



US007528779B2

(12) **United States Patent**
Stutzke

(10) **Patent No.:** **US 7,528,779 B2**
(45) **Date of Patent:** **May 5, 2009**

(54) **LOW PROFILE PARTIALLY LOADED PATCH ANTENNA**

(75) Inventor: **Nathan Stutzke**, Louisville, CO (US)

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

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

(21) Appl. No.: **11/552,868**

(22) Filed: **Oct. 25, 2006**

(65) **Prior Publication Data**
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H01Q 1/38 (2006.01)

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 4,021,810 A 5/1977 Urpo et al.
- 6,218,992 B1 4/2001 Sadler et al.
- 6,278,344 B1* 8/2001 Kurisu et al. 333/219.1
- 6,337,667 B1 1/2002 Ayala et al.

- 6,414,637 B2* 7/2002 Keilen 343/700 MS
- 6,507,316 B2* 1/2003 Mendelsohn et al. ... 343/700 MS
- 6,642,893 B1 11/2003 Hebron et al.
- 6,674,405 B2 1/2004 Wang
- 6,727,854 B2 4/2004 Fang et al.
- 6,738,023 B2 5/2004 Scott et al.
- 6,812,892 B2 11/2004 Tai et al.
- 6,870,506 B2 3/2005 Chen et al.
- 6,911,945 B2* 6/2005 Korva 343/702
- 7,352,326 B2* 4/2008 Korva et al. 343/700 MS
- 2002/0047802 A1* 4/2002 Voipio 343/700 MS
- 2004/0196190 A1* 10/2004 Mendolia et al. 343/700 MS
- 2005/0116875 A1* 6/2005 Yuanzhu et al. 343/846
- 2005/0259031 A1 11/2005 Sanz et al.
- 2005/0270243 A1 12/2005 Caimi et al.
- 2006/0071857 A1 4/2006 Pelzer
- 2007/0052588 A1* 3/2007 Liu et al. 343/700 MS

FOREIGN PATENT DOCUMENTS

EP 1 617 512 A1 1/2006

* cited by examiner

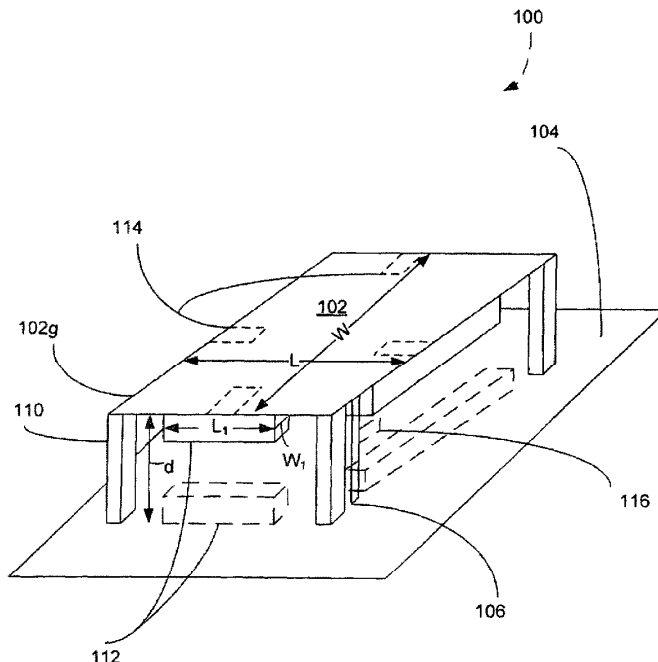
Primary Examiner—Tan Ho

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

(57) **ABSTRACT**

A low profile antenna comprises a radiating element arranged over a ground plane. The radiating element has a plurality of radiating edges. Dielectric elements are coupled to the radiating edges.

19 Claims, 2 Drawing Sheets





US007528781B2

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

(10) **Patent No.:** **US 7,528,781 B2**
(45) **Date of Patent:** **May 5, 2009**

(54) **CIRCULARLY POLARIZED ANTENNA**

(75) Inventors: **Hsiao-Cheng Lin**, Hsin-Tien (TW);
Chih-Jen Hsiao, Hsin-Tien (TW);
Tsung-Wen Chiu, Hsin-Tien (TW);
Fu-Ren Hsiao, Hsin-Tien (TW)

2004/0066338 A1 * 4/2004 Chen et al. 343/700 MS
2005/0057396 A1 * 3/2005 Boyanov 343/700 MS
2006/0097921 A1 * 5/2006 Luk et al. 343/700 MS
2007/0296635 A1 * 12/2007 Popugaev et al. 343/700 MS

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

* cited by examiner

(*) 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—Rexford Barnie
Assistant Examiner—Dylan White
(74) *Attorney, Agent, or Firm*—William E. Pelton, Esq.;
Cooper & Dunham LLP

(21) Appl. No.: **12/008,935**

(57) **ABSTRACT**

(22) Filed: **Jan. 15, 2008**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jan. 19, 2007 (TW) 96102097 A

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

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

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

See application file for complete search history.

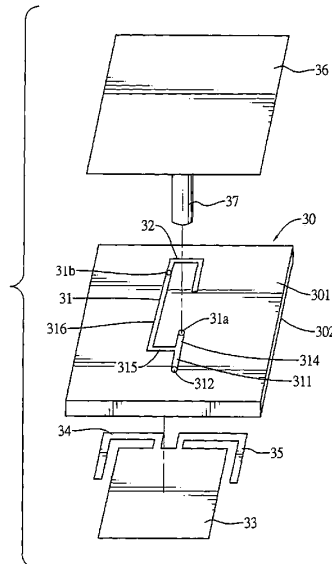
A circularly polarized antenna has a dielectric substrate, a feeding member, a coupling member, a ground plane, a support and a radiating patch. The feeding member is mounted on the dielectric substrate and has a first conductor, a second conductor, a connecting conductor and a third conductor. The second conductor is connected to the first conductor. The connecting conductor is connected to the first conductor. The third conductor is connected to the connecting conductor and is parallel to the second conductor. The coupling member is connected to the feeding member. The ground plane is mounted on the dielectric substrate. The support is mounted on the dielectric substrate. The radiating member is mounted on the support. The circularly polarized antenna generates the circularly polarized radiation being parallel to the ground plane so that portable wireless products with the circularly polarized antenna have an excellent gain.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,054,953 A * 4/2000 Lindmark 343/700 MS

8 Claims, 10 Drawing Sheets





US007528785B2

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

(10) **Patent No.:** **US 7,528,785 B2**
(45) **Date of Patent:** **May 5, 2009**

(54) **MULTIPLE FEED POINT SLOT ANTENNA**

(76) Inventors: **Ian J Forster**, 21 Great Cob,
Chelmsford, Essex (GB) CM1 6LA;
Peter Robert George Horrell, 22
Rothesay Avenue, Chelmsford, Essex
(GB) CM2 9BU

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

(21) Appl. No.: **11/318,339**

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

(65) **Prior Publication Data**

US 2006/0250314 A1 Nov. 9, 2006

Related U.S. Application Data

(63) Continuation of application No. 10/125,783, filed on
Apr. 18, 2002, now Pat. No. 6,985,119, which is a
continuation-in-part of application No. 09/536,334,
filed on Mar. 25, 2000, now Pat. No. 6,628,237.

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

(52) **U.S. Cl.** **343/767**; 343/746; 343/768;
343/757; 340/572.7; 340/572.1; 340/572.4;
340/572.8; 455/25; 455/523; 455/41.1; 399/24;
399/12; 399/13

(58) **Field of Classification Search** 343/767,
343/746, 768, 757; 340/572.7, 572.1, 572.4,
340/572.8

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,961,323 A 6/1976 Hartkorn
4,051,480 A 9/1977 Reggia
4,086,598 A 4/1978 Bogner
4,782,345 A 11/1988 Landt
4,975,711 A 12/1990 Lee

5,255,819 A 10/1993 Peckels
5,339,074 A 8/1994 Shindley
5,448,220 A 9/1995 Levy
5,461,393 A * 10/1995 Gordon 343/769
5,495,218 A 2/1996 Erb et al.
5,507,411 A 4/1996 Peckels
5,621,419 A 4/1997 Meek et al.
5,682,143 A 10/1997 Brady
5,691,731 A * 11/1997 van Erven 343/742
5,774,876 A 6/1998 Woolley et al.
5,864,323 A 1/1999 Berthon
5,906,031 A * 5/1999 Jensen 24/3.12

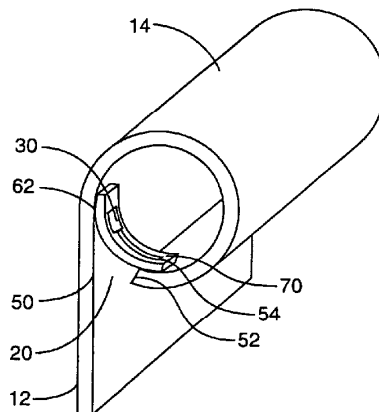
(Continued)

Primary Examiner—Marceau Milord
(74) *Attorney, Agent, or Firm*—Christensen O'Connor
Johnson Kindness PLLC

(57) **ABSTRACT**

A wireless communication device and method for identifying
a container, or communication information about a container
using a slot in the container as an antenna. The device
includes a wireless communication device for transmitting
information regarding the container. The container includes
an outer wall forming rim and a slot between the rim edge and
the outer wall that is circular and continues without bound-
aries. The wireless communication device is coupled to the
slot to provide the slot antenna for communications. An
impedance matching network is additionally provided to
make the operating frequency of the slot substantially the
same as the operating frequency of the wireless communi-
cation device. Alternatively, shorting posts may be placed in
the slot to define boundaries of the slot to match the operat-
ing frequency of the slot to the operating frequency of the
antenna. Multiple feed points may be provided between the
wireless communication device and the slot.

36 Claims, 19 Drawing Sheets





US007528790B2

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

(10) **Patent No.:** **US 7,528,790 B2**
(45) **Date of Patent:** **May 5, 2009**

(54) **SYSTEM AND METHOD FOR PREVENTING COPYING OF ELECTRONIC COMPONENT DESIGNS**

(75) Inventors: **Laurent Desclos**, San Diego, CA (US); **Seung-Woong Choi**, Giheung-gu (KR); **Jun-Ho Park**, Bucheon-si (KR); **Sung-Ki Jung**, DongAn-Gu (KR); **B. S. Kwak**, Gunpo-si (KR); **Ki-Su Kim**, Gunpo-si (KR); **Seong-Woo Lee**, Seongnam-si (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 140 days.

(21) Appl. No.: **11/761,955**

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

(65) **Prior Publication Data**

US 2008/0309574 A1 Dec. 18, 2008

(51) **Int. Cl.**
H01Q 1/52 (2006.01)

(52) **U.S. Cl.** **343/841**; 34/700 MS; 34/895

(58) **Field of Classification Search** 343/841, 343/700 MS, 702, 846, 895; 174/35 R; 340/10.1, 340/572.7, 572.8

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,367,308 A 11/1994 Weber
6,121,544 A * 9/2000 Petsinger 174/353

6,359,598 B1 3/2002 Sullivan
6,744,410 B2 * 6/2004 Shamblin et al. 343/702
6,859,175 B2 * 2/2005 Desclos et al. 343/700 MS
6,900,773 B2 5/2005 Poilasne et al.
6,911,940 B2 * 6/2005 Poilasne et al. 343/700 MS
7,084,813 B2 * 8/2006 Pathak et al. 343/700 MS
2004/0056334 A1 3/2004 Longden et al.
2007/0040653 A1 * 2/2007 Potts et al. 340/10.1

OTHER PUBLICATIONS

PCT Search Report dated Jul. 28, 2008 for PCT application No. PCT/US08/66431.

* cited by examiner

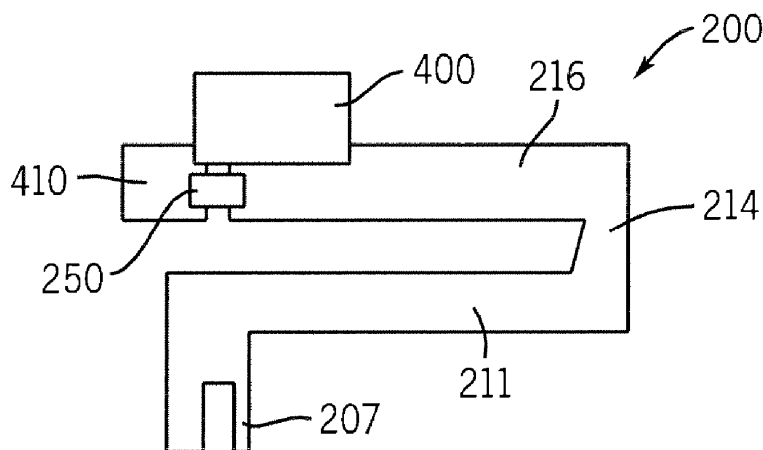
Primary Examiner—Hoang V Nguyen

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

(57) **ABSTRACT**

Techniques are provided to prevent undesired and/or unauthorized analysis and access to electronic components designs. A shield can be utilized to prevent invasive and/or non-invasive analysis methods such as the use of x-rays to determine the structural configuration and/or component makeup of an embedded antenna. In addition, a damageable material that can be utilized alone or in conjunction with the shield is also provided. When attempting to access the antenna and/or components included therein, any inappropriate force or exposure to certain elements, such as heat, will cause the material and the antenna and/or the components therein to be damaged or melted beyond a point of useful recognition for the entity. Furthermore, thin films can be utilized to construct one or more portions of the antenna to the same effect. In addition, the antenna and/or components can be configured for actively reconfiguring a resonant frequency of the antenna.

32 Claims, 15 Drawing Sheets





US007528791B2

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

(10) **Patent No.:** **US 7,528,791 B2**
(45) **Date of Patent:** **May 5, 2009**

(54) **ANTENNA STRUCTURE HAVING A FEED ELEMENT FORMED ON AN OPPOSITE SURFACE OF A SUBSTRATE FROM A GROUND PORTION AND A RADIATING ELEMENT**

(75) Inventors: **Feng-Chi Eddie Tsai**, Taipei Hsien (TW); **Chia-Tien Li**, Taipei Hsien (TW)

(73) Assignee: **Wistron NeWeb Corporation**, 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 62 days.

(21) Appl. No.: **11/457,461**

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

(65) **Prior Publication Data**

US 2007/0030203 A1 Feb. 8, 2007

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/164,364, filed on Nov. 21, 2005.

(30) **Foreign Application Priority Data**

Aug. 8, 2005 (TW) 94126825 A

(51) **Int. Cl.**

H01Q 1/48 (2006.01)

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,320,545 B1 11/2001 Nagumo

(Continued)

FOREIGN PATENT DOCUMENTS

TW 1220581 3/2003

(Continued)

OTHER PUBLICATIONS

Printed Dual-Band U-Slotted Monopole Antenna for WLAN Access Point (MOTL_V38-106_p436-438.pdf).

(Continued)

Primary Examiner—Hoang V Nguyen

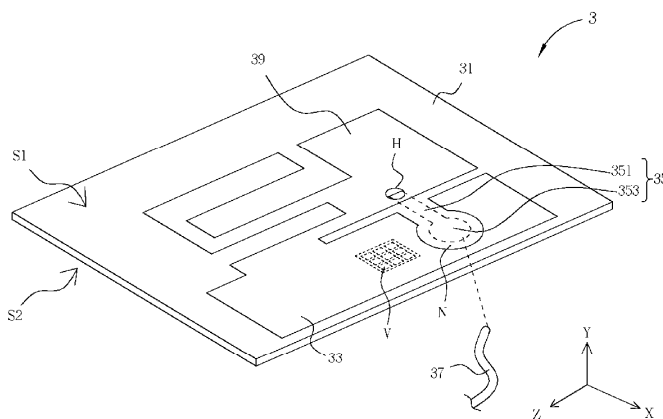
Assistant Examiner—Robert Karacsony

(74) *Attorney, Agent, or Firm*—Winston Hsu

(57) **ABSTRACT**

An antenna includes a substrate, a ground element, a radiating element and a feed element. The ground element is disposed on the substrate and has an opening. The radiating element is disposed on the substrate and electrically connects to the ground element. The radiating element comprises a first radiating trace and a second radiating trace. The first radiating trace includes a first segment, a second segment, and a first bended portion connected the first segment and the second segment. The second radiating trace connects to the second segment of the first radiating trace. The feed element is disposed on the substrate and electrically connects to the radiating element. The feed element and the radiating element are at the same surface of the substrate, and a part of the feed element extends and enters the opening.

11 Claims, 13 Drawing Sheets





US007532164B1

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

(10) **Patent No.:** **US 7,532,164 B1**
(45) **Date of Patent:** **May 12, 2009**

- (54) **CIRCULAR POLARIZED ANTENNA**
- (75) Inventors: **James P. Phillips**, Lake in the Hills, IL (US); **Guangli Yang**, Waukegan, IL (US); **Robert N. Shaddock**, Tempe, AZ (US); **Thomas J. Walczak**, Woodstock, IL (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 48 days.

6,836,246	B1	12/2004	Kadambi et al.
6,865,372	B2	3/2005	Mauney et al.
6,904,296	B2	6/2005	Geeraert et al.
6,919,943	B2	7/2005	Tsuyuki et al.
6,922,574	B2	7/2005	Abbasi et al.
6,930,644	B2	8/2005	Konishi et al.
2001/0031645	A1	10/2001	Jarrett
2001/0050646	A1	12/2001	Anterow
2002/0032510	A1	3/2002	Turnbull et al.
2002/0103006	A1	8/2002	Doe

(21) Appl. No.: **11/778,790**

(Continued)

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

FOREIGN PATENT DOCUMENTS

Related U.S. Application Data

EP 1018777 A2 7/2000

(63) Continuation of application No. 11/749,435, filed on May 16, 2007, now abandoned.

(Continued)

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

OTHER PUBLICATIONS

John D. Kraus; "Antennas"; 653 pages, 1988.

(52) **U.S. Cl.** **343/700 MS; 343/741**
(58) **Field of Classification Search** **343/700 MS, 343/702, 741-743, 866**
See application file for complete search history.

Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—Roland K. Bowler, II

(57) **ABSTRACT**

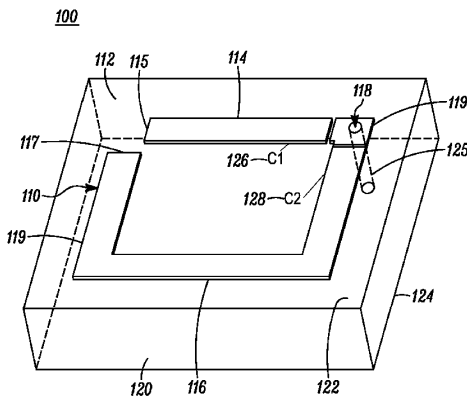
(56) **References Cited**

U.S. PATENT DOCUMENTS

4,573,053	A *	2/1986	Mori et al.	342/441
4,723,305	A	2/1988	Phillips et al.	
5,322,991	A	6/1994	Hanson	
5,541,398	A	7/1996	Hanson	
6,307,512	B1	10/2001	Geeraert	
6,308,074	B1	10/2001	Chandra et al.	
6,333,716	B1	12/2001	Pontoppidan	
6,392,605	B2	5/2002	Anterow	
6,567,050	B1 *	5/2003	Briggs	343/741
6,614,905	B1	9/2003	Kristensen	
6,650,298	B2	11/2003	Abbasi et al.	
6,731,246	B2 *	5/2004	Parsche et al.	343/741

A circular polarized signal receiving antenna (100) including an active element having first and second ends separated by a gap, a dimension of the active element, between the first and second ends thereof, corresponding to approximately one wavelength of a resonant operating frequency of the antenna. A feed-point is coupled to the active element, wherein the feed-point is located approximately one-quarter of the wavelength from the first end of the active element and approximately three-quarters of the wavelength from the second end of the active element. In one embodiment, the feed-point is reactively coupled to the active element.

20 Claims, 4 Drawing Sheets





US007532165B2

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

(10) **Patent No.:** **US 7,532,165 B2**
(45) **Date of Patent:** **May 12, 2009**

- (54) **BUILT-IN ANTENNA HAVING CENTER FEEDING STRUCTURE FOR WIRELESS TERMINAL**
- (75) Inventors: **Byung-Nam Kim**, Gyeonggi-do (KR);
Seung-Yong Lee, Gyeonggi-do (KR)
- (73) Assignee: **Ace Technology**, Incheon (KR)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 230 days.
- | | | | |
|-------------------|---------|------------------|------------|
| 6,239,765 B1 * | 5/2001 | Johnson et al. | 343/795 |
| 6,466,176 B1 * | 10/2002 | Maoz et al. | 343/767 |
| 6,768,464 B1 * | 7/2004 | Shoji et al. | 343/702 |
| 7,081,853 B2 * | 7/2006 | Amano et al. | 343/702 |
| 2002/0118142 A1 * | 8/2002 | Wang | 343/895 |
| 2003/0006937 A1 * | 1/2003 | Sekine et al. | 343/702 |
| 2003/0160728 A1 * | 8/2003 | Fukushima et al. | 343/702 |
| 2004/0104850 A1 * | 6/2004 | Otaka et al. | 343/700 MS |
| 2006/0017624 A1 * | 1/2006 | Nagano et al. | 343/702 |
| 2007/0080871 A1 * | 4/2007 | Ying | 343/702 |

- (21) Appl. No.: **10/560,381**
- (22) PCT Filed: **Nov. 12, 2003**
- (86) PCT No.: **PCT/KR03/02436**
- § 371 (c)(1),
(2), (4) Date: **Dec. 13, 2005**
- (87) PCT Pub. No.: **WO2004/112188**
- PCT Pub. Date: **Dec. 23, 2004**

FOREIGN PATENT DOCUMENTS

JP	08-078944 A	3/1996
JP	11-136020	5/1999
JP	2000-223931	8/2000
JP	2001-053520 A	2/2001
JP	2001-352212 A	12/2001
JP	2002-100915 A	4/2002
JP	2002-158530 A	5/2002
KR	10-2002-0022490 A	3/2002
KR	10-2002-0027083 A	4/2002
WO	WO 02/054532 A1	7/2002

- (65) **Prior Publication Data**
US 2007/0103371 A1 May 10, 2007
- (30) **Foreign Application Priority Data**
Jun. 13, 2003 (KR) 10-2003-0038221

* cited by examiner

Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Venable LLP; Michael A. Sartori; Catherine M. Voorhees

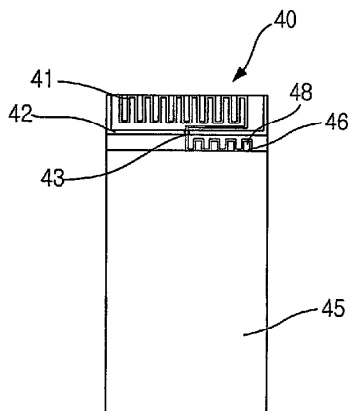
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702; 343/700 MS**
- (58) **Field of Classification Search** **343/702, 343/700 MS, 873, 725, 729**
See application file for complete search history.

(57) **ABSTRACT**

A built-in antenna having a center feed structure for wireless terminal. The antenna includes: a feeding means for providing an electromagnetic signal; and a radiating means for radiating the electromagnetic signal, wherein the feeding means is located on a point ranging from a midpoint of the antenna. The antenna radiates a nondirectional signal and can be embedded in a wireless terminal.

- (56) **References Cited**
- U.S. PATENT DOCUMENTS
- | | | | |
|---------------|--------|----------------|---------|
| 5,926,139 A * | 7/1999 | Korisch | 343/702 |
| 5,936,587 A * | 8/1999 | Gudilev et al. | 343/752 |

11 Claims, 9 Drawing Sheets





US007532172B2

(12) **United States Patent**
Kanno

(10) **Patent No.:** **US 7,532,172 B2**
(45) **Date of Patent:** **May 12, 2009**

(54) **DIFFERENTIALLY-FED VARIABLE DIRECTIVITY SLOT ANTENNA**

2004/0000959 A1 1/2004 Howard et al.
2005/0237252 A1 10/2005 Thudor et al.

(75) Inventor: **Hiroshi Kanno**, Osaka (JP)

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

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

(21) Appl. No.: **12/147,091**

(22) Filed: **Jun. 26, 2008**

(65) **Prior Publication Data**
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(30) **Foreign Application Priority Data**
Nov. 30, 2006 (JP) 2006-323382

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
(52) **U.S. Cl.** 343/770; 343/767; 343/768; 343/846
(58) **Field of Classification Search** 343/770, 343/767, 768, 846
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
6,531,984 B1 3/2003 Johannisson et al.
6,765,450 B2 7/2004 Howard et al.
6,864,848 B2* 3/2005 Sievenpiper 343/767
7,215,284 B2* 5/2007 Collinson 343/700 MS
7,298,343 B2* 11/2007 Forster et al. 343/767
7,336,233 B2* 2/2008 Thudor et al. 343/767
7,403,170 B2* 7/2008 Kanno et al. 343/770
2003/0122721 A1 7/2003 Sievenpiper

FOREIGN PATENT DOCUMENTS

JP 06-112732 4/1994
JP 2002-009540 1/2002
JP 2003-142919 5/2003
JP 2004-274757 9/2004

(Continued)

OTHER PUBLICATIONS

Gisin, F., et al., "Routing Differential I/O Signals Across Split Ground Planes at the Connector for EMI Control", Aug. 2000, 2000 IEEE International Symposium on Electromagnetic Compatibility Digest, vol. 1, 21-25, pp. 325-327.

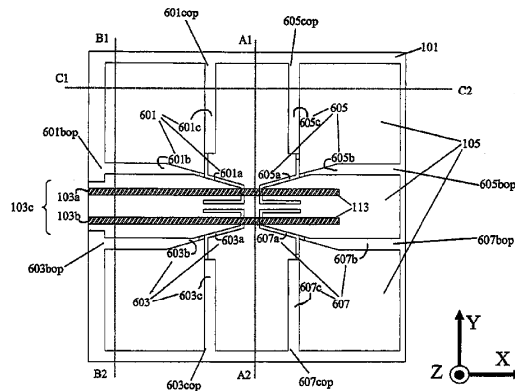
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Primary Examiner—Tho G Phan
(74) Attorney, Agent, or Firm—McDermott Will & Emery LLP

(57) **ABSTRACT**

With a differential feed line 103c, open-ended slot resonators 601, 603, 605, and 607 are allowed to operate in pair, a slot length of each slot resonator corresponding to a 1/4 effective wavelength during operation. Slot resonators which are excited out-of-phase with an equal amplitude are allowed to appear within the circuitry. Thus, positioning condition of the open end points of the selective radiation portions 601b, 601c, 603b, 603c, 605b, and 607b in the respective slot resonators is dynamically switched.

7 Claims, 25 Drawing Sheets





US00D592195S

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

(10) **Patent No.:** **US D592,195 S**

(45) **Date of Patent:** **** May 12, 2009**

(54) **ANTENNA**

(75) Inventors: **Hsin-Tsung Wu**, Taipei Hsien (TW);
Kai Shih, Taipei Hsien (TW); **Yu-Yuan Wu**, Taipei Hsien (TW)

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

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

(21) Appl. No.: **29/329,282**

(22) Filed: **Dec. 11, 2008**

(51) **LOC (9) Cl.** **14-03**

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

(58) **Field of Classification Search** D14/138,
D14/230-238, 299, 358; D12/42, 43; 34/700 MS,
34/700 R-705, 711-713, 741, 748, 767, 795,
34/819, 840, 846, 866, 871-908; 455/90.2,
455/90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

D456,388 S * 4/2002 Hwang D14/230
6,836,252 B2 * 12/2004 Tai et al. 343/702
7,061,437 B2 * 6/2006 Lin et al. 343/702
D531,622 S * 11/2006 Chen et al. D14/230
D555,154 S * 11/2007 Lin et al. D14/230
7,333,067 B2 * 2/2008 Hung et al. 343/770

7,352,329 B2 * 4/2008 Chung et al. 343/700 MS
D576,614 S * 9/2008 Lee et al. D14/230
D580,418 S * 11/2008 Yang et al. D14/230
2005/0128151 A1 * 6/2005 Kwak et al. 343/702
2006/0197705 A1 * 9/2006 Chen et al. 343/700 MS
2007/0040750 A1 * 2/2007 Tai et al. 343/700 MS
2009/0027273 A1 * 1/2009 Lin et al. 343/700 MS
2009/0033557 A1 * 2/2009 Wei 343/700 MS
2009/0040114 A1 * 2/2009 Okamura et al. 343/700 MS

* cited by examiner

Primary Examiner—T. Chase Nelson
Assistant Examiner—John Windmuller

(74) *Attorney, Agent, or Firm*—WPAT, P.C.; Anthony King

(57) **CLAIM**

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

DESCRIPTION

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

FIG. 2 is a front elevational view thereof;

FIG. 3 is a rear elevational view thereof;

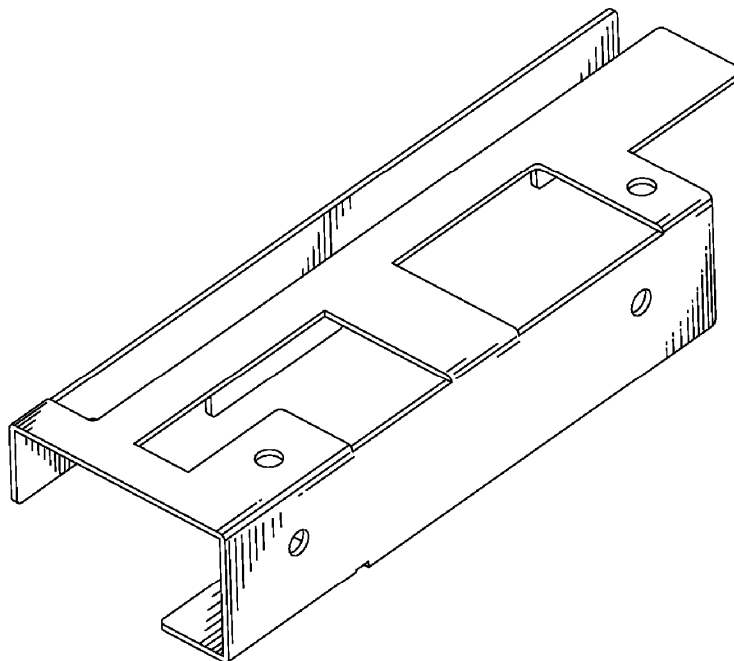
FIG. 4 is a left side elevational view thereof;

FIG. 5 is a right side elevational view thereof;

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

FIG. 7 is a bottom plan view thereof.

1 Claim, 7 Drawing Sheets





US007535364B2

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

(10) **Patent No.:** **US 7,535,364 B2**
(45) **Date of Patent:** **May 19, 2009**

(54) **ANTENNA APPARATUS**
(75) Inventors: **Isao Sakama**, Hiratsuka (JP); **Minoru Ashizawa**, Tokyo (JP)
(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 199 days.

6,326,922	B1	12/2001	Hegendoerfer	
6,861,993	B2 *	3/2005	Waldner	343/742
7,084,769	B2 *	8/2006	Bauer et al.	340/572.7
7,126,545	B2 *	10/2006	Nagano et al.	343/702
7,227,504	B2 *	6/2007	Deguchi et al.	343/742
7,250,867	B2 *	7/2007	Sakama et al.	340/572.7
2003/0160730	A1	8/2003	Alsliety	
2004/0266481	A1 *	12/2004	Patel et al.	455/558
2005/0057422	A1	3/2005	Deguchi	
2005/0192056	A1 *	9/2005	Karaki	455/561

(21) Appl. No.: **11/299,671**
(22) Filed: **Dec. 13, 2005**

FOREIGN PATENT DOCUMENTS
JP 2002-183676 6/2002
WO WO 2004/025554 3/2004

(65) **Prior Publication Data**
US 2007/0046465 A1 Mar. 1, 2007

* cited by examiner
Primary Examiner—Van T. Trieu
(74) *Attorney, Agent, or Firm*—Antonelli, Terry, Stout & Kraus, LLP.

(30) **Foreign Application Priority Data**
Aug. 25, 2005 (JP) 2005-244375

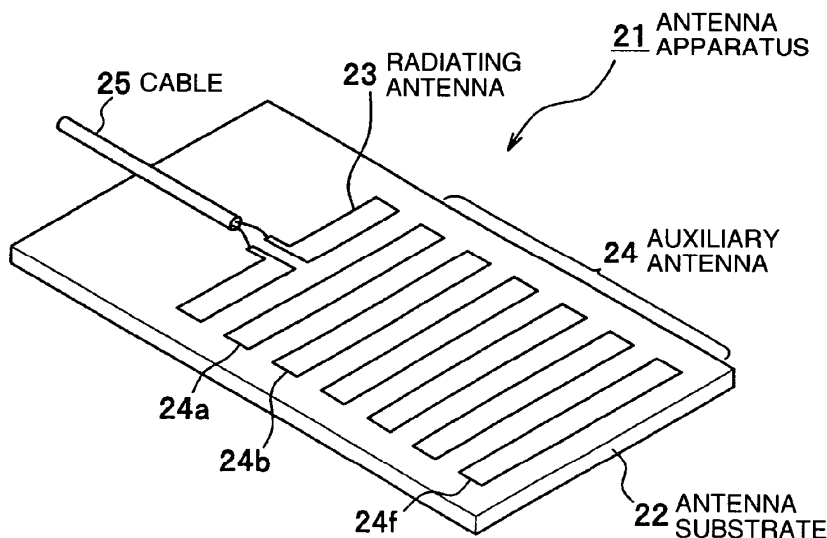
(57) **ABSTRACT**

(51) **Int. Cl.**
G08B 13/14 (2006.01)
(52) **U.S. Cl.** **340/572.7; 340/572.1**
(58) **Field of Classification Search** 340/572.1,
340/572.3, 572.4, 572.7, 572.8, 5.61, 5.66,
340/10.2, 10.3, 572.5; 235/492, 380; 342/44;
343/841
See application file for complete search history.

An antenna apparatus which ensures a wide reading area on a reader antenna and a reading operability of information recorded in a small-sized radio frequency IC tag is provided. The apparatus includes an auxiliary antenna of $\lambda/2$ long disposed near to a radiating antenna of $\lambda/2$ long and including plural conductive elements in an array. When the IC tag approaches the auxiliary antenna, a subsidiary tuning circuit is formed between it and an inlet antenna of IC tag, so making tuning complementary to each other. The inlet antenna having an antenna length shorter than the tuning frequency can receive energy from the auxiliary antenna efficiently and is excited integrally with the auxiliary antenna to thereby spread a reading area by apparatus and increase the communication distance.

(56) **References Cited**
U.S. PATENT DOCUMENTS
3,938,044 A * 2/1976 Lichtblau 340/572.3
5,461,386 A * 10/1995 Knebelkamp 342/44
5,561,430 A * 10/1996 Knebelkamp 342/44
6,172,608 B1 * 1/2001 Cole 340/572.1
6,176,433 B1 * 1/2001 Uesaka et al. 235/492

27 Claims, 20 Drawing Sheets





US007535421B2

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

(10) **Patent No.:** **US 7,535,421 B2**
(45) **Date of Patent:** **May 19, 2009**

(54) **ANTENNA ASSEMBLY WITH IMPROVED RADIATING EFFECT**

(56) **References Cited**

(75) Inventors: **Hsien-Sheng Tseng**, Tu-Cheng (TW);
Lung-Sheng Tai, Tu-Cheng (TW)

U.S. PATENT DOCUMENTS

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

6,801,169 B1 10/2004 Hai
7,119,748 B2 * 10/2006 Autti 343/702
2004/0178957 A1 * 9/2004 Chang et al. 343/700 MS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 43 days.

* cited by examiner

Primary Examiner—Anh Q Tran
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(21) Appl. No.: **11/906,364**

(57) **ABSTRACT**

(22) Filed: **Oct. 1, 2007**

(65) **Prior Publication Data**

US 2008/0094289 A1 Apr. 24, 2008

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

An antenna assembly includes a supporter forming two different continuous first and second surfaces, and a monopole antenna assembled on the supporter and comprising a radiating element comprising a first radiating portion, a second radiating portion respectively worked at different frequency bands, and a grounding element separated from the radiating element; wherein the first radiating portion, the radiating portion and the grounding element connecting together across the first and second surfaces to form a solid antenna.

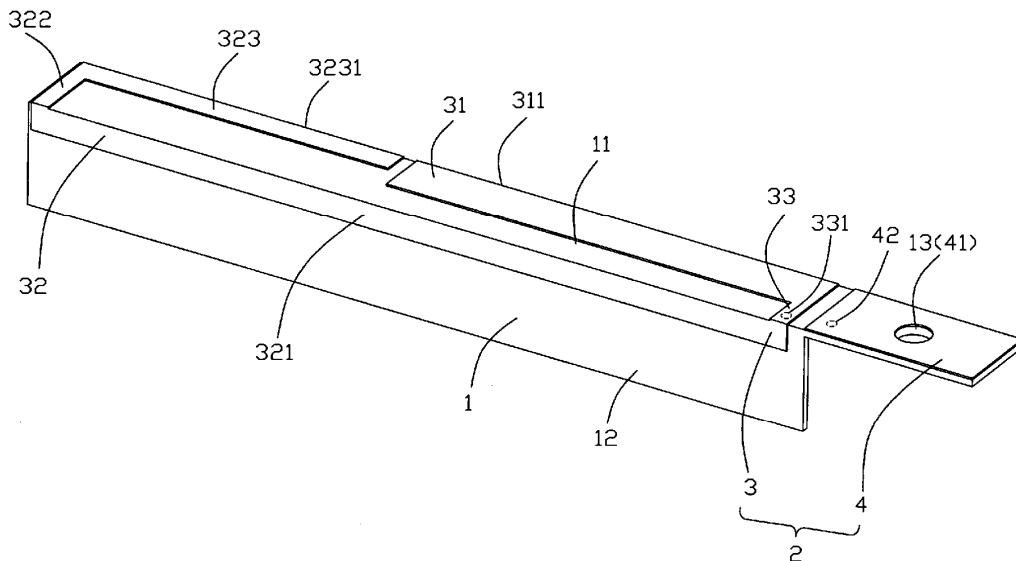
(52) **U.S. Cl.** **343/700 MS; 343/702**

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

See application file for complete search history.

18 Claims, 2 Drawing Sheets

100





US007535422B2

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

(10) **Patent No.:** **US 7,535,422 B2**
(45) **Date of Patent:** **May 19, 2009**

- (54) **NOTEBOOK AND ANTENNA STRUCTURE THEREOF**
- (75) Inventors: **Chih-Kai Liu**, Taipei (TW); **Kai-Hong Cheng**, Taipei Hsien (TW)
- (73) Assignee: **Wistron NeWeb Corp.**, 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 180 days.

6,717,551	B1 *	4/2004	Desclos et al.	343/700	MS
6,812,892	B2 *	11/2004	Tai et al.	343/700	MS
6,992,627	B1 *	1/2006	Honda et al.	343/700	MS
7,050,010	B2 *	5/2006	Wang et al.	343/702	
7,084,831	B2 *	8/2006	Takagi et al.	343/860	
7,136,022	B2 *	11/2006	Sato et al.	343/702	
2004/0090375	A1 *	5/2004	Dai et al.	343/700	MS
2004/0113848	A1 *	6/2004	Gaucher et al.	343/702	
2005/0110692	A1 *	5/2005	Andersson	343/702	
2006/0262016	A1 *	11/2006	Hung et al.	343/702	

FOREIGN PATENT DOCUMENTS

TW M258432 3/2005

* cited by examiner

Primary Examiner—HoangAnh T Le
(74) Attorney, Agent, or Firm—Quintero Law Office

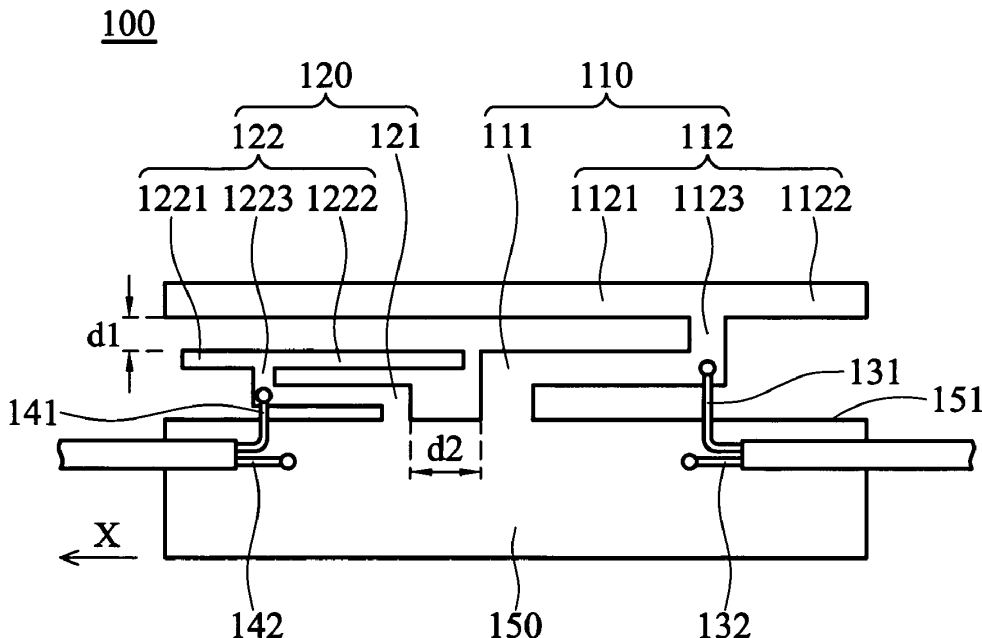
- (21) Appl. No.: **11/324,048**
- (22) Filed: **Dec. 31, 2005**
- (65) **Prior Publication Data**
US 2007/0040754 A1 Feb. 22, 2007
- (30) **Foreign Application Priority Data**
Aug. 16, 2005 (TW) 94127906 A
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702**; 343/700 MS
- (58) **Field of Classification Search** 343/700 MS,
343/702, 846, 848
See application file for complete search history.
- (56) **References Cited**

(57) **ABSTRACT**

An antenna structure includes a ground element, a first transmitting element and a second transmitting element. The first transmitting element transmits a first wireless signal, and comprises a first connecting portion and a first radiation portion. The first connecting portion is connected to the ground element and the first radiation portion. The second transmitting element transmits a second wireless signal and comprises a second connecting portion and a second radiation portion. The second connecting portion is connected to the ground element and the second radiation portion. The second connecting portion is shorter than the first connecting portion, and the second radiation portion is shorter than the first radiation portion.

- (U.S. PATENT DOCUMENTS
6,624,789 B1 * 9/2003 Kangasvieri et al. 343/702

22 Claims, 12 Drawing Sheets





US007535423B2

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

(10) **Patent No.:** **US 7,535,423 B2**
(45) **Date of Patent:** **May 19, 2009**

(54) **MULTIPLE-BAND MONOPOLE COUPLING ANTENNA**

(75) Inventors: **Ching-Chi Lin**, Taipei-Hsien (TW); **Kai Shih**, Taipei-Hsien (TW); **Yu-Yuan Wu**, Taipei-Hsien (TW)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 199 days.

(21) Appl. No.: **11/552,943**

(22) Filed: **Oct. 25, 2006**

(65) **Prior Publication Data**

US 2008/0100515 A1 May 1, 2008

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

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

(58) **Field of Classification Search** **343/702, 343/725, 729, 728, 700 MS**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,552,686 B2* 4/2003 Ollikainen et al. 343/700 MS

7,126,545 B2*	10/2006	Nagano et al.	343/702
2002/0149527 A1*	10/2002	Wen et al.	343/727
2005/0093750 A1*	5/2005	Vance	343/702
2005/0259010 A1*	11/2005	Soutome	343/702
2006/0049990 A1*	3/2006	Watada et al.	343/700 MS
2007/0069958 A1*	3/2007	Ozkar	343/700 MS
2007/0210969 A1*	9/2007	Vance	343/702

* cited by examiner

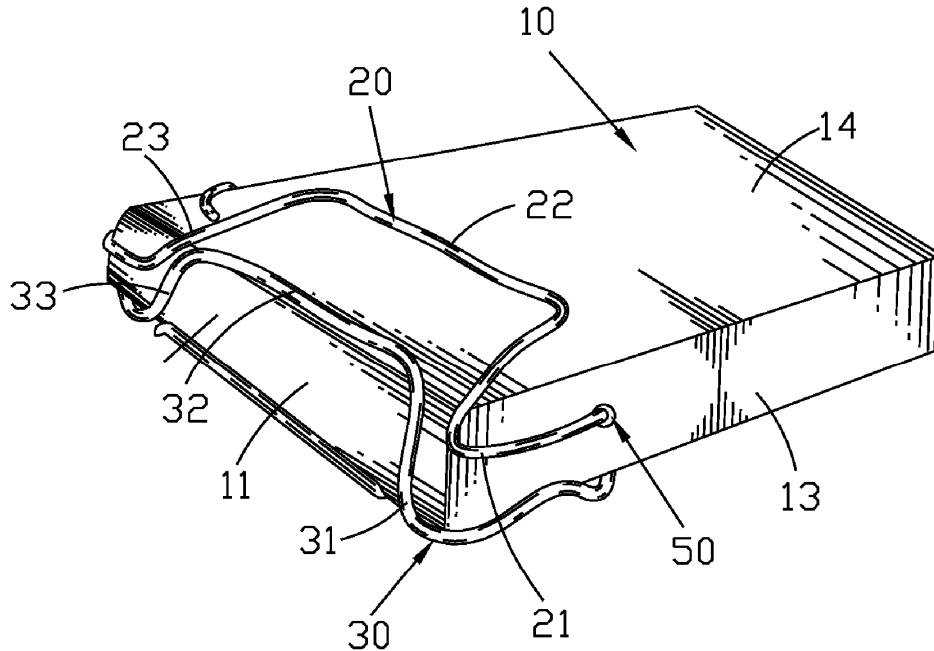
Primary Examiner—HoangAnh T Le

(74) *Attorney, Agent, or Firm*—WPAI, P.C.; Anthony King

(57) **ABSTRACT**

A multiple-band monopole coupling antenna includes a dielectric board, a low frequency antenna and a high frequency antenna. The low frequency antenna and the high frequency antenna are located on the front of the dielectric board. The length of the low frequency antenna equals to the half length of the low frequency waves and can receive and transmit two low frequency waves and a high frequency wave. The length of the high frequency antenna equals to the quarter length of the high frequency waves. The high frequency antenna is adjacent to the low frequency antenna and couples with the low frequency antenna while the low frequency antenna is receiving or transmitting signal. Thus, the high frequency antenna can receive and transmit three high frequency waves. The multiple-band monopole coupling antenna can receive and transmit all frequency bands, which are used in the mobile communication.

6 Claims, 4 Drawing Sheets





US007535429B2

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

(10) **Patent No.:** **US 7,535,429 B2**
(45) **Date of Patent:** **May 19, 2009**

(54) **VARIABLE SLOT ANTENNA AND DRIVING METHOD THEREOF**

6,285,333 B1 * 9/2001 Reed et al. 343/767
6,292,153 B1 9/2001 Aiello et al.

(75) Inventors: **Hiroshi Kanno**, Osaka (JP); **Ushio Sangawa**, Nara (JP)

(Continued)

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

FOREIGN PATENT DOCUMENTS

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

EP 1 158 605 A1 11/2001

(Continued)

(21) Appl. No.: **12/179,096**

OTHER PUBLICATIONS

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

Lei Zhu, "A Novel Broadband Microstrip-Fed Wide Slot Antenna With Double Rejection Zeros", IEEE Antennas and Wireless Propagation Letters, 2003, pp. 194-196, vol. 2, IEEE.

(65) **Prior Publication Data**

(Continued)

US 2009/0021439 A1 Jan. 22, 2009

Related U.S. Application Data

Primary Examiner—Hoang V Nguyen
Assistant Examiner—Robert Karacsony
(74) *Attorney, Agent, or Firm*—McDermott Will & Emery LLP

(63) Continuation of application No. PCT/JP2007/060551, filed on May 23, 2007.

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

May 25, 2006 (JP) 2006-144800

A variable directivity slot antenna includes: ground conductors **101a** and **101b**, which are divided by a slot region **109** both of whose ends are open ends **111a** and **111b**; a feed line **115** having a loop shape at a feeding site **113** for the slot region **109**; a first selective conduction path **119** connecting between the ground conductors **101a** and **101b** in a direction of the open end **111a** as viewed from the feeding site **113**; and a second selective conduction path **121** connecting between the ground conductors **101a** and **101b** in a direction of the open end **111b** as viewed from the feeding site **113**. Depending on the driving state, the first selective conduction path **119** and the second selective conduction path **121** are controlled into a conducting or open state.

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

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

(58) **Field of Classification Search** **343/767, 343/770, 700 MS, 771, 850, 862, 864**

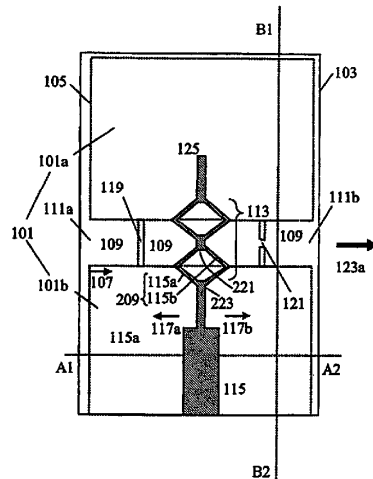
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,268,696 A 12/1993 Buck et al.
5,442,367 A 8/1995 Naito et al.
5,539,420 A 7/1996 Dusseux et al.
6,150,989 A 11/2000 Aubry

22 Claims, 26 Drawing Sheets





US007535431B2

(12) **United States Patent**
Rowell

(10) **Patent No.:** **US 7,535,431 B2**
(45) **Date of Patent:** **May 19, 2009**

(54) **ANTENNA SYSTEMS WITH GROUND PLANE EXTENSIONS AND METHOD FOR USE THEREOF**

2002/0053994	A1	5/2002	McCorkle	
2002/0122010	A1	9/2002	McCorkle	
2004/0001029	A1*	1/2004	Parsche et al.	343/866
2004/0125032	A1	7/2004	Ikuta et al.	
2005/0001770	A1	1/2005	Ikuta et al.	
2005/0156787	A1	7/2005	Myoung et al.	
2005/0156788	A1	7/2005	Lin	

(75) Inventor: **Corbett Rowell**, New Territories (CN)

(73) Assignee: **Hong Kong Applied Science and Technology Research Institute Co., Ltd.**, Hong Kong (CN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 337 days.

FOREIGN PATENT DOCUMENTS

CN	1599129	3/2005
EP	1469551	10/2004
JP	2005192183	7/2005
WO	WO02093690	11/2002
WO	WO03077360	9/2003
WO	WO-2005/062422	7/2005

(21) Appl. No.: **11/529,777**

OTHER PUBLICATIONS

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

International Search Report issued for PCT/CN2007/070456, dated Oct. 18, 2007; 4 pages.

(65) **Prior Publication Data**

US 2008/0079635 A1 Apr. 3, 2008

* cited by examiner

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

Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Fulbright & Jaworski L.L.P.

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

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

See application file for complete search history.

(57) **ABSTRACT**

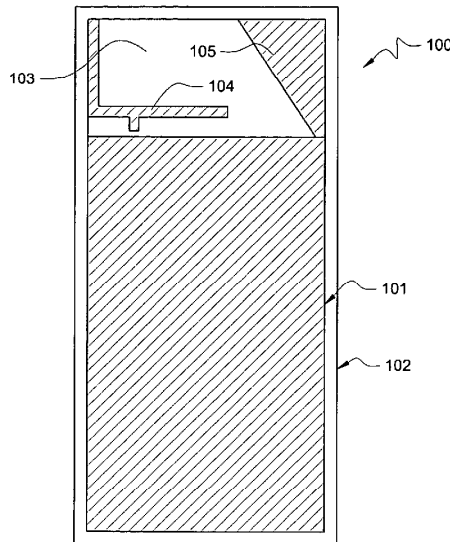
An antenna system comprising a ground plane structure on a substrate, an antenna space on the substrate adjacent to the ground plane structure, the antenna space including an ungrounded antenna therein with an associated first resonant length, an extension of the ground plane projecting into the antenna space, the ground plane extension defining a second resonant length that includes at least part of its own length and at least part of a length of the ground plane structure.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,828,340	A *	10/1998	Johnson	343/700 MS
7,116,276	B2 *	10/2006	Lee	343/700 MS
7,196,626	B2 *	3/2007	Chen et al.	340/572.7
7,202,819	B2 *	4/2007	Hatch	343/700 MS
7,345,633	B2 *	3/2008	Wielsma	343/700 MS

15 Claims, 5 Drawing Sheets





US007538728B1

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

(10) **Patent No.:** **US 7,538,728 B1**
(45) **Date of Patent:** **May 26, 2009**

(54) **ANTENNA AND RESONANT FREQUENCY TUNING METHOD THEREOF**

(75) Inventors: **Tze-Hsuan Chang**, Taipei (TW);
Jean-Fu Kiang, Taipei (TW)

(73) Assignee: **National Taiwan 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 55 days.

(21) Appl. No.: **11/950,360**

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

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 5/00 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/911 R**

(58) **Field of Classification Search** **343/700 MS, 343/911 R**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,054,875 A * 10/1977 Cachier 343/701
4,918,570 A * 4/1990 Okamura et al. 361/321.2
5,617,104 A * 4/1997 Das 343/700 MS

5,952,972 A * 9/1999 Ittipiboon et al. 343/700 MS
6,292,141 B1 * 9/2001 Lim 343/700 MS
6,426,725 B2 * 7/2002 Hiroshima et al. 343/741
6,556,169 B1 * 4/2003 Fukuura et al. 343/700 MS
7,292,204 B1 * 11/2007 Chang et al. 343/909
2007/0152884 A1 * 7/2007 Bouche et al. 343/700 MS

OTHER PUBLICATIONS

Tze-Hsuan Chang and Jean-Fu Kiang, "Dualband Split Dielectric Resonator Antenna", IEEE Transactions on Antennas and Propagation, Nov. 2007, pp. 3151-3162, vol. 55, No. 11, IEEE.

* cited by examiner

Primary Examiner—Vibol Tan

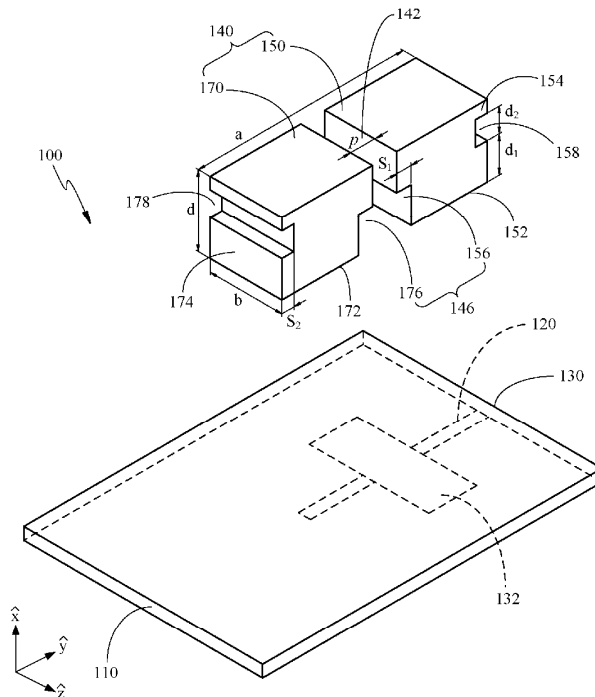
Assistant Examiner—Jason Crawford

(74) *Attorney, Agent, or Firm*—WPAI, P.C.; Justin King

(57) **ABSTRACT**

A dual-band dielectric resonator antenna (DRA) is designed by splitting a rectangular DR and carving notches and tunnels off the DR. The antenna comprises a substrate, a microstrip line, a ground plane and a resonant structure, wherein a first resonant part and a second resonant part of the resonant structure are separated by a gap. The proposed DRA can cover both the WiMAX (3.4-3.7 GHz) and the WLAN (5.15-5.35 GHz) bands by engraving notches and tunnels at different positions of the first resonant part and the second resonant part.

24 Claims, 13 Drawing Sheets





US007538729B2

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

(10) **Patent No.:** **US 7,538,729 B2**
(45) **Date of Patent:** **May 26, 2009**

(54) **COUPLING ANTENNA**

(56) **References Cited**

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

U.S. PATENT DOCUMENTS

6,762,723 B2 * 7/2004 Nallo et al. 343/700 MS
7,423,598 B2 * 9/2008 Bit-Babik et al. 343/702
2007/0229366 A1 * 10/2007 Kim et al. 343/700 MS
2008/0198089 A1 * 8/2008 Hsiao et al. 343/850

(73) Assignee: **Advanced Connectek Inc.** (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.

* cited by examiner

Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Hershkovitz & Associates, LLC.; Abraham Hershkovitz

(21) Appl. No.: **12/028,606**

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2008/0198088 A1 Aug. 21, 2008

A coupling antenna has a ground plane, a main radiating assembly and a secondary radiating assembly. The main radiating assembly is mounted on the ground plane and has a substrate, a feeding-and-coupling assembly and a shorting member. The feeding-and-coupling assembly has a feeding member, a coupling member and an extension member. The second radiating assembly is mounted on the ground plane, is connected to the main radiating assembly and has a first radiating patch and a second radiating patch. With the extension member and the first and second radiating patches, operating bandwidth of the coupling antenna is improved.

(30) **Foreign Application Priority Data**

Feb. 15, 2007 (TW) 96105851 A

(51) **Int. Cl.**

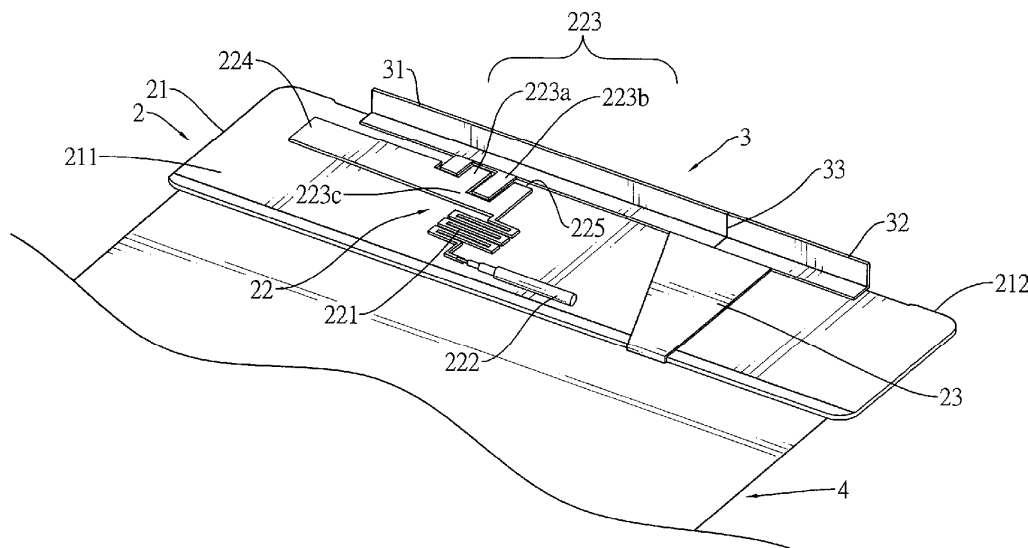
H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/702; 343/850**

(58) **Field of Classification Search** **343/850, 343/853, 702, 700 MS, 846, 848**
See application file for complete search history.

5 Claims, 6 Drawing Sheets





US007538732B2

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

(10) **Patent No.:** **US 7,538,732 B2**
(45) **Date of Patent:** **May 26, 2009**

(54) **ANTENNA STRUCTURE AND RADIO COMMUNICATION APPARATUS INCLUDING THE SAME**

2002/0030626 A1 3/2002 Nagumo et al.

(75) Inventors: **Takashi Ishihara**, Machida (JP); **Kengo Onaka**, Yokohama (JP); **Shoji Nagumo**, Sagamihara (JP)

(Continued)

FOREIGN PATENT DOCUMENTS

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

EP 0 938 158 8/1999

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 120 days.

(Continued)

OTHER PUBLICATIONS

(21) Appl. No.: **11/772,380**

PCT/JP2005/022100, Written Opinion (with English translation) dated Feb. 14, 2006.

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

(Continued)

(65) **Prior Publication Data**

US 2008/0122714 A1 May 29, 2008

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2005/022100, filed on Dec. 1, 2005.

Primary Examiner—Tan Ho

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

(30) **Foreign Application Priority Data**

Jan. 5, 2005 (JP) 2005-000773

(57) **ABSTRACT**

(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, 895**

See application file for complete search history.

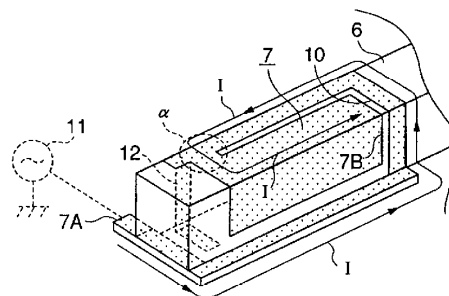
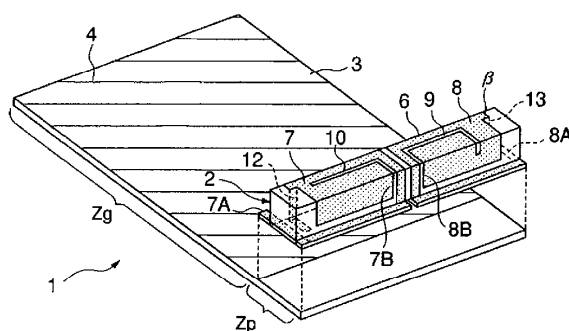
In an antenna structure 1 in which a feed radiation electrode provided on a dielectric base member performs an antenna operation in a fundamental mode and an antenna operation in a higher-order mode with a resonant frequency higher than that in the fundamental mode, one end of the feed radiation electrode defines a feed end connected to a circuit for radio communication, and the other end of the feed radiation electrode defines an open end. The position of a capacitance-loading portion α is set in advance between the feed end and the open end of the feed radiation electrode. A capacitance-loading conductor is connected to one or both of the feed end and the capacitance-loading portion α of the feed radiation electrode. The capacitance-loading conductor forms a capacitance for adjusting a resonant frequency in the fundamental mode between the feed end and the capacitance-loading portion α .

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,177,908 B1* 1/2001 Kawahata et al. 343/700 MS
6,657,593 B2* 12/2003 Nagumo et al. 343/700 MS
6,950,072 B2 9/2005 Miyata et al.
7,136,020 B2* 11/2006 Yamaki 343/702
2001/0048390 A1 12/2001 Nagumo et al.

33 Claims, 6 Drawing Sheets





US007538738B2

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

(10) **Patent No.:** **US 7,538,738 B2**
(45) **Date of Patent:** **May 26, 2009**

(54) **TAG-USE ANTENNA AND TAG USING THE SAME**

6,870,506 B2* 3/2005 Chen et al. 343/700 MS
6,999,028 B2* 2/2006 Egbert 343/700 MS
7,053,221 B2* 5/2006 Hedrick et al. 548/181

(75) Inventors: **Manabu Kai**, Kawasaki (JP); **Toru Maniwa**, Kawasaki (JP); **Takashi Yamagajo**, Kawasaki (JP)

(Continued)

FOREIGN PATENT DOCUMENTS

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

KR 2001-0073147 7/2001
WO WO 00/16286 3/2000

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 130 days.

OTHER PUBLICATIONS

Official Communication from the Korean Intellectual Property Office, Notice of filing of written argument; Application No. 10-2006-88888; Oct. 18, 2007 with Eng. Translation.

(Continued)

(21) Appl. No.: **11/513,188**

(22) Filed: **Aug. 31, 2006**

Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Hanify & King, P.C.

(65) **Prior Publication Data**

US 2007/0252770 A1 Nov. 1, 2007

(30) **Foreign Application Priority Data**

Apr. 26, 2006 (JP) 2006-122459

(51) **Int. Cl.**
H01Q 9/26 (2006.01)

(52) **U.S. Cl.** **343/795**; 343/802; 343/803;
343/806

(58) **Field of Classification Search** 343/795,
343/802, 803, 804, 806, 895
See application file for complete search history.

(56) **References Cited**

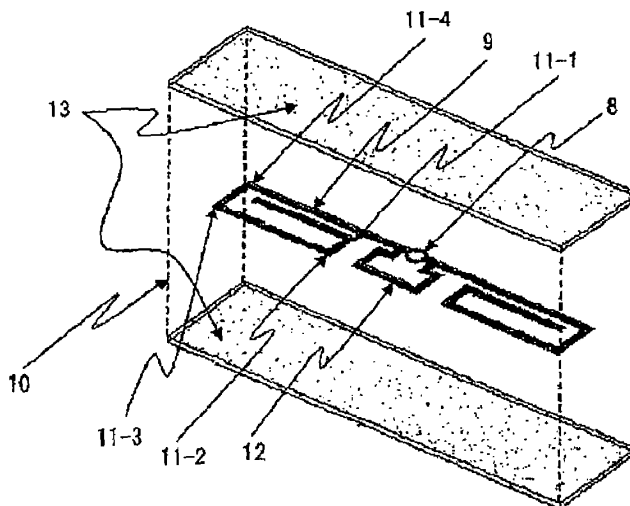
U.S. PATENT DOCUMENTS

2,724,053 A * 11/1955 Davis 343/803
4,736,207 A * 4/1988 Siikarla et al. 343/895
5,142,270 A * 8/1992 Appalucci et al. 340/572.3
6,285,342 B1 * 9/2001 Brady et al. 343/895
6,717,551 B1 * 4/2004 Desclos et al. 343/700 MS

(57) **ABSTRACT**

The present invention relates to a tag-use antenna allowing a miniaturization while maintaining a constant minimal change of a communication distance. The tag-use antenna has a feed part of a folded dipole antenna of a size of 53 mm long and 7 mm wide being connected to, and equipped with, an LSI chip of $R_c=500$ ohms and $C_c=1.4$ pF and is covered with plastic resin 13 of the dielectric constant $\epsilon_r=3$ and thickness of $t=0.75$ mm on both sides of the antenna. The dipole part of 1 mm wire path width of the tag-use antenna is formed in a rectangular spiral by being bent inward from both ends at bending parts at four places. The entire length of the dipole antenna when extending the four bending parts straight is featured so as to be shorter than one half of a resonance wavelength of the antenna. An inductance part is featured in the intermediate part of the both dipole parts in the neighborhood of the center of the antenna. The inductance part is connected to the chip equipment part in parallel with the both dipole parts.

7 Claims, 8 Drawing Sheets





US007538739B2

(12) **United States Patent**
Tao

(10) **Patent No.:** **US 7,538,739 B2**
(45) **Date of Patent:** **May 26, 2009**

(54) **FLAT ANTENNA** 6,765,539 B1 * 7/2004 Wang et al. 343/795
6,859,176 B2 * 2/2005 Choi 343/700 MS
(75) Inventor: **Wen-Szu Tao**, Hsinchu (TW) 6,882,324 B1 * 4/2005 Chen 343/790
7,064,729 B2 * 6/2006 Olson 343/795

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

* cited by examiner

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 440 days.

Primary Examiner—Michael C Wimer
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch &
Birch, LLP

(21) Appl. No.: **11/517,291**

(57) **ABSTRACT**

(22) Filed: **Sep. 8, 2006**

(65) **Prior Publication Data**

US 2008/0055179 A1 Mar. 6, 2008

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

(52) **U.S. Cl.** **343/795; 343/792; 343/812**

(58) **Field of Classification Search** **343/700 MS,**
343/792, 793, 795, 812, 813
See application file for complete search history.

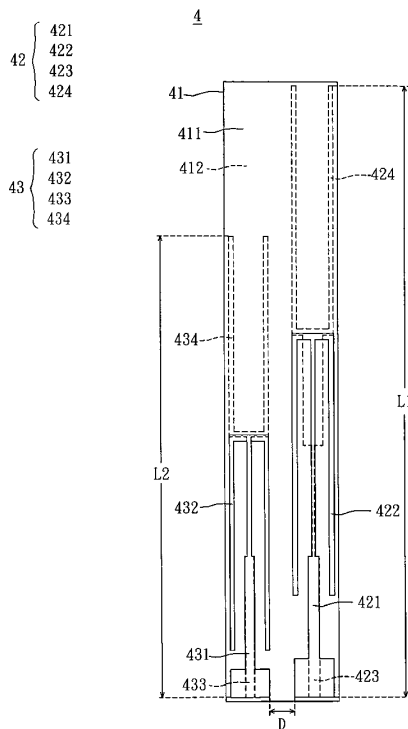
A flat antenna includes a substrate, a first antenna module having a first grounding unit, a first radiating unit, a first feeding unit and a second radiating unit, and a second antenna module having a second grounding unit, a third radiating unit, a second feeding unit and a fourth radiating unit. The second antenna module is disposed abreast with the first antenna module. The first and the second grounding units, and the first and the third radiating units are disposed on a first surface of the substrate. The first and the second feeding units, and the second and the fourth radiating units are disposed on a second surface of the substrate. The first, the second, the third and the fourth radiating units, which have a first, a second, a third and a fourth openings respectively, are electrically connected with the first grounding unit, the first feeding unit, the second grounding unit and the second feeding unit.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,747,605 B2 * 6/2004 Lebaric et al. 343/795

19 Claims, 9 Drawing Sheets





US007538743B1

(12) **United States Patent**
Chantz

(10) **Patent No.:** **US 7,538,743 B1**
(45) **Date of Patent:** **May 26, 2009**

- (54) **BALANCED AND SHORTENED ANTENNAS**
- (75) Inventor: **Hyman D. Chantz**, Scarsdale, NY (US)
- (73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 13 days.

6,172,655	B1	1/2001	Volman	
6,333,722	B1 *	12/2001	Kitano	343/895
6,344,834	B1 *	2/2002	Josypenko	343/895
6,388,626	B1 *	5/2002	Gamalielsson et al.	343/702
6,501,438	B2	12/2002	Nevermann et al.	
6,606,513	B2	8/2003	Lardo et al.	
7,183,998	B2	2/2007	Wilhelm et al.	
2007/0146226	A1 *	6/2007	Oh et al.	343/873
2008/0105826	A1 *	5/2008	Mercure et al.	250/394

* cited by examiner

- (21) Appl. No.: **11/940,391**
- (22) Filed: **Nov. 15, 2007**

Primary Examiner—Rexford Barnie
Assistant Examiner—Jason Crawford
 (74) *Attorney, Agent, or Firm*—Schmeiser, Olsen & Watts; Anna Linne

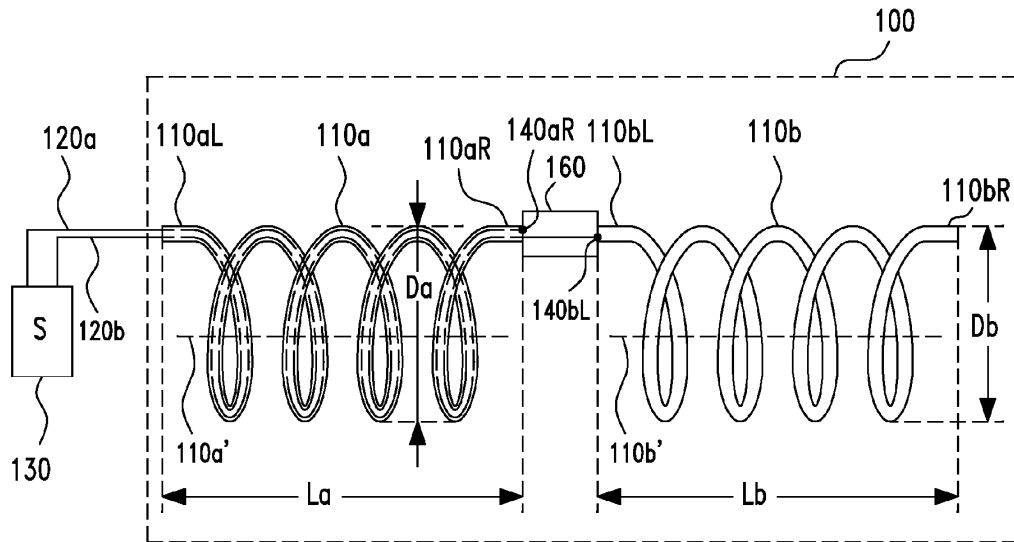
- (51) **Int. Cl.**
H01Q 1/36 (2006.01)
- (52) **U.S. Cl.** **343/895**; 343/788; 343/896; 343/898
- (58) **Field of Classification Search** 343/788, 343/895-896, 898
See application file for complete search history.

(57) **ABSTRACT**

An antenna for radiating and/or receiving signals. The antenna includes (i) a first hollow and helical pipe, (ii) a second hollow and helical pipe, (iii) a first transmission wire, (iv) a second transmission wire, and (v) a dielectric connector. The dielectric connector physically couples to the first hollow and helical pipe and the second hollow and helical pipe. The first hollow and helical pipe and the second hollow and helical pipe comprise an electrically conductive material. The first transmission wire comprises a first portion and a second portion. The second transmission wire comprises a third portion and a fourth portion. The first portion of the first transmission wire and the third portion of the second transmission wire are inside the first hollow and helical pipe.

- (56) **References Cited**
U.S. PATENT DOCUMENTS
- 3,906,509 A * 9/1975 DuHamel 343/895
- 4,489,276 A * 12/1984 Yu 324/338
- 5,453,755 A * 9/1995 Nakano et al. 343/872
- 5,928,145 A 7/1999 Ocali et al.
- 6,011,525 A * 1/2000 Piole 343/895
- 6,075,501 A * 6/2000 Kuramoto et al. 343/895
- 6,169,523 B1 * 1/2001 Ploussios 343/895

20 Claims, 1 Drawing Sheet





US007541979B2

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

(10) **Patent No.:** **US 7,541,979 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **SMALL SIZE THIN TYPE ANTENNA, MULTILAYERED SUBSTRATE, HIGH FREQUENCY MODULE, AND RADIO TERMINAL MOUNTING THEM**

7,253,772 B2* 8/2007 Chi et al. 343/700 MS
2002/0093456 A1 7/2002 Sawamura et al.
2002/0140610 A1 10/2002 Onaka et al.
2003/0080904 A1* 5/2003 Chen 343/700 MS

(75) Inventors: **Ken Takei**, Hitachi (JP); **Tomoyuki Ogawa**, Hitachi (JP); **Morihiko Ikegaya**, Hitachi (JP)

FOREIGN PATENT DOCUMENTS

JP 01-158805 6/1989
JP 03-192805 8/1991
JP 06-069717 3/1994
JP 62-39317 3/1994
JP 70221537 8/1995
JP 07-235825 9/1995
JP 2002-158529 5/2002
JP 2002-185238 6/2002
JP 2002-299933 10/2002
JP 2004-221661 8/2004
JP 2004-266681 9/2004
JP 2004-274223 9/2004

(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 180 days.

(21) Appl. No.: **11/252,889**

(22) Filed: **Oct. 19, 2005**

(65) **Prior Publication Data**

US 2006/0097932 A1 May 11, 2006

(30) **Foreign Application Priority Data**

Oct. 20, 2004 (JP) 2004-305873

(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.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,581,262 A 12/1996 Kawahata et al.
6,535,170 B2* 3/2003 Sawamura et al. 343/702
6,774,850 B2* 8/2004 Chen 343/700 MS
6,812,892 B2* 11/2004 Tai et al. 343/700 MS
6,861,986 B2* 3/2005 Fang et al. 343/700 MS
6,930,640 B2* 8/2005 Chung et al. 343/700 MS
6,963,310 B2* 11/2005 Horita et al. 343/702

OTHER PUBLICATIONS

Japanese Office Action dated Nov. 4, 2008 with English Translation.

* cited by examiner

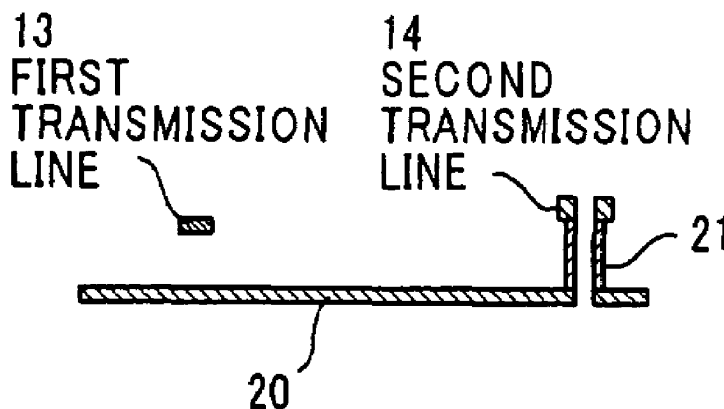
Primary Examiner—Tan Ho

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

(57) **ABSTRACT**

A small size thin type antenna using a thin type structure having a wavelength compaction effect without using a bulk conductive material and a high frequency module using the same are disclosed. The small size thin type antenna comprises an open stub 3 including at least one transmission line 13, 16, a connecting line 5 including at least one transmission line 15, and a short stub 4 including a transmission line 14. A characteristic impedance Z_o of the open stub 3 is determined to be lower than a characteristic impedance Z_b of the connecting line 5 and a characteristic impedance Z_s of the short stub 4.

20 Claims, 13 Drawing Sheets





US007541980B2

(12) **United States Patent**
Shih

(10) **Patent No.:** **US 7,541,980 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

- (54) **PRINTED ANTENNA** 6,348,894 B1 * 2/2002 Lahti 343/702
- (75) Inventor: **Yen-Yi Shih**, Taipei-Hsien (TW) 6,388,626 B1 * 5/2002 Gamalielsson et al. 343/702
- (73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
Tu-Cheng, Taipei Hsien (TW) 6,414,641 B1 * 7/2002 Carlson et al. 343/702
- 6,515,625 B1 * 2/2003 Johnson 343/700 MS
- 2006/0145925 A1 7/2006 Mei

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 123 days.

* cited by examiner

(21) Appl. No.: **11/558,476**

Primary Examiner—Tho G Phan

(22) Filed: **Nov. 10, 2006**

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

(65) **Prior Publication Data**

US 2007/0241968 A1 Oct. 18, 2007

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Apr. 14, 2006 (TW) 95113396 A

A printed antenna includes a radiation part (10) for radiating and receiving electromagnetic signals, a feed wire (30) for feeding the electromagnetic signals to the radiation part, a matching part (20) for impedance matching, and a ground plane (40). The radiation part includes a first radiation segment (12), a second radiation segment (14), and a third radiation segment (16). The second radiation segment is electrically connected to the first radiation segment and the third radiation segment. The feed wire is electrically connected to the radiation part. The matching part is electrically connected to the radiation part and the ground plane. The second radiation segment and the matching part extend from the first radiation segment to a same side of the first radiation segment.

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

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

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

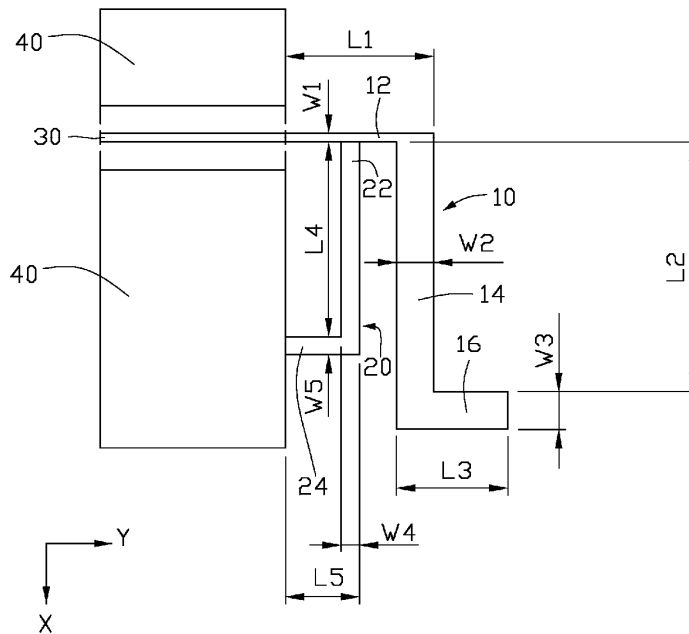
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,002,367 A * 12/1999 Engblom et al. 343/700 MS

18 Claims, 5 Drawing Sheets





US007541983B2

(12) **United States Patent**
Wang

(10) **Patent No.:** **US 7,541,983 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **PLANER ANTENNA FOR RECEIVING DIGITAL TELEVISION PROGRAMS**

7,248,227 B2* 7/2007 Chen 343/795
7,391,384 B2* 6/2008 Wong et al. 343/795
7,486,237 B2* 2/2009 Huang et al. 343/700 MS

(75) Inventor: **Cheng-Si Wang**, Chaunghua Hsien (TW)

(73) Assignee: **Trans Electric Co., Ltd.**, Changhua Hsien (TW)

* cited by examiner

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 140 days.

Primary Examiner—Hoang V Nguyen
(74) Attorney, Agent, or Firm—Rabin & Berdo, P.C.

(57) **ABSTRACT**

(21) Appl. No.: **11/782,823**

(22) Filed: **Jul. 25, 2007**

(65) **Prior Publication Data**

US 2009/0027274 A1 Jan. 29, 2009

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

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

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

See application file for complete search history.

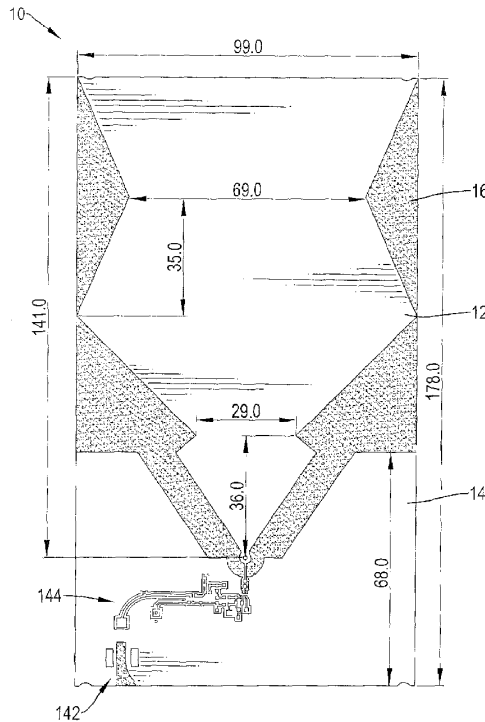
(56) **References Cited**

U.S. PATENT DOCUMENTS

6,670,922 B1* 12/2003 Huang et al. 343/700 MS

A planer antenna for receiving digital television programs is conductive and formed on a printed circuit board and has a body and an interface. The body is formed on the printed circuit board to receive an electromagnetic wave signal of television programs in a frequency range from around 470 MHz to around 860 MHz and has a longitudinal line of symmetry along which a series of shapes is formed starting with a trapezoid segment, then an hexagon segment and then a diamond segment and has a feeding port. The interface is rectangular, conductive and formed on the circuit board corresponding to the feeding port and connected electrically to the body at the feeding port. The interface has an output port formed on the interface for connecting to and transmitting signals to a television.

8 Claims, 6 Drawing Sheets





US007541984B2

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

(10) **Patent No.:** **US 7,541,984 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

- (54) **MULTIPLE FREQUENCY BAND ANTENNA**
- (75) Inventors: **Huang-Tse Peng**, Taipei (TW); **Kuo-Jen Lai**, Taipei (TW)
- (73) Assignee: **Arima Communications Corporation** (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 34 days.

7,119,747	B2 *	10/2006	Lin et al.	343/702
7,358,902	B2 *	4/2008	Erkocevic	343/700 MS
7,375,685	B1 *	5/2008	Nalbandian	343/700 MS
2004/0196187	A1 *	10/2004	Yeh	343/700 MS

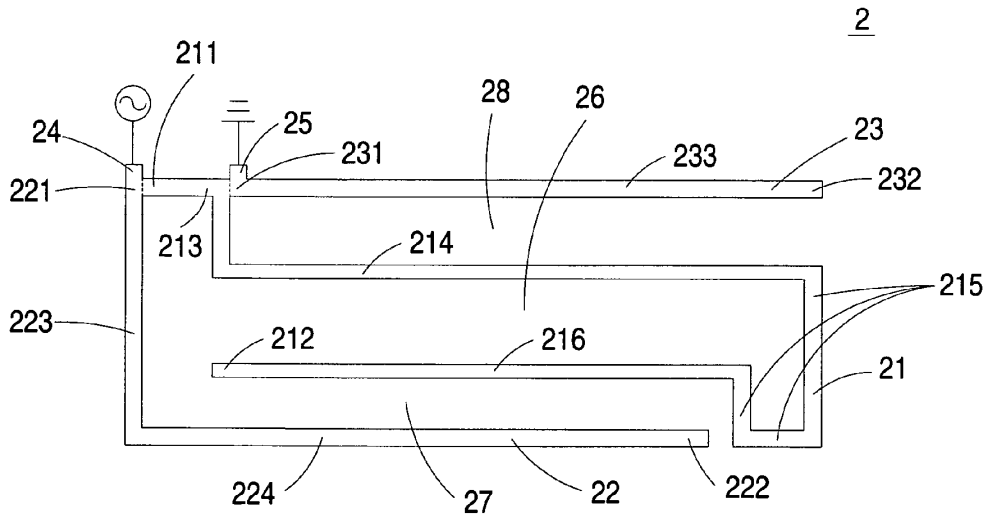
* cited by examiner
Primary Examiner—Trinh V Dinh
 (74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

- (21) Appl. No.: **11/878,656**
- (22) Filed: **Jul. 26, 2007**
- (65) **Prior Publication Data**
US 2009/0027299 A1 Jan. 29, 2009
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/702**
- (58) **Field of Classification Search** None
See application file for complete search history.
- (56) **References Cited**
U.S. PATENT DOCUMENTS
7,057,560 B2 * 6/2006 Erkocevic 343/700 MS

(57) **ABSTRACT**

 A multiple frequency band antenna is disclosed. The multiple frequency band antenna includes a first radiating element, a second radiating element, a third radiating element, a feeding point and ground. The second radiating element and the third radiating element are connected to the first radiating element and have a path length relatively shorter than that of the first radiating element. The feeding point is connected to the second radiating element. The ground is at least partially connected to the third radiating element and/or the first radiating element. The first radiating element, the second radiating element and the third radiating employ the common feeding point and the ground so that the first radiating element has a first frequency operating band and the second radiating element and the third radiating element have a plurality of second frequency operating bands.

9 Claims, 5 Drawing Sheets





US007541985B2

(12) **United States Patent**
Lin

(10) **Patent No.:** **US 7,541,985 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **MULTI-BROAD BAND ANTENNA AND ELECTRONIC DEVICE THEREOF**

(75) Inventor: **Hui Lin**, Taoyuan (TW)
(73) Assignee: **Quanta Computer Inc.**, Tao Yuan Shien (TW)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 17 days.

(21) Appl. No.: **11/892,730**
(22) Filed: **Aug. 27, 2007**

(65) **Prior Publication Data**
US 2008/0180343 A1 Jul. 31, 2008

(30) **Foreign Application Priority Data**
Jan. 30, 2007 (TW) 96103427 A

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

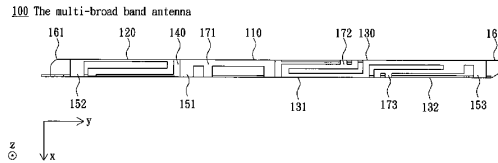
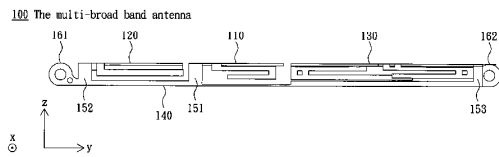
2008/0122698 A1 * 5/2008 Ollikainen et al. 343/700 MS
* cited by examiner

Primary Examiner—Rexford N Barnie
Assistant Examiner—Thienvu V Tran
(74) *Attorney, Agent, or Firm*—Rabin & Berdo, PC.

(57) **ABSTRACT**

A multi-broad band antenna including a first radiating body, a second radiating body, a third radiating body, a grounding plate and many short-circuit elements is provided. The first radiating body excites a first resonant mode, such that the multi-broad band antenna has a high frequency wide bandwidth. The second radiating body excites a second resonant mode, such that the multi-broad band antenna has a middle frequency wide bandwidth. The third radiating body excites a third resonant mode, such that the multi-broad band antenna has a low frequency wide bandwidth. A number of short-circuit elements connect the first radiating body, the second radiating body and the third radiating body to the grounding plate respectively. The radiation patterns of the first resonant mode, the second resonant mode and the third resonant mode do not disturb each other.

25 Claims, 12 Drawing Sheets





US007541986B2

(12) **United States Patent
Park**

(10) **Patent No.:** US 7,541,986 B2
(45) **Date of Patent:** Jun. 2, 2009

(54) **INTERNAL ANTENNA AND MOBILE
TERMINAL HAVING THE INTERNAL
ANTENNA**

7,236,065 B2 * 6/2007 Hyvonen 333/101
2001/0014547 A1 8/2001 Soh 439/67
2003/0103014 A1 6/2003 Birnbaum et al. 343/841

(75) Inventor: **Byung Duck Park**, 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 0 days.

CN 1308782 A 8/2001
CN 1409941 A 4/2003
EP 0407072 6/1990

(21) Appl. No.: **10/896,059**

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

(65) **Prior Publication Data**

US 2005/0017910 A1 Jan. 27, 2005

FOREIGN PATENT DOCUMENTS

(Continued)

OTHER PUBLICATIONS

European Search Report Dated Aug. 23, 2005.

(Continued)

(30) **Foreign Application Priority Data**

Jul. 23, 2003 (KR) 10-2003-0050710
Jul. 23, 2003 (KR) 10-2003-0050711

Primary Examiner—Douglas W Owens

Assistant Examiner—Jimmy T Vu

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

(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, 745, 841, 846; 455/90.1–90.3,
455/550.1; 361/816–818

See application file for complete search history.

(57) **ABSTRACT**

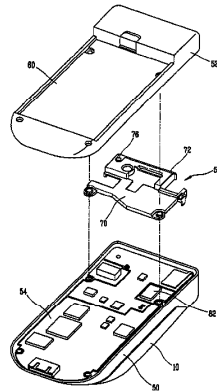
A mobile terminal includes a terminal case, a main PCB inside the terminal case mounting various circuit components thereon, and an internal antenna fixed on the main PCB. The internal antenna can transmit and receive radio waves bearing voice and image information to and from the main PCB and shield electromagnetic wave generating parts mounted on the main PCB. Thus, embodiments of an internal antenna, a mobile terminal and methods thereof can reduce size and costs, and can shield RF elements or the like discharging a large amount of electromagnetic waves or circuit components among parts installed on the main PCB so that leakage of electromagnetic waves can be reliably reduced or prevented.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,832,080 A * 11/1998 Beutler et al. 379/433.13
6,157,546 A 12/2000 Petty et al. 361/816
6,285,324 B1 * 9/2001 Korisch et al. 343/700 MS
6,342,869 B1 1/2002 Edvardsson et al. 343/841
6,392,603 B1 * 5/2002 Kurz et al. 343/702
6,486,837 B2 * 11/2002 Spiegel et al. 343/702
6,819,939 B2 * 11/2004 Masamura 455/550.1
6,867,746 B2 * 3/2005 Mendolia et al. 343/841
6,952,340 B2 * 10/2005 Son et al. 361/680
6,990,355 B2 * 1/2006 Ueyama et al. 455/550.1
7,081,854 B2 * 7/2006 Ying et al. 343/702

36 Claims, 8 Drawing Sheets





US007541989B2

(12) **United States Patent**
Shih

(10) **Patent No.:** **US 7,541,989 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **WIRELESS COMMUNICATION DEVICE AND ANTENNA THEREOF**

(75) Inventor: **Yen-Yi Shih**, Taipei Hsien (TW)

(73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
Tu-Cheng, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 10 days.

6,867,746	B2 *	3/2005	Mendolia et al.	343/841
6,922,471	B1	7/2005	Marqvardsen et al.	
6,958,732	B2 *	10/2005	Yuanzhu	343/702
2002/0022459	A1 *	2/2002	Kobayashi	455/90
2003/0201948	A1 *	10/2003	Phelan et al.	343/895
2005/0003849	A1	1/2005	Ramian	
2005/0233781	A1	10/2005	Erixon et al.	

FOREIGN PATENT DOCUMENTS

(21) Appl. No.: **11/615,009**

JP 4290345 10/1992

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

JP 2002044199 2/2002

(65) **Prior Publication Data**

US 2007/0296637 A1 Dec. 27, 2007

* cited by examiner

(30) **Foreign Application Priority Data**

Jun. 23, 2006 (TW) 95122727 A

Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

(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, 793, 797, 810–820, 846**
See application file for complete search history.

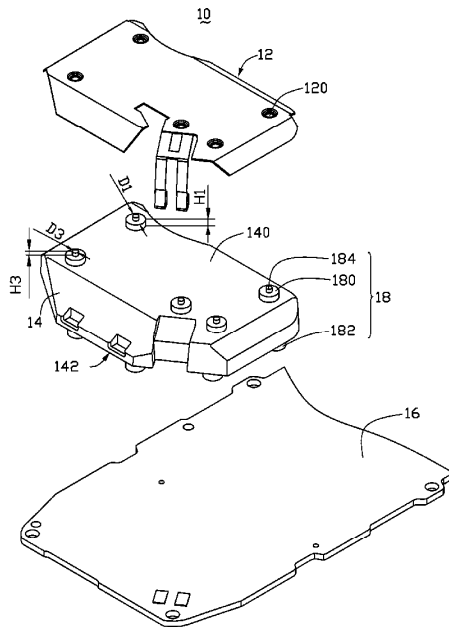
A wireless communication device (10) includes an antenna (12), an electronic element (14), and a support member (18). The antenna for radiating and receiving electromagnetic signals is disposed on one side of the electronic element. The support member includes at least one support portion disposed between the antenna and the electronic element to form a space for spacing the antenna and the electronic element to enhance the radiation efficiency of the antenna.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,930,694 A 7/1999 Shima

15 Claims, 9 Drawing Sheets





US007541993B2

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

(10) **Patent No.:** **US 7,541,993 B2**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **ANTENNA DEVICE WITH A DUAL-LOOP RADIATING ELEMENT**

(75) Inventors: **Tiao-Hsing Tsai**, Yungho (TW);
Chao-Hsu Wu, Tao Yuan Shien (TW);
Chi-Yin Fang, Pingtung Shien (TW)

(73) Assignee: **Quanta Computer Inc.** (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.: **12/072,796**

(22) Filed: **Feb. 28, 2008**

(65) **Prior Publication Data**
US 2009/0109105 A1 Apr. 30, 2009

(30) **Foreign Application Priority Data**
Oct. 29, 2007 (TW) 96140555 A

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

(52) **U.S. Cl.** **343/702; 343/866; 343/867**

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,958,737 B2 * 10/2005 Lee et al. 343/866
7,474,267 B2 * 1/2009 Chen et al. 343/702

* cited by examiner

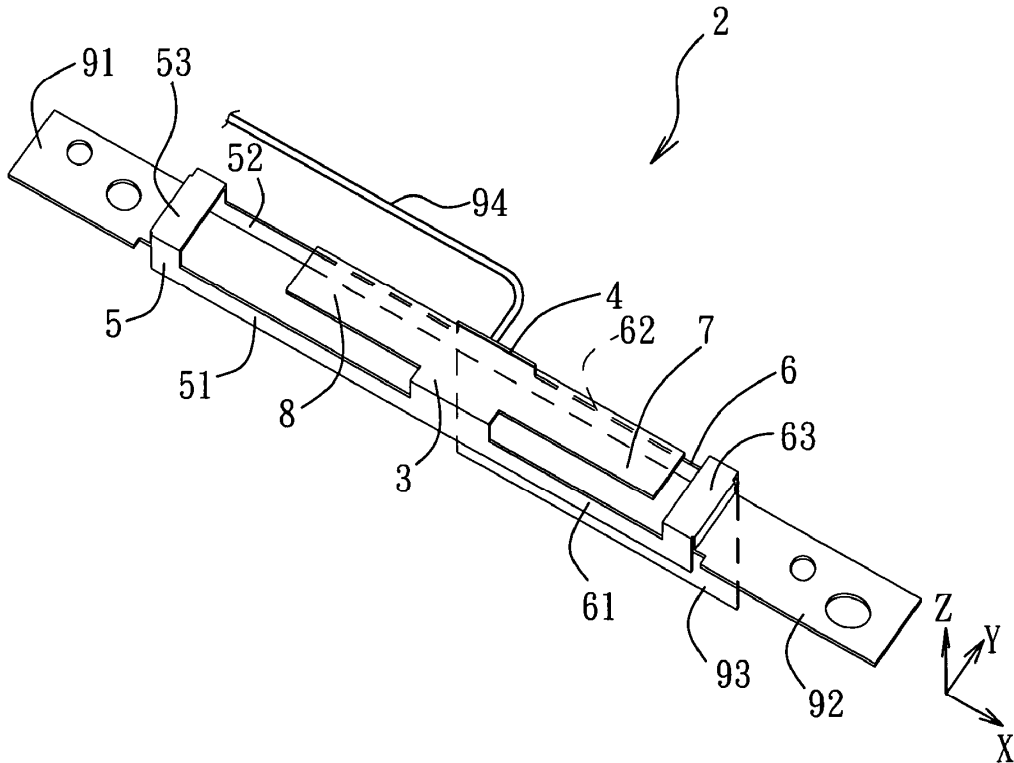
Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Ohlandt, Greeley, Ruggiero & Perle, L.L.P.

(57) **ABSTRACT**

An antenna device includes a dual-loop radiating element, first and second radiating arms, a feeding element, and a grounding element. The dual-loop radiating element has first and second loops. Each of the first and second radiating arms is disposed in a respective one of the first and second loops. The feeding element interconnects the first and second loops and the first and second radiating arms. The grounding element is connected to the first and second loops.

16 Claims, 7 Drawing Sheets





US007541998B1

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

(10) **Patent No.:** **US 7,541,998 B1**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **CIRCULARLY-POLARIZED DIELECTRIC RESONATOR ANTENNA**

(75) Inventors: **Tze-Hsuan Chang**, Taipei (TW);
Jean-Fu Kiang, Taipei (TW)

(73) Assignee: **National Taiwan 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 34 days.

(21) Appl. No.: **11/959,695**

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

(30) **Foreign Application Priority Data**

Nov. 20, 2007 (TW) 96143885 A

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

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

(58) **Field of Classification Search** 343/767,
343/700 MS, 702, 846-848, 829
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,147,647 A 11/2000 Tassoudji et al.
6,452,565 B1 * 9/2002 Kingsley et al. 343/873

6,879,287 B2 * 4/2005 Popov et al. 343/700 MS
6,900,764 B2 * 5/2005 Kingsley et al. 343/700 MS
6,940,463 B2 * 9/2005 Ittipiboon et al. 343/729
6,995,713 B2 2/2006 Le Bolzer et al.
7,009,565 B2 * 3/2006 Pidwerbetsky et al. 343/700 MS
7,196,663 B2 3/2007 Bolzer et al.
7,504,721 B2 * 3/2009 Chen et al. 257/724

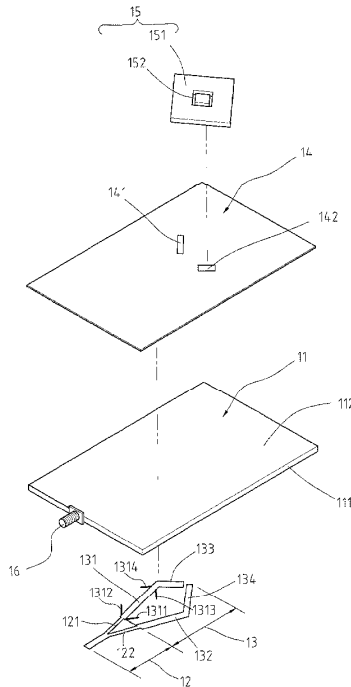
* cited by examiner

Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Rabin & Berdo, P.C.

(57) **ABSTRACT**

The present invention relates to a circularly-polarized dielectric resonator antenna (DRA). The antenna comprises a substrate, a Wilkinson power divider, a phase shifter, a ground plane and a dielectric resonator, wherein the phase shifter is connected to the Wilkinson power divider. Besides, the dielectric resonator is disposed on the ground plane, and includes a dielectric main body and a slot disposed above the substrate. Additionally, the antenna is adopted to increase the linear radiation bandwidth by utilizing the slot, and transceivers a circularly-polarized electromagnetic wave by utilizing the Wilkinson power divider. Consequently, the circularly-polarized dielectric resonator antenna can be applied in the fields of satellite communication, Worldwide Interoperability for Microwave Access (WiMAX), and wireless communication.

8 Claims, 8 Drawing Sheets





US007542002B1

(12) **United States Patent**
Andersson

(10) **Patent No.:** **US 7,542,002 B1**
(45) **Date of Patent:** **Jun. 2, 2009**

(54) **WIDEBAND MONOPOLE ANTENNA**

7,071,875 B2* 7/2006 Sugimoto et al. 343/700 MS
2008/0024366 A1* 1/2008 Cheng 343/700 MS

(75) Inventor: **Johan Andersson**, Malmö (SE)

* cited by examiner

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

Primary Examiner—James Cho

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

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

(57) **ABSTRACT**

(21) Appl. No.: **12/015,635**

A wideband monopole antenna arrangement, for a portable communication device, includes a substantially continuous conductor plate that includes a first antenna element and a second antenna element, and a signal ground arranged to interact with the antenna elements so as to form the wideband monopole antenna arrangement. The first antenna element extends substantially at an angle (θ) with respect to the second antenna element. The angle (θ) forms an acute angle of a right-angled triangle (T) in which the first antenna element extends substantially parallel to a hypotenuse (h) of the triangle (T) and the second antenna element extends substantially in parallel to a longer cathetus (c1) of two catheti (c1, c2) in the triangle (T).

(22) Filed: **Jan. 17, 2008**

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,661,380 B1* 12/2003 Bancroft et al. 343/700 MS

30 Claims, 8 Drawing Sheets

