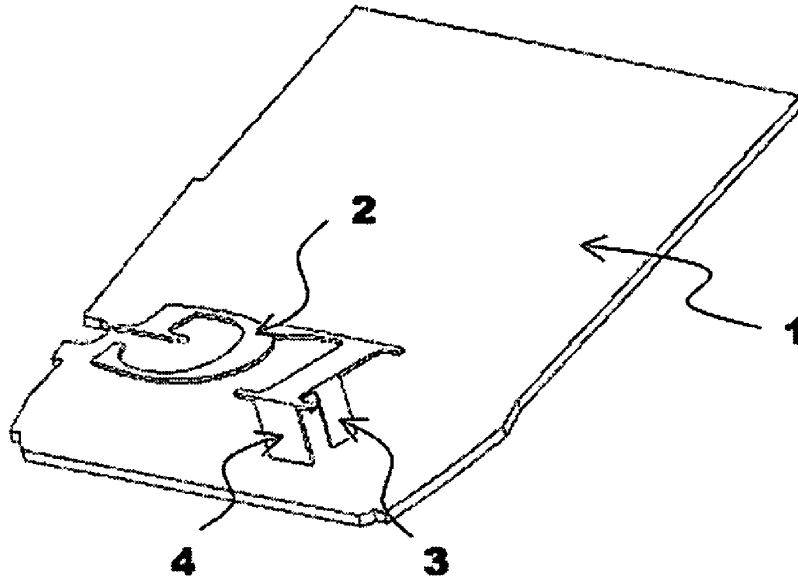
- (21) Appl. No.: **11/236,108**
- (22) Filed: **Sep. 26, 2005**
- (65) **Prior Publication Data**  
US 2006/0066491 A1 Mar. 30, 2006
- (30) **Foreign Application Priority Data**  
Sep. 24, 2004 (KR) ..... 10-2004-0077468
- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **343/700 MS; 343/702**
- (58) **Field of Classification Search** ..... 343/700 MS,  
343/702  
See application file for complete search history.

(57) **ABSTRACT**

The present invention relates, in general, to antennas formed in the pattern of characters and, more particularly, to a character pattern antenna, in which a radiation unit thereof is formed in the pattern of a plurality of characters. The character pattern antenna includes a radiation unit, a feeding unit, and a short circuit unit. The radiation unit is formed in a character pattern group to radiate radio waves. The feeding unit is formed on a predetermined portion of the character pattern to provide current. The short circuit unit is formed on a predetermined location of the radiation unit and adapted to function as a ground. As described above, the present invention proposes a character pattern antenna, which allows the pattern thereof to contain a specific meaning while having the performance of an antenna. Accordingly, the present invention is advantageous in that it can increase the freedom of a pattern when an antenna is designed, thus facilitating the design of the antenna.

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





US00735553B1

(12) **United States Patent**  
**Ryken, Jr. et al.**

(10) **Patent No.:** **US 7,355,553 B1**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **TEN INCH DIAMETER MICROSTRIP ANTENNA**

(75) Inventors: **Marvin L. Ryken, Jr.**, Oxnard, CA (US); **Albert F. Davis**, Ventura, 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 0 days.

(21) Appl. No.: **11/645,266**

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

(51) **Int. Cl.**  
**H01Q 1/28** (2006.01)  
**H01Q 1/38** (2006.01)

(52) **U.S. Cl.** ..... **343/705; 343/700 MS**

(58) **Field of Classification Search** ..... **343/705, 343/708, 700 MS, 846, 853, 829**

See application file for complete search history.

(56) **References Cited**

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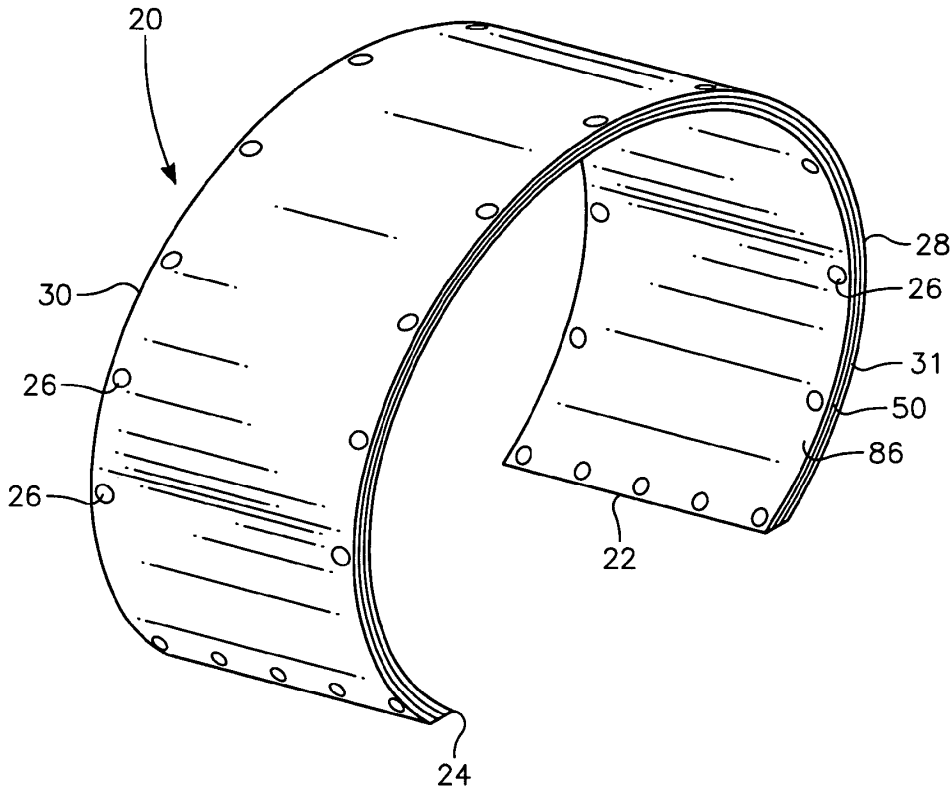
*Primary Examiner*—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—David S. Kalmbaugh

(57) **ABSTRACT**

A microstrip antenna configured to wrap around approximately 270 degrees a projectile's body without interfering with the aerodynamic design of the projectile. The microstrip antenna has two identical grounded quarter wavelength microstrip antenna elements positioned around the circumference of the projectile's body. The antenna has an operating frequency of 425 MHz  $\pm$ 375 KHz, a maximum diameter of ten inches and a maximum length of nine inches. The microstrip antenna outputs a pair of equal amplitude flight termination signals and produces a quasi omni-directional radiation pattern with linear polarization.

**20 Claims, 4 Drawing Sheets**







US00735554B2

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

(10) **Patent No.:** **US 7,355,554 B2**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **METHOD OF PRODUCING A PHOTONIC BANDGAP STRUCTURE ON A MICROWAVE DEVICE AND SLOT TYPE ANTENNAS EMPLOYING SUCH A STRUCTURE**

(75) Inventors: **Nicolas Boisbouvier**, Rennes (FR); **Françoise Le Bolzer**, Rennes (FR); **Ali Louzir**, Rennes (FR); **Anne-Claude Tarot**, Etrelles (FR); **Kouroch Mahdjoubi**, Cesson (FR)

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

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

(21) Appl. No.: **10/530,336**

(22) PCT Filed: **Oct. 3, 2003**

(86) PCT No.: **PCT/FR03/50080**

§ 371 (c)(1),  
(2), (4) Date: **Nov. 10, 2006**

(87) PCT Pub. No.: **WO2004/034502**

PCT Pub. Date: **Apr. 22, 2004**

(65) **Prior Publication Data**

US 2007/0097005 A1 May 3, 2007

(30) **Foreign Application Priority Data**

Oct. 11, 2002 (FR) ..... 02 12656

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

(52) **U.S. Cl.** ..... **343/767; 343/909**

(58) **Field of Classification Search** ..... **343/767, 343/769, 770, 909**

See application file for complete search history.

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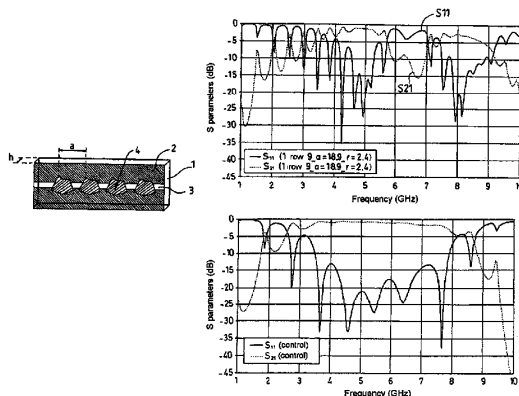
Primary Examiner—Tan Ho

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

(57) **ABSTRACT**

The invention relates to a method of producing a photonic bandgap structure on a slot-type microwave device which is produced on a metallized substrate. According to the invention, periodically-spaced patterns are formed on the surface of the aforementioned substrate opposite the surface comprising the slot. The invention is suitable for slot-type antennas.

**14 Claims, 8 Drawing Sheets**





US00735555B2

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

(10) **Patent No.:** **US 7,355,555 B2**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **ANTENNA**

(75) Inventors: **Dean Kitchener**, Brentwood (GB);  
**Andrew Urquhart**, Bishops Stortford  
(GB); **David Adams**, Chelmsford (GB)

(73) Assignee: **Nortel Networks Limited**, St. Laurent,  
Quebec (CA)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 168 days.

(21) Appl. No.: **11/225,520**

(22) Filed: **Sep. 13, 2005**

(65) **Prior Publication Data**  
US 2007/0057859 A1 Mar. 15, 2007

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

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

(58) **Field of Classification Search** ..... **343/770,**  
**343/789, 767, 771**

See application file for complete search history.

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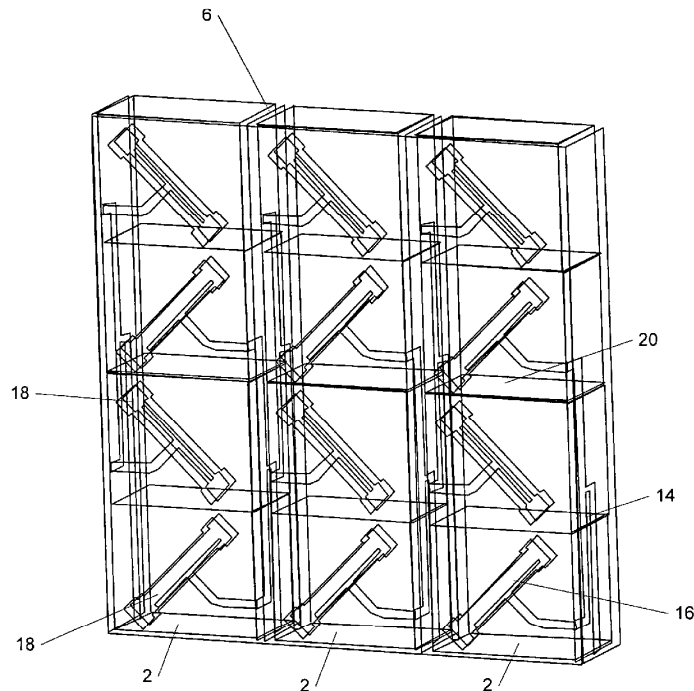
*Primary Examiner*—Huedung Mancuso

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

(57) **ABSTRACT**

An antenna array may be constructed using a plurality of tubes of electrically conducted material in conjunction with an additionally electrically conductive component which covers the front faces of tubes and at least part of the sides. Between the structures, a further electrically conductive material may be placed separated by dielectric material, and may be used to provide radiating elements and a feed structure by producing stripline structures. This structure is thereby able to reduce cavity back slots fed with triplate stripline along the sides of the tubes. This structure, particularly when made from plastics material, is low in complexity and cost and lightweight. These features overcome many of the disadvantages of the existing designs.

**38 Claims, 6 Drawing Sheets**





US00735556B2

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

(10) **Patent No.:** **US 7,355,556 B2**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **ANTENNA AND ELECTRONIC DEVICE**

(75) Inventors: **Kazuaki Abe**, Iruma (JP); **Kaoru Someya**, Kiyose (JP)

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

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

(21) Appl. No.: **11/238,034**

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

(65) **Prior Publication Data**

US 2006/0066498 A1 Mar. 30, 2006

(30) **Foreign Application Priority Data**

Sep. 30, 2004	(JP)	.....	2004-287860
Oct. 14, 2004	(JP)	.....	2004-300205
May 26, 2005	(JP)	.....	2005-153916
May 27, 2005	(JP)	.....	2005-155213

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

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

(58) **Field of Classification Search** ..... 343/788,  
343/718, 787, 702; 455/575.7; 368/47,  
368/88, 204

See application file for complete search history.

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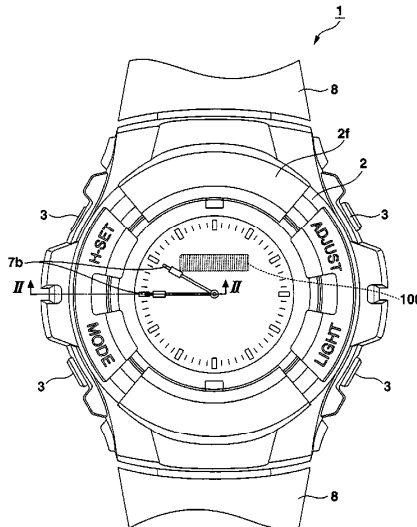
*Primary Examiner*—Huedung Mancuso

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

(57) **ABSTRACT**

An antenna includes a rod-like core configured by an amorphous metal formed into a bulk configuration, and a coil wound around the core. An electronic device includes a case encasing the antenna, a sectional area of each longitudinal end portion of the core being larger than that of a central portion of the core. The antenna may be disposed under a radio wave permeable decorative plate in such a manner that a magnetic sheet is attached to each end portion of the core to protrude outwards from the core or that an expanded portion is disposed in each end portion and has such a shape to make a side of a surface of the expanded portion facing the decorative plate receive more radio wave than a side of a surface of the expanded portion opposite to the facing surface in relation to an axial line of the antenna.

**9 Claims, 44 Drawing Sheets**





US00735557B2

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

(10) **Patent No.:** US 7,355,557 B2  
(45) **Date of Patent:** Apr. 8, 2008

(54) **ANTENNA UNIT AND FEEDING COMPONENT**

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6,133,883 A \* 10/2000 Munson et al. .... 343/700 MS  
6,246,368 B1 \* 6/2001 Deming et al. .... 343/700 MS  
6,861,990 B2 \* 3/2005 Hung et al. .... 343/702  
6,879,288 B2 \* 4/2005 Byrne et al. .... 343/700 MS

(75) Inventors: **Junichi Noro**, Akita (JP); **Kyuichi Sato**, Akita (JP); **Nobuaki Monma**, Akita (JP); **Shozo Miyamoto**, Akita (JP); **Takumi Suzuki**, Akita (JP)

(73) Assignee: **Mitsumi Electric 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 265 days.

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(21) Appl. No.: **11/320,086**

*Primary Examiner*—Douglas W. Owens

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

*Assistant Examiner*—Chuc Tran

(65) **Prior Publication Data**

US 2006/0214852 A1 Sep. 28, 2006

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

(30) **Foreign Application Priority Data**

Mar. 28, 2005 (JP) ..... 2005-090852

(57) **ABSTRACT**

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

(52) **U.S. Cl.** ..... 343/846; 343/872; 343/767

(58) **Field of Classification Search** ..... 343/846, 343/872, 848, 767, 789, 700 MS, 829-830  
See application file for complete search history.

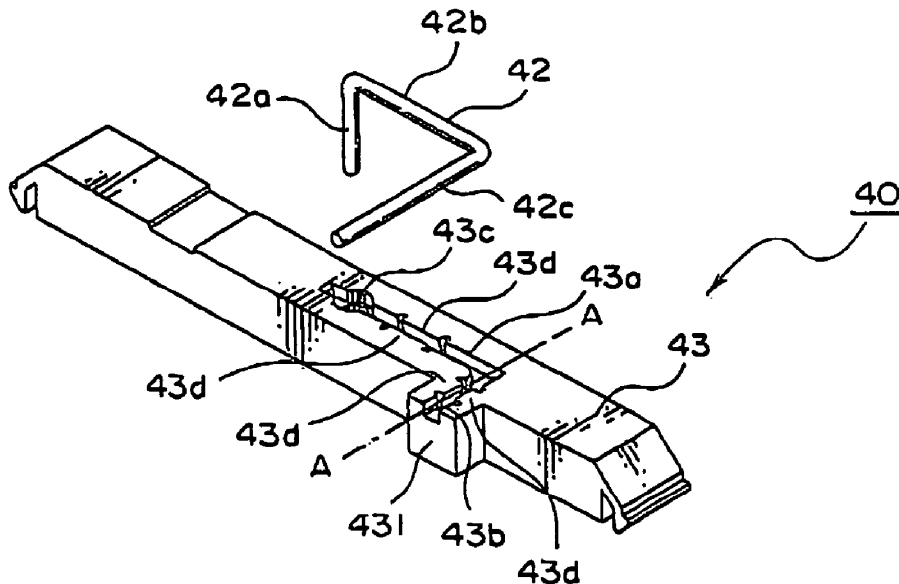
A feeding component 40 has a wire (or a feeding line) 42 and an attaching member 43 made of resin. The attaching member 43 provides wire receiving grooves 43a and 43b to receive and support the wire 42. At least one pair of wire holding parts 43d are formed on inner wall defining the wire receiving grooves 43a and 43b. The wire holding parts 43d of each pair are opposite to each other and inclined to narrow a width of the wire receiving groove 43a or 43b with increasing proximity to an upper side of the wire receiving groove 43a or 43b. The wire holding parts 43d hold the wire 42 put into the wire receiving grooves 43a and 43b.

(56) **References Cited**

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**8 Claims, 4 Drawing Sheets**





US00735558B2

(12) **United States Patent**  
**Lee**

(10) **Patent No.:** **US 7,355,558 B2**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **CHIP ANTENNA** 6,819,289 B2\* 11/2004 Kim et al. .... 343/700 MS  
2003/0001793 A1\* 1/2003 Park ..... 343/895

(75) Inventor: **Jae Chan Lee**, Kyungki-do (KR)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 88 days.

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(21) Appl. No.: **11/320,197**

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

*Primary Examiner*—Hoang V. Nguyen

(65) **Prior Publication Data**

*Assistant Examiner*—Robert Karacsony

US 2006/0145928 A1 Jul. 6, 2006

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

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Jan. 3, 2005 (KR) ..... 10-2005-0000267

(51) **Int. Cl.**  
**H01Q 1/36** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 1/38** (2006.01)  
**H01Q 5/00** (2006.01)  
**H01Q 9/04** (2006.01)

The present invention relates to a chip antenna including first and second conductor patterns formed on upper and lower surfaces of a dielectric block in a width direction of the dielectric block. The chip antenna also includes conductive vertical-connecting parts formed in a vertical direction of the dielectric block to connect the first conductor patterns with the second conductor patterns to form a radiation line. The first and second conductor patterns comprise pairs of L-shaped and symmetrical L-shaped conductor patterns having bent parts overlapped in part with each other in a width direction and extended in a longitudinal direction of the dielectric block. Also, horizontal-connecting conductor patterns are formed in a width direction of the dielectric block.

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

(58) **Field of Classification Search** ..... 343/702,  
343/700 MS, 895

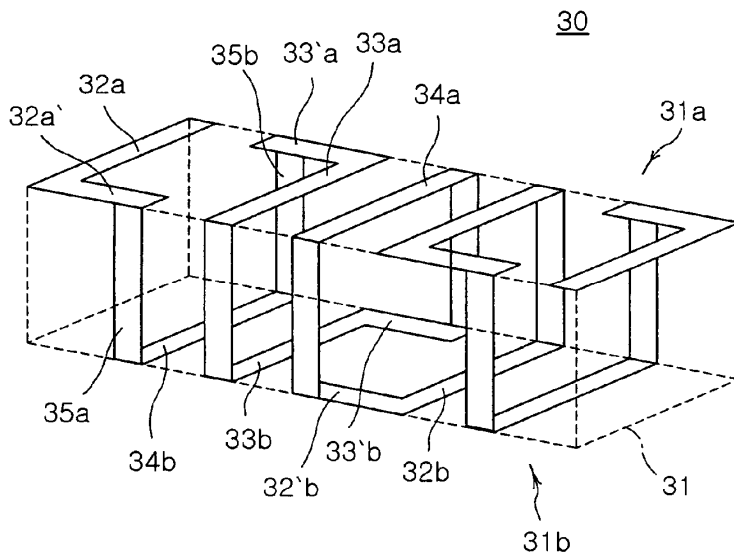
See application file for complete search history.

(56) **References Cited**

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**12 Claims, 8 Drawing Sheets**





US00735559B2

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

(10) **Patent No.:** **US 7,355,559 B2**  
(45) **Date of Patent:** **Apr. 8, 2008**

(54) **SMALL PLANAR ANTENNA WITH ENHANCED BANDWIDTH AND SMALL STRIP RADIATOR**

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7,190,319 B2 *	3/2007	Forster et al. ....	343/806
2004/0001023 A1 *	1/2004	Peng .....	343/725

(75) Inventors: **Yuri Tikhov**, Suwon-si (KR);  
**Young-hoon Min**, Anyang-si (KR);  
**Yong-jin Kim**, Seoul (KR)

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

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

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(21) Appl. No.: **11/639,247**

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

(65) **Prior Publication Data**

US 2007/0096993 A1 May 3, 2007

**Related U.S. Application Data**

(62) Division of application No. 11/207,725, filed on Aug. 22, 2005, now Pat. No. 7,289,076.

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*Primary Examiner*—Tho Phan

(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(30) **Foreign Application Priority Data**

Aug. 21, 2004	(KR)	.....	2004-66159
Jul. 8, 2005	(KR)	.....	2005-61666

(57) **ABSTRACT**

A planar small antenna and a small strip radiator are provided which have increased bandwidth. The small strip radiator has a main strip pattern and a plurality of convoluted strip patterns terminating the main strip pattern at each end. The plurality of convoluted strip patterns are arranged in mirror-symmetrical arrangement with reference to the longitudinal axis of the main strip such that one pair of convoluted strip patterns is convoluted clockwise while another pair is convoluted counterclockwise. As a result, an electrically small antenna radiator requires less metal or conductive material than conventional radiators, and also can operate without adversely affecting the radiation characteristics of the antenna.

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

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

(58) **Field of Classification Search** ..... **343/700 MS, 343/895, 767, 770, 846**

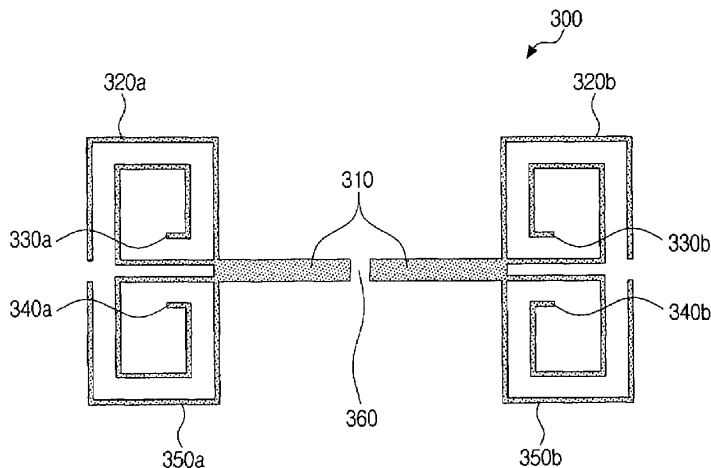
See application file for complete search history.

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**7 Claims, 13 Drawing Sheets**





US007358900B2

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

(10) **Patent No.:** **US 7,358,900 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **SYMMETRIC-SLOT MONOPOLE ANTENNA**

(75) Inventors: **Jia-Jiu Song**, Taipei County (TW);  
**Jr-Ren Jeng**, Taipei (TW)

(73) Assignee: **SmartAnt Telecom.Co., Ltd.**, Hsinchu (TW)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 64 days.

(21) Appl. No.: **11/225,182**

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

(65) **Prior Publication Data**

US 2007/0057846 A1 Mar. 15, 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, 343/767, 770, 846, 848, 893**

See application file for complete search history.

(56) **References Cited**

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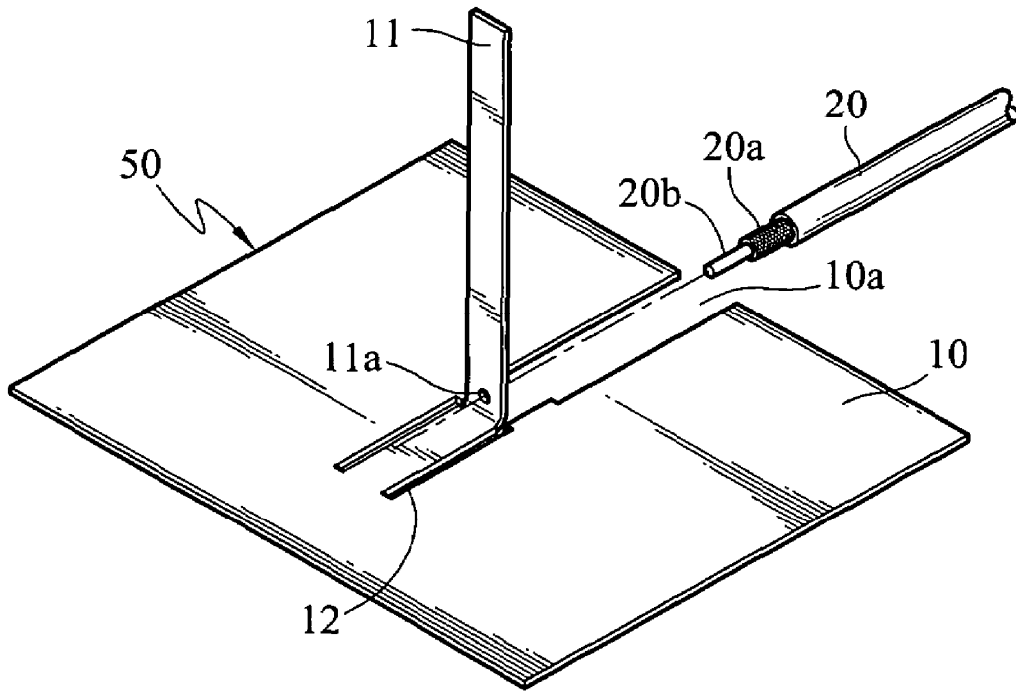
*Primary Examiner*—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Harness, Dickey & Pierce P.L.C.

(57) **ABSTRACT**

A symmetric-slot monopole antenna is provided, including a metallic board. Formed on the metallic board are a ground connection part to provide a ground circuit for the monopole antenna and a radiation part formed integrally on the ground connection part to receive and radiate signals transmitted through a signal cable.

**10 Claims, 7 Drawing Sheets**





US007358901B2

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

(10) **Patent No.:** **US 7,358,901 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **ANTENNA SYSTEM AND APPARATUS**

(75) Inventors: **Paul Eberhardt**, Encinitas, CA (US);  
**Vince Salazar**, San Diego, CA (US)

(73) Assignee: **Pulse-LINK, Inc.**, Carlsbad, CA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 227 days.

(21) Appl. No.: **11/254,148**

(22) Filed: **Oct. 18, 2005**

(65) **Prior Publication Data**

US 2007/0085743 A1 Apr. 19, 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, 828, 795, 797  
See application file for complete search history.

(56) **References Cited**

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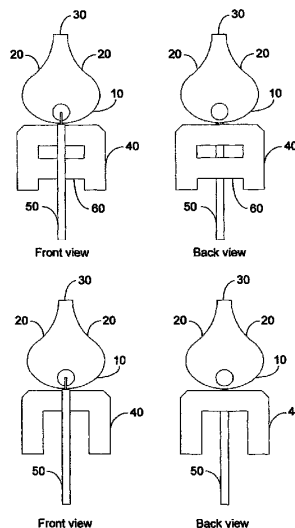
*Primary Examiner*—Tan Ho

(74) *Attorney, Agent, or Firm*—Peter Martinez

(57) **ABSTRACT**

An antenna design is provided. In one embodiment, the antenna is a planar element with a radiating element containing an elliptical curved portion connected to two curved regions, the curved regions meeting at a geometric construct. Another embodiment provides an antenna constructed with intersecting planar elements. A third embodiment is an antenna that is a solid of revolution of a planar element. Some antenna embodiments include ground plane elements to shape the radiation patterns. This Abstract is provided for the sole purpose of complying with the Abstract requirement rules that allow a reader to quickly ascertain the subject matter of the disclosure contained herein. This Abstract is submitted with the explicit understanding that it will not be used to interpret or to limit the scope or the meaning of the claims.

**24 Claims, 8 Drawing Sheets**







US007358902B2

(12) **United States Patent**  
**Erkocevic**

(10) **Patent No.:** **US 7,358,902 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **DUAL-BAND ANTENNA FOR A WIRELESS LOCAL AREA NETWORK DEVICE**

(75) Inventor: **Nedim Erkocevic**, Delfgauw (NL)

(73) Assignee: **Agere Systems Inc.**, Allentown, PA (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.: **11/279,520**

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

(65) **Prior Publication Data**

US 2006/0181464 A1 Aug. 17, 2006

**Related U.S. Application Data**

(63) Continuation of application No. 10/696,852, filed on Oct. 30, 2003, now Pat. No. 7,057,560.

(60) Provisional application No. 60/468,460, filed on May 7, 2003.

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

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

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

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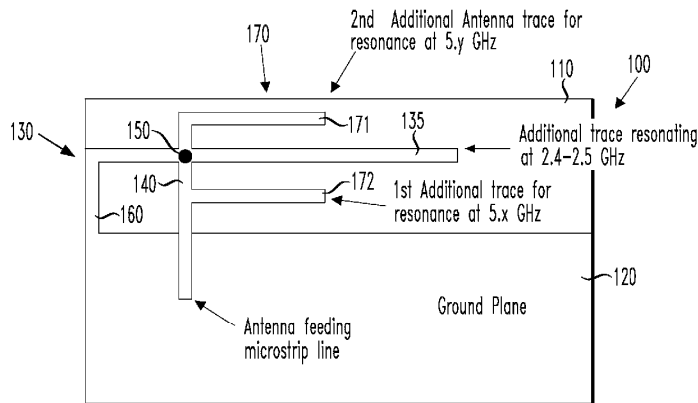
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*Primary Examiner*—Huedung Mancuso

(57) **ABSTRACT**

A dual-band antenna, a method of manufacturing the same and a wireless networking card incorporating the antenna. In one embodiment, the antenna includes: (1) a substrate, (2) an inverted F antenna printed circuit supported by the substrate and tuned to resonate in a first frequency band, wherein the inverted F antenna has a ground plane and a radiator located on one plane of the substrate and (3) a monopole antenna printed circuit supported by the substrate and located on a different plane than the ground plane, wherein the monopole antenna printed circuit is tuned to resonate in a second frequency band.

**20 Claims, 4 Drawing Sheets**





US007358903B1

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

(10) **Patent No.:** US 7,358,903 B1  
(45) **Date of Patent:** Apr. 15, 2008

(54) **TRIPLE-BAND EMBEDDED ANTENNA**

6,995,714 B2\* 2/2006 Sim et al. .... 343/702

(75) Inventors: **Jia-hung Su**, Tu-Cheng (TW);  
**Hung-jen Chen**, Tu-Cheng (TW); **Kai Shih**, Tu-Cheng (TW); **Yu-yuan Wu**, Tu-Cheng (TW)

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*Primary Examiner*—Shih-Chao Chen

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

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

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

(57) **ABSTRACT**

A triple-band embedded antenna includes an antenna base and a metal connecting board. A left groove, a right groove and a square opening are formed in the antenna base. A left branch is separated from the antenna base by the left groove, the left branch arranged in the outside of the left groove, a signal feed point formed in the left branch. A right branch is separated from the antenna base by the right groove, the right branch arranged in the outside of the right groove, a ground point formed in the right branch. The antenna base is for receiving or radiating the low frequency band signal. The left groove is for receiving or radiating the high frequency band signal. While the right groove coupled with the left groove, the left groove can receive or radiate another high frequency band signal, which is the third frequency band signal.

(21) Appl. No.: **11/730,400**

(22) Filed: **Apr. 2, 2007**

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01Q 11/12** (2006.01)  
**H01Q 13/10** (2006.01)

(52) **U.S. Cl.** ..... **343/700 MS**; 343/742; 343/770

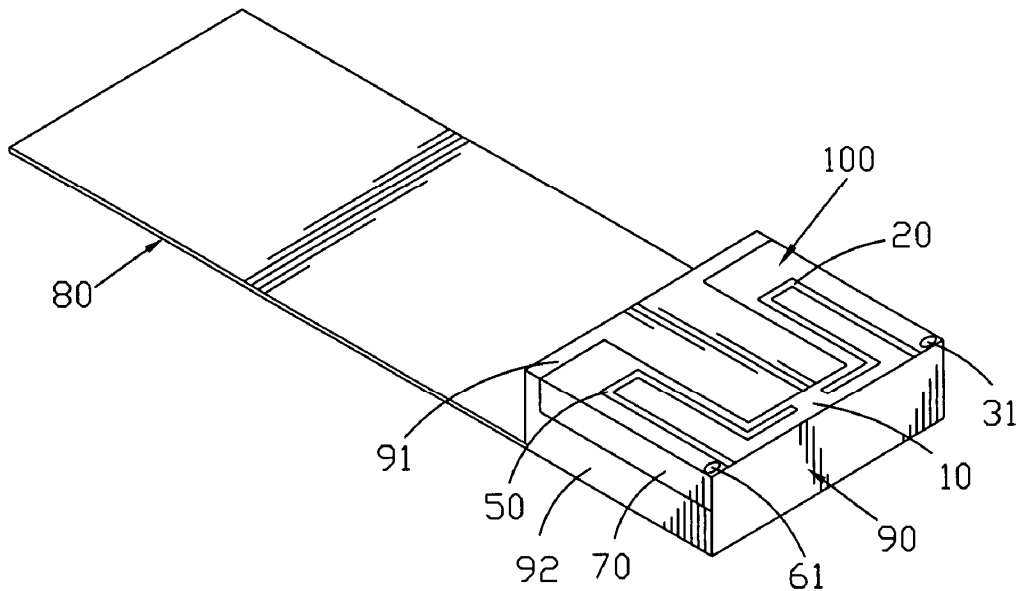
(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 742, 770, 725  
See application file for complete search history.

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**5 Claims, 2 Drawing Sheets**





US007358906B2

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

(10) **Patent No.:** **US 7,358,906 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **ANTENNA DEVICE AND MOBILE COMMUNICATION TERMINAL EQUIPPED WITH ANTENNA DEVICE**

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2002/0190903 A1 12/2002 Watada et al.  
2003/0169209 A1 9/2003 Ohara et al.

(75) Inventors: **Koichi Sato**, Fuchu (JP); **Takashi Amano**, Soka (JP)

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WO 97/47054 A 12/1997

(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 543 days.

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(21) Appl. No.: **10/948,877**

(22) Filed: **Sep. 24, 2004**

(65) **Prior Publication Data**

US 2005/0153756 A1 Jul. 14, 2005

(30) **Foreign Application Priority Data**

Jan. 13, 2004 (JP) ..... 2004-005751

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

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

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

See application file for complete search history.

(56) **References Cited**

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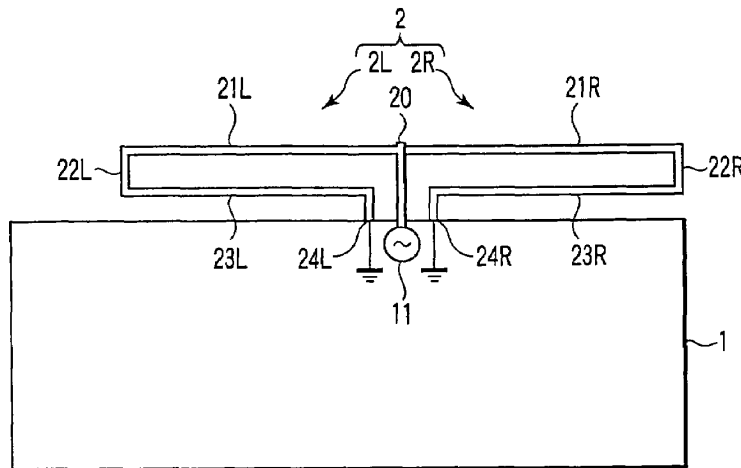
*Primary Examiner*—Tho Phan

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

(57) **ABSTRACT**

In an antenna device, a half wavelength dipole antenna is folded so as to form a forward path section, a folding section and a backward path section such that the backward path section is connected to the substrate at the ground terminal, and an electric power is supplied from the power supply source at the branching point, so as to configure a folded monopole antenna. Also, an additional antenna is folded similarly and connected to the monopole antenna such that the branching point and the power supply section are shared by the monopole antenna and the additional antenna.

**7 Claims, 8 Drawing Sheets**





US007358907B2

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

(10) **Patent No.:** **US 7,358,907 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

- (54) **SMALL-SIZED ANTENNA**
- (75) Inventors: **Shinichi Takaba**, Hitachi (JP); **Makoto Usui**, Hitachi (JP)
- (73) Assignee: **Hitachi Cable, Ltd.**, Tokyo (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 314 days.
- (21) Appl. No.: **11/077,158**
- (22) Filed: **Mar. 11, 2006**
- (65) **Prior Publication Data**  
US 2006/0097928 A1 May 11, 2006
- (30) **Foreign Application Priority Data**  
Nov. 5, 2004 (JP) ..... 2004-321925
- (51) **Int. Cl.**  
**H01Q 1/24** (2006.01)
- (52) **U.S. Cl.** ..... **343/702**
- (58) **Field of Classification Search** ..... 343/702,  
343/700 MS, 829, 841, 846  
See application file for complete search history.

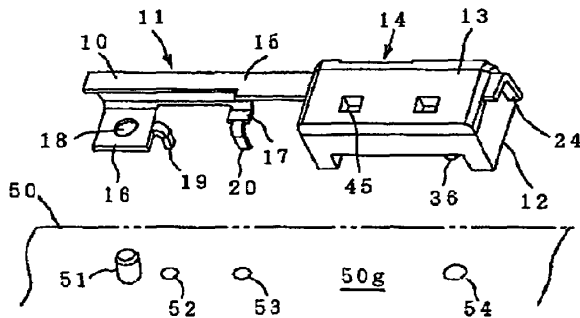
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- \* cited by examiner
- Primary Examiner*—Huedung Mancuso
- (74) *Attorney, Agent, or Firm*—McGinn IP Law Group, PLLC

(57) **ABSTRACT**

A small-sized antenna is adapted to be mounted on a circuit substrate. The antenna has an antenna body and a resin-molded body that has a first resin-molded body and a second resin-molded body. The antenna body is sandwiched by the first and second resin-molded bodies. The first resin-molded body engages to the second resin-molded body, and the first resin-molded body is mounted on the circuit substrate.

**14 Claims, 5 Drawing Sheets**



- 11:ANTENNA BODY
- 12:FIRST RESIN-MOLDED BODY
- 13:SECOND RESIN-MOLDED BODY
- 50:CIRCUIT SUBSTRATE
- 50g:GROUND PLANE
- 54:POSITIONING HOLE



US007358912B1

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

(10) **Patent No.:** **US 7,358,912 B1**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **COVERAGE ANTENNA APPARATUS WITH  
SELECTABLE HORIZONTAL AND  
VERTICAL POLARIZATION ELEMENTS**

(75) Inventors: **William Kish**, Saratoga, CA (US);  
**Victor Shtrom**, Sunnyvale, CA (US)

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

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

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(21) Appl. No.: **11/413,461**

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

EP 0 534 612 3/1993

**Related U.S. Application Data**

(60) Provisional application No. 60/694,101, filed on Jun.  
24, 2005.

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**H01Q 21/00** (2006.01)

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nia, Los Angeles, 2000 IEEE, pp. 544-548.

(52) **U.S. Cl.** ..... **343/725; 343/727**

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

(Continued)

See application file for complete search history.

*Primary Examiner*—Hoang V Nguyen

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

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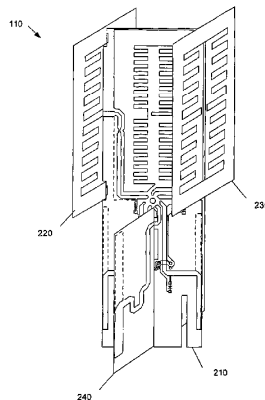
(57) **ABSTRACT**

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An antenna apparatus comprises selectable antenna ele-  
ments including a plurality of dipoles and/or a plurality of  
slot antennas ("slot"). Each dipole and/or each slot provides  
gain with respect to isotropic. The dipoles may generate  
vertically polarized radiation and the slots may generate  
horizontally polarized radiation. Each antenna element may  
have one or more loading structures configured to decrease  
the footprint (i.e., the physical dimension) of the antenna  
element and minimize the size of the antenna apparatus.

**17 Claims, 7 Drawing Sheets**





US007358914B1

(12) **United States Patent**  
**Horner**

(10) **Patent No.:** **US 7,358,914 B1**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **TAPERED SLOT ANTENNA END CAPS**

FOREIGN PATENT DOCUMENTS

(75) Inventor: **Rob Horner**, San Diego, CA (US)

JP 2003-152433 \* 5/2003

JP 2005-20389 \* 1/2005

(73) Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, DC (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 0 days.

*Primary Examiner*—Hoang V Nguyen  
(74) *Attorney, Agent, or Firm*—Peter A. Lipovsky; J. Eric Anderson; Ryan J. Friedl

(21) Appl. No.: **11/645,261**

(57) **ABSTRACT**

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

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

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

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

See application file for complete search history.

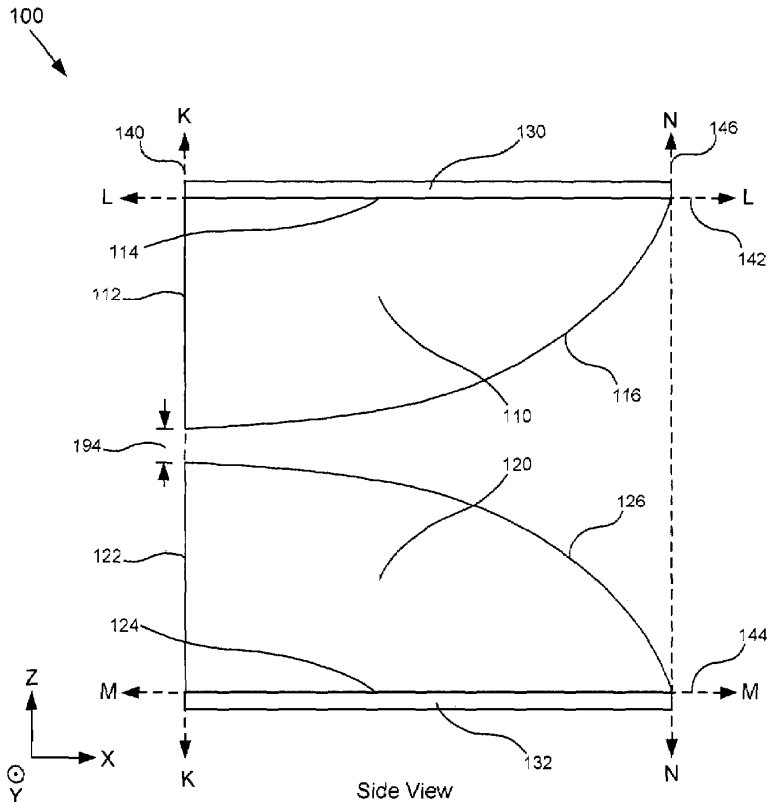
An apparatus includes a first end cap, a second end cap and a tapered slot antenna pair having a first antenna element and a second antenna element. The first end cap is electrically coupled to the first antenna element and comprises conductive material. The second end cap is electrically coupled to the second antenna element and comprises conductive material. The first end cap and the second end cap are configured to provide induction-cancelling, capacitive coupling when the apparatus operates at frequencies below a theoretical cutoff frequency.

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**16 Claims, 8 Drawing Sheets**





US007358916B2

(12) **United States Patent**  
**Milyakh**

(10) **Patent No.:** **US 7,358,916 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

(54) **POLARIZATION DIVERSITY ANTENNA SYSTEM**  
(75) Inventor: **Yaroslav Milyakh, Suwon-si (KR)**  
(73) Assignee: **Samsung Electronics Co., Ltd., Suwon (KR)**

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

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(21) Appl. No.: **11/581,446**

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

(65) **Prior Publication Data**

US 2007/0097007 A1 May 3, 2007

(30) **Foreign Application Priority Data**

Nov. 3, 2005 (KR) ..... 10-2005-0104995

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

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

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

(56) **References Cited**

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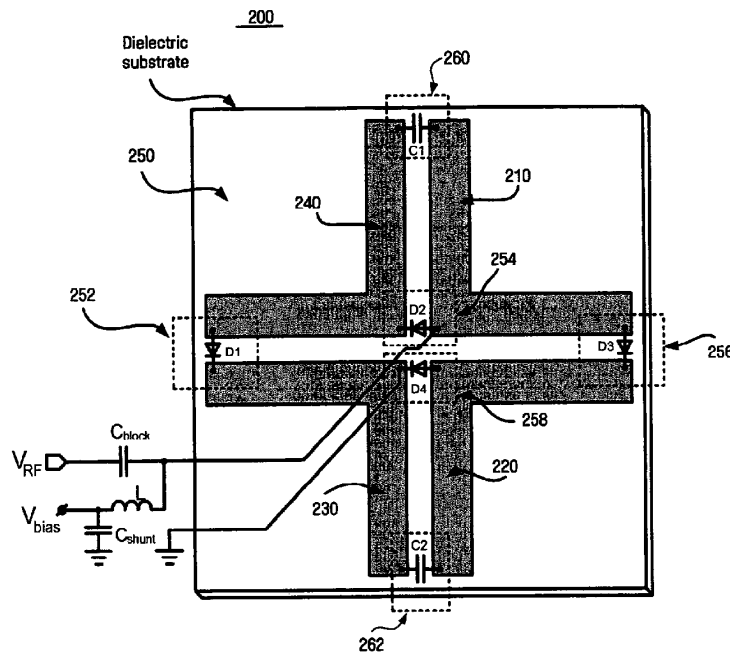
*Primary Examiner*—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

A polarization diversity antenna system includes antenna elements having first to fourth slotlines bent at right angles so that the second slotline is provided adjacent to the first slotline, the third slotline is diagonally opposite to the first slotline and provided adjacent to the second slotline, and the fourth slotline is provided adjacent to the third slotline and diagonally opposite to the second slotline, and a switching network in which coupling units are formed between ends of the horizontal slotlines and between ends of the vertical slotlines that are close to intersections of the vertical and horizontal slotlines to determine polarization.

**10 Claims, 6 Drawing Sheets**





US007358918B2

(12) **United States Patent**  
**Itsuji**

(10) **Patent No.:** **US 7,358,918 B2**  
(45) **Date of Patent:** **Apr. 15, 2008**

- (54) **PLANAR ANTENNA APPARATUS**
- (75) Inventor: **Takeaki Itsuji**, Hiratsuka (JP)
- (73) Assignee: **Canon Kabushiki Kaisha**, Tokyo (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 239 days.

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*Primary Examiner*—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Fitzpatrick, Cella, Harper & Scinto

- (21) Appl. No.: **11/230,821**
- (22) Filed: **Sep. 21, 2005**
- (65) **Prior Publication Data**  
US 2006/0061510 A1 Mar. 23, 2006
- (30) **Foreign Application Priority Data**  
Sep. 21, 2004 (JP) ..... 2004-272676  
Mar. 17, 2005 (JP) ..... 2005-077213

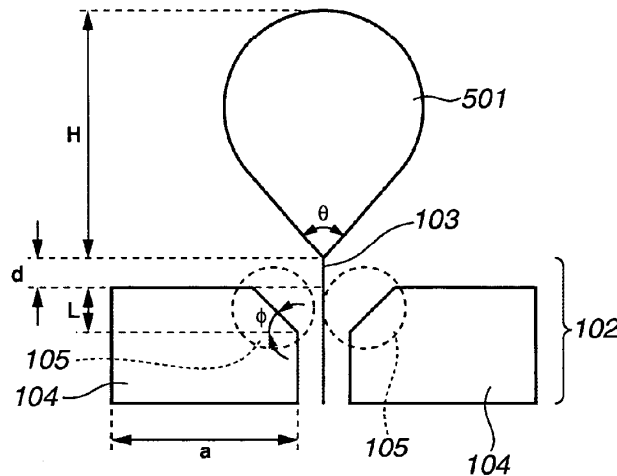
- (51) **Int. Cl.**  
**H01Q 13/00** (2006.01)  
**H01Q 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **343/772; 343/700 MS**
- (58) **Field of Classification Search** ..... **343/700 MS, 343/795, 845, 846, 772**  
See application file for complete search history.

- (56) **References Cited**  
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6,448,553 B1 9/2002 Itsuji et al. .... 250/306

(57) **ABSTRACT**

An antenna apparatus including a dielectric substrate, a planar antenna element disposed on the substrate, and a waveguide for propagating electromagnetic waves to or from the planar antenna element. The waveguide includes at least a first conductor and a second conductor extending along each other. Near a connection portion formed between the first and second conductors and the planar antenna element, there is provided a taper region in which a distance between mutually-facing edge portions of the first conductor and the second conductor increases approximately monotonically toward the planar antenna element.

**8 Claims, 20 Drawing Sheets**







US007358926B2

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

(10) **Patent No.:** US 7,358,926 B2  
(45) **Date of Patent:** Apr. 15, 2008

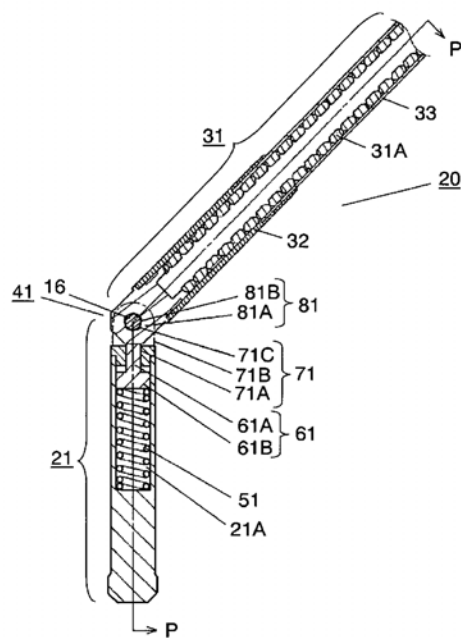
- (54) **ANTENNA DEVICE**
  - (75) Inventors: **Shinzo Komoto**, Okayama (JP); **Hideto Sadamori**, Okayama (JP); **Setsuo Takesako**, Osaka (JP)
  - (73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka (JP)
  - (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 91 days.
  - (21) Appl. No.: **11/398,722**
  - (22) Filed: **Apr. 6, 2006**
  - (65) **Prior Publication Data**  
US 2006/0227055 A1 Oct. 12, 2006
  - (30) **Foreign Application Priority Data**  
Apr. 7, 2005 (JP) ..... 2005-110615
  - (51) **Int. Cl.**  
**H01Q 9/30** (2006.01)
  - (52) **U.S. Cl.** ..... **343/900; 343/702**
  - (58) **Field of Classification Search** ..... 343/900,  
343/702, 882, 889
- See application file for complete search history.

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- Primary Examiner*—Trinh Dinh  
*Assistant Examiner*—Dieu Hien T Duong  
(74) *Attorney, Agent, or Firm*—Wenderoth, Lind & Ponack, L.L.P.

(57) **ABSTRACT**

An antenna device is provided that is preferably used for various wireless devices such as television receivers and the like. An antenna rod can be stopped at a predetermined angle position via a hinge mechanism. The antenna device includes a hinge mechanism by which a biasing force of a coil spring stored in an antenna base causes an upper end of a circular-cylindrical projection of an abutting member to be abutted with an end face of a projection section of an intermediate member fixed to a lower part or antenna rod, thereby stopping the antenna rod at a predetermined angle position. When the antenna rod is moved to a different angle position, the abutting member has a biased movement in the downward direction. This can suppress the wear of the circular-cylindrical projection.

**19 Claims, 8 Drawing Sheets**





US007362271B2

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

(10) **Patent No.:** **US 7,362,271 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **ANTENNA APPARATUS, COMMUNICATION APPARATUS, AND ANTENNA APPARATUS DESIGNING METHOD**

(75) Inventors: **Hiroshi Iwai**, Kantano (JP); **Atsushi Yamamoto**, Osaka (JP); **Kenichi Yamada**, Yokohama (JP); **Shinji Kamaeguchi**, 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 0 days.

(21) Appl. No.: **10/347,060**

(22) Filed: **Jan. 17, 2003**

(65) **Prior Publication Data**  
US 2003/0179143 A1 Sep. 25, 2003

(30) **Foreign Application Priority Data**  
Jan. 18, 2002 (JP) ..... 2002-010572

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

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

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

See application file for complete search history.

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*Primary Examiner*—Wilson Lee

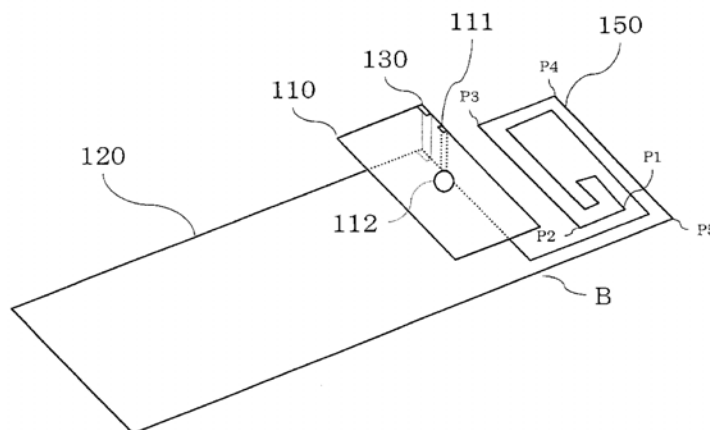
(74) *Attorney, Agent, or Firm*—RatnerPrestia

(57) **ABSTRACT**

For a PDC (Personal Digital Cellular) folding cellular phone that uses, for example, an 800-MHz band for communication, it is desirable to reduce a height of an antenna apparatus in order to reduce a thickness of the cellular phone.

An antenna apparatus including an antenna element having a feeding plate, a ground plate arranged opposite the antenna element, a short circuit section that connects the antenna element and the ground plate together, and one or more ground wires each connected to the ground plate at a predetermined position and each having a (1) linear shape or a (2) bent or curved shape.

**3 Claims, 27 Drawing Sheets**





US007362272B2

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

(10) **Patent No.:** **US 7,362,272 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **CIRCULARLY POLARIZED ANTENNA**

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7,026,998 B2\* 4/2006 Chang et al. .... 343/700 MS  
7,138,949 B1\* 11/2006 Ryken et al. .... 343/700 MS

(75) Inventors: **The-Nan Chang**, Taipei (TW);  
**Shih-Wei Lin**, Taipei (TW)

(73) Assignees: **Tatung Company**, Taipei (TW);  
**Tatung University**, Taipei (TW)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 58 days.

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*Primary Examiner*—Trinh Dinh  
*Assistant Examiner*—Dieu Hien T Duong  
(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(21) Appl. No.: **11/362,824**

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

(65) **Prior Publication Data**

US 2007/0096989 A1 May 3, 2007

(30) **Foreign Application Priority Data**

Nov. 1, 2005 (TW) ..... 94138300 A

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/820; 343/732**

(58) **Field of Classification Search** ..... **343/700 MS, 343/820, 732**

See application file for complete search history.

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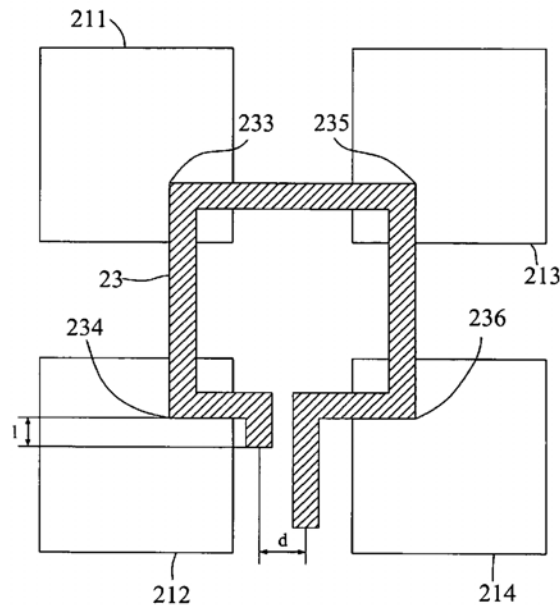
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(57) **ABSTRACT**

The present invention relates to techniques to excite a circularly polarized antenna and, more particularly, to a circularly polarized antenna having a QUAD-EMC unit structure. It comprises plural polarized antenna elements; a signal distributor; and a signal coupling element electrically coupled to the polarized antenna elements and electrically connected to the signal distributor; wherein, when the circularly polarized antenna is in a transmitting state, the signal coupling element sends the electrical signal from the signal distributor to the polarized antenna elements, and the polarized antenna elements transform the electrical signal into the circularly polarized signal and transmit the circularly polarized signal thereafter; when the circularly polarized antenna is in a receiving state, the polarized antenna elements receive the circularly polarized signal and transform the circularly polarized signal into the electrical signal, and the signal coupling element sends the electrical signal from the polarized antenna elements to the signal distributor.

**5 Claims, 8 Drawing Sheets**





US007362273B2

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

(10) **Patent No.:** **US 7,362,273 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

- (54) **DUAL-POLARIZED FEED ANTENNA APPARATUS AND METHOD OF USE**
- (75) Inventors: **Mohammad Sarehraz**, Tampa, FL (US); **Kenneth A. Buckle**, Tampa, FL (US); **Elias Stefanakos**, Tampa, FL (US); **Thomas Weller**, Lutz, FL (US); **D. Yogi Goswami**, Gainesville, FL (US)
- (73) Assignee: **University of South Florida**, Tampa, FL (US)
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 4 days.
- (21) Appl. No.: **11/534,781**
- (22) Filed: **Sep. 25, 2006**
- (65) **Prior Publication Data**  
US 2007/0096990 A1 May 3, 2007
- Related U.S. Application Data**
- (60) Provisional application No. 60/720,331, filed on Sep. 23, 2005, provisional application No. 60/720,296, filed on Sep. 23, 2005.
- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)

- (52) **U.S. Cl.** ..... **343/700 MS; 343/771**
- (58) **Field of Classification Search** ..... **343/700 MS, 343/771, 772; 333/252; 455/81**  
See application file for complete search history.

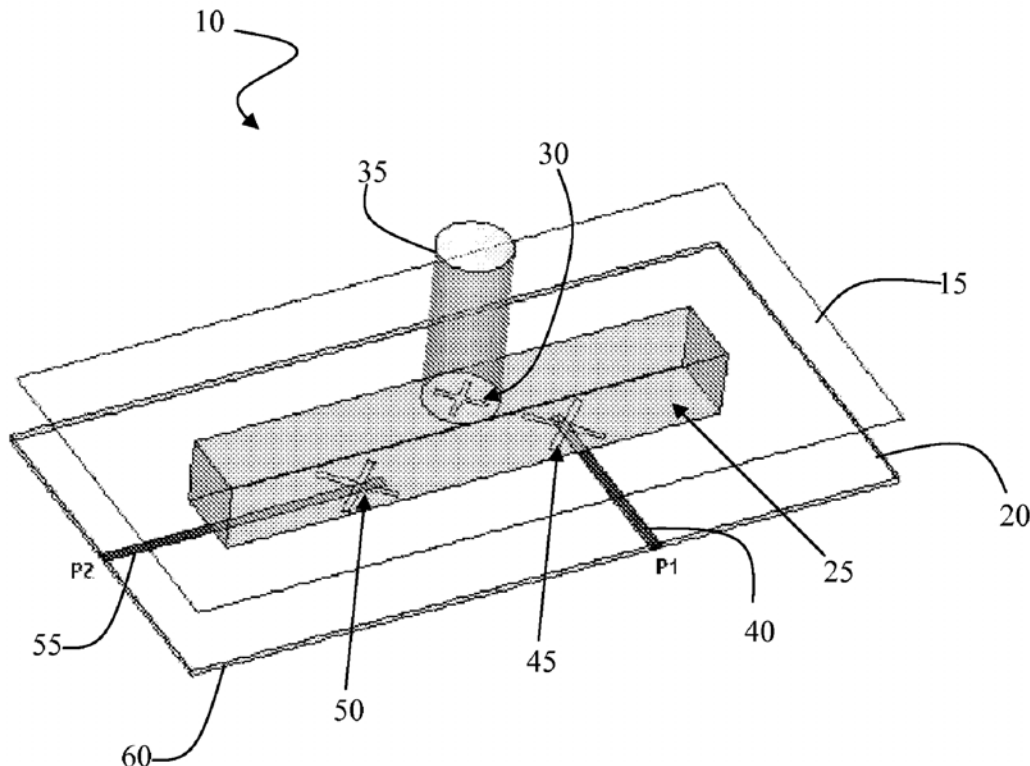
- (56) **References Cited**  
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*Primary Examiner*—Huedung Mancuso  
*(74) Attorney, Agent, or Firm*—Moll L. Sauter; Smith & Hopen, P.A.

(57) **ABSTRACT**  
 An antenna apparatus and method for the interception of randomly polarized electromagnetic waves utilizing a dual polarized antenna which is excited through a cross-slot aperture using two well-isolated orthogonal feeds.

**15 Claims, 4 Drawing Sheets**





US007362274B1

(12) **United States Patent**  
**Lien**

(10) **Patent No.:** **US 7,362,274 B1**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **COUPLED FEED-IN BUTTERFLY SHAPED LEFT/RIGHT HAND CIRCULARLY POLARIZED MICROSTRIP ANTENNA**

2007/0188384 A1\* 8/2007 Liu ..... 343/700 MS  
\* cited by examiner

*Primary Examiner*—Trinh Vo Dinh

(76) **Inventor:** **Huan-Cheng Lien**, No. 13, Alley 36, Lane 457, Siping Rd., Douliou City, Yunlin County 640 (TW)

(57) **ABSTRACT**

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

A coupled feed-in butterfly shaped left/right hand circularly polarized microstrip antenna includes a delta resonator, a butterfly shaped radiator, an elongated rectangular feed line, a connecting sheet, a cylindrical conductor, a signal receiving adapter, and a feed-in terminal. All the above components are disposed in parallel in the three dimensional space. The butterfly shaped radiator has a cavity formed at the position corresponding to the delta resonator. A pair of front wing tips and a pair of rear wing tips are respectively formed symmetrically at the front corners and the rear corners of the butterfly shaped radiator. The elongated rectangular feed line is electrically connected to the butterfly shaped radiator with the connecting sheet, and the cylindrical conductor is facing to a circular hole formed on the butterfly shaped radiator in the manner able to adjust the impedance bandwidth. With this structure, a left/right hand circularly polarized microstrip antenna having broader impedance and axial ratio bandwidth can be obtained.

(21) **Appl. No.:** **11/563,682**

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

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/750**

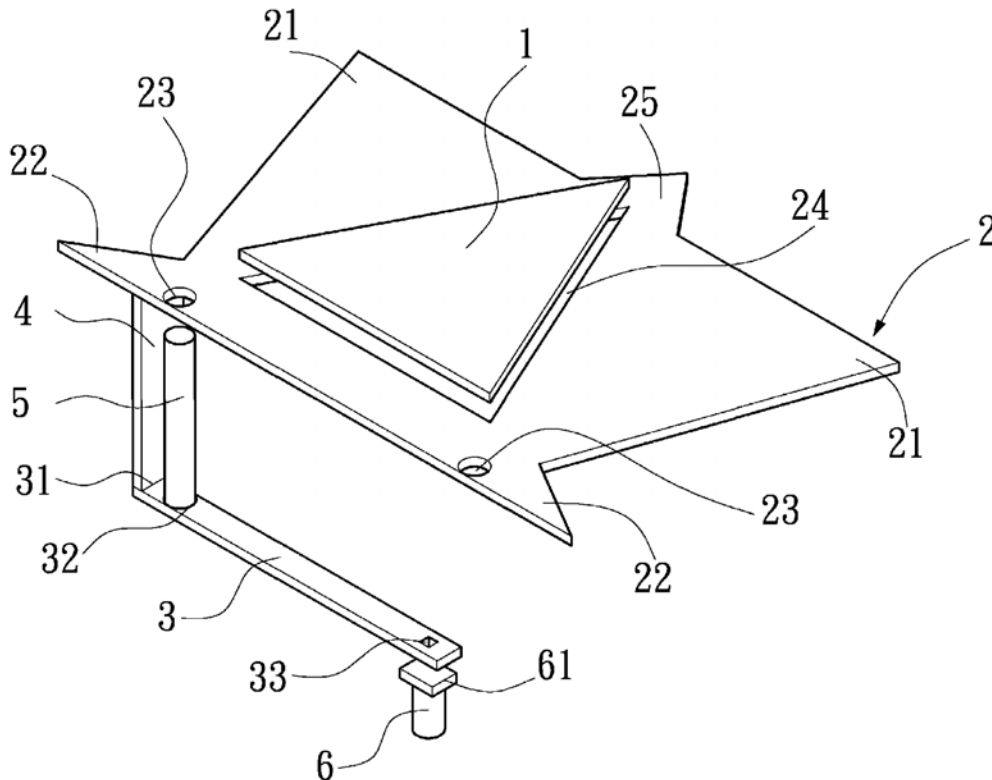
(58) **Field of Classification Search** ..... 343/700 MS  
See application file for complete search history.

(56) **References Cited**

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**3 Claims, 9 Drawing Sheets**





US007362275B2

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

(10) **Patent No.:** **US 7,362,275 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **INTERNAL ANTENNA AND MOTHERBOARD ARCHITECTURE**

(75) Inventors: **Jerome Tu**, Saratoga, CA (US);  
**Weiping Dou**, San Jose, CA (US)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 51 days.

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2004/0253972 A1 *	12/2004	Iwai et al.	455/550.1
2007/0052589 A1 *	3/2007	Liu	343/700 MS

(21) Appl. No.: **11/355,159**

(22) Filed: **Feb. 14, 2006**

(65) **Prior Publication Data**  
US 2007/0188391 A1 Aug. 16, 2007

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
(52) **U.S. Cl.** ..... **343/702**  
(58) **Field of Classification Search** ..... **343/702,**  
**343/700 MS, 846, 848, 841; 455/90.3, 117,**  
**455/575.5**

See application file for complete search history.

(56) **References Cited**  
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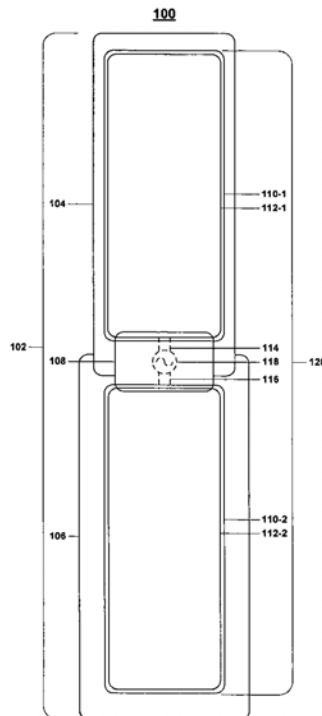
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*Primary Examiner*—Huedung Mancuso  
(74) *Attorney, Agent, or Firm*—Kacvinsky LLC

(57) **ABSTRACT**

Various embodiments of an internal antenna and motherboard architecture are described. In one embodiment, a wireless device may include a housing enclosing a first motherboard and a second motherboard. The ground plane of the first motherboard may be coupled to the ground plane of the second motherboard within the housing. The first motherboard and the second motherboard may act as an internal antenna system for the wireless device. Other embodiments are described and claimed.

**20 Claims, 13 Drawing Sheets**





US007362276B2

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

(10) **Patent No.:** **US 7,362,276 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **HAND-HELD COMMUNICATION DEVICE WITH A ROTATABLE ANTENNA**

(75) Inventors: **Kuo-Chu Liao**, Taipei (TW);  
**Ching-Chung Tang**, Taipei (TW);  
**Chung-Yuan Kuang**, Taipei (TW)

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

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

(21) Appl. No.: **11/527,673**

(22) Filed: **Sep. 27, 2006**

(65) **Prior Publication Data**

US 2007/0080875 A1 Apr. 12, 2007

(30) **Foreign Application Priority Data**

Sep. 29, 2005 (TW) ..... 94133985 A

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

(52) **U.S. Cl.** ..... 343/702; 343/882

(58) **Field of Classification Search** ..... 343/702,  
343/872, 881, 882

See application file for complete search history.

(56) **References Cited**

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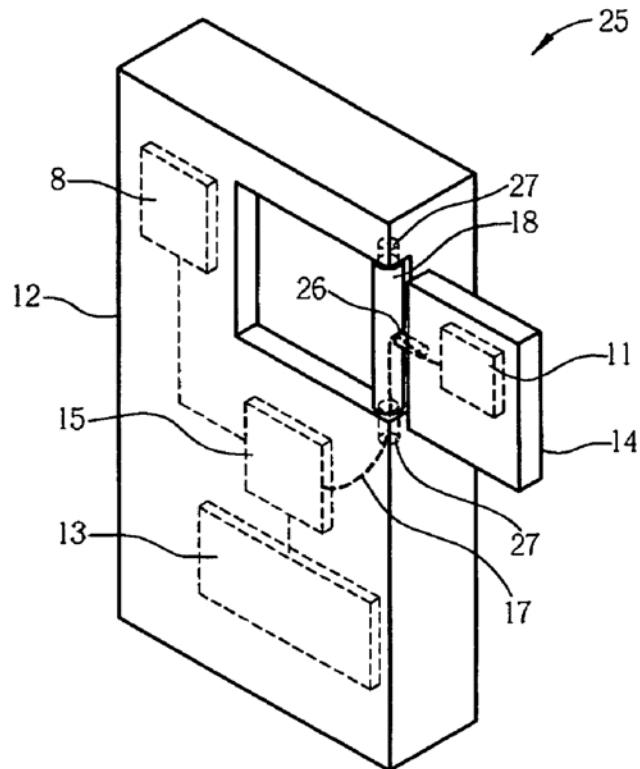
*Primary Examiner*—Tho Phan

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

(57) **ABSTRACT**

Hand-held communication device includes a first housing, a rotation axle connected to the first housing in a rotatable manner, a second housing, an antenna installed inside the second housing, and a rod with one end connected to the rotation axle in a rotatable manner and the other end connected to the second housing. The antenna can be positioned to optimize radio frequency signal reception by rotating the rotation axle with respect to the first housing and rotating the rod with respect to the rotation axle.

**8 Claims, 8 Drawing Sheets**





US007362277B2

(12) **United States Patent**  
**Su**

(10) **Patent No.:** **US 7,362,277 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **MULTI-BAND ANTENNA**

(75) Inventor: **Wen-Fong Su, 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 0 days.

(21) Appl. No.: **11/599,659**

(22) Filed: **Nov. 14, 2006**

(65) **Prior Publication Data**  
US 2007/0109200 A1 May 17, 2007

(30) **Foreign Application Priority Data**  
Nov. 14, 2005 (TW) ..... 94139847 A

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

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

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 846, 829, 830**

See application file for complete search history.

(56) **References Cited**

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*Primary Examiner*—Hoang V Nguyen

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

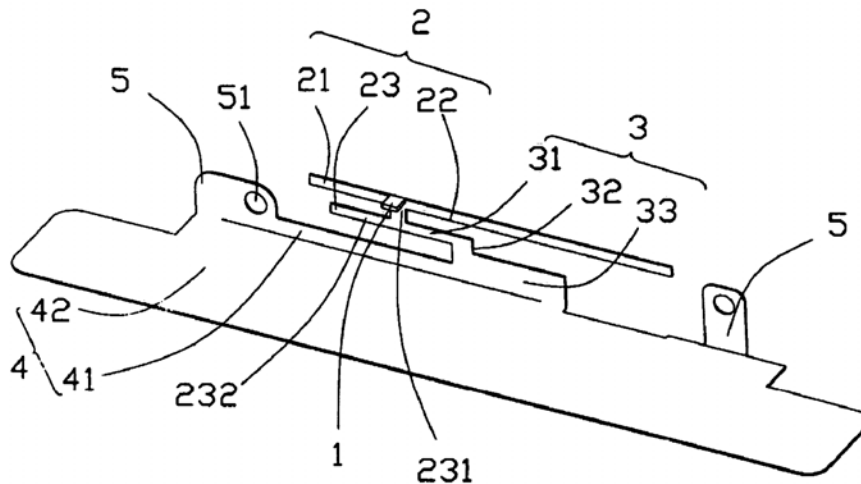
(57) **ABSTRACT**

A multi-band antenna used in an electronic device, including a radiating element, a grounding element, a connecting element connecting the radiating element and the grounding element, a feeding cap, and an installing element. The feeding cap locates at the feeding point according to calculation. An inner conductor of a feeding line (no shown) of the multi-band antenna in accordance with the present invention is capable of being soldered inerrably at the feeding cap, accordingly, the multi-band antenna can achieve a good performance of operation.

**19 Claims, 2 Drawing Sheets**

10

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US007362280B2

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

(10) **Patent No.:** **US 7,362,280 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **SYSTEM AND METHOD FOR A MINIMIZED ANTENNA APPARATUS WITH SELECTABLE ELEMENTS**

5,220,340 A 6/1993 Shafai  
5,754,145 A 5/1998 Evans  
5,767,809 A 6/1998 Chuang et al.

(75) Inventors: **Victor Shtrom**, Sunnyvale, CA (US);  
**William S. Kish**, Saratoga, CA (US)

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

EP 0534612 3/1993

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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 106 days.

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U.S. Appl. No. 11/022,080, Victor Shtrom, Circuit Board Having a Peripheral Antenna Apparatus with Selectable Antenna Elements, filed Dec. 23, 2004.

(21) Appl. No.: **11/041,145**

(Continued)

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

*Primary Examiner*—Shih-Chao Chen

(65) **Prior Publication Data**

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

US 2006/0038735 A1 Feb. 23, 2006

(57) **ABSTRACT**

**Related U.S. Application Data**

A system and method for a wireless link to a remote receiver includes a communication device for generating RF and an antenna apparatus for transmitting the RF. The antenna apparatus comprises a plurality of substantially coplanar modified dipoles. Each modified dipole provides gain with respect to isotropic and a horizontally polarized directional radiation pattern. Further, each modified dipole has one or more loading structures configured to decrease the footprint (i.e., the physical dimension) of the modified dipole and minimize the size of the antenna apparatus. The modified dipoles may be electrically switched to result in various radiation patterns. With multiple of the plurality of modified dipoles active, the antenna apparatus may form an omnidirectional horizontally polarized radiation pattern. One or more directors may be included to concentrate the radiation pattern. The antenna apparatus may be conformally mounted to a housing containing the communication device and the antenna apparatus.

(60) Provisional application No. 60/602,711, filed on Aug. 18, 2004, provisional application No. 60/603,157, filed on Aug. 18, 2004.

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

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

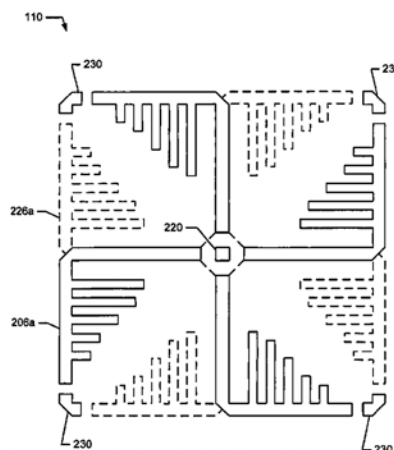
(58) **Field of Classification Search** ..... **343/700 MS, 343/793, 795, 846, 876**  
See application file for complete search history.

(56) **References Cited**

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**24 Claims, 5 Drawing Sheets**





US007362281B2

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

(10) **Patent No.:** **US 7,362,281 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **PLANAR ANTENNA FOR RADIO  
FREQUENCY IDENTIFICATION TAG**

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

(75) Inventors: **Chi-Fang Huang**, Taipei (TW);  
**Jing-Qing Zhan**, Taipei (TW)

(56) **References Cited**

(73) Assignees: **Tatung Company**, Taipei (TW);  
**Tatung University**, Taipei (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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MS

(21) Appl. No.: **11/557,500**

7,202,822 B2\* 4/2007 Baliarda et al. .... 343/700 MS  
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(22) Filed: **Nov. 8, 2006**

*Primary Examiner*—Hoang V Nguyen  
(74) *Attorney, Agent, or Firm*—Jianq Chyun IP Office

(65) **Prior Publication Data**  
US 2008/0001838 A1 Jan. 3, 2008

(57) **ABSTRACT**

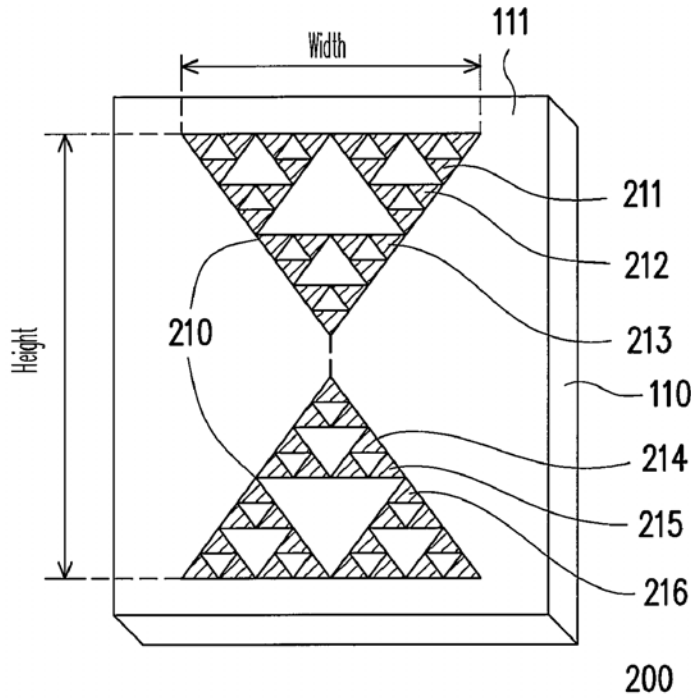
(30) **Foreign Application Priority Data**  
Jun. 29, 2006 (TW) ..... 95123484 A

A planar antenna for a radio frequency identification tag which receives or transmits an electromagnetic signal is provided. The planar antenna comprises a dielectric slab and a fractal dipole antenna. The height of the fractal dipole antenna is 0.3 to 0.7 times of the half wavelength of the electromagnetic signal, and the width of the fractal dipole antenna is 0.7 to 1.1 times of the half wavelength of the electromagnetic signal. The planar antenna achieves miniaturization and a good matching by utilizing the optimal size of the fractal dipole antenna.

(51) **Int. Cl.**  
**H01Q 9/28** (2006.01)  
**H01Q 1/38** (2006.01)

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

**16 Claims, 3 Drawing Sheets**





US007362283B2

(12) **United States Patent**  
**Quintero Illera et al.**

(10) **Patent No.:** **US 7,362,283 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **MULTILEVEL AND SPACE-FILLING  
GROUND-PLANES FOR MINIATURE AND  
MULTIBAND ANTENNAS**

(75) Inventors: **Ramiro Quintero Illera**, Barcelona  
(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.: **10/797,732**

(22) Filed: **Mar. 10, 2004**

(65) **Prior Publication Data**

US 2004/0217916 A1 Nov. 4, 2004

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

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

(58) **Field of Classification Search** ..... **343/700 MS,**  
**343/846, 848, 828, 829, 702**  
See application file for complete search history.

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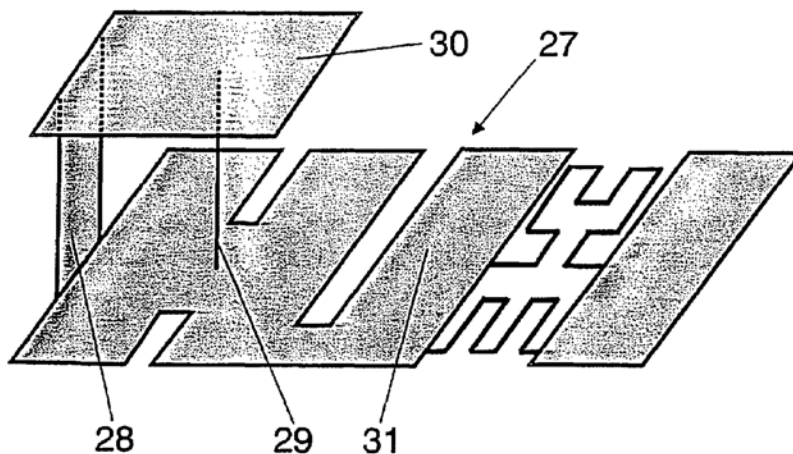
(Continued)

*Primary Examiner*—Hoanganh Le  
(74) *Attorney, Agent, or Firm*—Winstead PC

(57) **ABSTRACT**

An antenna system includes one or more conductive elements acting as radiating elements, and a multilevel or space-filling ground-plane, wherein said ground-plane has a particular geometry which affects the operating characteristics of the antenna. The return loss, bandwidth, gain, radiation efficiency, and frequency performance can be controlled through multilevel and space-filling ground-plane design. Also, said ground-plane can be reduced compared to those of antennas with solid ground-planes.

**36 Claims, 19 Drawing Sheets**





US007362285B2

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

(10) **Patent No.:** **US 7,362,285 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **COMPACT RADIO FREQUENCY TRANSMITTING AND RECEIVING ANTENNA AND CONTROL DEVICE EMPLOYING SAME**

5,340,954 A 8/1994 Hoffman et al.  
5,736,965 A 4/1998 Mosebrook et al.  
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(75) Inventors: **Spencer L. Webb**, Pelham, NH (US);  
**Stephen S. Thompson**, London (GB);  
**Gregory S. Altonen**, Easton, PA (US);  
**Edward M. Felegy, Jr.**, Macungie, PA (US);  
**Siddharth P. Sinha**, London (GB)

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(73) Assignee: **Lutron Electronics Co., Ltd.**,  
Coopersburg, PA (US)

DE 88 00 025 U1 4/1988

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 276 days.

(Continued)

*Primary Examiner*—Trinh Vo Dinh  
(74) *Attorney, Agent, or Firm*—Ostrolenk, Faber, Gerb & Soffen, LLP

(21) Appl. No.: **10/873,033**

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2005/0280598 A1 Dec. 22, 2005

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

(52) **U.S. Cl.** ..... **343/866; 343/867; 343/841; 235/451**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 741, 742, 866, 867, 870; 235/451**  
See application file for complete search history.

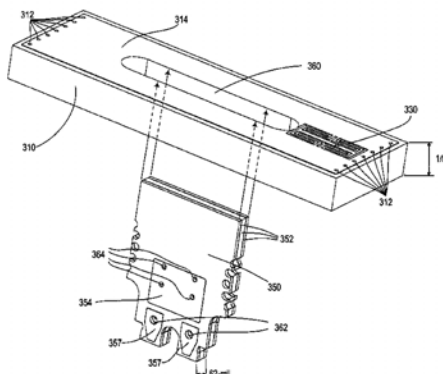
A compact antenna for use in a device for controlling the power delivered to an electric load and operable to transmit or receive radio frequency signals at a specified frequency is presented. The antenna comprises a first loop of conductive material having a capacitance and an inductance forming a circuit being resonant at the specified frequency, and a second loop of conductive material having two ends adapted to be electrically coupled to an electronic circuit. The second loop is substantially only magnetically coupled to the first loop and is electrically isolated from the first loop. In a first embodiment of the antenna, the first and second loops are formed on respective first and second printed circuit boards, which allow for a small, low-cost antenna that is easy to manufacture and maximizes efficiency. When the antenna is installed in a load control device, such as a dimmer, the first loop of the antenna is mounted on an outer surface of the device. The second loop of the antenna may be at a high-voltage potential such as line voltage.

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**18 Claims, 13 Drawing Sheets**





US007362286B2

(12) **United States Patent**  
**Fang**

(10) **Patent No.:** **US 7,362,286 B2**  
(45) **Date of Patent:** **Apr. 22, 2008**

(54) **DUAL BAND ANTENNA DEVICE, WIRELESS COMMUNICATION DEVICE AND RADIO FREQUENCY CHIP USING THE SAME**

(75) Inventor: **Shyh-Tirng Fang**, Tainan (TW)

(73) Assignee: **Mediatek Inc.**, Hsin-Chu (TW)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 270 days.

(21) Appl. No.: **11/236,199**

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

(65) **Prior Publication Data**  
US 2006/0082506 A1 Apr. 20, 2006

(30) **Foreign Application Priority Data**  
Oct. 14, 2004 (TW) ..... 93131132 A

(51) **Int. Cl.**  
**H01Q 1/36** (2006.01)  
(52) **U.S. Cl.** ..... **343/895; 343/702**  
(58) **Field of Classification Search** ..... **343/895, 343/700 MS, 702**  
See application file for complete search history.

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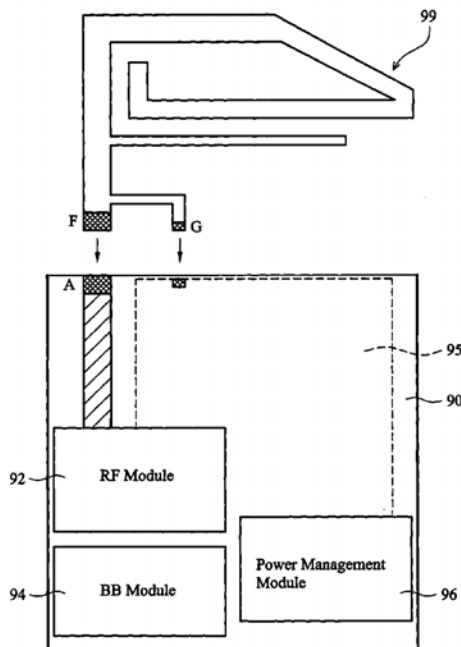
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*Primary Examiner*—Hoanganh Le  
(74) *Attorney, Agent, or Firm*—Thomas, Kayden, Horstemeyer & Risley

(57) **ABSTRACT**

A dual band antenna device operable in a first frequency band and a second frequency band is disclosed. The device comprises a first radiation body and a second radiation body. The first radiation body forms a single path with at least two bend portions. A portion of the second radiation body is parallel to a portion of the first radiation body in a specific distance. In addition, a wireless communication device and radio frequency chip having a built in dual band antenna device are also disclosed.

**44 Claims, 10 Drawing Sheets**





US007365684B2

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

(10) **Patent No.:** **US 7,365,684 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **ANTENNA HAVING A FILTER AND A SIGNAL FEED-IN POINT**

(75) Inventors: **Jia-Haur Liang**, Kaohsiung (TW);  
**Ting-Yi Tsal**, Taipei (TW)

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

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 64 days.

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(21) Appl. No.: **11/255,657**

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

(65) **Prior Publication Data**

US 2006/0273975 A1 Dec. 7, 2006

(30) **Foreign Application Priority Data**

Jun. 1, 2005 (TW) ..... 94118077 A

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/795; 343/909**

(58) **Field of Classification Search** ..... **343/700 MS, 343/795, 909**  
See application file for complete search history.

(56) **References Cited**

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*Primary Examiner*—Tan Ho

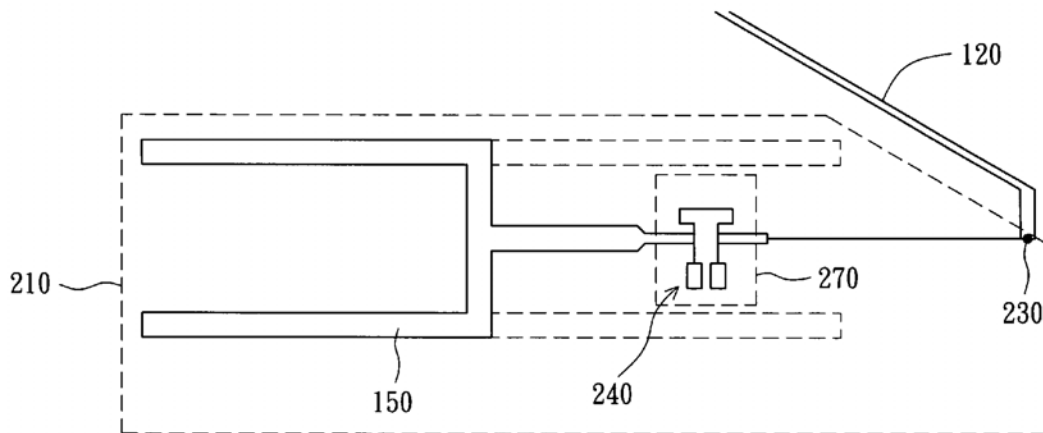
(74) *Attorney, Agent, or Firm*—Thomas, Kayden, Horstemeyer & Risley

(57) **ABSTRACT**

An antenna structure used in an electronic device includes a signal transmission line and an antenna unit. The signal transmission line is electrically coupled to the electronic device. The antenna unit includes a signal feed-in point, a filter, and a radiation part. The signal feed-in point is electrically coupled to the electronic device via the signal transmission line. The filter has a first end electrically coupled to the signal feed-in point. The radiation part is electrically coupled to a second end of the filter.

**21 Claims, 4 Drawing Sheets**

200





US007365685B2

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

(10) **Patent No.:** **US 7,365,685 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **ANTENNA DEVICE**  
(75) Inventors: **Shoichi Takeuchi**, Aiko-gun (JP);  
**Hiroyuki Hayakawa**, Aiko-gun (JP);  
**Koichi Osada**, Aiko-gun (JP); **Ryuta**  
**Sonoda**, Aiko-gun (JP)

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(73) Assignee: **Asahi Glass Company, Limited**, 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 92 days.

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(21) Appl. No.: **11/256,050**

(Continued)

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

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(65) **Prior Publication Data**  
US 2006/0109178 A1 May 25, 2006

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**Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2004/  
005880, filed on Apr. 23, 2004.

*Primary Examiner*—Tan Ho

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

(30) **Foreign Application Priority Data**

Apr. 24, 2003 (JP) ..... 2003-119944  
Aug. 1, 2003 (JP) ..... 2003-285224  
Mar. 9, 2004 (JP) ..... 2004-065647

(57) **ABSTRACT**

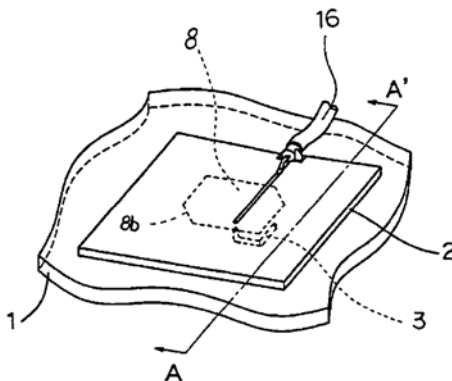
A antenna device, which includes a first dielectric substrate  
having a patch conductor disposed thereon; a second dielectric  
substrate having a grounding conductor disposed on a  
confronting substrate surface confronting the patch conduc-  
tor; and a conductor for electromagnetic coupling, extending  
from the confronting substrate surface of the second dielectric  
substrate toward the first dielectric substrate, is provided.  
The antenna device is small and is capable of being  
mounted to a windowpane for a vehicle since the conductor  
for electromagnetic coupling is not connected to the ground-  
ing conductor with respect to a direct current and since the  
conductor for electromagnetic coupling and the patch conduc-  
tor are electromagnetically coupled each other.

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
(52) **U.S. Cl.** ..... **343/700 MS; 343/713**  
(58) **Field of Classification Search** ..... 343/700 MS,  
343/711, 713, 846  
See application file for complete search history.

(56) **References Cited**  
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**67 Claims, 14 Drawing Sheets**





US007365687B2

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

(10) **Patent No.:** **US 7,365,687 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **ANTENNA WITH DISK RADIATOR USED IN AUTOMATIC METER READING (AMR) DEVICE**

(75) Inventors: **Andrew J. Borleske**, Garner, NC (US); **Mark R. Wolski**, Cedarburg, WI (US); **Charles Cunningham, Jr.**, Raleigh, NC (US); **Garry M. Loy**, Raleigh, NC (US)

(73) Assignee: **Elster Electricity, LLC**, Raleigh, NC (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.: **11/408,565**

(22) Filed: **Apr. 21, 2006**

(65) **Prior Publication Data**  
US 2007/0247380 A1 Oct. 25, 2007

**Related U.S. Application Data**  
(60) Provisional application No. 60/673,862, filed on Apr. 22, 2005.

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01Q 1/04** (2006.01)

(52) **U.S. Cl.** ..... **343/700 MS**; 343/719  
(58) **Field of Classification Search** ..... 343/719, 343/700 MS, 846, 872; 340/870.02, 870.01  
See application file for complete search history.

(56) **References Cited**

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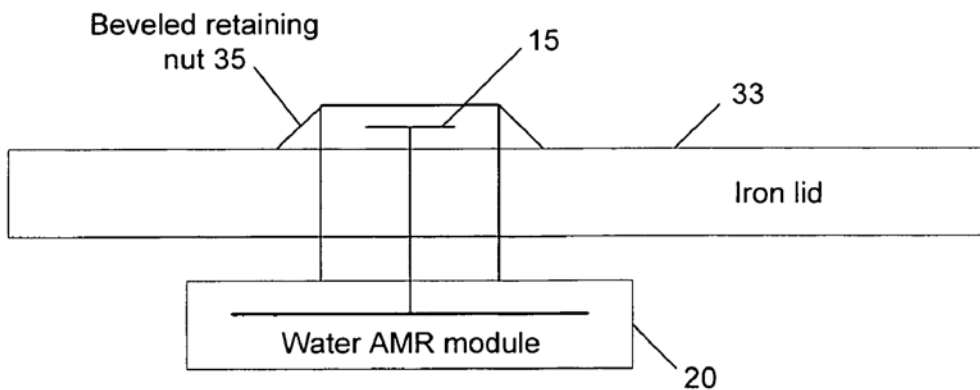
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*Primary Examiner*—Hoang V Nguyen  
(74) *Attorney, Agent, or Firm*—Woodcock & Washburn LLP

(57) **ABSTRACT**

An antenna for use in an automatic meter reading (AMR) module comprises a pin and a radiator. The radiator may be a disk radiator for example, that comprises an opening which may receive the pin. Desirably, the pin is affixed to the radiator at one end, and is disposed on a ground plane at the other end. The antenna may be a top loaded short monopole antenna, for example. Additionally, the antenna may be used in a module for a water meter. The pin and disk radiator may be stamped from a single sheet of material.

**17 Claims, 7 Drawing Sheets**







US007365688B2

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

(10) **Patent No.:** **US 7,365,688 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

- (54) **FLAT MINIATURIZED ANTENNA OF A WIRELESS COMMUNICATION DEVICE**
- (75) Inventors: **Kuan-Hsueh Tseng**, Taipei Hsien (TW); **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.

- (21) Appl. No.: **11/464,208**
- (22) Filed: **Aug. 14, 2006**

- (65) **Prior Publication Data**  
US 2008/0018537 A1 Jan. 24, 2008

- (30) **Foreign Application Priority Data**  
Jul. 20, 2006 (TW) ..... 95126493 A

- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01Q 1/36** (2006.01)

- (52) **U.S. Cl.** ..... **343/700 MS; 343/895**
- (58) **Field of Classification Search** ..... **343/700 MS, 343/702, 895, 792, 846**

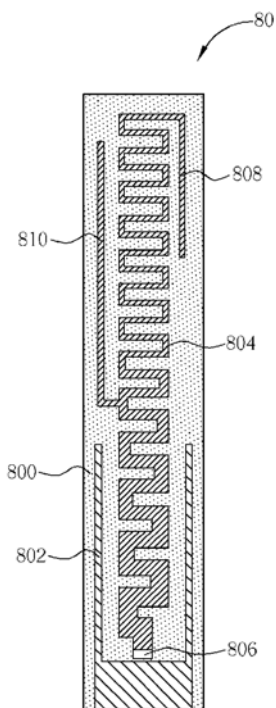
See application file for complete search history.

- (56) **References Cited**  
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*Primary Examiner*—Hoang V Nguyen  
*(74) Attorney, Agent, or Firm*—Winston Hsu

- (57) **ABSTRACT**
- A flat miniaturized antenna of a wireless communication device includes a baseboard, a sleeve conductor formed on the baseboard and coupled to system ground, a meander-shaped conductor formed inside the sleeve conductor and isolated from the sleeve conductor, having a wide end and a narrow end, a feed-in end formed on the wide end of meander-shaped conductor, for transmitting wireless signals to the wireless communication device, and a branch conductor coupled to the meander-shaped conductor.

**13 Claims, 14 Drawing Sheets**





US007365689B2

(12) **United States Patent**  
**Lee**

(10) **Patent No.:** **US 7,365,689 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **METAL INVERTED F ANTENNA**

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(75) **Inventor:** **Chang-Jung Lee**, Longtan Township,  
Taoyuan County (TW)

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2005/0264455 A1\* 12/2005 Talvitie et al. .... 343/702

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

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

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*Primary Examiner*—Tho Phan

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

(21) **Appl. No.:** **11/473,268**

(22) **Filed:** **Jun. 23, 2006**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2007/0296636 A1 Dec. 27, 2007

(51) **Int. Cl.**

**H01Q 1/12** (2006.01)

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

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

See application file for complete search history.

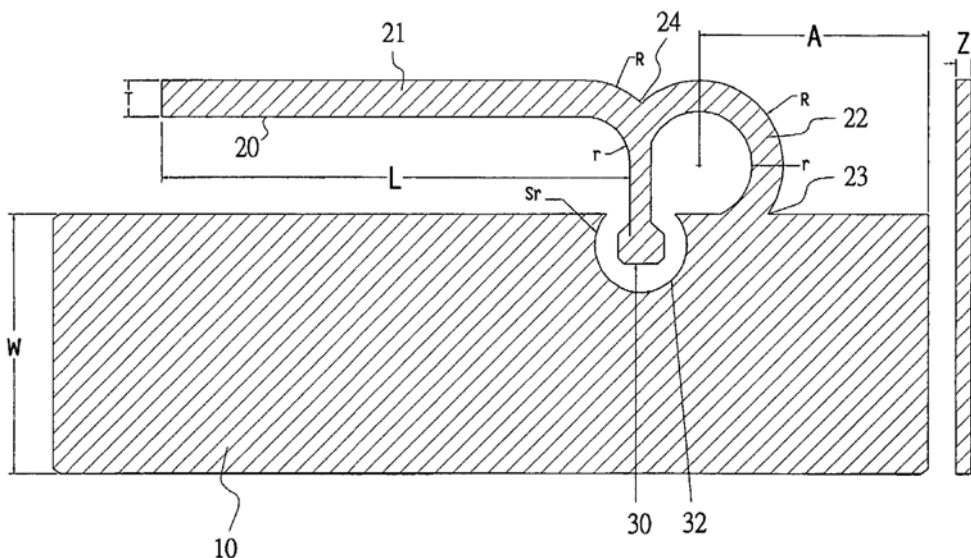
The present invention discloses an antenna structure comprising a ground plane; a radiator having a curved shape portion and a rectangular portion connected to the ground plane via a first end of the curved shape portion and grounded by a ground point of the ground plane, the rectangular portion being connected to a second end of the curved shape portion; and a feed point projected into a groove within the ground plane and connected to the second end of the curved shape portion of the radiator; and wherein the ground plane is extended over the rectangular portion of the radiator.

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**14 Claims, 6 Drawing Sheets**





US007365692B1

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

(10) **Patent No.:** **US 7,365,692 B1**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **WIDEBAND OMNIDIRECTIONAL ANTENNA FOR PLUG AND PLAY DEVICE**

2005/0024268 A1\* 2/2005 McKinzie et al. ... 343/700 MS  
2005/0062670 A1 3/2005 Suh et al.  
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2007/0194997 A1\* 8/2007 Nakanishi et al. .... 343/702

(75) Inventors: **Saou-Wen Su**, Taipei (TW);  
**Hong-Ming Tai**, Taipei (TW)

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(73) Assignee: **Lite-On Technology Corp.**, Neihu,  
Taipei (TW)

*Primary Examiner*—Trinh Dinh  
*Assistant Examiner*—Dieu Hien T Duong  
(74) *Attorney, Agent, or Firm*—Winston Hsu

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

(57) **ABSTRACT**

A wideband omnidirectional antenna for a plug and play device includes a system ground plane, a radiating element, a feeding element. The radiating element is installed above an edge of the system ground plane and comprises a first sub-radiating element and a second sub-radiating element. The first sub-radiating element is parallel to the system ground plane. The second sub-radiating element is electronically connected to an edge of the first sub-radiating element in a foldable manner. The second sub-radiating element is approximately perpendicular to the first sub-radiating element and extends in an upright direction above the system ground plane when in use condition, and is approximately parallel to the first sub-radiating element and extends horizontally above the system ground plane when not in use condition. The feeding element is electronically connected to a signal source and is used for transmitting signals outputted from the signal source to the radiating element.

(21) Appl. No.: **11/670,428**

(22) Filed: **Feb. 2, 2007**

(30) **Foreign Application Priority Data**

Oct. 11, 2006 (TW) ..... 95137404 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**

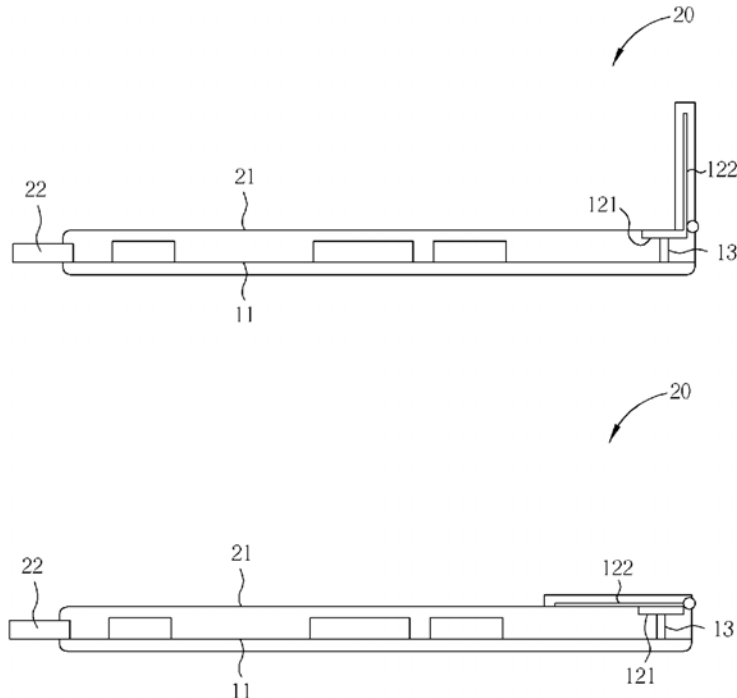
See application file for complete search history.

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**8 Claims, 13 Drawing Sheets**





US007365693B2

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

(10) **Patent No.:** **US 7,365,693 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **ANTENNA DEVICE, ELECTRONIC APPARATUS AND VEHICLE USING THE SAME ANTENNA DEVICE**

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2006/0170604 A1 \* 8/2006 Almog et al. .... 343/795

(75) Inventors: **Akihiro Hoshiai**, Osaka (JP); **Susumu Fukushima**, Osaka (JP); **Yosuke Wada**, Nara (JP)

(73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka (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 3 days.

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(21) Appl. No.: **11/528,038**

*Primary Examiner*—Trinh Vo Dinh

(22) Filed: **Sep. 26, 2006**

(74) *Attorney, Agent, or Firm*—RatnerPrestia

(65) **Prior Publication Data**

US 2007/0069964 A1 Mar. 29, 2007

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Sep. 29, 2005 (JP) ..... 2005-284337  
Feb. 7, 2006 (JP) ..... 2006-029363

An antenna device includes a grounding subject, a feeder insulated from the grounding subject, a first conductor shaping like substantially a looped triangle and coupled to the feeder at a first feeder top, and a second conductor symmetric to the first conductor with respect to a phantom line extending through the feeder and coupled to the feeder at a second feeder top. The first feeder top is placed closest to the grounding subject among other elements of the first conductor, and the second feeder top is placed closest to the grounding subject among other elements of the second conductor. The foregoing structure allows a high electrical field section of a first side of the first conductor and that of a first side of the second conductor to leave further away from the grounding subject.

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

(52) **U.S. Cl.** ..... **343/711; 343/713; 343/700 MS**

(58) **Field of Classification Search** ..... **343/711, 343/713**

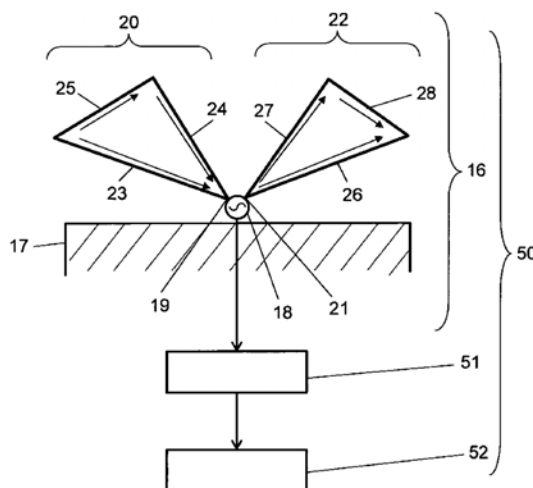
See application file for complete search history.

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**9 Claims, 6 Drawing Sheets**





US007365698B2

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

(10) **Patent No.:** **US 7,365,698 B2**  
(45) **Date of Patent:** **Apr. 29, 2008**

(54) **DIPOLE ANTENNA**

(75) Inventors: **Bradley Lance Dwyer**, Forest Hill (AU); **Warwick Thomas Armstrong**, Warrandyte (AU); **Robert Andrew Daly**, Chirside Park (AU); **Mark Anthony Mezzapica**, Mosman (AU)

(73) Assignee: **RF Industries Pty Ltd**, North Rocks, South Wales (AU)

(\* ) 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.: **11/465,159**

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

(65) **Prior Publication Data**

US 2007/0040758 A1 Feb. 22, 2007

(30) **Foreign Application Priority Data**

Aug. 19, 2005 (AU) ..... 2005904524

(51) **Int. Cl.**  
**H01Q 9/16** (2006.01)

(52) **U.S. Cl.** ..... **343/792; 343/795**

(58) **Field of Classification Search** ..... **343/795, 343/700 MS, 792, 790, 812, 813**  
See application file for complete search history.

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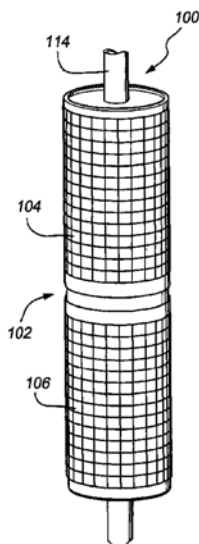
*Primary Examiner*—Hoang V Nguyen

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

(57) **ABSTRACT**

A method of manufacturing a dipole antenna comprises the steps of forming first and second radiating elements on the surface of a flexible substrate, the radiating elements including respective feed points for making operative electrical contact with a feed line including corresponding first and second feed conductors. The radiating elements are arranged on the substrate such that, in use, an input impedance of the dipole antenna is substantially matched to a characteristic impedance of the feed line over a selected frequency band. The flexible substrate is then formed into a substantially cylindrical shape. The resulting antenna comprises an integral dipole antenna member having radiating elements disposed on a surface of a substantially cylindrical substrate. The antenna avoids the need to separately manufacture the radiating elements, and subsequently to assemble the elements to form a dipole antenna. The antenna is simple to construct, has a relatively low number of mechanical and electrical joints and contacts, and may provide improved mechanical stability and electrical performance as compared with prior art antennas.

**20 Claims, 8 Drawing Sheets**





US007365702B2

(12) **United States Patent**  
**Liu**

(10) **Patent No.:** **US 7,365,702 B2**  
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- (54) **ANTENNA DEVICE**
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- (58) **Field of Classification Search** ..... 343/912, 343/815, 817, 818, 819, 834, 835  
See application file for complete search history.

- (56) **References Cited**  
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- (57) **ABSTRACT**  
An antenna device includes a first elliptic reflective surface, a first antenna and a second antenna. The first elliptic reflective surface has a first focus and a second focus. The first antenna is disposed on the first focus, and the second antenna is disposed on the second focus. The first antenna transmits a first signal and a second signal, and the second antenna receives the first signal and the second signal. The first signal is transmitted directly to the second antenna from the first antenna. The second signal is reflected by the first elliptic reflective surface and transmitted to the second antenna.

**21 Claims, 5 Drawing Sheets**

