



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**

(75) Inventors: **Daniel Chang**, Pa-Te (TW); **Chia-Lun Tang**, Pa-Te (TW)

(73) Assignee: **Auden Techno Corp.**, Pa-Te, Tao-Yuan Hsien (TW)

(*) 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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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.

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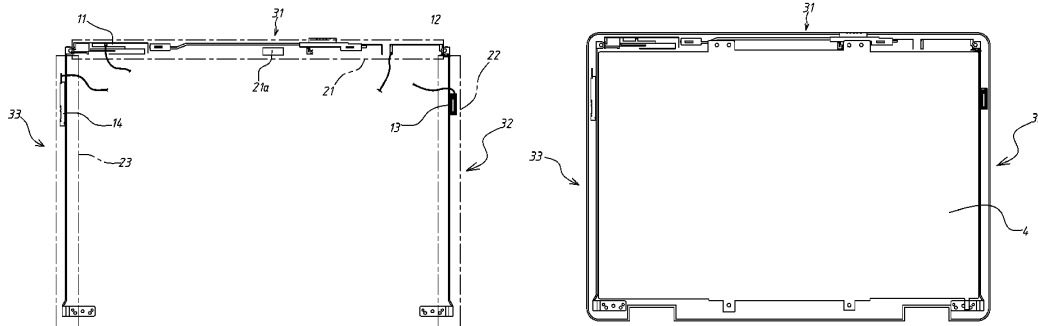
Primary Examiner—Minh Trinh

(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



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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**

(75) Inventor: **Eswarappa Channabasappa**, Acton,
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(73) Assignee: **Cobham Defense Electronic Systems**,
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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 195 days.

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

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

(65) **Prior Publication Data**

US 2008/0048929 A1 Feb. 28, 2008

(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.

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Primary Examiner—Jacob Y Choi

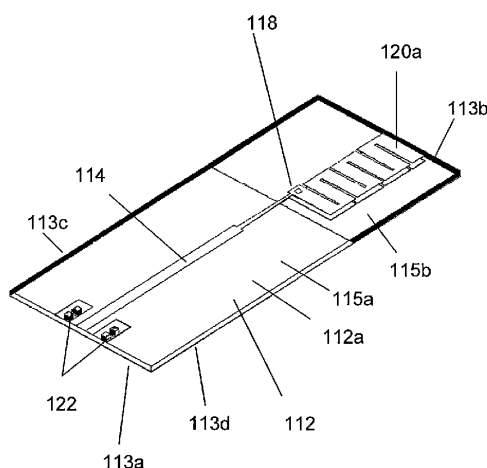
Assistant Examiner—Robert Karacsony

(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



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US007847738B2

(12) **United States Patent**
Teng

(10) **Patent No.:** **US 7,847,738 B2**

(45) **Date of Patent:** **Dec. 7, 2010**

(54) **MICROSTRIP ANTENNA**

(75) Inventor: **Jia-Lin Teng**, Taipei Hsien (TW)

(73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
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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.

(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.

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Primary Examiner—Douglas W Owens

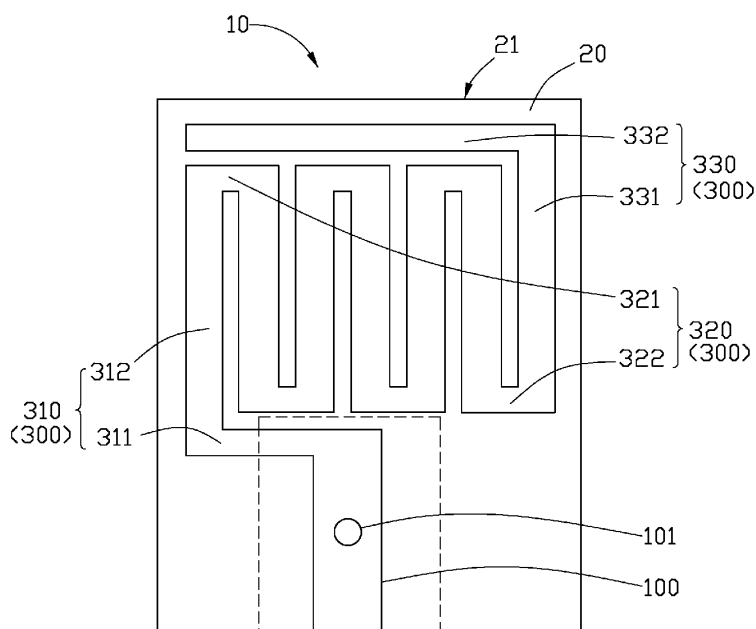
Assistant Examiner—Chuc D Tran

(74) *Attorney, Agent, or Firm*—Frank R. Niranjan

(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 third 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



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US007847746B2

(12) **United States Patent**
Moser

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

(54) **BROADBAND ANTENNA**

(75) Inventor: **Michael Moser**, Hägersten (SE)

(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.

(21) Appl. No.: **12/167,420**

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

(65) **Prior Publication Data**

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(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.

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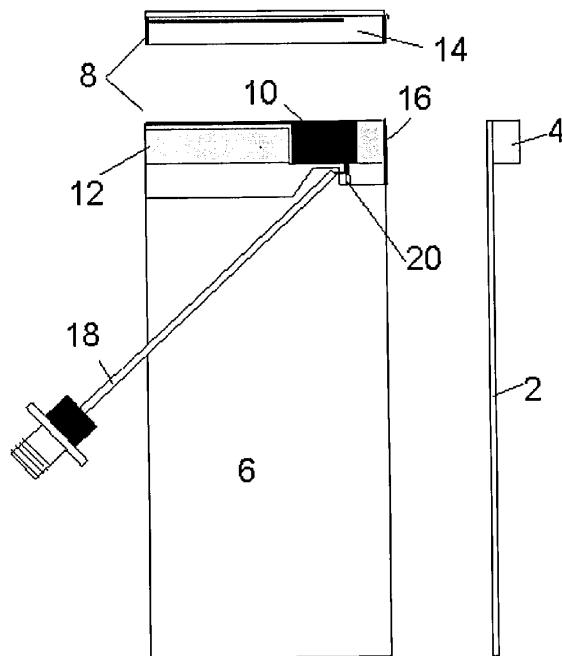
Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Renner, Otto, Boisselle & Sklar, LLP

(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.

8 Claims, 3 Drawing Sheets



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

- (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)

- (58) **Field of Classification Search** 343/702

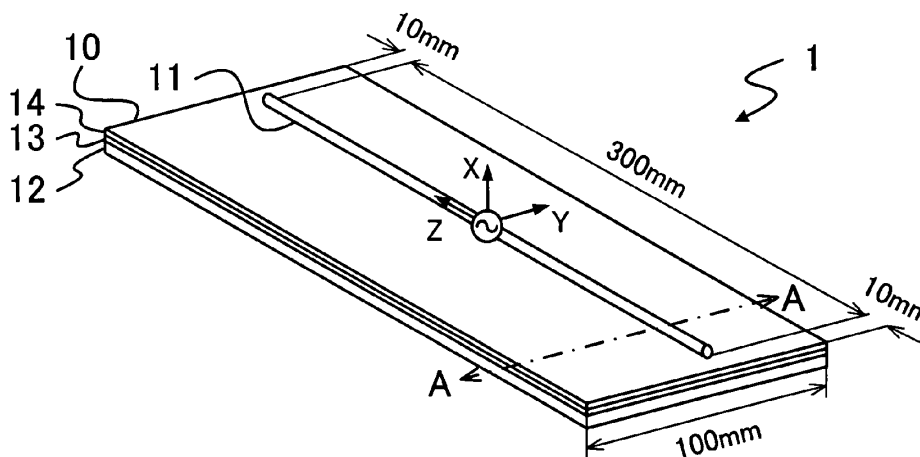
- (58) Field of Classification Search 343/729, 787, 788

- See application file for complete search history.

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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**

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(30) **Foreign Application Priority Data**

Nov. 9, 2004 (DE) 10 2004 054 015

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(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**

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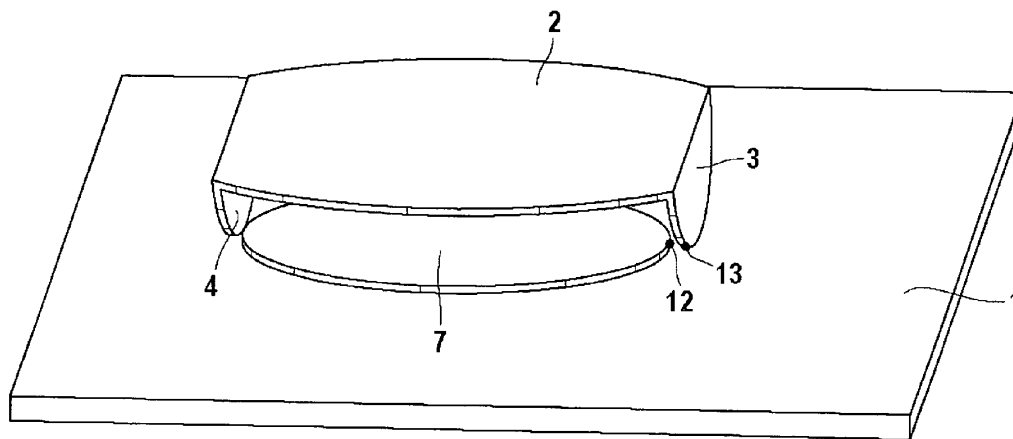
Primary Examiner—Tan Ho

(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



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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**

(75) Inventors: **Atsushi Yamada**, Tenri (JP); **Keisuke Satoh**, Osaka (JP); **Hiroki Tanaka**, Nara (JP)

(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**

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(30) **Foreign Application Priority Data**

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Jul. 1, 2008 (JP) 2008-172496

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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**

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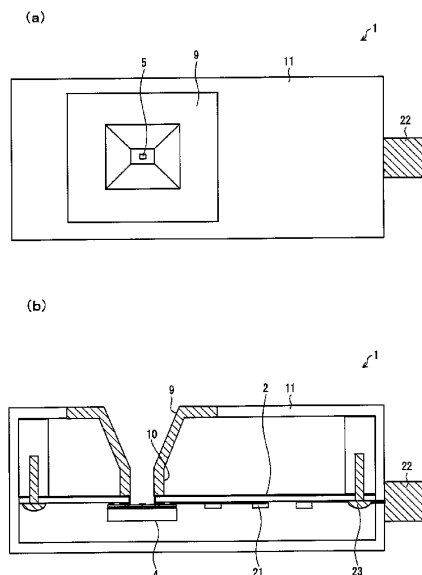
Primary Examiner—Hoang V Nguyen

(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 λ is a wavelength of the radiation wave.

14 Claims, 9 Drawing Sheets



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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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(30) **Foreign Application Priority Data**

Nov. 1, 2004 (JP) 2004-318109

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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.

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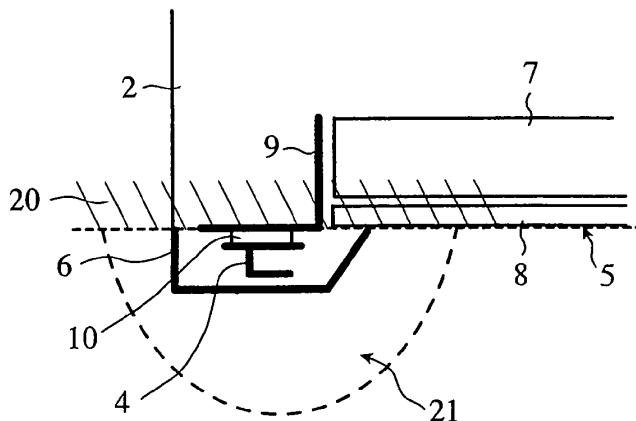
Primary Examiner—Shih-Chao Chen

(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



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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)

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

(21) Appl. No.: **11/904,986**

(22) Filed: **Sep. 28, 2007**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
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333/248

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

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Primary Examiner—Michael C Wimer

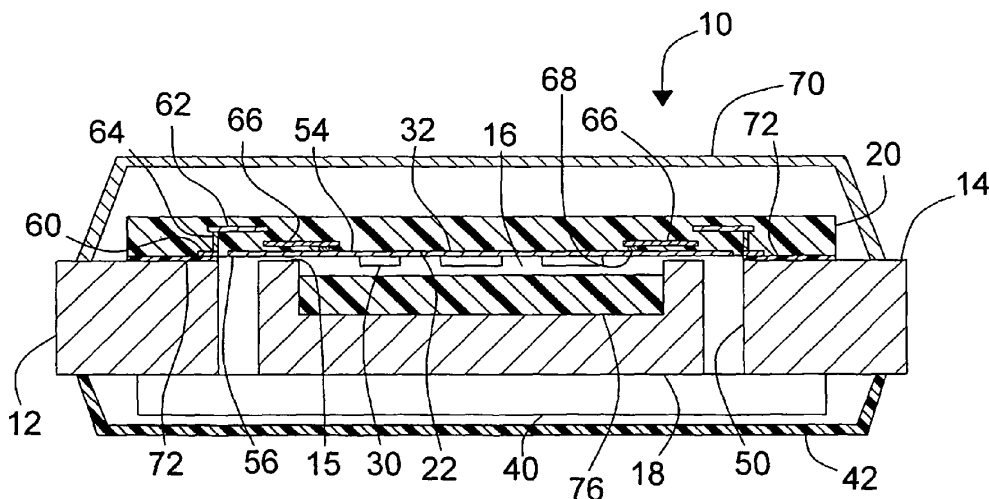
Assistant Examiner—Kyana R Robinson

(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



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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)

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

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

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

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

See application file for complete search history.

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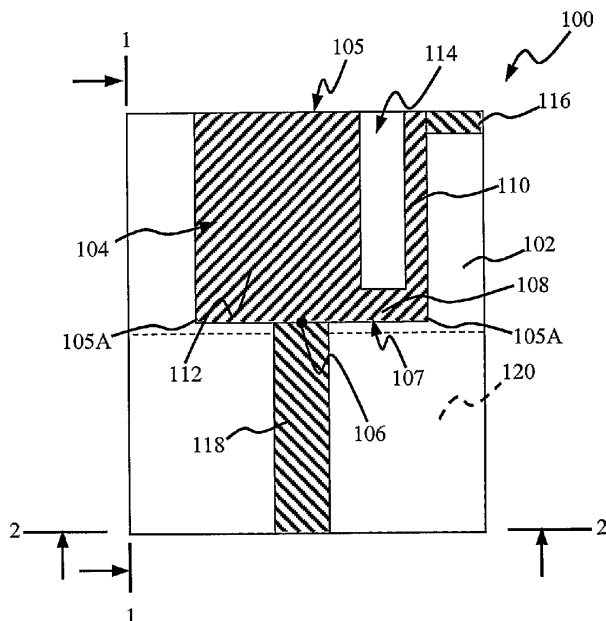
Primary Examiner—Tho G Phan

(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



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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**

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Primary Examiner—Douglas W Owens

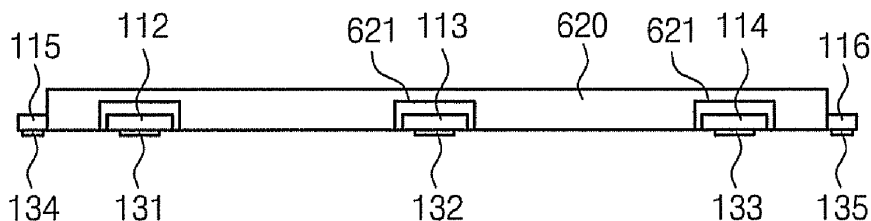
Assistant Examiner—Chuc D Tran

(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



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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**

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Primary Examiner—Douglas W Owens

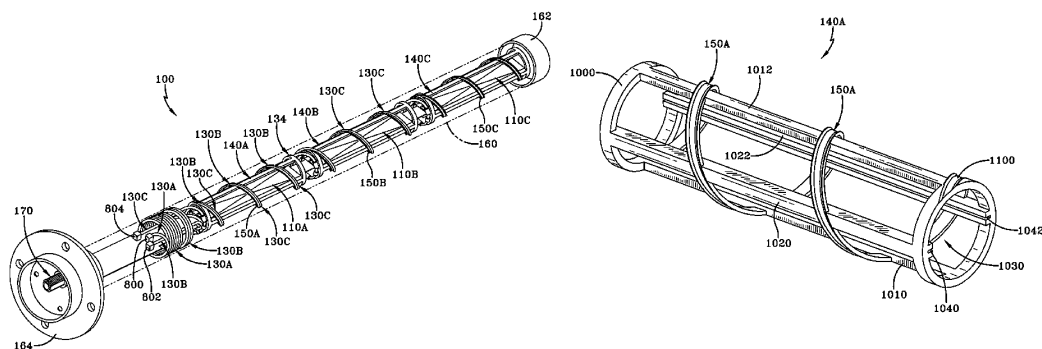
Assistant Examiner—Dieu Hien T Duong

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

(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



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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**

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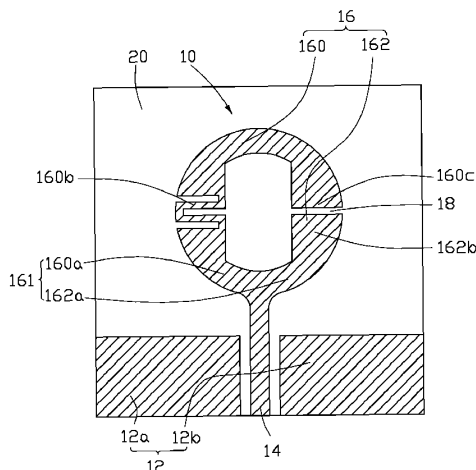
Primary Examiner—Tan Ho

(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



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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**

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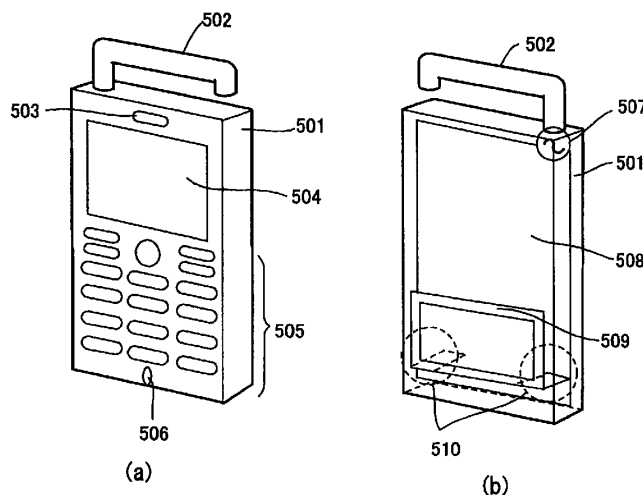
Primary Examiner—Trinh V Dinh

(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



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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.

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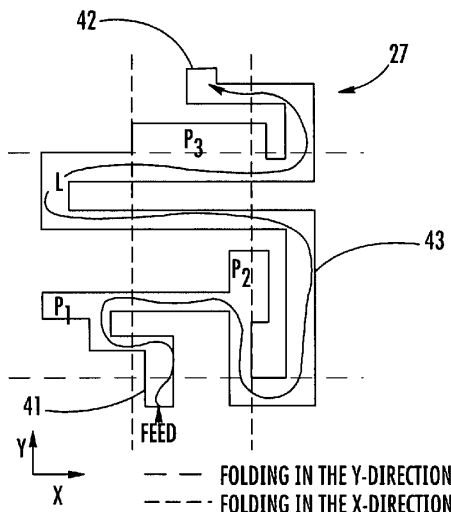
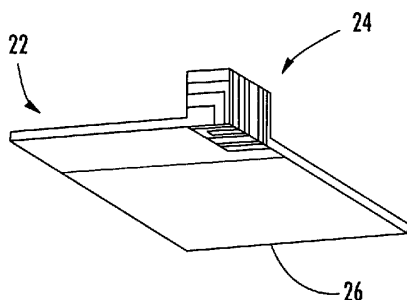
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Primary Examiner—Michael C Wimer

(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



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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**

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

(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.

(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**

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Primary Examiner—Rexford N Barnie

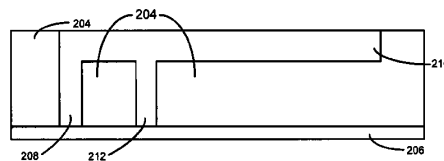
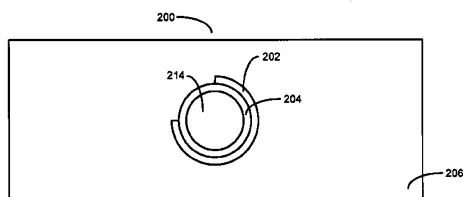
Assistant Examiner—Thienvu V Tran

(74) *Attorney, Agent, or Firm*—David S. Park; Haynes Boone
LLP

(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.

36 Claims, 6 Drawing Sheets



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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.

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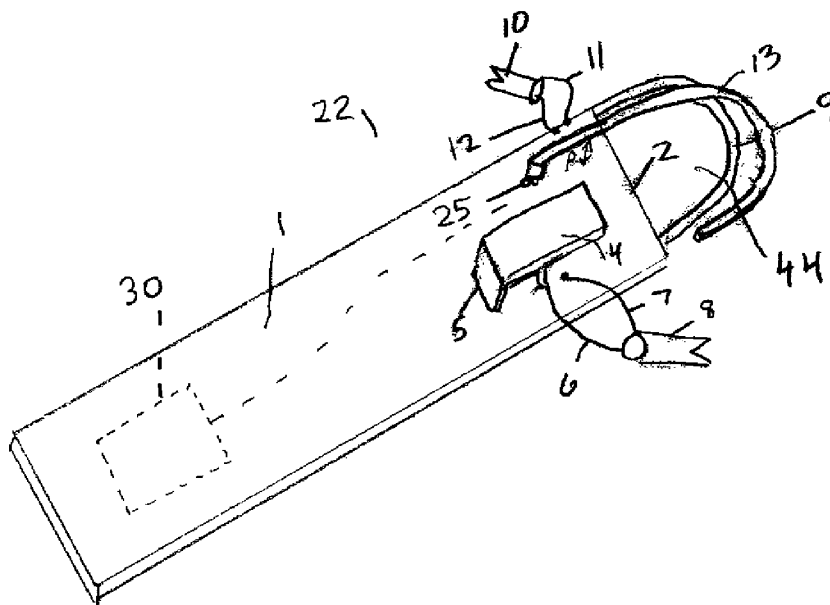
Primary Examiner—Hoang V Nguyen

(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



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