



US007583226B2

(12) **United States Patent**  
**Sakurada**

(10) **Patent No.:** **US 7,583,226 B2**  
(45) **Date of Patent:** **Sep. 1, 2009**

(54) **DIELECTRIC ANTENNA** 6,759,990 B2\* 7/2004 Rossman ..... 343/700 MS  
6,876,328 B2\* 4/2005 Adachi et al. .... 343/700 MS  
(75) Inventor: **Kiyoyasu Sakurada**, Moriyama (JP) 2003/0011533 A1 1/2003 Sakurada et al.

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 602 days.

(21) Appl. No.: **10/585,672**

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

(86) PCT No.: **PCT/JP2005/002392**

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(2), (4) Date: **Jul. 7, 2006**

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PCT Pub. Date: **Sep. 1, 2005**

(65) **Prior Publication Data**  
US 2009/0021443 A1 Jan. 22, 2009

(30) **Foreign Application Priority Data**  
Feb. 25, 2004 (JP) ..... 2004-049515

(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, 911 R**  
See application file for complete search history.

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WO	WO-97/32314	9/1997
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Japanese Office Action dated Apr. 26, 2005 (with English translation).

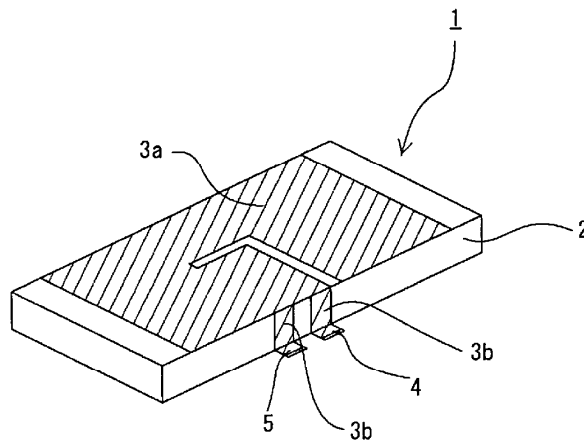
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*Primary Examiner*—Hoang V Nguyen  
(74) *Attorney, Agent, or Firm*—Dickstein Shapiro LLP

(57) **ABSTRACT**

A dielectric antenna is provided which uses a compounded material and exhibits a small change in relative dielectric constant at room temperature against a load due to temperature changes. The dielectric antenna includes a dielectric block, a radiation electrode, a feeding electrode and a fixing electrode provided on the dielectric block. The dielectric block contains a crystalline thermoplastic resin, ceramic powder, and an acid-modified styrenic thermoplastic elastomer. The acid-modified styrenic thermoplastic elastomer content in the dielectric block is 3% to 20% by volume.

**12 Claims, 1 Drawing Sheet**





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

(10) **Patent No.:** **US 7,583,227 B2**  
(45) **Date of Patent:** **Sep. 1, 2009**

- (54) **ELECTRONIC DEVICE WITH BUILT-IN ANTENNA**
- (75) Inventors: **Shinji Kuraoka**, Kanagawa (JP);  
**Yasuhito Omori**, Kanagawa (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 225 days.

(21) Appl. No.: **11/571,385**

(22) PCT Filed: **Jul. 6, 2005**

(86) PCT No.: **PCT/JP2005/012483**

§ 371 (c)(1),  
(2), (4) Date: **Feb. 23, 2007**

(87) PCT Pub. No.: **WO2006/004153**

PCT Pub. Date: **Jan. 12, 2006**

(65) **Prior Publication Data**

US 2008/0084355 A1 Apr. 10, 2008

(30) **Foreign Application Priority Data**

Jul. 6, 2004 (JP) ..... 2004-199628

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

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

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

See application file for complete search history.

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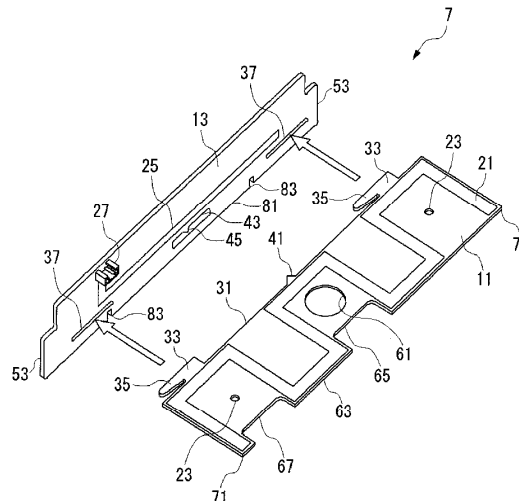
\* cited by examiner

*Primary Examiner*—HoangAnh T Le  
(74) *Attorney, Agent, or Firm*—Pearne & Gordon LLP

(57) **ABSTRACT**

An antenna substrate (13) and a waveguide substrate (11) are housed in a main unit case (3). The waveguide substrate (11) is fixed to an attachment part (9) in the main unit case (3). The antenna substrate (13) is disposed adjacent to the waveguide substrate (11) in a standing position on the attachment part (9). The waveguide substrate (11) has an insert (33) on an edge (31) thereof. The antenna substrate (13) has a slit (37) aligned with the edge (31) of the waveguide substrate (11). The insert (33) is inserted into the slit (37), thereby restricting the movement of the antenna substrate (13). The antenna substrate (13) and the waveguide substrate (11) can be coupled to each other without using a metal plate bracket and integrally assembled to the main unit case (3). Therefore, the antenna performance is improved.

**6 Claims, 5 Drawing Sheets**





US007583231B2

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

(10) **Patent No.:** **US 7,583,231 B2**  
(45) **Date of Patent:** **Sep. 1, 2009**

(54) **PRINTED ANTENNA WITH BAND REJECTION FILTER**

(75) Inventors: **Do-hoon Kwon**, Seoul (KR); **Young-eil Kim**, Suwon-si (KR); **Yong-jin Kim**, Seoul (KR); **Nikolay Petrovich Chubinsky**, Moscow (RU)

(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 556 days.

(21) Appl. No.: **11/339,516**

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

(65) **Prior Publication Data**  
US 2006/0170602 A1 Aug. 3, 2006

(30) **Foreign Application Priority Data**  
Feb. 3, 2005 (KR) ..... 10-2005-0010152

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

(52) **U.S. Cl.** ..... **343/749**; 343/700 MS; 343/850

(58) **Field of Classification Search** ..... 343/749, 343/752

See application file for complete search history.

(56) **References Cited**

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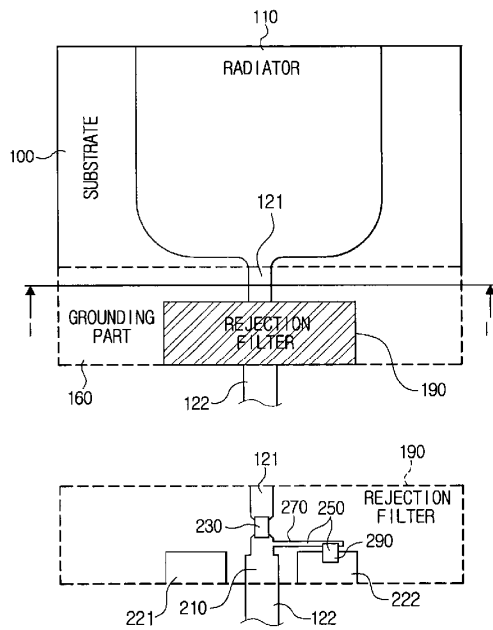
*Primary Examiner*—Trinh V Dinh

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

(57) **ABSTRACT**

An antenna having a band rejection filter. The antenna includes: a radiator formed of a single plate, a grounding part formed of a single plate, a dielectric substrate including a surface on which the radiator is attached and another surface on which the grounding part is attached, and the band rejection filter connected to an end of the radiator. The band rejection filter includes a first capacitor connected to a signal line in parallel, a resonator including an end connected to the first capacitor in parallel and another end grounded, and a second capacitor in parallel and another end grounded, and a second capacitor including an end connected to the first capacitor in series and another end connected to the radiator in series. The resonator includes an inductor and a third capacitor connected to the inductor in series. As a result, the antenna may remove a frequency lower than an ultra wide band pass.

**14 Claims, 4 Drawing Sheets**





US007583233B2

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

(10) **Patent No.:** **US 7,583,233 B2**  
(45) **Date of Patent:** **\*Sep. 1, 2009**

(54) **RF RECEIVING AND TRANSMITTING APPARATUSES HAVING A MICROSTRIP-SLOT LOG-PERIODIC ANTENNA**

(75) Inventors: **Mark Russell Goldberg**, Simi Valley, CA (US); **Harold Kregg Hunsberger**, Simi Valley, CA (US)

(73) Assignee: **Alliant Techsystems Inc.**, Minneapolis, MN (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 14 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/861,477**

(22) Filed: **Sep. 26, 2007**

(65) **Prior Publication Data**

US 2008/0007471 A1 Jan. 10, 2008

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 11/163,119, filed on Oct. 5, 2005, now Pat. No. 7,292,197.

(60) Provisional application No. 60/617,454, filed on Oct. 8, 2004.

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

(52) **U.S. Cl.** ..... **343/792.5; 343/767; 343/700 MS; 343/770**

(58) **Field of Classification Search** ..... **343/792.5**  
See application file for complete search history.

(56) **References Cited**

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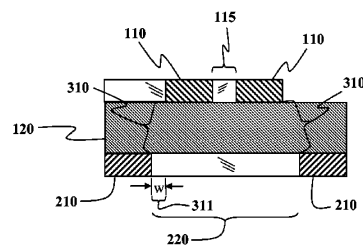
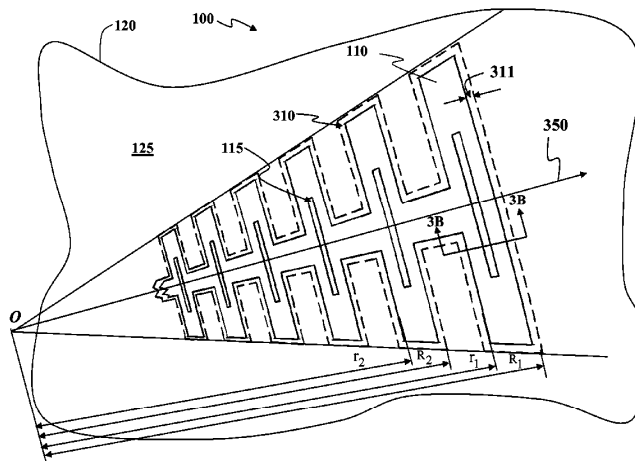
*Primary Examiner*—Trinh V Dinh

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

(57) **ABSTRACT**

A log-periodic antenna having a layer of dielectric media interposed between a microstrip log-periodic portion and a slot log-periodic portion where an array of two or more log-periodic antennas that may be placed about vehicles, such as air vehicles, or mounted on stationary structures, such as communication towers.

**24 Claims, 14 Drawing Sheets**





US007583234B2

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

(10) **Patent No.:** **US 7,583,234 B2**  
(45) **Date of Patent:** **Sep. 1, 2009**

(54) **ANTENNA DEVICE**  
(75) Inventors: **Hideki Iwata**, Shinagawa (JP); **Shigemi Kurashima**, Shinagawa (JP); **Masahiro Yanagi**, Shinagawa (JP); **Takashi Yuba**, Shinagawa (JP); **Takashi Arita**, Shinagawa (JP)

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2004/0100406 A1 \* 5/2004 Okado ..... 343/700 MS

(73) Assignee: **Fujitsu Component 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 25 days.

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(21) Appl. No.: **11/783,291**

Taniguchi, T. and Takehiko Kobayashi (Tokyo Denki University); "An Omnidirectional and Low-VSWR Antenna for the FCC-approved UWB Frequency Band," Institute of Electronics, Information, and Communications Engineers, B-1-133, B201, Mar. 22, 2003.

(22) Filed: **Apr. 6, 2007**

\* cited by examiner

(65) **Prior Publication Data**  
US 2008/0062047 A1 Mar. 13, 2008

*Primary Examiner*—Michael C Wimer  
(74) *Attorney, Agent, or Firm*—Staas & Halsey LLP

(30) **Foreign Application Priority Data**  
Sep. 13, 2006 (JP) ..... 2006-248631

(57) **ABSTRACT**

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

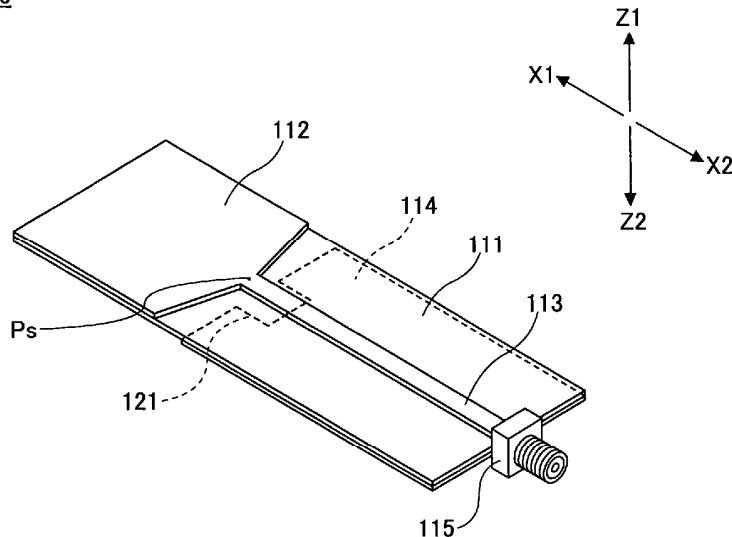
An antenna device is disclosed that includes a dielectric substrate having first and second surfaces facing away from each other, an element pattern formed on the first surface of the dielectric substrate, a conductive pattern formed on the first surface of the dielectric substrate so as to extend from the feeding point of the element pattern, and a ground pattern formed on the second surface of the dielectric substrate so as to form a microstrip line in cooperation with the conductive pattern. The ground pattern has a cutout part formed in a portion thereof opposing the feeding point.

(52) **U.S. Cl.** ..... **343/795; 343/846**  
(58) **Field of Classification Search** ..... 343/700 MS, 343/767, 792, 795, 846  
See application file for complete search history.

(56) **References Cited**  
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**10 Claims, 11 Drawing Sheets**

100





US007583235B2

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

(10) **Patent No.:** **US 7,583,235 B2**  
(45) **Date of Patent:** **Sep. 1, 2009**

(54) **FOLDED DIPOLE LOOP ANTENNA HAVING MATCHING CIRCUIT INTEGRALLY FORMED THEREIN**

(75) Inventors: **Yong-jin Kim**, Yongin-si (KR);  
**Wee-sang Park**, Yongin-si (KR);  
**Young-eil Kim**, Yongin-si (KR);  
**Yun-taek Im**, Yongin-si (KR)

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

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 3 days.

(21) Appl. No.: **11/700,049**

(22) Filed: **Jan. 31, 2007**

(65) **Prior Publication Data**  
US 2008/0122710 A1 May 29, 2008

(30) **Foreign Application Priority Data**  
Sep. 12, 2006 (KR) ..... 10-2006-0088238

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

(52) **U.S. Cl.** ..... **343/803; 343/860**

(58) **Field of Classification Search** ..... 343/742,  
343/726, 700 MS, 867, 741, 866, 727, 728,  
343/803, 850, 860

See application file for complete search history.

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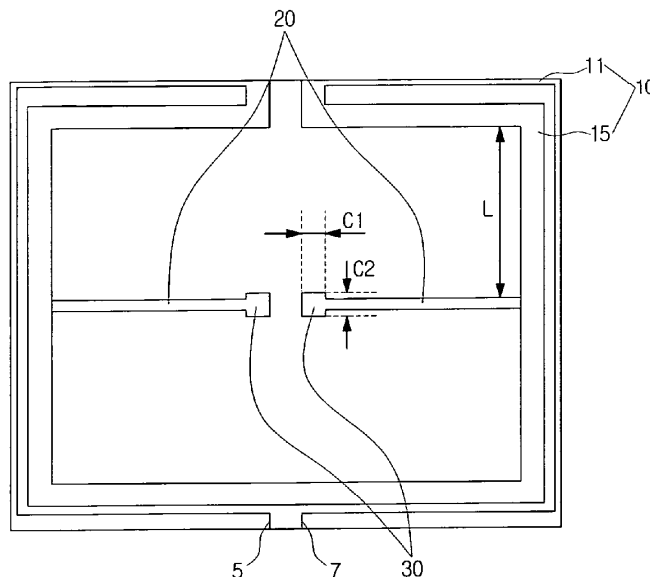
*Primary Examiner*—Hoang V Nguyen

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

(57) **ABSTRACT**

A folded dipole loop antenna has a matching circuit integrally formed therein. The antenna includes a radiating unit formed in the shape of a loop, and the matching circuit has an extended part projected and extended toward a central area of the radiating unit from an inner side surface of the radiating unit, thereby eliminating the need for a separate space for the matching circuit. The antenna can change a resonant frequency thereof by adjusting input reactance through the matching circuit.

**8 Claims, 10 Drawing Sheets**





US007586445B2

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

(10) **Patent No.:** **US 7,586,445 B2**  
(45) **Date of Patent:** **Sep. 8, 2009**

- (54) **MIMO ANTENNA** 6,496,148 B2 \* 12/2002 Ngounou Kouam et al. . 343/700 MS
- (75) Inventors: **Xiang-Hong Qin**, Shenzhen (CN);  
**Jia-Lin Teng**, Taipei Hsien (TW) 6,961,028 B2 \* 11/2005 Joy et al. .... 343/895  
7,405,699 B2 \* 7/2008 Qin ..... 343/700 MS
- (73) Assignees: **Hong Fu Jin Precision Industry (ShenZhen) Co., Ltd.**, Shenzhen, Guangdong Province (CN); **Hon Hai Precision Industry Co., Ltd.**, Tu-Cheng, Taipei Hsien (TW) 7,411,554 B2 \* 8/2008 Jung et al. .... 343/700 MS  
7,439,923 B2 \* 10/2008 Quintero Illera et al. .... 343/702  
2007/0115181 A1 5/2007 Park et al.

(\* ) 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*—Vibol Tan  
*Assistant Examiner*—Jason Crawford  
(74) *Attorney, Agent, or Firm*—Frank R. Niranjana

(21) Appl. No.: **11/934,092**

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Apr. 6, 2007 (CN) ..... 2007 1 0200405

(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; 343/895**

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

See application file for complete search history.

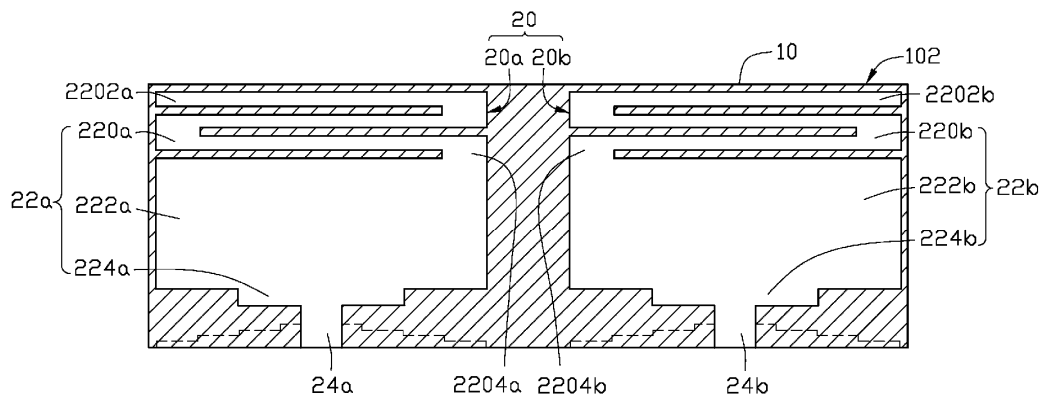
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U.S. PATENT DOCUMENTS

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A MIMO antenna is disposed on a substrate. The substrate includes a first surface and a second surface. The MIMO antenna includes a first antenna and a second antenna set as mirror image to the first antenna, each of the first and the second antennas includes a radiation body, a feeding portion, and a grounded portion. The radiation portion is disposed on the first surface for transceiving electromagnetic signals. The radiation body includes a first radiation portion and a second radiation portion electronically connected to the first radiation portion. The first radiation portion is serpentine-shaped and the second radiation portion is rectangular-shaped. The feeding portion is disposed on the first surface, and electronically connected to the second radiation portion for feeding electromagnetic signals to the radiation body. The grounded portion is disposed on the second surface.

**14 Claims, 7 Drawing Sheets**





US007586448B2

(12) **United States Patent**  
**Wei**

(10) **Patent No.:** **US 7,586,448 B2**  
(45) **Date of Patent:** **Sep. 8, 2009**

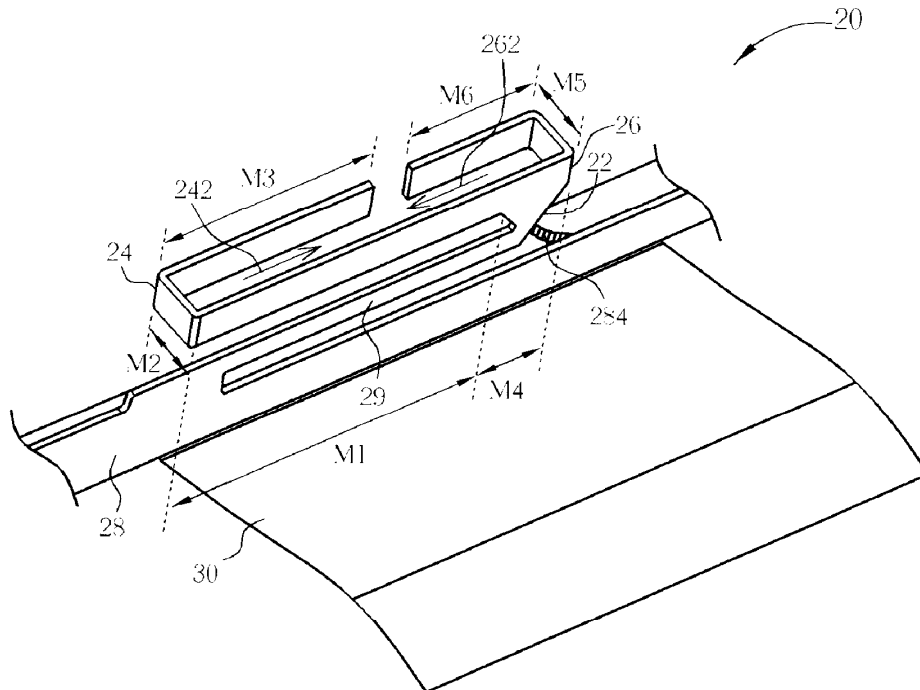
- (54) **MULTI-FREQUENCY ANTENNA**
  - (75) Inventor: **Shen-Pin Wei**, Taipei Hsien (TW)
  - (73) Assignee: **Wistron NeWeb Corporation**,  
Hsi-Chih, Taipei Hsien (TW)
  - (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 186 days.
  - (21) Appl. No.: **11/770,728**
  - (22) Filed: **Jun. 28, 2007**
  - (65) **Prior Publication Data**  
US 2008/0129603 A1 Jun. 5, 2008
  - (30) **Foreign Application Priority Data**  
Dec. 4, 2006 (TW) ..... 95145044 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, 846**
- See application file for complete search history.

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  - 2007/0164909 A1 \* 7/2007 Ogawa et al. .... 343/702
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- Primary Examiner*—Hoang V Nguyen  
(74) *Attorney, Agent, or Firm*—Winston Hsu

(57) **ABSTRACT**

A multi-frequency antenna includes a feeding element, a first U-shaped radiator, a second U-shaped radiator, a grounding element and a coupling element. The first U-shaped radiator is coupled to the feeding element and forms a first gap toward the feeding element. The second U-shaped radiator is coupled to the feeding element and forms a second gap toward the first U-shaped radiator. The grounding element is coupled to a ground end. The coupling element is coupled between the feeding element and the grounding element.

**25 Claims, 16 Drawing Sheets**







US007586449B1

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

(10) **Patent No.:** **US 7,586,449 B1**  
(45) **Date of Patent:** **Sep. 8, 2009**

(54) **ANTENNA STRUCTURE AND METHOD FOR MANUFACTURING THE ANTENNA STRUCTURE**

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7,079,081 B2 \* 7/2006 Parsche et al. .... 343/767  
7,310,068 B2 \* 12/2007 Hu et al. .... 343/702  
2007/0200774 A1 \* 8/2007 Wang et al. .... 343/702

(75) Inventors: **Yung-Jen Chen**, Taipei Hsien (TW);  
**Shih-Hao Hu**, Taipei Hsien (TW); **Kai Shih**, Taipei Hsien (TW); **Yu-Yuan Wu**, Taipei Hsien (TW)

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

*Primary Examiner*—Tho G Phan

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

(\* ) 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**

An antenna structure includes an antenna pattern having a feeding hollow and a grounding hollow formed in one surface thereof and a feeding cable having an inner lead, a metallic shield, a feeding piece connected to one end of the inner lead and a grounding piece connected to one end of the metallic shield. The feeding piece and the grounding piece of the feeding cable respectively connect to the antenna pattern by conductive glue prearranged in the feeding hollow and the grounding hollow of the antenna pattern. Therefore, the electrical connection between the antenna pattern and the feeding cable is more stable. In addition, the antenna pattern can be formed integrated with a housing of an electric apparatus or plated on the housing, so an extra space can be saved to make the electric apparatus more compact. The present invention also discloses a method for manufacturing the antenna structure.

(21) Appl. No.: **12/115,806**

(22) Filed: **May 6, 2008**

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

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

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

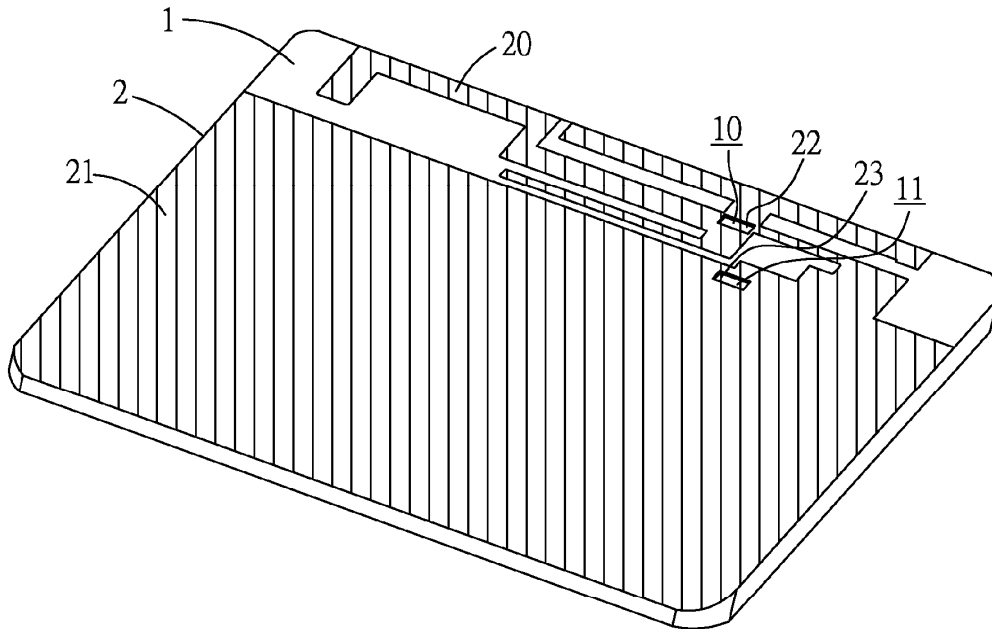
See application file for complete search history.

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**10 Claims, 5 Drawing Sheets**





US007586456B2

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

(10) **Patent No.:** **US 7,586,456 B2**  
(45) **Date of Patent:** **Sep. 8, 2009**

(54) **BROADBAND ANTENNA**

(75) Inventors: **Shih-Huang Yeh**, Douliou (TW);  
**Kin-Lu Wong**, Kaohsiung (TW);  
**Yun-Wen Chi**, Sinjhuang (TW)

(73) Assignees: **Industrial Technology Research Institute**, Hsinchu (TW); **National Sun Yat-Sen University**, Kaohsiung (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.: **11/503,235**

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

(65) **Prior Publication Data**

US 2008/0122699 A1 May 29, 2008

(30) **Foreign Application Priority Data**

Jun. 15, 2006 (TW) ..... 95121386 A

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

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

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

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2004/0140941 A1 7/2004 Joy et al. .... 343/795  
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DVB-T Antenna; May 28, 2006; p. 1 of 1; Inpaq Technology Co., Ltd. Author: Unknown, "DVB-T NB/PC/Car Antenna" May 28, 2006; p. 1 of 1; Inpaq Technology Co., Ltd.  
Author: Unknown, "Product Specification, Automobile Digital Antenna for DVB102" Date, Pertinent Pages & Place of Publication: Unknown, (English & Chinese, 2 pages total).

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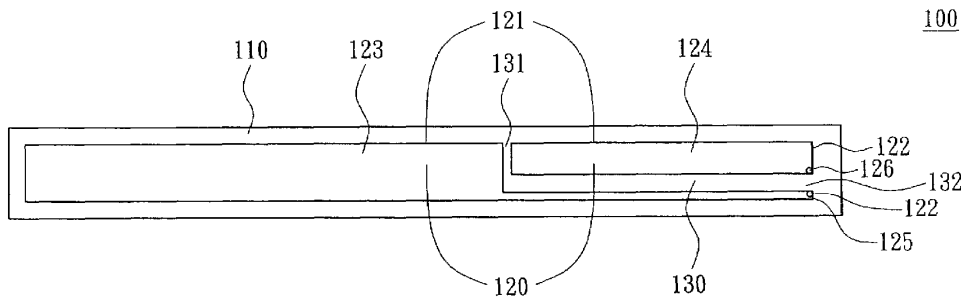
Primary Examiner—Tan Ho

(74) Attorney, Agent, or Firm—Bacon & Thomas, PLLC

(57) **ABSTRACT**

A broadband antenna includes a dielectric substrate, a radiation conductor and a feeding gap. The radiation conductor is disposed on the dielectric substrate and has a first side and a second side. The first side is adjacent to the second side, and the first side is longer than the second side. The second side has a first feeding point and a second feeding point. The feeding gap has a first end located at the first side and a second end located at the second side. The feeding gap divides the radiation conductor into a first sub-radiation conductor and a second sub-radiation conductor. The first feeding point is located on the first sub-radiation conductor and the second feeding point is located on the second sub-radiation conductor.

**11 Claims, 7 Drawing Sheets**





US007589675B2

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

(10) **Patent No.:** **US 7,589,675 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **BROADBAND ANTENNA**  
(75) Inventors: **Chih-Chen Chang**, Banciao (TW);  
**Yung-Chin Lo**, Pusin Township,  
Changhua County (TW)

2001/0007335	A1 *	7/2001	Tuttle et al.	235/492
2002/0011967	A1 *	1/2002	Goff et al.	343/895
2005/0024287	A1	2/2005	Jo et al.	
2007/0182658	A1 *	8/2007	Ozden	343/866

(73) Assignee: **Industrial Technology Research Institute**, Hsinchu (TW)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 286 days.

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TW	I255068		5/2006
WO	WO-03/096478		11/2003

(21) Appl. No.: **11/523,658**

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

(65) **Prior Publication Data**  
US 2007/0290928 A1 Dec. 20, 2007

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Cho, C. et al., "Broadband RFID tag antenna with quasi-isotropic radiation pattern", Electronics Letters, vol. 41, No. 20, Sep. 29, 2005, pp. 1091-1092.

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*Primary Examiner*—Trinh V Dinh  
*Assistant Examiner*—Dieu Hien T Duong  
(74) *Attorney, Agent, or Firm*—Rabin & Berdo, P.C.

**Related U.S. Application Data**

(60) Provisional application No. 60/801,382, filed on May 19, 2006.

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

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **343/700 MS; 343/866; 340/572.1**  
(58) **Field of Classification Search** ..... **343/700 MS, 343/866**

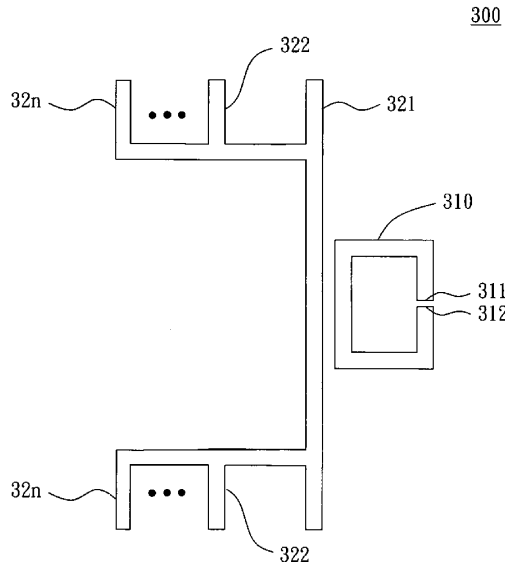
A broadband antenna includes a coupling loop and a number of radiation bodies. The coupling loop is electrically coupled to a chip and the chip records several pieces of data. The radiation bodies respectively form a number of resonance loops with the coupling loop for providing a number of resonance frequencies of the broadband antenna. The coupling loop can feed in signals for reading data in the chip according to the resonance frequencies.

See application file for complete search history.

(56) **References Cited**  
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**4 Claims, 7 Drawing Sheets**





US007589676B2

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

(10) **Patent No.:** **US 7,589,676 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **APERTURE-COUPLED ANTENNA**

2002/0171595 A1 11/2002 Schultze et al.

(75) Inventors: **Alexander Popugaev**, Erlangen (DE);  
**Rainer Wansch**, Hagenau (DE)

(Continued)

(73) Assignee: **Fraunhofer-Gesellschaft zur  
Foerderung der angewandten  
Forschung e.V.**, Munich (DE)

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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 131 days.

EP 0 700 117 A1 3/1996

(Continued)

(21) Appl. No.: **11/844,520**

OTHER PUBLICATIONS

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

Official communication issued in counterpart International Applica-  
tion No. PCT/EP2006/001056, mailed on May 26, 2006.

(65) **Prior Publication Data**

US 2007/0296634 A1 Dec. 27, 2007

(Continued)

**Related U.S. Application Data**

*Primary Examiner*—Trinh V Dinh

(63) Continuation of application No. PCT/EP2006/  
001056, filed on Feb. 7, 2006.

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

(30) **Foreign Application Priority Data**

Mar. 9, 2005 (DE) ..... 10 2005 010 895

(57) **ABSTRACT**

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

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

(58) **Field of Classification Search** ..... None  
See application file for complete search history.

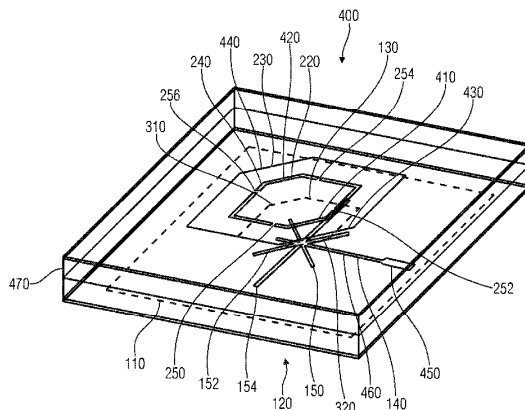
An aperture-coupled antenna has a first radiation electrode, a ground area and a wave guide which is implemented to supply energy to the antenna. The wave guide is arranged spaced apart from the ground area on a first side of the ground area, and the first radiation electrode is arranged spaced apart from the ground area on a second side of the ground area. The ground area has an aperture including a first slot in the ground area, a second slot in the ground area and a third slot in the ground area. The first slot and the second slot together form a slot in the shape of a cross. The third slot passes through an intersection of the first slot and the second slot. The wave guide and the radiation electrode are arranged such that energy can be coupled from the wave guide through the aperture to the patch.

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**21 Claims, 8 Drawing Sheets**





US007589677B2

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

(10) **Patent No.:** **US 7,589,677 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **WIRELESS ELECTRONIC PRODUCT WITH STEP-SHAPED WIDEBAND ANTENNA**

(75) Inventor: **Po-Chuan Chen**, Hsinchu (TW)

(73) Assignee: **Alpha Networks, Inc.**, Hsinchu (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.: **12/076,468**

(22) Filed: **Mar. 19, 2008**

(65) **Prior Publication Data**

US 2009/0115667 A1 May 7, 2009

(30) **Foreign Application Priority Data**

Nov. 7, 2007 (TW) ..... 96141999 A

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

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

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

See application file for complete search history.

(56) **References Cited**

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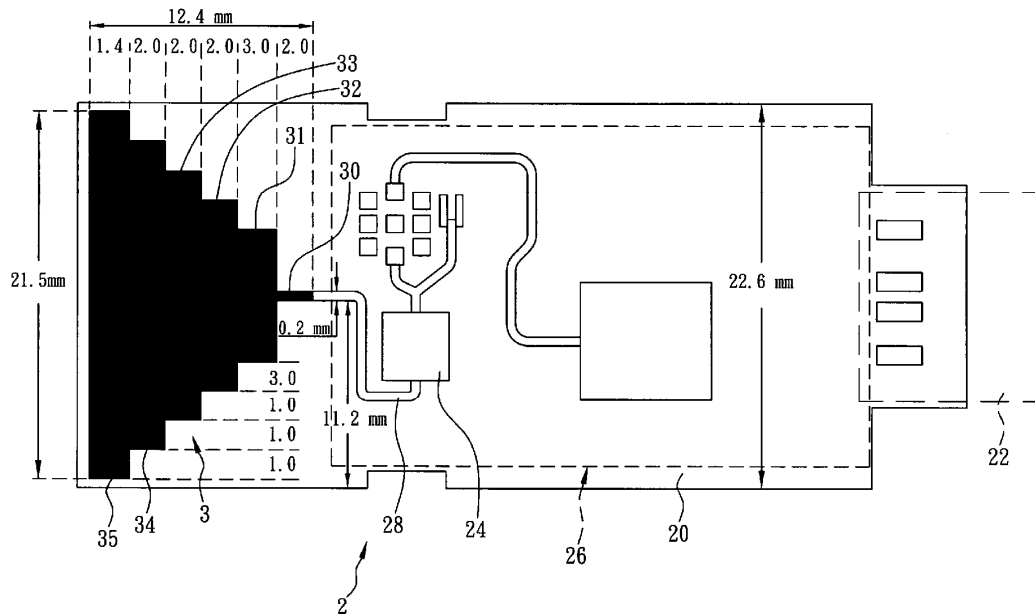
*Primary Examiner*—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(57) **ABSTRACT**

This invention is a wireless electronic product including a printed circuit board and a signal line installed at an end of the printed circuit board, wherein a wideband antenna is installed on the printed circuit board and has a shape extending from an another end of the printed circuit board towards the central position of the printed circuit board to form a symmetrical step-shaped antenna, and a microstrip feedline is extended from an end of the wideband antenna away from the another end of the printed circuit board and coupled with the signal line, such that the current produced by microstrip feedline due to an electro-inductive effect can flow along a step-shaped path on both sides of the wideband antenna, and the current can be distributed uniformly on the wideband antenna to effectively reduce the electro-inductive effect of the microstrip feedline.

**10 Claims, 6 Drawing Sheets**





US007589678B2

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

(10) **Patent No.:** **US 7,589,678 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **MULTI-BAND ANTENNA WITH A COMMON  
RESONANT FEED STRUCTURE AND  
METHODS**

7,176,838 B1 2/2007 Kinezos

(75) Inventors: **Jari Perunka**, Tupos (FI); **Kimmo  
Koskiniemi**, Oulu (FI)

(Continued)

FOREIGN PATENT DOCUMENTS

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

DE 101 50 149 A1 4/2003

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 301 days.

(Continued)

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(21) Appl. No.: **11/544,173**

(22) Filed: **Oct. 5, 2006**

(65) **Prior Publication Data**

US 2007/0159399 A1 Jul. 12, 2007

"A Novel Approach of a Planar Multi-Band Hybrid Series Feed  
Network for Use in Antenna Systems Operating at Millimeter Wave  
Frequencies," by M.W. Elsallal and B.L. Hauck, Rockwell Collins,  
Inc., pp. 15-24, walsall@rockwellcollins.com and  
blhauck@rockwellcollins.com.

(Continued)

(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

See application file for complete search history.

*Primary Examiner*—Tho G Phan

(74) *Attorney, Agent, or Firm*—Gazdzinski & Associates, PC

(57) **ABSTRACT**

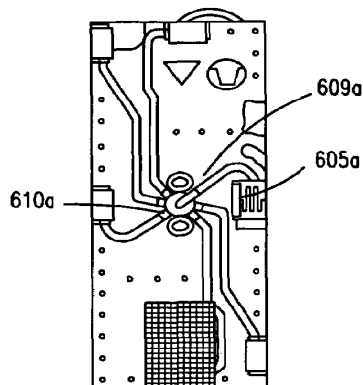
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A multi-band antenna and associated apparatus for commu-  
nication systems and other applications. In one embodiment,  
a common junction network is provided having a first and a  
second radiator. The first radiator resonates in a first fre-  
quency band. The second radiator resonates in a second fre-  
quency band. The first and second frequency bands are dif-  
ferent from one another (yet may overlap). A first electrical  
component is coupled to the common junction network and  
proximately located to the first radiator. The first electrical  
component creates a resonance with the common junction  
network to create a third frequency band proximate to the first  
frequency band. The first radiator is capable of communicat-  
ing RF energy in the first frequency band and the third fre-  
quency band.

**30 Claims, 18 Drawing Sheets**





US007589679B2

(12) **United States Patent**  
**Shih**

(10) **Patent No.:** **US 7,589,679 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **ANTENNA DEVICE**  
(75) Inventor: **Yen-Yi Shih**, Taipei Hsien (TW)  
(73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,  
Tu-Cheng, Taipei Hsien (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 222 days.

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TW	I255073	5/2006
TW	M292175	6/2006

(21) Appl. No.: **11/615,949**

\* cited by examiner

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

*Primary Examiner*—HoangAnh T Le

(65) **Prior Publication Data**

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

US 2008/0036666 A1 Feb. 14, 2008

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Aug. 11, 2006 (TW) ..... 95129620 A

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

An antenna device (10) is disposed on a substrate (30), and includes a feed part (14), a holder (20), a body part (18), at least one ground plane (11), and a matching part (16). The feed part is for feeding electromagnetic signals. The body part for radiating and receiving the electromagnetic signals is electronically connected to the feed part. The body part includes at least two radiation parts electronically connected in sequence and disposed on at least two adjacent surfaces of the holder. The at least one ground plane for grounding is disposed on one side of the substrate. The matching part for impedance matching includes one end electronically connected to the body part and another end electronically connected to the ground plane. The ground plane surrounds two adjacent sides of the matching part.

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

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

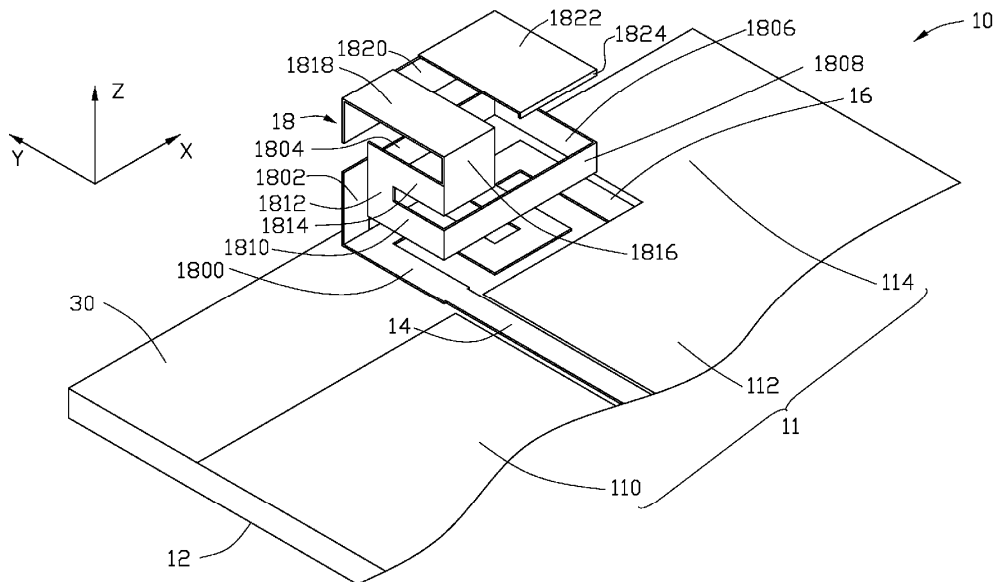
See application file for complete search history.

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6,965,346 B2 11/2005 Sung et al.

**17 Claims, 7 Drawing Sheets**





US007589680B2

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

(10) **Patent No.:** **US 7,589,680 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **ANTENNA UNIT WITH A PARASITIC COUPLER**

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

(75) Inventors: **Tiao-Hsing Tsai**, Tao Yuan Shien (TW);  
**Chieh-Ping Chiu**, Tao Yuan Shien (TW);  
**Chih-Wei Liao**, Tao Yuan Shien (TW)

(56) **References Cited**

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(73) Assignee: **Quanta Computer Inc.**, Tao Yuan Shien (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 149 days.

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(21) Appl. No.: **11/841,097**

*Primary Examiner*—Tho G Phan

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

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

(65) **Prior Publication Data**

US 2008/0258992 A1 Oct. 23, 2008

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Apr. 17, 2007 (TW) ..... 96113455 A

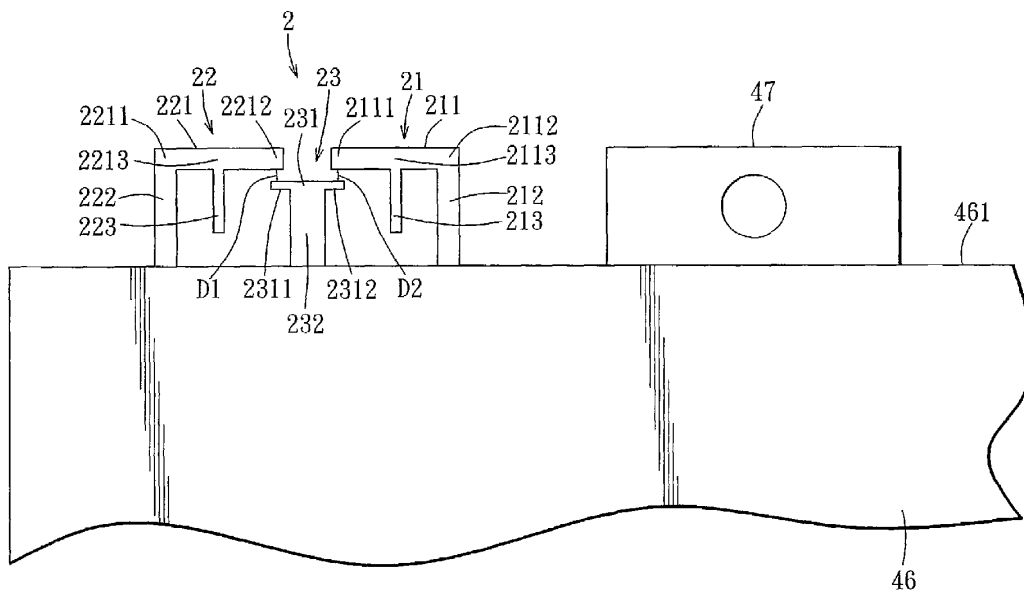
An antenna unit includes left and right antennas that are spaced apart from each other and that are operable within a first frequency bandwidth, and a parasitic coupler that is spaced apart from and disposed between the left and right antennas, and that is electromagnetically coupled to the left and right antennas so as to be operable within a second frequency bandwidth.

(51) **Int. Cl.**

**H01Q 1/24** (2006.01)

**14 Claims, 15 Drawing Sheets**

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







US007589682B1

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

(10) **Patent No.:** **US 7,589,682 B1**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **SINGLE-PLATE DUAL-BAND ANTENNA AND WIRELESS NETWORK DEVICE HAVING THE SAME**

2008/0165065 A1\* 7/2008 Hill et al. .... 343/702  
\* cited by examiner

(75) Inventors: **Jung Tai Wu**, Taipei (TW); **Jin-Bo Chen**, Taipei (TW)

*Primary Examiner*—Hoang V Nguyen

(73) Assignee: **Cameo Communications Inc.** (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 1 day.

The present invention discloses a single-plate dual-band antenna for a wireless network device. The antenna comprises a base portion, a ground portion, a radiating portion and a signal portion. The base portion is combined with the wireless network device. The ground portion has an end connected with the base portion and extends upwards from the base portion to a certain height. The signal portion is generally perpendicular to the radiating portion, the ground portion and the base portion, respectively. The signal portion has an upper side and a lower end. The upper side is formed with a connecting edge connected with the radiating portion while the lower end is formed with a feed pin, so that the signal portion generally has a downwardly tapered, inverted triangular structure. The radiating portion further comprises a first radiating section and a second radiating section. The first radiating section extends a first length from an upper end of the ground portion along the connecting edge of the signal portion, while the second radiating section extends a second length sinusously from an end of the first radiating section distal from the ground portion.

(21) Appl. No.: **12/077,333**

(22) Filed: **Mar. 18, 2008**

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

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

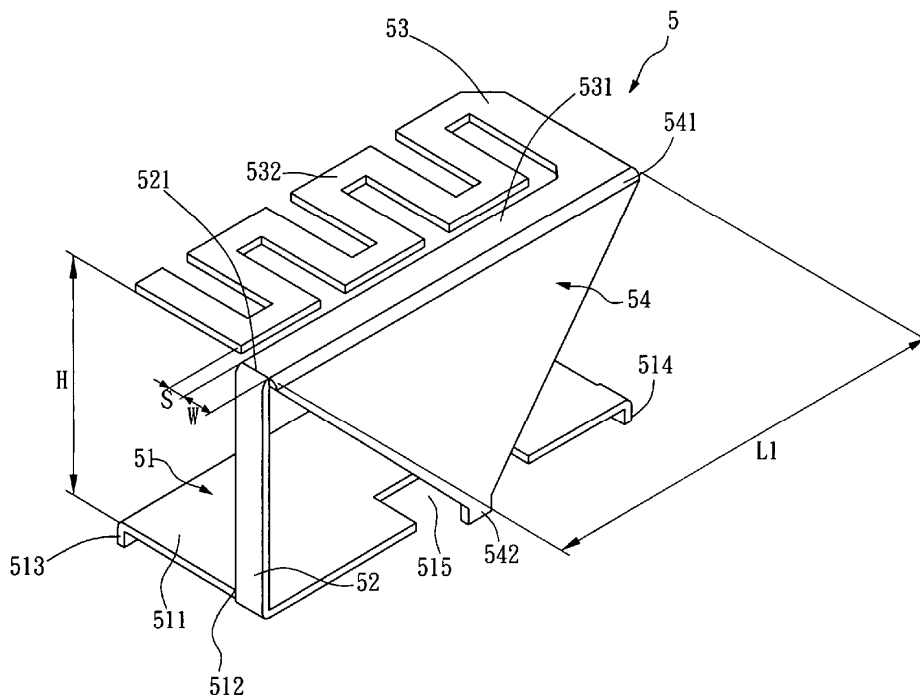
(58) **Field of Classification Search** ..... **343/702, 343/700 MS, 846, 895**  
See application file for complete search history.

(56) **References Cited**

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**20 Claims, 11 Drawing Sheets**





US007589686B2

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

(10) **Patent No.:** **US 7,589,686 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **SMALL ULTRA WIDEBAND ANTENNA HAVING UNIDIRECTIONAL RADIATION PATTERN**

(75) Inventors: **Evgeny V. Balzovsky**, Tomsk (RU); **Yuri I. Buyanov**, Tomsk (RU); **Yong-jin Kim**, Seoul (KR); **Vladimir I. Koshelev**, Tomsk (RU); **Do-Hoon Kwon**, Seoul (KR); **Seong-soo Lee**, Suwon-si (KR)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 414 days.

(21) Appl. No.: **11/334,567**

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

(65) **Prior Publication Data**  
US 2007/0257851 A1 Nov. 8, 2007

(30) **Foreign Application Priority Data**  
Jan. 19, 2005 (KR) ..... 10-2005-0005078  
Oct. 26, 2005 (KR) ..... 10-2005-0101159

(51) **Int. Cl.**  
**H01Q 21/00** (2006.01)  
(52) **U.S. Cl.** ..... **343/726; 343/767**  
(58) **Field of Classification Search** ..... **343/725, 343/726, 767**

See application file for complete search history.

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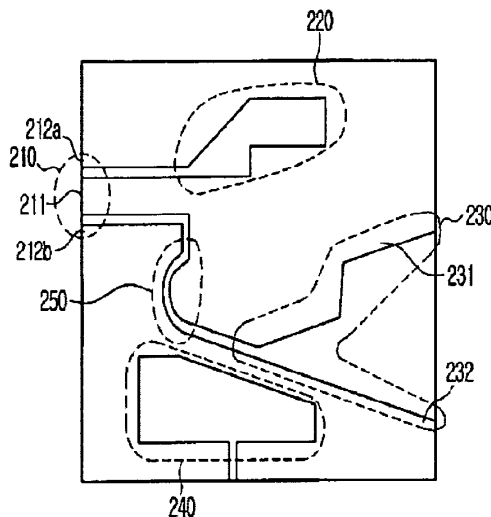
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*Primary Examiner*—Trinh V Dinh  
*Assistant Examiner*—Dieu Hien T Duong  
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

A small ultra wideband (UWB) antenna designed to have a unidirectional radiation pattern is disclosed. The UWB antenna includes a substrate; a power feeding part, provided on an upper surface of the substrate, for receiving a supply of an external electromagnetic energy; a dipole radiator excited by the electromagnetic energy fed through the power feeding part and radiating electromagnetic waves in one and the other directions of the substrate; and an active loop radiator excited by the electromagnetic energy fed through the power feeding part, respectively enhancing and canceling the electromagnetic fields produced in one or the other directions of the substrate by the dipole radiator.

**1 Claim, 10 Drawing Sheets**





US007589687B2

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

(10) **Patent No.:** **US 7,589,687 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **ANTENNA APPARATUS PROVIDED WITH ANTENNA ELEMENT EXCITED THROUGH MULTIPLE FEEDING POINTS**

(75) Inventors: **Hiroshi Iwai**, Osaka (JP); **Atsushi Yamamoto**, Kyoto (JP); **Tsutomu Sakata**, Osaka (JP); **Yoshio Koyanagi**, Ishikawa (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.: **11/951,141**

(22) Filed: **Dec. 5, 2007**

(65) **Prior Publication Data**

US 2008/0143612 A1 Jun. 19, 2008

(30) **Foreign Application Priority Data**

Dec. 5, 2006 (JP) ..... P2006-328194

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

(52) **U.S. Cl.** ..... 343/767; 343/702; 343/850

(58) **Field of Classification Search** ..... 343/767, 343/702, 850

See application file for complete search history.

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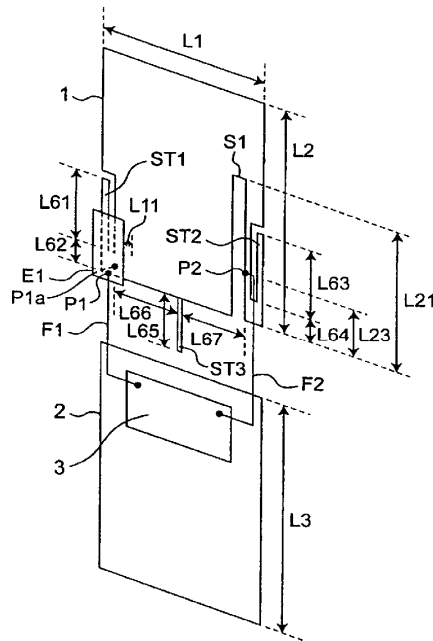
Primary Examiner—Anh Q Tran

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

(57) **ABSTRACT**

An antenna apparatus includes an antenna element having at least one slit, a first feeding point provided at a position on the antenna element, and a second feeding point provided along the slit. The antenna element is excited as an electric current antenna through the first feeding point, and at the same time, the slit is excited as a magnetic current antenna through the second feeding point.

**8 Claims, 36 Drawing Sheets**





US007589688B2

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

(10) **Patent No.:** **US 7,589,688 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **RADIATING SLOT PLANAR ANTENNAS**

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(75) Inventors: **Jean-François Pintos**, Bourgbarre (FR);  
**Philippe Minard**, Saint Medard sur Ille (FR); **Ali Louzir**, Rennes (FR)

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

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

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(21) Appl. No.: **12/001,720**

Tsai H S et al.: "Planar Amplifier Array With Improved Bandwidth Using Folded-Slots" IEEE Microwave And Guided Wave Letters, IEEE Inc., New York, US vol. 4, No. 4 1 avril 1994 (Apr. 1, 1994), pp. 112-114 XP000442740 ISSN: 1051-8207.

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

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(65) **Prior Publication Data**

US 2008/0143623 A1 Jun. 19, 2008

(30) **Foreign Application Priority Data**

Dec. 18, 2006 (EP) ..... 0655584

*Primary Examiner*—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Robert D. Shedd; Jeffrey M. Navon

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

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **343/767; 343/768**

The present invention relates to a compact planar antenna containing, on a substrate featuring at least one ground plane, a radiating slot forming at least one ground plane with parallel strand parts. The antenna contains at least one means of phase inversion between two successive strand parts, the means of phase inversion being positioned on the strand in such a manner that the field components of the parallel strand parts are added together. The use of phase inversion means makes it possible to reduce the dimensions of the antenna, facilitating its integration on a card.

(58) **Field of Classification Search** ..... 343/767,  
343/768, 770

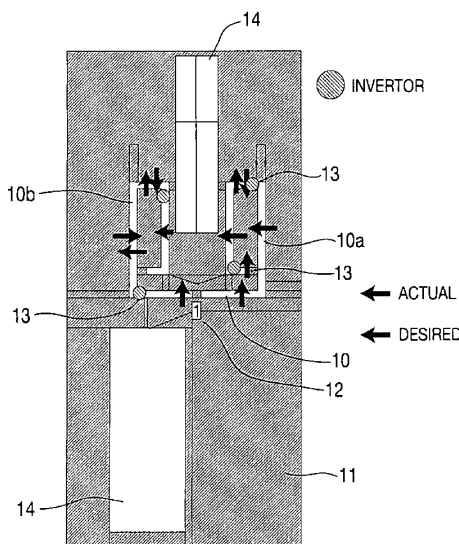
See application file for complete search history.

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**7 Claims, 6 Drawing Sheets**





US007589692B2

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

(10) **Patent No.:** **US 7,589,692 B2**  
(45) **Date of Patent:** **Sep. 15, 2009**

(54) **PLANAR INVERTED F ANTENNA TAPERED TYPE PIFA WITH CORRUGATION**

(75) Inventors: **Byung-Chan Kim**, Daejon (KR); **Je-Hoon Yun**, Daejon (KR); **Hyung-Do Choi**, Seoul (KR)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 155 days.

(21) Appl. No.: **10/575,347**

(22) PCT Filed: **Oct. 15, 2004**

(86) PCT No.: **PCT/KR2004/002654**

§ 371 (c)(1),  
(2), (4) Date: **Apr. 11, 2006**

(87) PCT Pub. No.: **WO2005/038984**

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

(65) **Prior Publication Data**

US 2007/0132640 A1 Jun. 14, 2007

(30) **Foreign Application Priority Data**

Oct. 16, 2003 (KR) ..... 10-2003-0072082

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01Q 5/00** (2006.01)  
**H01Q 9/04** (2006.01)  
**H01Q 1/24** (2006.01)  
**H01Q 13/10** (2006.01)

(52) **U.S. Cl.** ..... **343/846; 343/700 MS; 343/770; 343/702**

(58) **Field of Classification Search** ..... **343/702, 343/700 MS, 770, 846**

See application file for complete search history.

(56) **References Cited**

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*Primary Examiner*—Douglas W Owens

*Assistant Examiner*—Jennifer F Hu

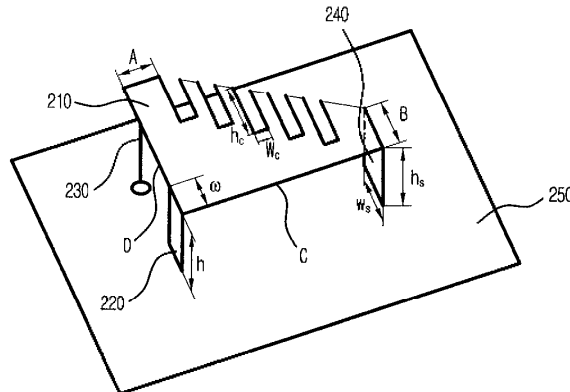
(74) *Attorney, Agent, or Firm*—Lowe Hauptman Ham & Berner, LLP

(57) **ABSTRACT**

A planar inverted F antenna having a radiation patch having an asymmetric shape of linearly-tapered rectangle with a plurality of corrugated hollows is disclosed. The planar inverted F antenna having a radiation patch, includes: a first radiation patch for radiating a signal; a ground plate for grounding the first radiation patch; a feeding line for supplying an electric power to the first radiation patch; a short plate having one side coupled to the first radiation patch and other side coupled to the ground plate for shorting the first radiation patch, wherein the first radiation patch having an asymmetrical shape of linearly tapered rectangle and has one or more corrugated hollows.

**13 Claims, 2 Drawing Sheets**

200





US007592963B2

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

(10) **Patent No.:** **US 7,592,963 B2**  
(45) **Date of Patent:** **Sep. 22, 2009**

(54) **MULTI-BAND SLOT RESONATING RING ANTENNA**

6,518,930 B2\* 2/2003 Itoh et al. .... 343/767  
7,106,264 B2\* 9/2006 Lee et al. .... 343/767

(75) Inventor: **Dajun Cheng**, Acton, MA (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 369 days.

(21) Appl. No.: **11/540,444**

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

(65) **Prior Publication Data**

US 2008/0079644 A1 Apr. 3, 2008

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

(52) **U.S. Cl.** ..... **343/770; 343/769**

(58) **Field of Classification Search** ..... 343/769,  
343/770, 767, 700 MS, 846

See application file for complete search history.

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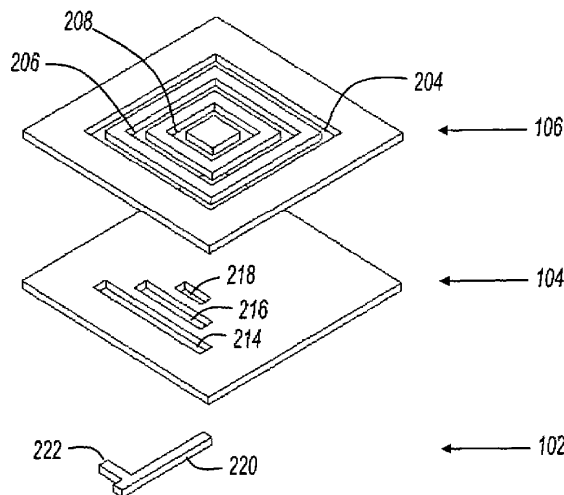
*Primary Examiner*—Hoang Anh T Le

(74) *Attorney, Agent, or Firm*—Dana B. Lemioine; Lemioine Patent Services, PLLC

(57) **ABSTRACT**

A multi-band slot resonating ring antenna (SRRRA) is suitable to be manufactured on a circuit board. A first conductive plane includes concentric slots corresponding to different frequency bands. The antenna may be fed by microstrip feed lines. The antenna may also be fed by probes. A conductive layer may include coupling apertures to couple signal energy to the concentric slots.

**13 Claims, 14 Drawing Sheets**





US007592966B2

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

(10) **Patent No.:** **US 7,592,966 B2**  
(45) **Date of Patent:** **Sep. 22, 2009**

(54) **BROADBAND ANTENNA AND ASSEMBLY COMBINATION THEREOF**

(75) Inventors: **Feng-Chi Eddie Tsai**, Taipei Hsien (TW); **Chih-Ming Wang**, 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 331 days.

(21) Appl. No.: **11/604,783**

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

(65) **Prior Publication Data**  
US 2007/0279291 A1 Dec. 6, 2007

(30) **Foreign Application Priority Data**  
Jun. 2, 2006 (TW) ..... 95209640 U

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

(52) **U.S. Cl.** ..... **343/828**; 343/795; 343/830; 343/834

(58) **Field of Classification Search** ..... 343/700 MS, 343/795, 828-830, 834, 846  
See application file for complete search history.

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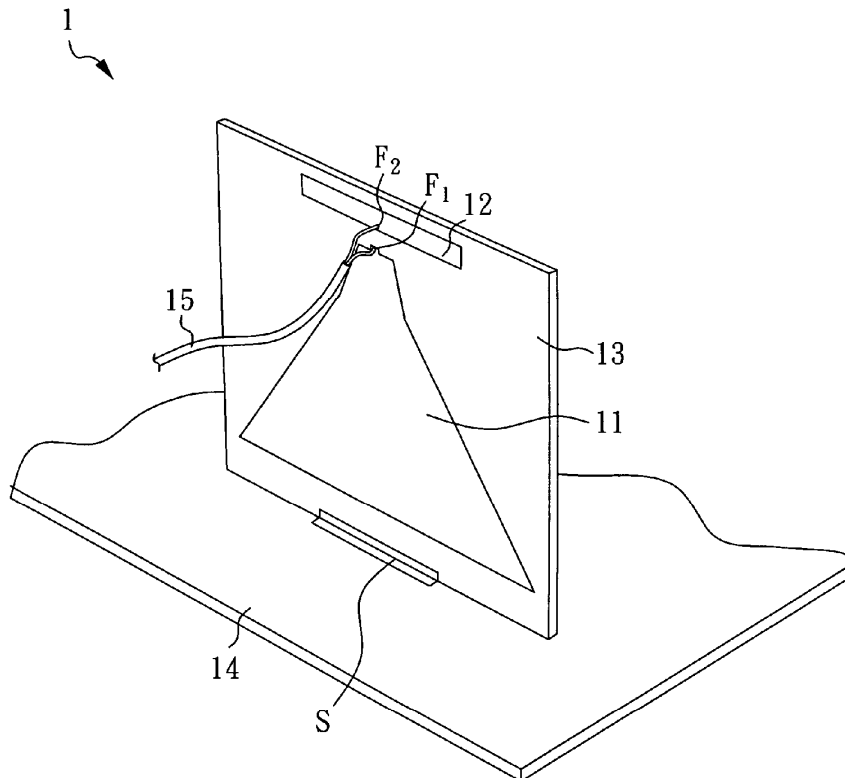
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*Primary Examiner*—Michael C Wimer  
(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(57) **ABSTRACT**

A broadband antenna and an assembly combination thereof are disclosed. The broadband antenna according to the present invention comprises a first radiation element, a second radiation element, a substrate, and a reflector. The first radiation element having a first trapezoid portion and the second radiation element are disposed on the substrate that is fixed on the reflector. The first radiation element and the second radiation element are excited so as to reflect the energy by the radiator.

**28 Claims, 17 Drawing Sheets**





US007592968B2

(12) **United States Patent**  
**Modro**

(10) **Patent No.:** **US 7,592,968 B2**  
(45) **Date of Patent:** **Sep. 22, 2009**

(54) **EMBEDDED ANTENNA**

(75) Inventor: **Joseph Modro**, Dublin (IE)  
(73) Assignee: **TDK 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 369 days.

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(21) Appl. No.: **11/386,851**

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

(65) **Prior Publication Data**  
US 2007/0222699 A1 Sep. 27, 2007

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*Primary Examiner*—Huedung Mancuso  
(74) *Attorney, Agent, or Firm*—Oliff & Berridge, PLC

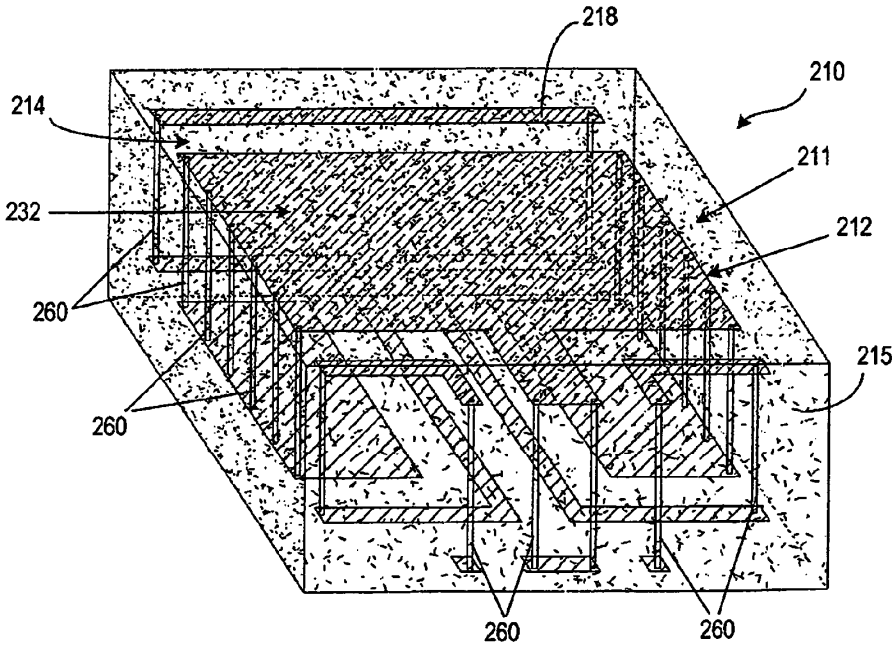
(51) **Int. Cl.**  
**H01Q 1/40** (2006.01)  
(52) **U.S. Cl.** ..... **343/873**  
(58) **Field of Classification Search** ..... 343/873,  
343/700 MS, 702, 876, 895, 820  
See application file for complete search history.

(57) **ABSTRACT**

An antenna comprising a resonant structure having a first portion disposed in a first plane, and a second portion disposed in a non-parallel plane. The resonant structure is embedded in a non-conductive or dielectric material and the second portion is formed from electrically conductive vias.

(56) **References Cited**  
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7,369,086 B2\* 5/2008 Luen ..... 343/700 MS

**16 Claims, 2 Drawing Sheets**







US007595731B1

(12) **United States Patent  
Tang**

(10) **Patent No.: US 7,595,731 B1**  
(45) **Date of Patent: Sep. 29, 2009**

- (54) **IC PACKAGE ANTENNA**
- (75) Inventor: **Chia-Lun Tang**, Pa-Te (TW)
- (73) Assignee: **Auden Techno Corp.**, Pa-Te (TW)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 21 days.

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*Primary Examiner*—Tho G Phan

(74) *Attorney, Agent, or Firm*—Ming Chow; Sinorica, LLC

- (21) Appl. No.: **12/127,041**
- (22) Filed: **May 27, 2008**

(57) **ABSTRACT**

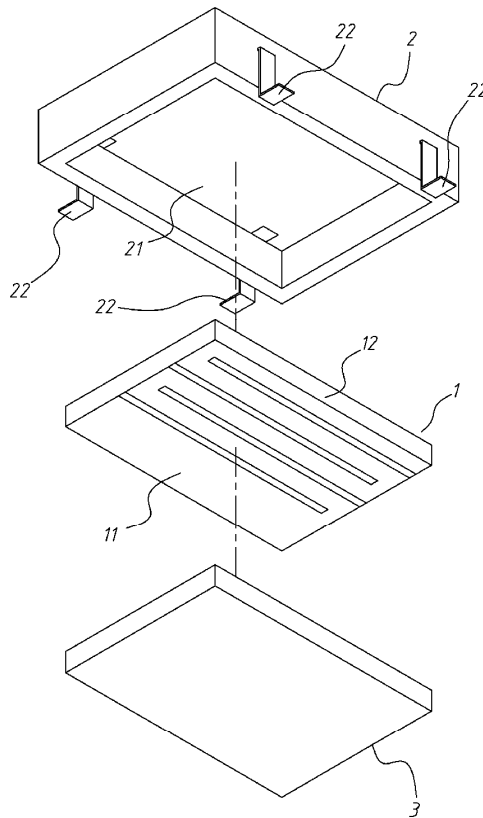
An IC package antenna of which a metal radiating member is firstly provided on a base board to form an antenna base board; the antenna base board is formed thereon at least a feed point; and the IC package antenna is packaged with an IC packaging housing and a packaging bottom portion to form an IC chip. The IC packaging housing has a plurality of connecting pins extending outward from inside of itself; wherein the inner end of at least one connecting pin is soldering connected with a feed point of the base board of the antenna. Such an IC package antenna can allow standardized and miniaturized antenna designing, and is applicable to Surface Mount Technology (SMT).

- (51) **Int. Cl.**  
**G08B 13/14** (2006.01)
  - (52) **U.S. Cl.** ..... **340/572.1**; 340/572.5; 343/700 MS
  - (58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 873; 340/572.1, 572.5, 572.8, 10.1,  
340/10.4
- See application file for complete search history.

(56) **References Cited**  
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**6 Claims, 6 Drawing Sheets**





US007595758B2

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

(10) **Patent No.:** **US 7,595,758 B2**  
(45) **Date of Patent:** **Sep. 29, 2009**

(54) **COMPACT DTV RECEIVING ANTENNA**

(75) Inventors: **Kin-Lu Wong**, Kao-Hsiung (TW);  
**Wei-Yu Li**, I-Lan (TW); **Saou-Wen Su**,  
Taipei (TW)

(73) Assignees: **Lite-On Technology Corp.**, Taipei  
(TW); **National Sun Yat-Sen**  
**University**, Kao-Hsiung (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.: **11/560,821**

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

(65) **Prior Publication Data**

US 2008/0024367 A1 Jan. 31, 2008

(30) **Foreign Application Priority Data**

Jul. 28, 2006 (TW) ..... 95127839 A

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

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

(58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 880-882, 793, 803, 805, 806  
See application file for complete search history.

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*Primary Examiner*—Trinh V Dinh

*Assistant Examiner*—Dieu Hien T Duong

(74) *Attorney, Agent, or Firm*—Kile Goekjian Reed &  
McManus PLLC

(57) **ABSTRACT**

A digital television receiving antenna includes a first radiating element and a second radiating element electrically connected to the first radiating element. The second radiating element is foldable, and includes a wide radiating metal plate, and a narrow radiating metal strip, wherein one end of the narrow radiating metal strip is a feeding point insulated from the first radiating element with a predefined distance, and the other end of the narrow radiating metal strip is electrically connected to the wide radiating metal plate.

**21 Claims, 9 Drawing Sheets**

