



US007845066B2

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

(10) **Patent No.:** **US 7,845,066 B2**  
(45) **Date of Patent:** **Dec. 7, 2010**

(54) **METHOD OF INSTALLING AN ANTENNA OF A NOTEBOOK COMPUTER**

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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 400 days.

(21) Appl. No.: **11/876,576**

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

(65) **Prior Publication Data**

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

(52) **U.S. Cl.** ..... **29/600; 29/601; 29/830;**  
343/700 MS; 343/702

(58) **Field of Classification Search** ..... 29/600-601,  
29/830-832; 343/700 MS, 786, 702, 846-848;  
455/90.3

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,966,098 A \* 10/1999 Qi et al. .... 343/702

6,181,834 B1 *	1/2001	Li et al. ....	382/298
6,285,328 B1 *	9/2001	Masaki et al. ....	343/702
6,980,159 B2 *	12/2005	Sun et al. ....	343/702
7,072,690 B2 *	7/2006	Shin et al. ....	455/557
7,215,286 B2 *	5/2007	Chen ....	343/700 MS
7,262,701 B1 *	8/2007	Nguyen ....	340/572.7
7,388,503 B2 *	6/2008	Posamentier ....	340/572.8
7,505,004 B2 *	3/2009	Chen et al. ....	343/702
2007/0040754 A1 *	2/2007	Liu et al. ....	343/702

\* cited by examiner

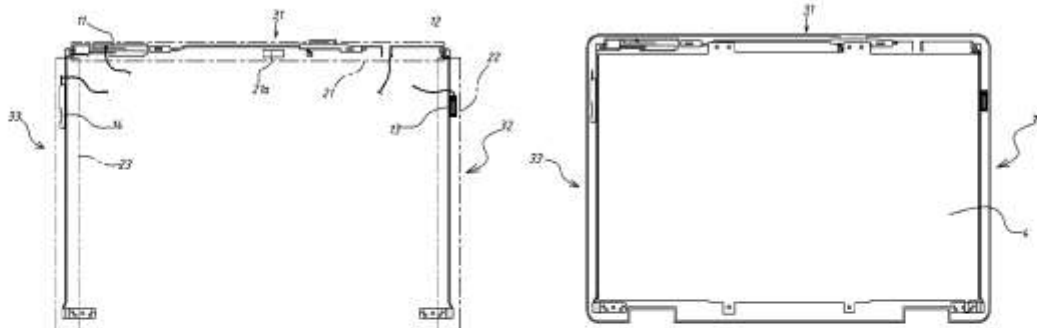
*Primary Examiner*—Minh Trinh

(74) *Attorney, Agent, or Firm*—Guice Patents PLLC

(57) **ABSTRACT**

A method of installation of a notebook computer antenna, the method is mainly to design to use a mode of manufacturing tags to make groups of or integrate antenna sections required by the notebook computer to make a tag antenna; then the tag antenna is stuck and fixed on an inner layer of the housing of the notebook computer. This method can reduce cost of manufacturing and thickness and weight of notebook computers.

**7 Claims, 3 Drawing Sheets**





US007847736B2

(12) **United States Patent**  
**Channabasappa**

(10) **Patent No.:** **US 7,847,736 B2**  
(45) **Date of Patent:** **Dec. 7, 2010**

(54) **MULTI SECTION MEANDER ANTENNA**

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(73) Assignee: **Cobham Defense Electronic Systems**, Bolton, MA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 195 days.

(21) Appl. No.: **11/466,997**

(22) Filed: **Aug. 24, 2006**

(65) **Prior Publication Data**

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

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/895, 846, 893, 702

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

6,351,241	B1	2/2002	Wass	
6,624,795	B2	9/2003	Boyle	
6,642,893	B1	11/2003	Hebron et al.	
6,680,701	B2*	1/2004	Sung	343/700 MS
6,842,143	B2	1/2005	Otake et al.	
6,987,483	B2*	1/2006	Tran	343/700 MS
6,995,714	B2*	2/2006	Sim et al.	343/702
7,106,258	B2*	9/2006	Kuramoto	343/700 MS
7,274,334	B2*	9/2007	O'Riordan et al.	343/702
7,339,533	B2*	3/2008	Kurashima et al.	343/702
2001/0011964	A1	8/2001	Sadler et al.	
2002/0118142	A1	8/2002	Wang	

2006/0267844	A1*	11/2006	Yanagi et al.	343/700 MS
2007/0001925	A1*	1/2007	Bae et al.	343/895

**FOREIGN PATENT DOCUMENTS**

EP	0 969 547	A2	1/2000
JP	2001217632	*	8/2001
WO	01/11721	A1	2/2001

**OTHER PUBLICATIONS**

- Shin, Y-S, et al., A Broadband Interior Antenna of Planar Monopole Type in Handsets, IEEE Antennas and Wireless Propagation Letters, vol. 4, 2005, pp. 9-12.
- Sim, D-U, et al., An Internal Triple-Ban Antenna for PCS/IMT-2000/Bluetooth Applications, IEEE Antennas and Wireless Propagation Letters, vol. 3, 2004, pp. 23-25.
- Sim, D-U, et al., A Wideband Monopole Antenna for PCS/IMT-2000/Bluetooth Applications, IEEE Antennas and Wireless Propagation Letters, vol. 3, 2004, pp. 45-47.
- Lin, C-C, et al., A 2.4-GHz Printed Meander-Line Antenna for USB WLAN With Notebook-PC Housing, IEEE Microwave and Wireless Components Letters, vol. 15, No. 9, Sep. 2005, pp. 546-548.
- Olsson, R, et al., The Eleven Antenna: A Compact Low-Profile Decade Bandwidth Dual Polarized Feed for Reflector Antennas, IEEE Transactions on Antennas and Propagation, vol. 54, No. 2, Feb. 2006, pp. 368-375.
- European Search Report, Application No. EP07 11 4443, Dated Nov. 22, 2007.

\* cited by examiner

*Primary Examiner*—Jacob Y Choi

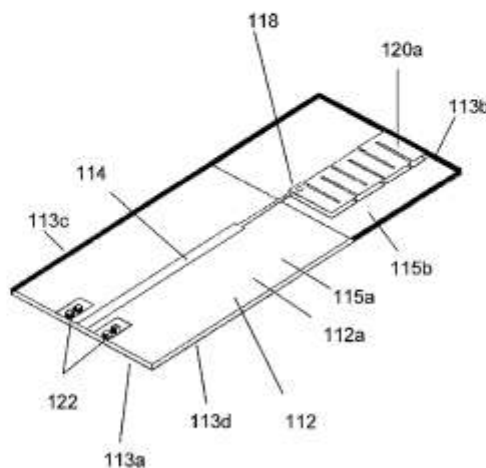
*Assistant Examiner*—Robert Karacsony

(74) *Attorney, Agent, or Firm*—Jaeckle Fleischmann & Mugel LLP

(57) **ABSTRACT**

An antenna formed on a dielectric substrate having first and second opposing surfaces, a first meander antenna element disposed on the first surface of the substrate and a second meander antenna element disposed on the second surface of the substrate.

**23 Claims, 7 Drawing Sheets**





US007847738B2

(12) **United States Patent**  
**Teng**

(10) **Patent No.:** **US 7,847,738 B2**  
(45) **Date of Patent:** **Dec. 7, 2010**

(54) **MICROSTRIP ANTENNA**  
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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 338 days.

7,319,432 B2 \* 1/2008 Andersson ..... 343/702  
7,342,500 B2 \* 3/2008 Ho et al. .... 340/572.7  
7,432,861 B2 \* 10/2008 Shih ..... 343/700 MS

**FOREIGN PATENT DOCUMENTS**

CN 1702908 11/2005

\* cited by examiner

*Primary Examiner*—Douglas W Owens  
*Assistant Examiner*—Chuc D Tran  
(74) *Attorney, Agent, or Firm*—Frank R. Niranjan

(21) Appl. No.: **12/206,730**

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

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Mar. 28, 2008 (CN) ..... 2008 1 0300767

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

(52) **U.S. Cl.** ..... **343/700 MS**; 343/702;  
343/767; 343/770; 343/846

(58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 767, 770, 846, 895  
See application file for complete search history.

(56) **References Cited**

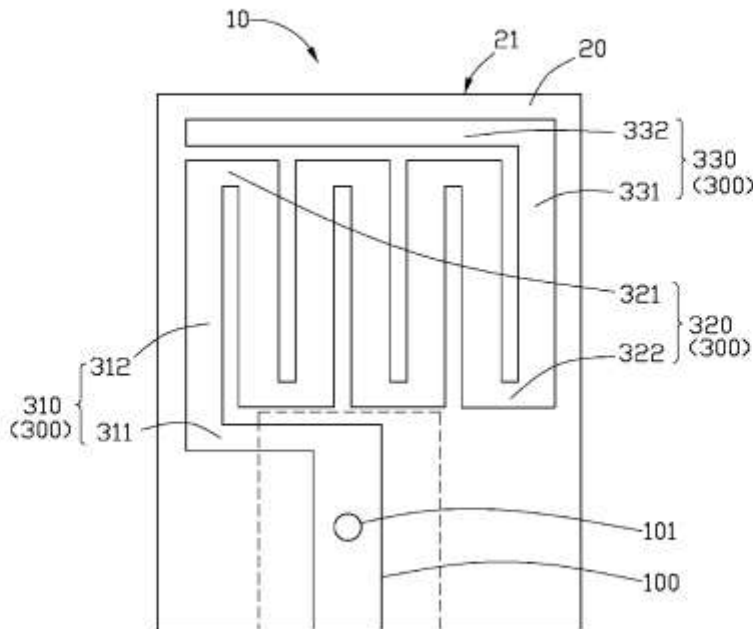
**U.S. PATENT DOCUMENTS**

7,183,982 B2 \* 2/2007 Kadambi et al. .... 343/702

(57) **ABSTRACT**

A microstrip antenna positioned on a substrate includes a feeding portion, a grounding portion, and a radiating portion. The substrate includes a first surface and a second surface opposite to the first surface. The feeding portion is positioned on the first surface. The grounding portion is positioned on the second surface. The radiating portion is positioned on the first surface, and includes a first radiator, a second radiator in zigzag shape, and a third radiator. The first radiator includes a first radiating section and a second radiating section. The third radiator includes a third radiating section and a fourth radiating section. The first radiating section, the second radiating section, the second radiator, the third radiating section, and the fourth radiating section are perpendicular to one another connected one by one in sequence. The first radiator and the third radiator co-define a receiving area, and the second radiator is positioned in the receiving area.

**9 Claims, 4 Drawing Sheets**





US007847746B2

(12) **United States Patent**  
**Moser**

(10) **Patent No.:** **US 7,847,746 B2**  
(45) **Date of Patent:** **Dec. 7, 2010**

(54) **BROADBAND ANTENNA**  
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(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 208 days.

EP 1 146 590 A2 10/2001  
EP 1 146 590 A3 10/2001  
EP 1 162 688 A1 12/2001  
JP 2001 177331 A 6/2001  
JP 2001 217631 A 8/2001  
WO 02/13307 A1 2/2002  
WO 2006/070233 A1 7/2006

(21) Appl. No.: **12/167,420**  
(22) Filed: **Jul. 3, 2008**  
(65) **Prior Publication Data**  
US 2010/0001913 A1 Jan. 7, 2010

**OTHER PUBLICATIONS**

International Search Report, corresponding to PCT/EP2009/050223, mailed May 25, 2009.  
Written Opinion of the International Searching Authority, corresponding to PCT/EP2009/050223, mailed May 25, 2009.

*Primary Examiner*—Michael C Wimer  
(74) *Attorney, Agent, or Firm*—Renner, Otto, Boisselle & Sklar, LLP

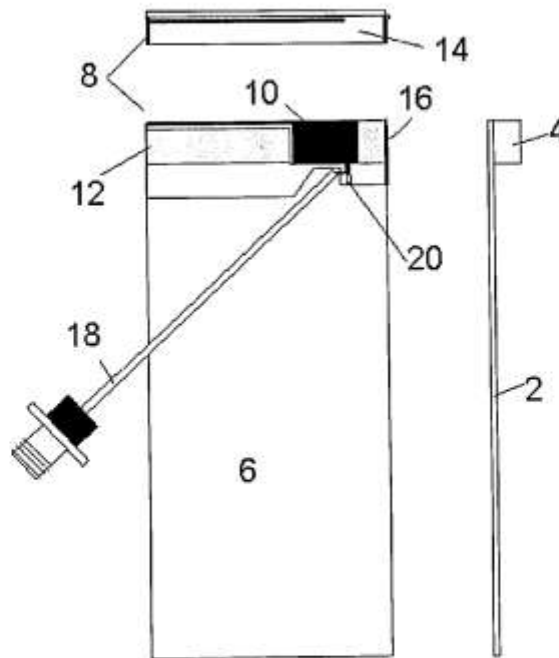
(51) **Int. Cl.**  
**H01Q 1/36** (2006.01)  
**H01Q 5/00** (2006.01)  
(52) **U.S. Cl.** ..... **343/722; 343/829**  
(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 722, 828-830, 846**  
See application file for complete search history.

(57) **ABSTRACT**

The present invention relates to a broadband antenna for at least six frequency bands provided on an isolating antenna support structure comprising. The antenna comprises a low band branch and a high band branch coupled to a substantially rectangular ground plane provided on a PCB. The coupling between the ground plane and the low band branch is a capacitive coupling and has a vertical distance of 3-7 mm there in between.

(56) **References Cited**  
**FOREIGN PATENT DOCUMENTS**  
EP 1 122 812 A2 8/2001  
EP 1 122 812 A3 8/2001

**8 Claims, 3 Drawing Sheets**





US007847750B2

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

(10) **Patent No.:** **US 7,847,750 B2**  
(45) **Date of Patent:** **Dec. 7, 2010**

(54) **ANTENNA DEVICE ADAPTED FOR PORTABLE RADIO APPARATUS**

(75) Inventors: **Isao Ohba**, Tokyo (JP); **Takashi Amano**, Saitama-ken (JP); **Akihiro Tsujimura**, Tokyo (JP); **Satoshi Mizoguchi**, Tokyo (JP); **Koichi Sato**, Tokyo (JP)

(73) Assignee: **Kabushiki Kaisha Toshiba**, Tokyo (JP)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 449 days.

(21) Appl. No.: **11/973,807**

(22) Filed: **Oct. 10, 2007**

(65) **Prior Publication Data**  
US 2008/0143627 A1 Jun. 19, 2008

(30) **Foreign Application Priority Data**  
Dec. 15, 2006 (JP) ..... 2006-338273

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

(52) **U.S. Cl.** ..... **343/787**

(58) **Field of Classification Search** ..... 343/702,  
343/729, 787, 788  
See application file for complete search history.

(56) **References Cited**  
**U.S. PATENT DOCUMENTS**  
7,088,304 B2\* 8/2006 Endo et al. .... 343/788

7,515,111 B2*	4/2009	Tsujimura et al. ....	343/787
2004/0046699 A1*	3/2004	Amano et al. ....	343/702
2005/0162331 A1*	7/2005	Endo et al. ....	343/788
2007/0052600 A1*	3/2007	Kamitani et al. ....	343/702

**FOREIGN PATENT DOCUMENTS**

JP	2001-156484 A	6/2001
JP	2006-222873 A	8/2006

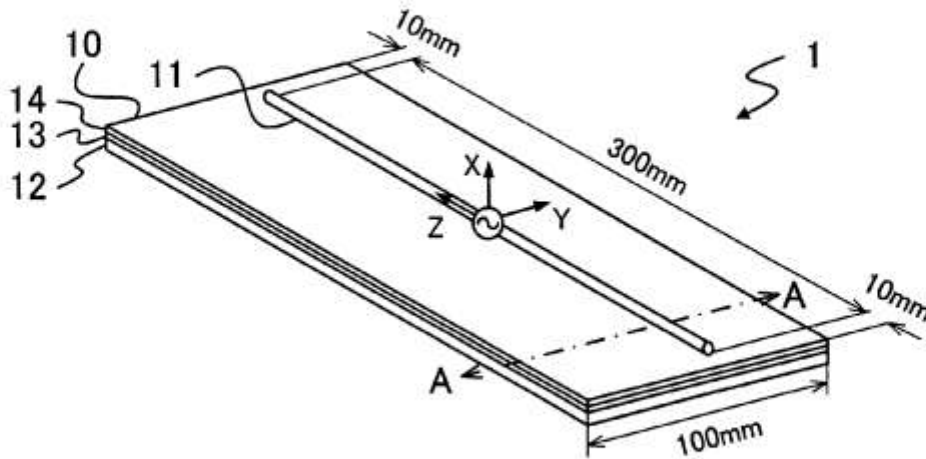
\* cited by examiner

*Primary Examiner*—Michael C Wimer  
*Assistant Examiner*—Kyana R Robinson  
(74) *Attorney, Agent, or Firm*—Holtz, Holtz, Goodman & Chick, PC

(57) **ABSTRACT**

An antenna device includes a printed circuit board and an antenna element. The printed circuit board has a face a portion of which is formed by a conductive layer overlaid with a magnetic material layer made of anisotropic magnetic material. The magnetic material layer is arranged in such a way that a hard magnetization axis of the anisotropic magnetic material is directed almost parallel to the face. The antenna element is arranged almost parallel to the printed circuit board on a side of the face. The antenna element is arranged in such a way that an antenna current distributed on the antenna element if the antenna element is excited is directed almost perpendicular to the hard magnetization axis.

**13 Claims, 8 Drawing Sheets**





US007847751B2

(12) **United States Patent**  
**Schano**

(10) **Patent No.:** **US 7,847,751 B2**  
(45) **Date of Patent:** **Dec. 7, 2010**

- (54) **PLANAR BROADBAND ANTENNA**
- (75) Inventor: **Thomas Schano**, Giesen (DE)
- (73) Assignee: **Robert Bosch GmbH**, Stuttgart (DE)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 588 days.

- (21) Appl. No.: **11/667,428**
- (22) PCT Filed: **Sep. 9, 2005**
- (86) PCT No.: **PCT/EP2005/054492**

§ 371 (c)(1),  
(2), (4) Date: **Feb. 28, 2008**

- (87) PCT Pub. No.: **WO2006/051010**  
PCT Pub. Date: **May 18, 2006**

- (65) **Prior Publication Data**  
US 2008/0297430 A1 Dec. 4, 2008

- (30) **Foreign Application Priority Data**  
Nov. 9, 2004 (DE) ..... 10 2004 054 015

- (51) **Int. Cl.**  
**H01Q 1/50** (2006.01)
- (52) **U.S. Cl.** ..... **343/860; 343/841**
- (58) **Field of Classification Search** ..... **343/700 MS, 343/841, 860**

See application file for complete search history.

- (56) **References Cited**  
U.S. PATENT DOCUMENTS

6,124,829 A	9/2000	Iwasaki	
6,590,541 B1	7/2003	Schultze	
6,819,287 B2 *	11/2004	Sullivan et al.	343/700 MS
7,436,360 B2 *	10/2008	Chen et al.	343/700 MS
2003/0076269 A1	4/2003	Kuramoto	

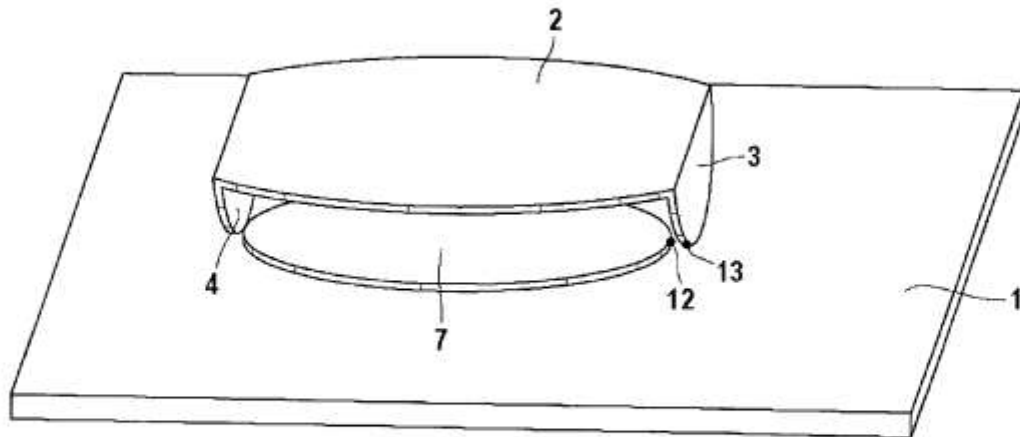
- FOREIGN PATENT DOCUMENTS

EP	0 444 679	9/1991
JP	2000 091834	3/2000
JP	2003 133841	5/2003
WO	WO 2004/073112	8/2004

\* cited by examiner  
*Primary Examiner*—Tan Ho  
(74) *Attorney, Agent, or Firm*—Kenyon & Kenyon LLP

- (57) **ABSTRACT**  
A planar broadband antenna includes a flat elliptical antenna device. The elliptical antenna device includes a central antenna element, a first angular antenna element and a second angular antenna element. The central antenna element is disposed parallel to a support. The angular antenna elements are formed by two opposite segments of the elliptical antenna device and point toward the support. The first angular antenna element is provided with a base point through which a signal is capable of being fed in. An impedance device connects the second angular antenna element to a ground point located near the base point.

**10 Claims, 2 Drawing Sheets**





US007852270B2

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

(10) **Patent No.:** **US 7,852,270 B2**  
(45) **Date of Patent:** **Dec. 14, 2010**

(54) **WIRELESS COMMUNICATION DEVICE**

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(73) Assignee: **Sharp Kabushiki Kaisha**, Osaka-Shi (JP)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 328 days.

(21) Appl. No.: **12/203,547**

(22) Filed: **Sep. 3, 2008**

(65) **Prior Publication Data**  
US 2009/0066590 A1 Mar. 12, 2009

(30) **Foreign Application Priority Data**  
Sep. 7, 2007 (JP) ..... 2007-233431  
Jul. 1, 2008 (JP) ..... 2008-172496

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/702; 343/786**

(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 772, 786, 846  
See application file for complete search history.

(56) **References Cited**  
**U.S. PATENT DOCUMENTS**  
6,061,026 A \* 5/2000 Ochi et al. .... 343/700 MS

7,227,502 B2 \* 6/2007 Yamamoto ..... 343/700 MS  
7,236,070 B2 \* 6/2007 Ajioka et al. .... 333/247  
2008/0042917 A1 \* 2/2008 Seki et al. .... 343/767

**FOREIGN PATENT DOCUMENTS**

JP 9-237867 A 9/1997

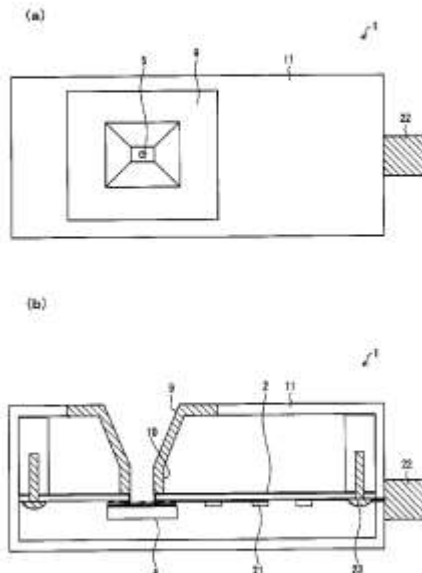
\* cited by examiner

*Primary Examiner*—Hoang V Nguyen  
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

A wireless communication device including an antenna-integrated module which realizes a high-end antenna having an improved antenna efficiency includes a mounting board having a through hole whose cross-sectional shape is rectangular; and an antenna-integrated module mounted on the mounting board so as to cover over the through hole, a patch antenna, which radiates radiation wave, being provided on a surface of the antenna-integrated module, which surface is exposed in the through hole, an annular grounding sheet being provided between the antenna-integrated module and the mounting board so as to surround the patch antenna, and the through hole having a longer side whose length satisfies  $\lambda/2 \leq a \leq \lambda$ , where  $\lambda$  is a wavelength of the radiation wave.

**14 Claims, 9 Drawing Sheets**





US007852273B2

(12) **United States Patent**  
**Saitou**

(10) **Patent No.:** **US 7,852,273 B2**  
(45) **Date of Patent:** **Dec. 14, 2010**

(54) **DISPLAY DEVICE**

(75) Inventor: **Yasuo Saitou**, Tokyo (JP)

(73) Assignee: **Mitsubishi Electric 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 263 days.

(21) Appl. No.: **11/664,871**

(22) PCT Filed: **Sep. 2, 2005**

(86) PCT No.: **PCT/JP2005/016134**

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(2), (4) Date: **Apr. 6, 2007**

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PCT Pub. Date: **May 11, 2006**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Nov. 1, 2004 (JP) ..... 2004-318109

(51) **Int. Cl.**  
*H01Q 1/32* (2006.01)  
*H01Q 1/24* (2006.01)

(52) **U.S. Cl.** ..... 343/711; 343/702

(58) **Field of Classification Search** ..... 343/702,  
343/711, 713, 846

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

6,285,328 B1 9/2001 Masaki et al.  
6,342,858 B1 1/2002 Dakeya et al.

6,509,877 B2 1/2003 Masaki  
7,043,209 B2\* 5/2006 Hirota ..... 455/101  
2003/0148784 A1 8/2003 Sawamura et al.  
2004/0021608 A1 2/2004 Kojima et al.  
2004/0066342 A1\* 4/2004 Takaoka et al. .... 343/711

**FOREIGN PATENT DOCUMENTS**

CN 1212078 3/1999  
JP 5-335826 A 12/1993  
JP 9-261749 A 10/1997  
JP 2000-172376 A 6/2000  
JP 2000-259295 A 9/2000  
JP 2001-16019 A 1/2001  
JP 2001-312339 A 11/2001  
JP 2002-84117 A 3/2002  
JP 2002-232220 A 8/2002  
JP 2002-368850 A 12/2002  
JP 2003-37538 A 2/2003  
JP 2003-110329 A 4/2003  
JP 2004-5653 A 1/2004  
JP 2004-236179 A 8/2004  
JP 2004-266681 A 9/2004  
JP 2006-50586 A 2/2006

\* cited by examiner

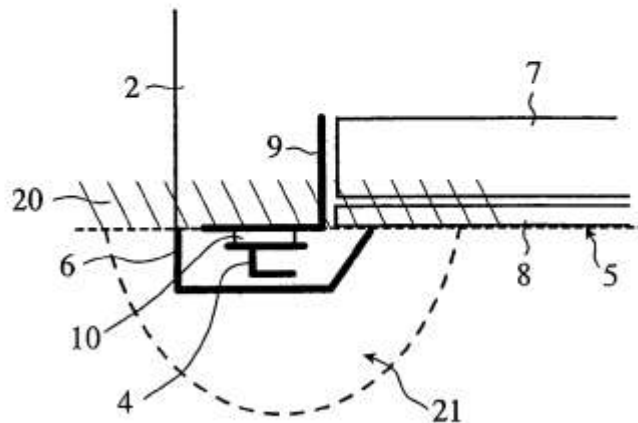
*Primary Examiner*—Shih-Chao Chen

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

(57) **ABSTRACT**

A plurality of antennas are arranged on the fringe of a monitor supported by a device body such that the antennas are located in a floating manner from a display surface and the central axis of these directional patterns is disposed in a vertical direction to the display surface; these antennas are enclosed within the outer frame; and further electroconductive members reflecting electric waves are located away from the antennas, to thus establish a virtual GND plane to be formed on the rear of an antenna.

**4 Claims, 8 Drawing Sheets**







US007855685B2

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

(10) **Patent No.:** **US 7,855,685 B2**  
(45) **Date of Patent:** **Dec. 21, 2010**

(54) **MICROWAVE COMMUNICATION PACKAGE**

(75) Inventors: **Matthew R. Walsh**, Sharpsville, IN (US); **Deepukumar M. Nair**, Christiansburg, VA (US); **David W. Zimmerman**, Fishers, IN (US); **Benjamin E. Haffke**, Kokomo, IN (US); **Scott D. Brandenburg**, Kokomo, IN (US); **Charles I. Delheimer**, Noblesville, IN (US); **Michael E. Miller**, Rossville, IN (US); **Bruce Wayne Butler**, Sharpsville, IN (US)

(73) Assignee: **Delphi Technologies, Inc.**, Troy, MI (US)

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(65) **Prior Publication Data**

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(58) **Field of Classification Search** ..... 343/700 MS; 333/245, 246, 247, 248; 257/664, 700  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,878,060 A \* 10/1989 Barbier et al. .... 343/778

5,023,624 A *	6/1991	Heckaman et al. ....	343/860
6,172,412 B1 *	1/2001	Wein et al. ....	257/664
6,809,688 B2 *	10/2004	Yamada ....	343/700 MS
6,967,543 B2 *	11/2005	Ammar ....	333/26
7,236,070 B2 *	6/2007	Ajioka et al. ....	333/247
2005/0218505 A1 *	10/2005	Oman et al. ....	257/702

**OTHER PUBLICATIONS**

Paul Dixon, Dampening Cavity Resonance Using Absorber Material, RF Design, May 16-18, 2004.\*

Paul Dixon, Dampening Cavity Resonance Using Absorber Material, May 2004, RF Design, pp. 16-19.\*

\* cited by examiner

*Primary Examiner*—Michael C Wimer

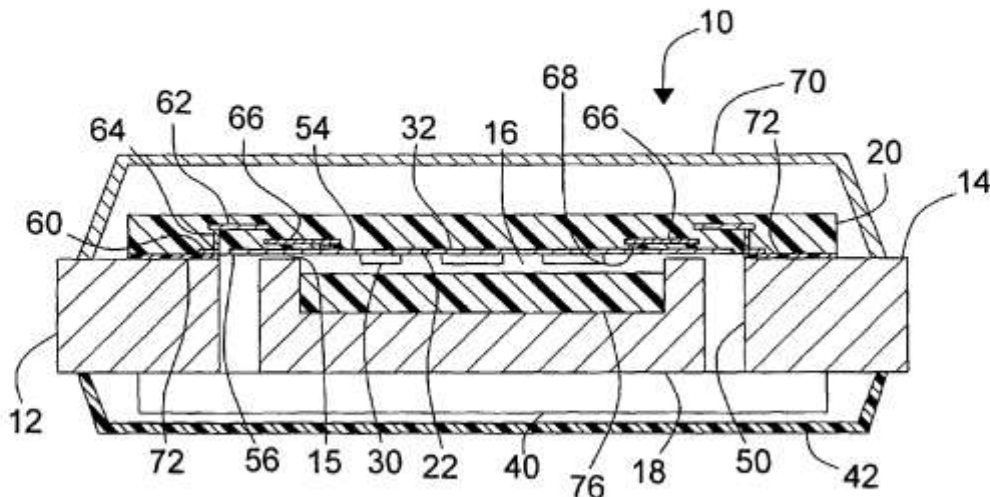
*Assistant Examiner*—Kyana R Robinson

(74) *Attorney, Agent, or Firm*—Thomas N. Twomey

(57) **ABSTRACT**

A microwave communication package is constructed on an electrically conducting base plate having a first side defining a base plate cavity, with an antenna apparatus mounted on an opposite, second side. A dielectric substrate on the first side of the base plate covers the base plate cavity; and sealing apparatus contacting the dielectric substrate and the base plate completely around the base plate cavity hermetically seals the cavity. Circuitry mounted on a surface of the substrate within the base plate cavity includes one or more microstrip lines communicating components to one or more waveguides comprising openings extending through the base plate; and the waveguides are coupled at their opposite ends to the antenna apparatus.

**18 Claims, 3 Drawing Sheets**





US007855686B2

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

(10) **Patent No.:** **US 7,855,686 B2**  
(45) **Date of Patent:** **Dec. 21, 2010**

(54) **COMPACT ANTENNAS FOR  
ULTRA-WIDEBAND APPLICATIONS**

(75) Inventors: **Zhining Chen**, Singapore (SG); **Shie Ping Terence See**, Singapore (SG)

(73) Assignee: **Agency for Science, Technology and Research**, Singapore (SG)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 145 days.

(21) Appl. No.: **12/063,992**

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

(86) PCT No.: **PCT/SG2005/000282**

§ 371 (c)(1),

(2), (4) Date: **Jun. 11, 2008**

(87) PCT Pub. No.: **WO2007/021247**

PCT Pub. Date: **Feb. 22, 2007**

(65) **Prior Publication Data**

US 2008/0316108 A1 Dec. 25, 2008

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,535,166	B1 *	3/2003	Ali	343/700 MS
6,798,383	B2 *	9/2004	Nakase et al.	343/700 MS
6,914,565	B2 *	7/2005	Shikata et al.	343/700 MS
7,176,843	B2 *	2/2007	Shimasaki et al.	343/795
7,405,664	B2 *	7/2008	Sakama et al.	340/572.7
2007/0120740	A1 *	5/2007	Iellici et al.	343/700 MS

\* cited by examiner

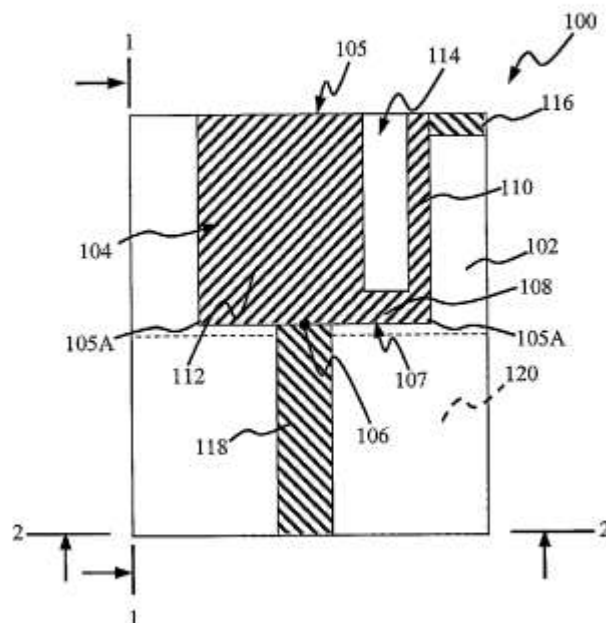
*Primary Examiner*—Tho G Phan

(74) *Attorney, Agent, or Firm*—McDonnell Boehnen Hulbert & Berghoff LLP

(57) **ABSTRACT**

The antenna (100) has a radiating element (104) for transmitting and receiving signals. The radiating element (104) comprises a first portion (110), a second portion (112) and a notch (114). The notch (114) extends from a portion of the periphery of the radiating element into the radiating element and is for substantially segregating the radiating element into the first portion (110) and the second portion (112). The radiating element (104) also has an interconnecting portion (108) for structurally interconnecting the first portion and the second portion. The interconnecting portion is formed substantially distal to the portion of the periphery of the radiating element. In addition, the antenna (100) has a first arm (116) that extends from the first portion of the radiating element for modifying the operating frequency range of the antenna.

**26 Claims, 7 Drawing Sheets**





US007855687B2

(12) **United States Patent**  
**Kang**

(10) **Patent No.:** **US 7,855,687 B2**  
(45) **Date of Patent:** **Dec. 21, 2010**

(54) **PRINTED CIRCUIT BOARD, DISPLAY DEVICE HAVING THE SAME AND A METHOD THEREOF**

(75) Inventor: **Byeong-Soo Kang**, Cheonan-si (KR)

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

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 594 days.

(21) Appl. No.: **11/838,271**

(22) Filed: **Aug. 14, 2007**

(65) **Prior Publication Data**

US 2008/0074334 A1 Mar. 27, 2008

(30) **Foreign Application Priority Data**

Sep. 27, 2006 (KR) ..... 10-2006-0094277

(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, 725, 767, 770, 846

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,509,877 B2\* 1/2003 Masaki ..... 343/702  
6,728,559 B2\* 4/2004 Masaki ..... 455/575.5

6,809,690 B2\* 10/2004 Tao ..... 343/702  
6,980,159 B2\* 12/2005 Sun et al. .... 343/702  
7,068,229 B2\* 6/2006 Lin ..... 343/702  
7,508,680 B2\* 3/2009 Lee et al. .... 361/765  
2004/0264119 A1\* 12/2004 Hirota ..... 361/683

**FOREIGN PATENT DOCUMENTS**

JP 2000172376 6/2000  
KR 1020040028370 4/2004  
KR 1020050092258 9/2005  
KR 1020060010259 2/2006

\* cited by examiner

*Primary Examiner*—Douglas W Owens

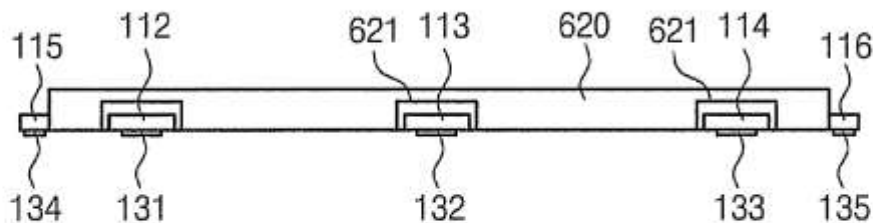
*Assistant Examiner*—Chuc D Tran

(74) *Attorney, Agent, or Firm*—Cantor Colburn LLP

(57) **ABSTRACT**

A display device including a display panel and a printed circuit board. The printed circuit board includes an insulating layer, a circuit wire portion, an antenna arranged on the insulating layer and a connection wire portion. The insulating layer includes a base portion and a protruding portion protruded from a side of the base portion. The circuit wire portion is arranged on the base portion. The antenna is arranged on the protruding portion and insulated from the circuit wire portion. The connection wire portion is arranged on the base portion and electrically connected to the antenna. The antenna is exposed outside of the display panel.

**12 Claims, 7 Drawing Sheets**





US007855693B2

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

(10) **Patent No.:** **US 7,855,693 B2**  
(45) **Date of Patent:** **Dec. 21, 2010**

(54) **WIDE BAND BICONICAL ANTENNA WITH A HELICAL FEED SYSTEM**

(75) Inventors: **Gary A. Martek**, Blythewood, SC (US);  
**Leon Fulmer**, Prosperity, SC (US);  
**John M. Maynard**, Columbia, SC (US);  
**Henry R. Jarman**, Gadsden, SC (US)

(73) Assignee: **Shakespeare Company, LLC**,  
Columbia, SC (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 725 days.

(21) Appl. No.: **11/890,257**

(22) Filed: **Aug. 3, 2007**

(65) **Prior Publication Data**

US 2009/0033578 A1 Feb. 5, 2009

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

(52) **U.S. Cl.** ..... **343/773; 343/895; 343/791**

(58) **Field of Classification Search** ..... **343/895, 343/791, 773, 774**

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,527,163 A 7/1985 Stanton ..... 343/700 MS  
5,534,880 A \* 7/1996 Buffon et al. .... 343/774

5,668,510 A *	9/1997	Humpherys	333/127
6,259,416 B1	7/2001	Qi et al.	343/767
6,377,227 B1	4/2002	Zhu et al.	343/795
6,525,694 B2	2/2003	Jiang et al.	343/742
6,879,296 B2	4/2005	Jiang et al.	343/767
7,050,014 B1	5/2006	Chen et al.	343/795
2006/0001578 A1	1/2006	Holmes et al.	343/702
2006/0017644 A1 *	1/2006	Martek	343/795
2008/0024374 A1	1/2008	Cornwell	343/703

**FOREIGN PATENT DOCUMENTS**

CA	2 270 302 A1	4/1999
CA	2 307 515 A1	4/2000

\* cited by examiner

*Primary Examiner*—Douglas W Owens

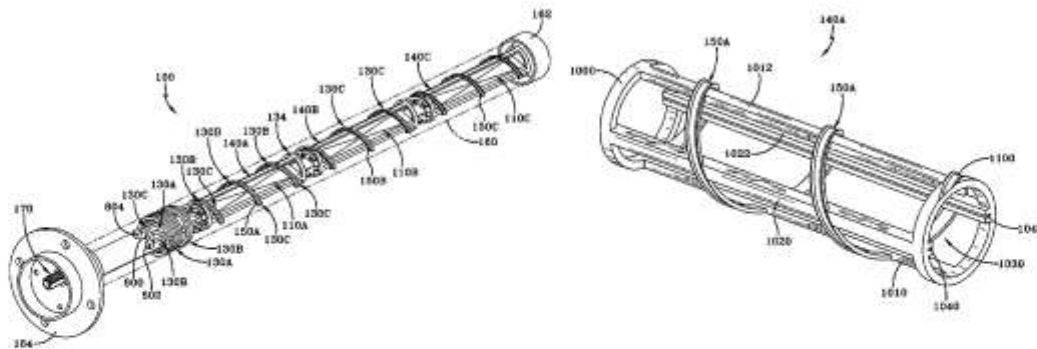
*Assistant Examiner*—Dieu Hien T Duong

(74) *Attorney, Agent, or Firm*—Lawrence J. Sharupoff

(57) **ABSTRACT**

A wide band biconical antenna with a helical feed system comprises a printed circuit board (PCB) that maintains a plurality of antenna elements having an entry conic and a termination conic arranged about a common axis. Each of the antenna elements receive a signal from a signal splitter via respective feed lines that each have the same physical length. In addition, the antenna system includes a matching system disposed within the ground plane formed by the entry conic of each of the antenna elements. The antenna elements are retained within retention sections that maintain helical support channels that allow the feed lines to be arranged in a helical manner about the antenna elements.

**15 Claims, 15 Drawing Sheets**





US007859466B2

(12) **United States Patent**  
**Mei**

(10) **Patent No.:** **US 7,859,466 B2**  
(45) **Date of Patent:** **Dec. 28, 2010**

(54) **DUAL-BAND ANTENNA**

(75) Inventor: **Chia-Hao Mei**, 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 960 days.

(21) Appl. No.: **11/684,639**

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

(65) **Prior Publication Data**  
US 2008/0122700 A1 May 29, 2008

(30) **Foreign Application Priority Data**  
Nov. 24, 2006 (CN) ..... 2006 1 0157057

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

(52) **U.S. Cl.** ..... **343/700 MS; 343/848**

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

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

6,337,663 B1 1/2002 Chi-Ming  
6,856,285 B2\* 2/2005 Bettin et al. .... 343/700 MS  
6,992,631 B2\* 1/2006 Lu ..... 343/700 MS  
7,385,556 B2\* 6/2008 Chung et al. .... 343/700 MS

7,573,424 B2\* 8/2009 Mei ..... 343/700 MS  
2008/0024366 A1\* 1/2008 Cheng ..... 343/700 MS

**FOREIGN PATENT DOCUMENTS**

TW 557608 10/2003  
TW I223470 11/2004

**OTHER PUBLICATIONS**

H.S.Choi et al., Ultra-compact CPW-fed Monopole Antenna with Double Inverted-L Strips for Dual-Band WLAN Applications, IEEE Trans. Antennas Propagat., vol. 52, pp. 978-982, Apr. 2004.

\* cited by examiner

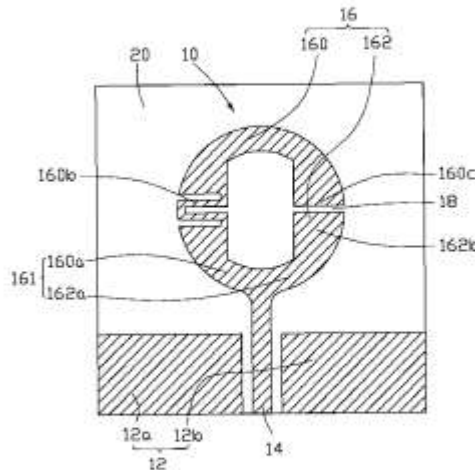
*Primary Examiner*—Tan Ho

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

(57) **ABSTRACT**

A dual-band antenna (10) is disposed on a substrate (20), for transceiving electromagnetic signals of different frequencies. The dual-band antenna includes a grounded portion (12), a feeding portion (14), and a radiation body (16). The feeding portion is adjacent to the grounded portion. The radiation body electronically connected to the feeding portion, includes a first radiation portion (160) and a second radiation portion (162). The first radiation portion includes a first free end (160c), a first connecting end (160a) electronically connected to the feeding portion, and a serpentine portion (160b) between the first free end and the first connecting end. The second radiation portion, includes a second connecting end (162a) electronically connected to the first connecting end, and a second free end (162b), wherein the first free end and the second free end face each other and a gap (18) is formed therebetween.

**15 Claims, 8 Drawing Sheets**





US007859467B2

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

(10) **Patent No.:** **US 7,859,467 B2**  
(45) **Date of Patent:** **Dec. 28, 2010**

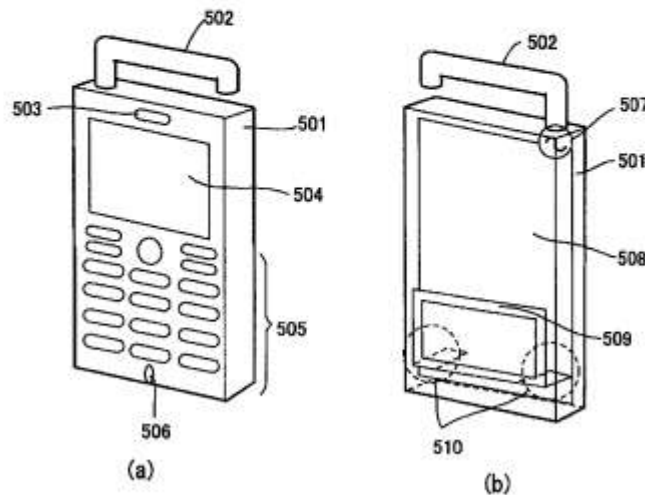
- (54) **RADIO MACHINE ANTENNA DEVICE AND PORTABLE RADIO MACHINE**
- (75) Inventors: **Daigo Imano**, Miyagi (JP); **Mitsuharu Nakasato**, Miyagi (JP); **Nobuaki Tanaka**, Kanagawa (JP)
- (73) Assignee: **Panasonic Corporation**, Osaka (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 667 days.
- (21) Appl. No.: **11/570,129**
- (22) PCT Filed: **Sep. 28, 2005**
- (86) PCT No.: **PCT/JP2005/017815**  
§ 371 (c)(1),  
(2), (4) Date: **Dec. 7, 2006**
- (87) PCT Pub. No.: **WO2006/035802**  
PCT Pub. Date: **Apr. 6, 2006**
- (65) **Prior Publication Data**  
US 2008/0266188 A1 Oct. 30, 2008
- (30) **Foreign Application Priority Data**  
Sep. 28, 2004 (JP) ..... 2004-281586  
Apr. 13, 2005 (JP) ..... 2005-116049
- (51) **Int. Cl.**  
**H01Q 1/24** (2006.01)
- (52) **U.S. Cl.** ..... **343/702; 343/700 MS**
- (58) **Field of Classification Search** ..... None  
See application file for complete search history.

- (56) **References Cited**  
U.S. PATENT DOCUMENTS  
6,456,248 B2 9/2002 Ito  
7,253,773 B2\* 8/2007 Chiba et al. .... 343/702  
2002/0011956 A1 1/2002 Ito  
(Continued)  
FOREIGN PATENT DOCUMENTS  
CN 1329449 A 1/2002  
(Continued)  
OTHER PUBLICATIONS  
European Search Report.  
(Continued)  
*Primary Examiner*—Trinh V Dinh  
(74) *Attorney, Agent, or Firm*—Seed IP Law Group PLLC

(57) **ABSTRACT**

An object of the present invention is to provide an antenna device for a radio apparatus in which the amount of energy (SAR) absorbed by a head of a human body can be reduced without lowering the power of radio waves transmitted during a call. There is provided a board **108** serving as a base plate of an antenna element, an antenna element **102** disposed in a longitudinally end portion of the board **108** through a feeding portion **107**, a conductor plate **109** disposed substantially in parallel with a main surface of the board **108** and disposed on the opposite side to a surface having a sound hole of a receiver portion, and a plurality of short-circuit conductors **110** disposed on a lower end portion of the conductor plate **109**. The conductor plate **109** is short-circuited to a lower end portion of the board **108** through the short-circuit conductors **110**.

**6 Claims, 13 Drawing Sheets**





US007859468B2

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

(10) **Patent No.:** **US 7,859,468 B2**  
(45) **Date of Patent:** **Dec. 28, 2010**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE INCLUDING A FOLDED MONOPOLE MULTI-BAND ANTENNA AND RELATED METHODS**

(75) Inventors: **Shirook Ali**, Mississauga (CA); **Geyi Wen**, Waterloo (CA)

(73) Assignee: **Research In Motion Limited**, Ontario (CA)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 582 days.

(21) Appl. No.: **11/847,477**

(22) Filed: **Aug. 30, 2007**

(65) **Prior Publication Data**

US 2009/0058734 A1 Mar. 5, 2009

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

(52) **U.S. Cl.** ..... **343/702; 343/828**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 803, 804, 846**  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,757,333 A	5/1998	Kitchener	343/246
6,054,955 A	4/2000	Schlegel, Jr. et al.	343/702
6,683,571 B2*	1/2004	Ghosh et al.	343/700 MS
7,023,387 B2	4/2006	Wen et al.	343/700 MS
7,084,831 B2*	8/2006	Takagi et al.	343/860
7,504,997 B2	3/2009	Baliarda et al.	

7,629,933 B2*	12/2009	Wen et al.	343/702
2003/0001781 A1	1/2003	Konishi	
2004/0008141 A1	1/2004	Sato et al.	
2005/0057410 A1	3/2005	Chiang et al.	343/730
2006/0001592 A1	1/2006	Chang	343/895
2006/0017635 A1	1/2006	Zheng	343/748
2006/0109183 A1	5/2006	Rosenberg et al.	343/702
2006/0152415 A1	7/2006	Huang et al.	343/700

**FOREIGN PATENT DOCUMENTS**

EP	0863571	9/1998
JP	08288731	11/1996
JP	2003289214	10/2003
JP	2004056580	2/2004
JP	2005080229	3/2005

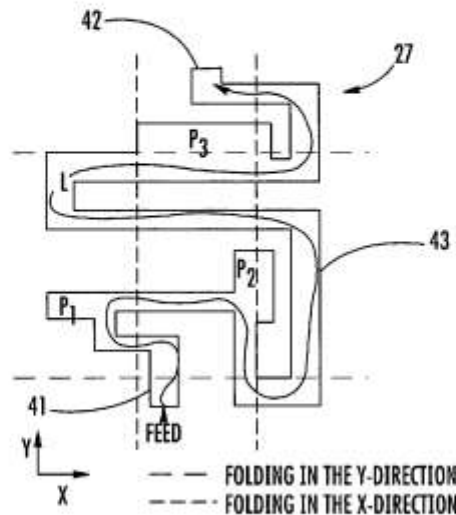
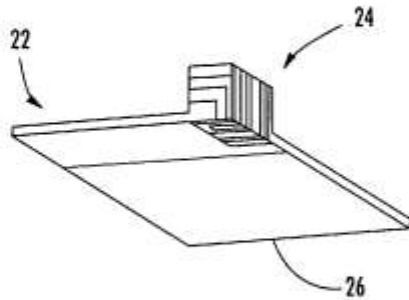
\* cited by examiner

*Primary Examiner*—Michael C Wimer

(57) **ABSTRACT**

A mobile wireless communications device may include a portable housing, a printed circuit board (PCB) carried within the portable housing, and wireless communications circuitry carried by the PCB within the portable housing. The device may also include a folded monopole antenna assembly coupled to the wireless communications circuitry. The folded monopole antenna assembly may include a dielectric body adjacent the PCB and having a generally rectangular shape defining opposing top and bottom faces, opposing first and second end faces, and opposing first and second side faces. The antenna may also include a conductive trace coupled to the wireless communications circuitry and having a first end section extending along the first end face, a second end section extending along the second end face, and an intermediate section extending along the top, bottom, first side and second side faces.

**21 Claims, 7 Drawing Sheets**





US007859469B1

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

(10) **Patent No.:** **US 7,859,469 B1**  
(45) **Date of Patent:** **Dec. 28, 2010**

(54) **COMBINED BATTERY HOLDER AND ANTENNA APPARATUS**

6,067,056 A \* 5/2000 Lake ..... 343/873  
6,424,301 B1 7/2002 Johnson et al.

(75) Inventors: **Douglas K. Rosener**, Santa Cruz, CA (US); **Joseph P. Watson**, San Jose, CA (US); **Thomas R. Trumbull**, Los Gatos, CA (US)

\* cited by examiner

*Primary Examiner*—Rexford N Barnie  
*Assistant Examiner*—Thienvu V Tran  
(74) *Attorney, Agent, or Firm*—David S. Park; Haynes Boone LLP

(73) Assignee: **Plantronics, Inc.**, Santa Cruz, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 40 days.

(57) **ABSTRACT**

A combined, compact battery holder and antenna apparatus. The combined, compact battery holder and antenna apparatus includes a dielectric battery holder and a conductive antenna element having a radiating arm that is supported by the dielectric battery holder. When mounted on a printed circuit board (PCB), the dielectric battery holder maintains the radiating arm of the conductive antenna element at a constant height above a ground plane on the PCB. The compact, combined battery holder and antenna apparatus may be beneficially adapted and configured for use in a variety of electronic devices including, for example, wireless headsets or headphones, cellular communications devices, personal digital assistants (PDAs), and may be adapted and configured to operate according to various types of wireless technologies such as Bluetooth, Wi-Fi and cellular wireless technologies.

(21) Appl. No.: **11/891,503**

(22) Filed: **Aug. 10, 2007**

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

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

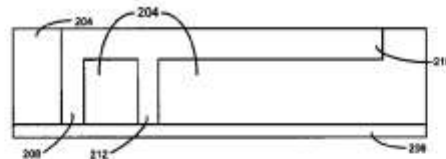
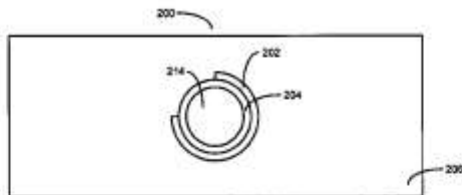
(58) **Field of Classification Search** ..... 343/702  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,963,177 A \* 10/1999 Tuttle et al. .... 343/872

**36 Claims, 6 Drawing Sheets**







US007859470B2

(12) **United States Patent**  
**Johnson**

(10) **Patent No.:** **US 7,859,470 B2**  
(45) **Date of Patent:** **Dec. 28, 2010**

(54) **MULTIPLE ELEMENT ANTENNA ASSEMBLY**

(75) Inventor: **Greg F. Johnson**, Aptos, CA (US)

(73) Assignee: **Aerius International, Ltd.**, Lewes, DE (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 196 days.

(21) Appl. No.: **12/199,474**

(22) Filed: **Aug. 27, 2008**

(65) **Prior Publication Data**

US 2009/0085814 A1 Apr. 2, 2009

**Related U.S. Application Data**

(60) Provisional application No. 60/968,175, filed on Aug. 27, 2007.

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

(52) **U.S. Cl.** ..... **343/702; 343/725; 343/846**

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,771,022 A 6/1998 Vaughan et al.

6,222,496 B1	4/2001	Liu	
6,295,030 B1	9/2001	Kozakai et al.	
6,326,924 B1	12/2001	Muramoto et al.	
6,337,670 B1	1/2002	Chen	
6,339,402 B1	1/2002	McKivergan	
6,768,460 B2 *	7/2004	Honshi et al.	343/700 MS
7,443,566 B2 *	10/2008	Lerenius et al.	359/265

\* cited by examiner

*Primary Examiner*—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Briggs and Morgan, P.A.

(57) **ABSTRACT**

An antenna assembly for multiple band operation of a wireless communications devices such as cellphones. Embodiments of the present invention provides for operation over 824-960 MHz Cellphone and 1575 MHz GPS bands and 1710-2155 MHz. Coverage over the GPS frequency band is highly desirable for wireless communication devices such as cell phones, in order to provide location information. Radiating conducting elements can be positioned in close proximity to an inverted PIFA-type antenna, requiring very little additional space or volume and allowing nearly the same form factor to be used for the antenna assembly. An illuminated panel may be positioned within an aperture of the ground plane. The panel may be back lit and activated in response to an external signal.

**19 Claims, 5 Drawing Sheets**

