



US007642964B2

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

(10) **Patent No.:** **US 7,642,964 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

(54) **LOW PROFILE INTERNAL ANTENNA**

(75) Inventors: **Carlo DiNallo**, Plantation, FL (US);
Antonio Faraone, Fort Lauderdale, FL (US)

(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 29 days.

(21) Appl. No.: **11/553,845**

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

(65) **Prior Publication Data**

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

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

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

See application file for complete search history.

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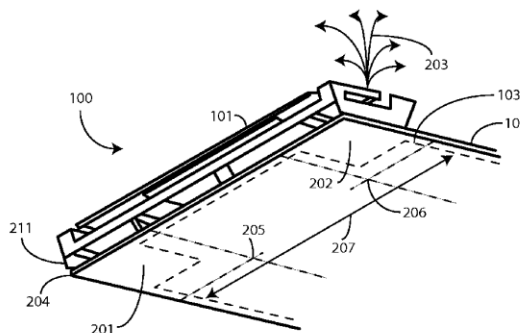
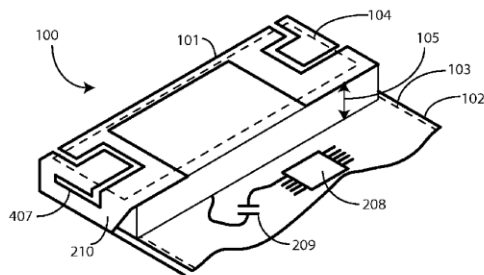
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—Philip H. Burrus, IV

(57) **ABSTRACT**

A multi-band folded inverted conformal antenna (101), suitable for use internally within an electronic device (501), facilitates low-profile designs with the multi-band folded inverted conformal antenna (601) extending less than five millimeters above a circuit substrate (102) in some embodiments. The multi-band folded inverted conformal antenna (601) includes planar sections and a slot (407), and is capable of multi-mode operation. For example, one embodiment is configured to operate in a first common mode (401), a differential mode (402), and a second common mode (403), thereby allowing the multi-band folded inverted conformal antenna (601) to operate in a first operational bandwidth, second operational bandwidth, and third operational bandwidth. Portions of the ground plane conductor (103) passing beneath the multi-band folded inverted conformal antenna (101) are selectively removed at areas corresponding to concentrations of electrical charge, thereby allowing a more low-profile design.

20 Claims, 5 Drawing Sheets





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(12) **United States Patent**
Zhang

(10) **Patent No.:** **US 7,642,965 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

(54) **ANTENNA DEVICE**

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7,486,235 B2* 2/2009 Leeper et al. 343/700 MS

(75) Inventor: **Xin Zhang**, Hitachi (JP)

(73) Assignee: **Hitachi Cable, Ltd.**, Tokyo (JP)

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

(21) Appl. No.: **12/010,156**

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

(65) **Prior Publication Data**

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Related U.S. Application Data

(62) Division of application No. 11/131,186, filed on May 18, 2005, now Pat. No. 7,443,345.

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 19/10 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/817; 343/818; 343/819; 343/836; 343/837**

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

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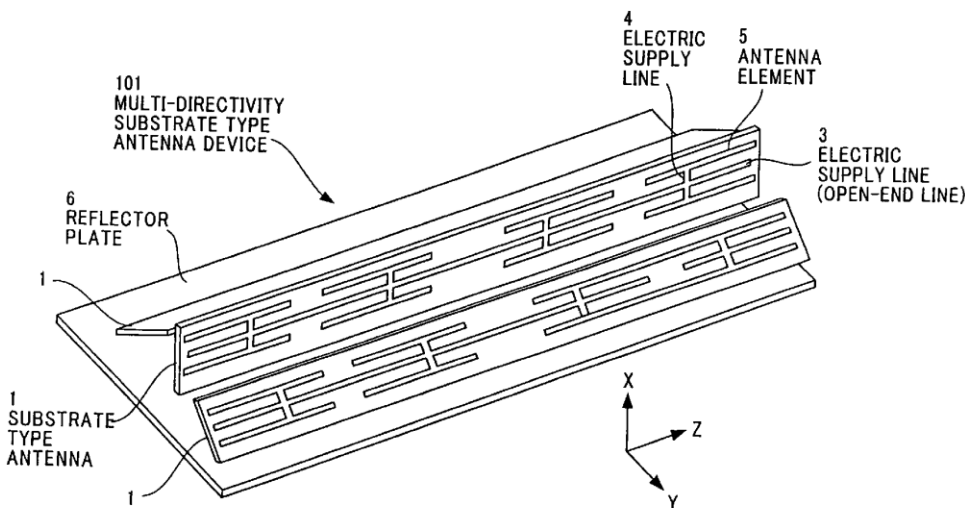
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Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—McGinn Intellectual Property Law Group, PLLC

(57) **ABSTRACT**

An antenna device, includes a plurality of substrate type antennas arranged in a direction, each of the substrate type antennas includes a dielectric substrate, an electric supply line that includes a microstrip line and is formed on the dielectric substrate, and antenna elements each of which includes microstrip lines and formed on the dielectric substrate, and a reflector plate located along the direction that the substrate type antennas are arranged. The substrate type antennas each have different angles of inclination relative to the reflector plate.

7 Claims, 30 Drawing Sheets





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(12) **United States Patent**
Vance

(10) **Patent No.:** **US 7,642,966 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

- (54) **CARRIER AND DEVICE**
- (75) Inventor: **Scott Vance**, Staffanstorp (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 11 days.
- (21) Appl. No.: **12/048,889**
- (22) Filed: **Mar. 14, 2008**
- (65) **Prior Publication Data**
US 2009/0231199 A1 Sep. 17, 2009
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/702**
- (58) **Field of Classification Search** **343/700 MS, 343/702**
See application file for complete search history.

- (56) **References Cited**
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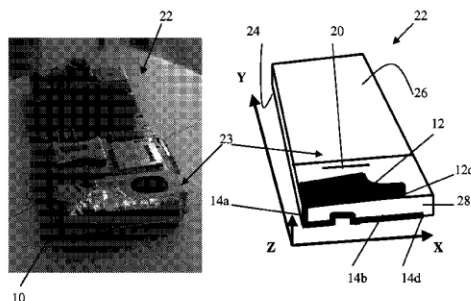
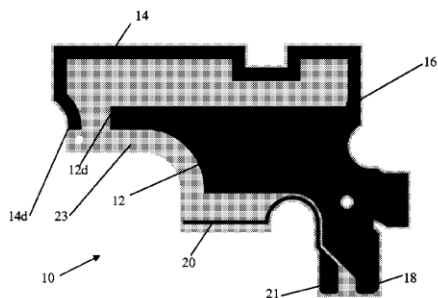
Primary Examiner—Tan Ho

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

(57) **ABSTRACT**

A carrier that extends in three mutually orthogonal directions, X, Y and Z, when in use and which comprises a back surface defining a first XY-plane and a side surface defining an XZ-plane, whereby the carrier comprises an antenna pattern. The antenna pattern comprises a wider branch that is located on the back surface of the carrier, and a narrower branch that comprises a first section that extends substantially along the Z-direction of the side surface and a second section that extends substantially in the X-direction of the side surface.

20 Claims, 3 Drawing Sheets





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

(10) **Patent No.:** **US 7,642,967 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Shu-Yean Wang**, Tu-Cheng (TW);
Chen-Ta Hung, Tu-Cheng (TW);
Lung-Sheng Tai, Tu-Cheng (TW)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 281 days.

(21) Appl. No.: **11/645,481**

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

(65) **Prior Publication Data**
US 2007/0146216 A1 Jun. 28, 2007

(30) **Foreign Application Priority Data**
Dec. 26, 2005 (TW) 94222625 U

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

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

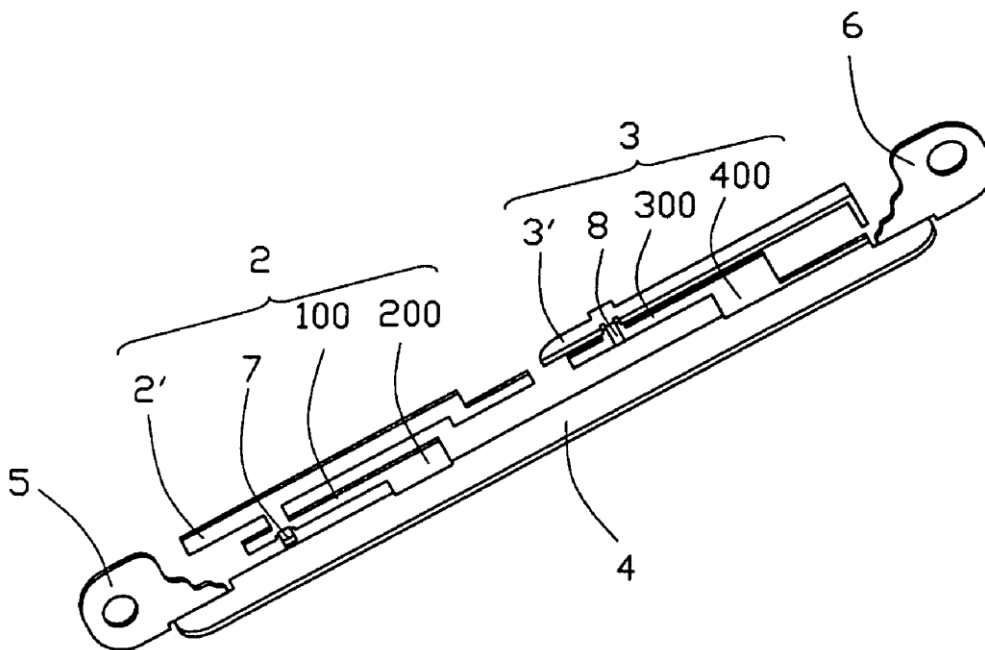
(58) **Field of Classification Search** **343/700 MS, 343/702, 815, 829, 846**
See application file for complete search history.

Primary Examiner—Douglas W Owens
Assistant Examiner—Chuc D Tran
(74) *Attorney, Agent, or Firm*—Wei Te Chung; Andrew C. Cheng; Ming Chieh Chang

(57) **ABSTRACT**

A multi-band antenna (1) includes a first antenna (2), a second antenna (3) and a common grounding element (4). Both of the first antenna and the second antenna include a radiating element (2', 3'), a connecting element (100, 300) respectively connecting the radiating element (2', 3') and a grounding portion (200, 400).

20 Claims, 5 Drawing Sheets





US007642969B2

(12) **United States Patent**
Nam

(10) **Patent No.:** **US 7,642,969 B2**

(45) **Date of Patent:** **Jan. 5, 2010**

(54) **MOBILE COMMUNICATION TERMINAL
INCORPORATING INTERNAL ANTENNA**

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7,319,432	B2 *	1/2008	Andersson	343/702

(75) Inventor: **Soo Hyun Nam**, Gyeonggi-do (KR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

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

(21) Appl. No.: **11/695,543**

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

(65) **Prior Publication Data**

US 2007/0236398 A1 Oct. 11, 2007

(30) **Foreign Application Priority Data**

Apr. 6, 2006	(KR)	10-2006-0031383
Nov. 23, 2006	(KR)	10-2006-0116279

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

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

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

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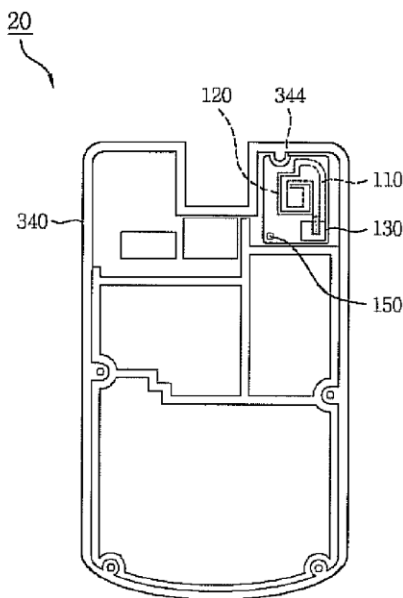
Primary Examiner—Hoang V Nguyen

(74) *Attorney, Agent, or Firm*—Lee, Hong, Degerman, Kang & Waimey

(57) **ABSTRACT**

A mobile communication terminal and an internal multi-band antenna are described. The internal antenna is formed on a substrate and has a first pattern and a second pattern. Both patterns may be formed on one side of the substrate, or one pattern may be formed on each side of the substrate. The first pattern and the second pattern have different widths. The terminal may be of any type such as a folding type terminal, a slider-type terminal, or a bar type terminal.

32 Claims, 14 Drawing Sheets





US007642970B2

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

(10) **Patent No.:** **US 7,642,970 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

(54) **ANTENNA DEVICE AND WIRELESS COMMUNICATION APPARATUS USING SAME**

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2005/0237244 A1 * 10/2005 Annabi et al. 343/702
2007/0285321 A1 * 12/2007 Chung et al. 343/702

(75) Inventors: **Hiroyuki Aoyama**, Saitama (JP); **Kazuo Kazama**, Saitama (JP)

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(73) Assignee: **Hitachi Metals, Ltd.**, Tokyo (JP)

JP 2004-088218 3/2004

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 277 days.

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Primary Examiner—Tan Ho

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

(21) Appl. No.: **11/723,388**

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

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

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

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

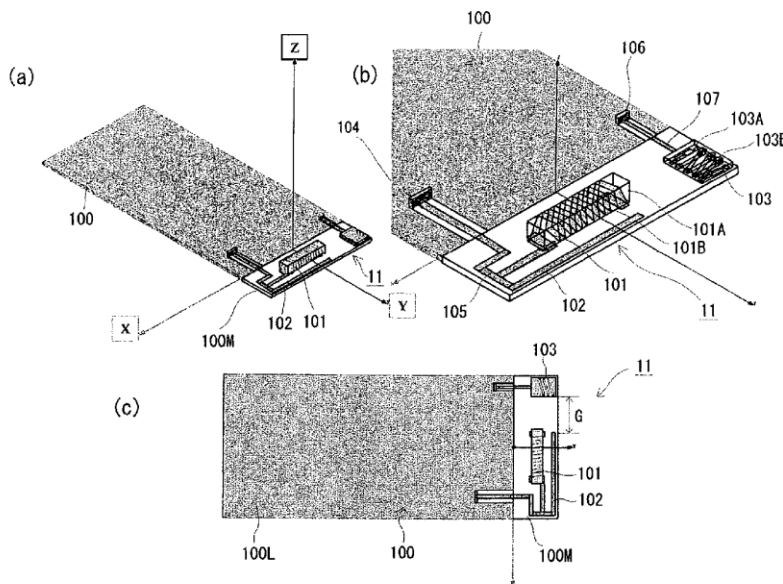
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An antenna device is provided which is capable of operating in a wider band of frequencies (in a plurality of transmitting and receiving frequency bands), achieving an excellent gain, maintaining non-directivity of vertically polarized waves in each of the transmitting and receiving frequency bands, and saving space. The antenna device includes the first antenna **101** being a chip-type antenna operating in a GSM band, second antenna **102** being a pattern antenna operating in DCS and PCS bands, third antenna **103** being a layer-stacked antenna operating in an UMTS band, all being mounted on a substrate **100**. The second antenna **102** is connected to a line **105** extending from a power feeding port **104** connected to the first antenna **101**. A gap is interposed between the second antenna **102** and third antenna **103** wherein the second antenna **102** is capacitively coupled to the third antenna **103** on the substrate **100** with no antenna switch being provided.

22 Claims, 27 Drawing Sheets





US007642971B2

(12) **United States Patent**
Bolin

(10) **Patent No.:** **US 7,642,971 B2**

(45) **Date of Patent:** **Jan. 5, 2010**

(54) **COMPACT DIVERSITY ANTENNA ARRANGEMENT**

(75) Inventor: **Thomas Bolin**, Lund (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 237 days.

(21) Appl. No.: **11/754,040**

(22) Filed: **May 25, 2007**

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US 2008/0291103 A1 Nov. 27, 2008

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

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

(58) **Field of Classification Search** **343/702,**
343/700 MS, 846, 742, 867

See application file for complete search history.

(56) **References Cited**

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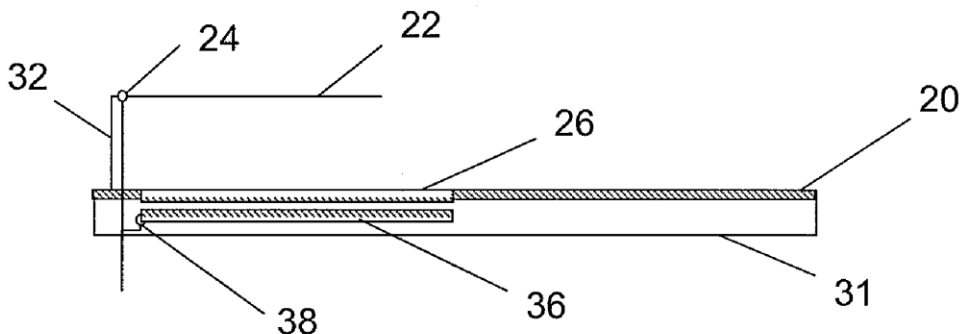
Primary Examiner—Huedung Mancuso

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

(57) **ABSTRACT**

The present invention relates to an antenna arrangement for a portable communication device as well as to a portable communication device comprising such an antenna arrangement. The antenna arrangement includes a ground plane, a first radiating electrical antenna element provided in a plane arranged at a distance above and parallel with at least part of the ground plane, where the first radiating electrical antenna element is dimensioned for resonating at least at one frequency, and a second radiating magnetic antenna element provided in the ground plane below the first antenna element and being dimensioned for resonating at the same frequency as the first radiating antenna element.

10 Claims, 3 Drawing Sheets





US007642972B1

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

(10) **Patent No.:** **US 7,642,972 B1**
(45) **Date of Patent:** **Jan. 5, 2010**

- (54) **ANTENNA**
- (75) Inventors: **Chao-Hui Yu**, Tu-Cheng (TW);
Hung-Jen Chen, Tu-Cheng (TW);
Yu-Yuan Wu, Tu-Cheng (TW);
Chih-Kuo Wang, Tu-Cheng (TW)
- (73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 15 days.
- (21) Appl. No.: **12/176,652**
- (22) Filed: **Jul. 21, 2008**
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702; 455/575.7**
- (58) **Field of Classification Search** 343/700 MS, 343/702, 846; 455/575.7
See application file for complete search history.

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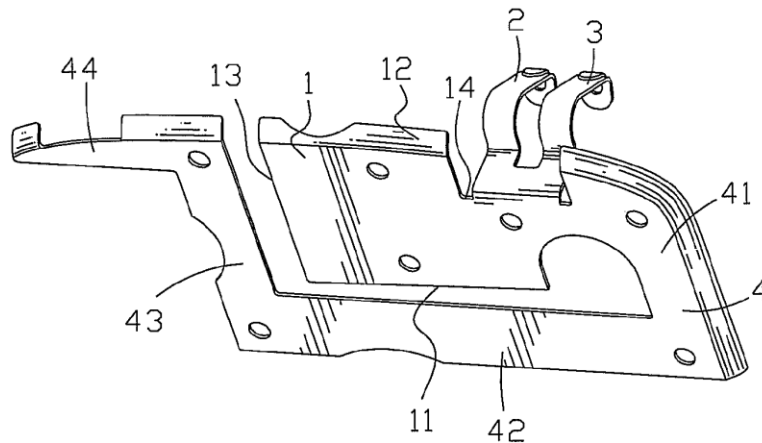
Primary Examiner—Michael C Wimer

(57) **ABSTRACT**

An antenna includes a first radiating conductor and a second radiating conductor. The first radiating conductor defines a first edge, a second edge and a lateral edge connecting the first edge and the second edge. The second radiating conductor has a main body spaced away from the second edge and connected to an end of the first radiating conductor far away from the lateral edge by a first connecting portion and extending towards the lateral edge. A free end of the main body bends to the second edge to form a second connecting portion spaced away from the lateral edge. A radiating end bends oppositely to the first radiating conductor from an end of the second connecting portion and is adjacent to the second edge. A feeding conductor and a grounding conductor are connected to an edge of the first radiating conductor different from the first edge and the lateral edge.

7 Claims, 3 Drawing Sheets

- (56) **References Cited**
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US007642977B2

(12) **United States Patent**
Seo

(10) **Patent No.:** **US 7,642,977 B2**

(45) **Date of Patent:** **Jan. 5, 2010**

(54) **EXTENDABLE BUILT-IN ANTENNA UNIT OF MOBILE DEVICE**

(75) Inventor: **Sung In Seo**, Suwon-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 154 days.

(21) Appl. No.: **11/709,313**

(22) Filed: **Feb. 21, 2007**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Aug. 3, 2006 (KR) 10-2006-0073405

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 21/00 (2006.01)

H01Q 1/00 (2006.01)

H01Q 1/10 (2006.01)

(52) **U.S. Cl.** **343/729**; 343/702; 343/725; 343/895; 343/901; 455/575.7

(58) **Field of Classification Search** 343/702, 343/901, 725, 729, 895; 455/575.7

See application file for complete search history.

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Primary Examiner—Douglas W Owens

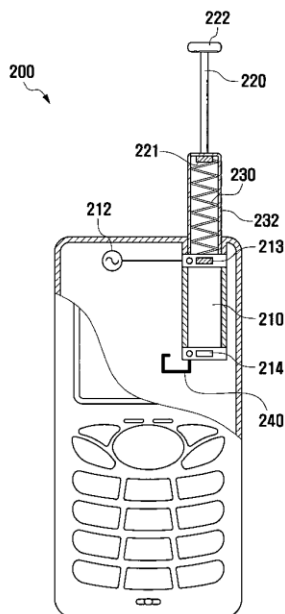
Assistant Examiner—Jennifer F Hu

(74) *Attorney, Agent, or Firm*—The Farrell Law Firm, LLP

(57) **ABSTRACT**

An extendable built-in antenna unit for a mobile device is disclosed that includes a whip antenna, a helical antenna, an antenna receiving part and an antenna pattern. The helical antenna may be extractably and retractably mounted in the antenna receiving part. The whip antenna may be extractably and retractably mounted in the helical antenna. The helical antenna and the antenna pattern may be formed with lengths determined according to the resonance frequency.

7 Claims, 5 Drawing Sheets





US007642984B2

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

(10) **Patent No.:** **US 7,642,984 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

(54) **ANTENNA FOR A WIRELESS PERSONAL AREA NETWORK**

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

(73) Assignee: **Quanta Computer Inc.** (TW)

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

(21) Appl. No.: **12/169,362**

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

(65) **Prior Publication Data**
US 2009/0195466 A1 Aug. 6, 2009

(30) **Foreign Application Priority Data**
Feb. 4, 2008 (TW) 97104200 A

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

(52) **U.S. Cl.** **343/828; 343/702; 343/741**

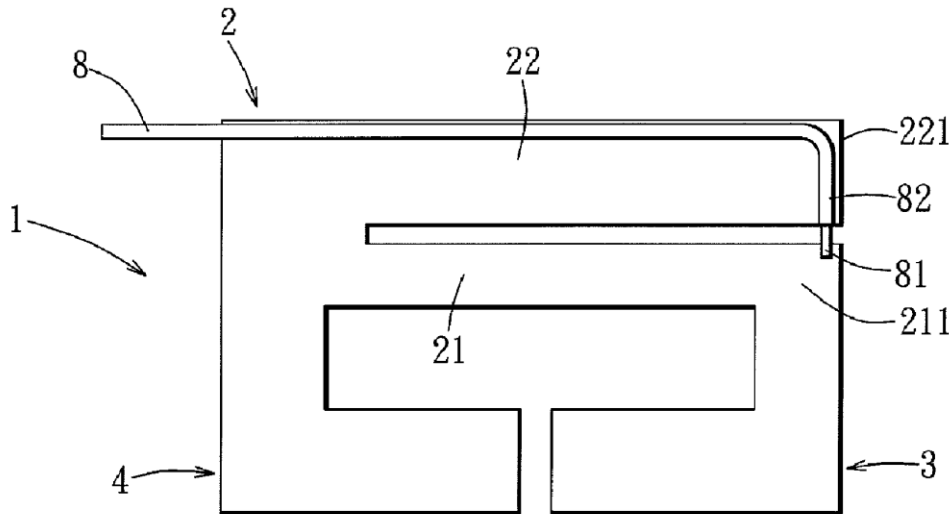
(58) **Field of Classification Search** 343/700 MS,
343/702, 741, 828–830, 846
See application file for complete search history.

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Primary Examiner—Michael C Wimer
(74) *Attorney, Agent, or Firm*—Sunstein Kann Murphy & Timbers LLP

(57) **ABSTRACT**
An antenna includes a loop radiating element, and first and second radiating arms. The loop radiating element includes first and second segments, each of which has opposite first and second ends, and an intermediate segment that interconnects the second ends of the first and second segments thereof. The first and second radiating arms extend outwardly and respectively from the first and second ends of the first segment of the loop radiating element.

17 Claims, 8 Drawing Sheets





US007646341B1

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

(10) **Patent No.:** **US 7,646,341 B1**
(45) **Date of Patent:** **Jan. 12, 2010**

(54) **ULTRA-WIDEBAND (UWB) ANTENNA**

(75) Inventors: **Yi-Cheng Lin**, Taipei (TW); **Kuan-Jung Hung**, Taipei (TW)

(73) Assignee: **National Taiwan University**, Taipei (TW)

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

(21) Appl. No.: **11/455,541**

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

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

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

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

See application file for complete search history.

(56) **References Cited**

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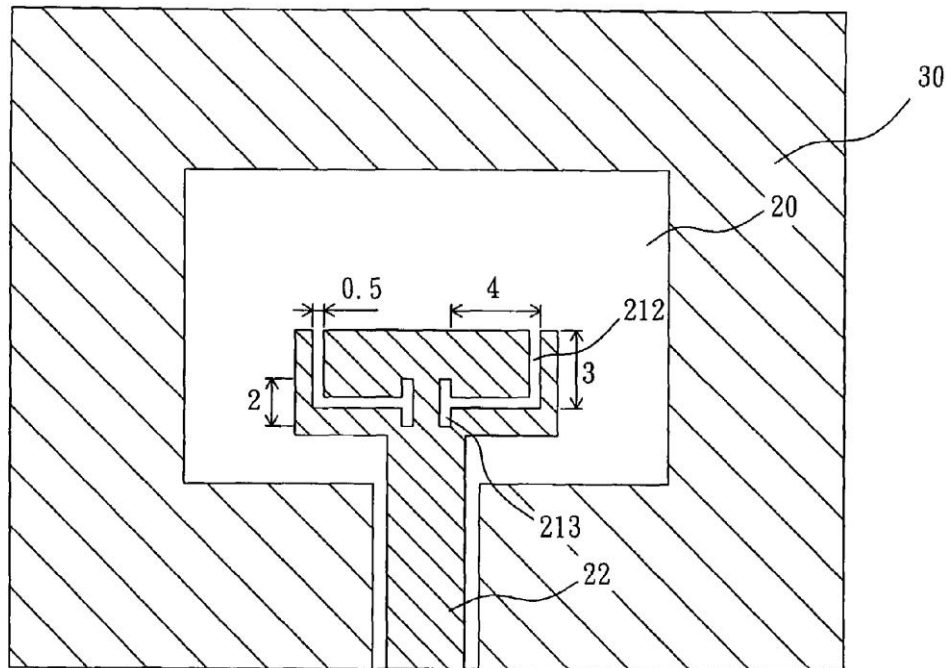
Primary Examiner—HoangAnh T Le

(74) *Attorney, Agent, or Firm*—The Weintraub Group, P.L.C.

(57) **ABSTRACT**

The present invention relates to an ultra-wideband (UWB) antenna, which comprises: a rectangular aperture portion, formed from a ground plane of a printed circuit board and having an aperture; and a co-plane feeding structure, having a horizontal portion and a vertical portion, wherein the vertical portion is perpendicular to the horizontal portion, and the vertical portion is disposed in the aperture and connected with an external terminal. The ultra-wideband (UWB) antenna of the present invention can receive the wireless signal with 3.1~10.6 GHz band, and have a very compact area (13 mm×23 mm) and is easy to be mass produced. Furthermore, a parasitism element can be added into the co-plane feeding structure, so as to reject the in-band interferences from the existing systems like 5~6 GHz signals of wireless LAN.

15 Claims, 12 Drawing Sheets





US007646342B2

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

(10) **Patent No.:** **US 7,646,342 B2**
(45) **Date of Patent:** **Jan. 12, 2010**

- (54) **ANTENNA**
- (75) Inventors: **Jiunn-Ming Huang**, Taipei (TW);
Shen-Pin Wei, Taipei (TW); **Yuan-Li Chang**, Taipei (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 101 days.

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- (21) Appl. No.: **11/769,638**
- (22) Filed: **Jun. 27, 2007**
- (65) **Prior Publication Data**
US 2008/0100512 A1 May 1, 2008
- (30) **Foreign Application Priority Data**
Oct. 31, 2006 (TW) 95140196 A

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Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Quintero Law Office

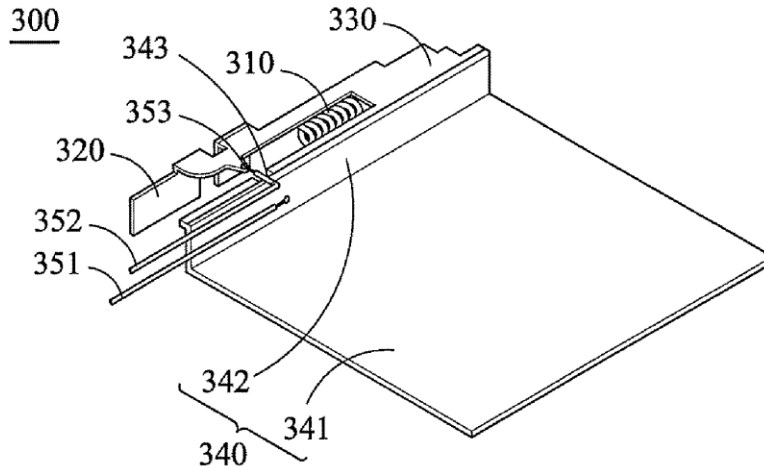
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/702; 343/846**
- (58) **Field of Classification Search** **343/702, 343/700 MS, 846**
See application file for complete search history.

(57) **ABSTRACT**

An antenna comprises a first transmission element, a second transmission element, a conductive element, a ground element, a ground line and a signal line. The conductive element is connected to the ground element. The first transmission element is connected to the conductive element. The first transmission element comprises a first spiral structure and a first axis. The second transmission element is connected to the conductive element. The ground line is electrically connected to the ground element. The signal line is electrically connected to the conductive element at a feed point.

- (56) **References Cited**
U.S. PATENT DOCUMENTS
6,147,652 A 11/2000 Sekine

7 Claims, 10 Drawing Sheets





US007646349B2

(12) **United States Patent**
Wee

(10) **Patent No.:** **US 7,646,349 B2**
(45) **Date of Patent:** **Jan. 12, 2010**

(54) **MOBILE TERMINAL FOR REDUCING SPECIFIC ABSORPTION RATE**

(75) Inventor: **Hee Geol Wee**, Gumi-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 90 days.

(21) Appl. No.: **11/832,863**

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

(65) **Prior Publication Data**
US 2008/0158065 A1 Jul. 3, 2008

(30) **Foreign Application Priority Data**
Dec. 28, 2006 (KR) 10-2006-0136205

(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.

(56) **References Cited**

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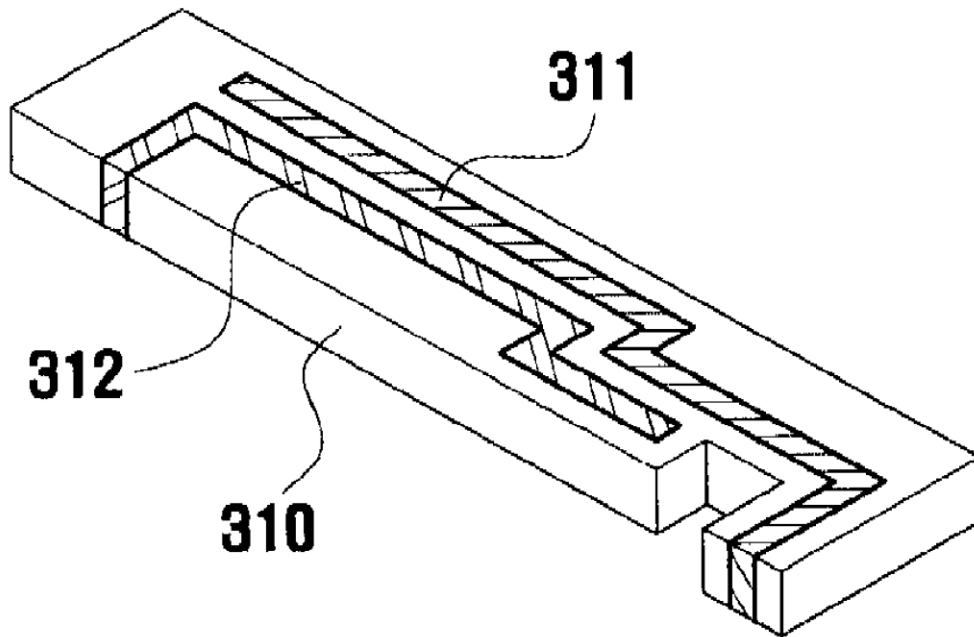
Primary Examiner—HoangAnh T Le

(74) *Attorney, Agent, or Firm*—H.C. Park & Associates, PLC

(57) **ABSTRACT**

A mobile terminal that may reduce a specific absorption rate (SAR) includes a case, a circuit board in the case, a ground in the circuit board, an antenna pattern, and a ground pattern spaced apart from the antenna pattern and made of a material that absorbs electromagnetic waves. The ground pattern is connected to the ground of the circuit board or an auxiliary ground.

7 Claims, 4 Drawing Sheets





US007646350B2

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

(10) **Patent No.:** **US 7,646,350 B2**
(45) **Date of Patent:** **Jan. 12, 2010**

(54) **ANTENNA STRUCTURE**

(75) Inventors: **Ying-Chieh Chuang**, Taipei (TW);
Ching-Chung Tang, Taipei (TW);
Shen-Yuan Lee, Taipei (TW)
(73) Assignee: **Asustek Computer Inc.**, Peitou, Taipei
(TW)
(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/098,462**
(22) Filed: **Apr. 7, 2008**

(65) **Prior Publication Data**
US 2008/0252554 A1 Oct. 16, 2008

(30) **Foreign Application Priority Data**
Apr. 16, 2007 (TW) 96113315 A

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/700 MS**
(58) **Field of Classification Search** **343/700 MS,**
343/702, 906
See application file for complete search history.

(56) **References Cited**

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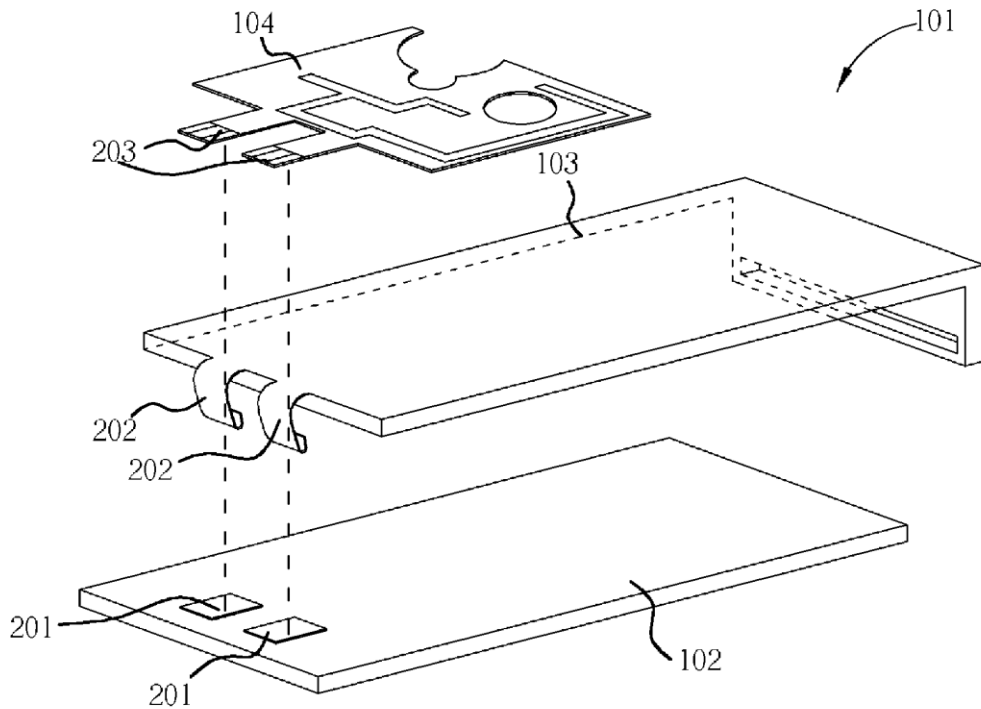
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Primary Examiner—Tho G Phan
(74) *Attorney, Agent, or Firm*—Winston Hsu

(57) **ABSTRACT**

The present invention provides an antenna structure. The antenna structure includes a main board, at least having a signal feeding portion; a bearing component, connected to the main board and at least having a protrusive portion; and an antenna, connected to the bearing component and at least having a pin portion, wherein the pin portion is disposed on the protrusive portion, and the signal feeding portion and the pin portion contact with each other.

23 Claims, 2 Drawing Sheets





US007649500B2

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

(10) **Patent No.:** **US 7,649,500 B2**
(45) **Date of Patent:** **Jan. 19, 2010**

(54) **FILM ANTENNA ASSEMBLY AND FABRICATION METHOD**

(75) Inventors: **Chia-Yu Liao**, Jhongli (TW);
Yuan-Ming Chang, Fongyuan (TW)

(73) Assignee: **Paragon Technologies, Co., Ltd.**, Taipei County (TW)

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

(21) Appl. No.: **12/111,038**

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

(65) **Prior Publication Data**
US 2009/0267839 A1 Oct. 29, 2009

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

(52) **U.S. Cl.** **343/700 MS**; 343/906

(58) **Field of Classification Search** 343/700 MS,
343/767, 906

See application file for complete search history.

(56) **References Cited**

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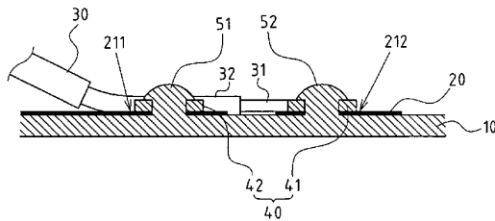
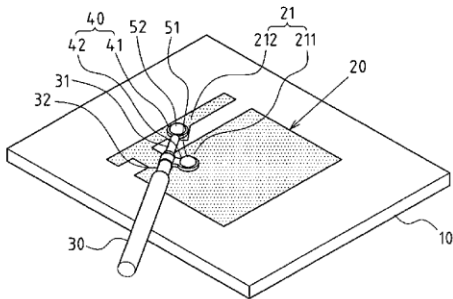
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—Egbert Law Offices PLLC

(57) **ABSTRACT**

The present invention provides a film antenna assembly and a fabrication method thereof. The assembly includes an antenna body, which is a conducting body placed onto the substrate. The antenna body is provided with a signal connector, a feeder, and a conducting medium. One side of the conducting medium is coupled with the feeder, and the other side is located on the signal connector of antenna body. With this combined structure of the feeder, the film antenna assembly could be protected against damage, and the stable electrical connection resolves the coupling issue of the film antenna and feeder for improved applicability and economic efficiency.

5 Claims, 8 Drawing Sheets





US007649501B2

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

(10) **Patent No.:** **US 7,649,501 B2**
(45) **Date of Patent:** **Jan. 19, 2010**

(54) **ULTRA-WIDEBAND ANTENNA STRUCTURE**

(75) Inventors: **Kin-Lu Wong**, Kaohsiung (TW);
Jui-Hung Chou, Taichung (TW);
Saou-Wen Su, Taipei (TW)

(73) Assignees: **Lite-On Technology Corp.**, Taipei
(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 241 days.

(21) Appl. No.: **11/675,588**

(22) Filed: **Feb. 15, 2007**

(65) **Prior Publication Data**
US 2007/0273604 A1 Nov. 29, 2007

(30) **Foreign Application Priority Data**
May 29, 2006 (TW) 95119076 A

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

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

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

(56) **References Cited**

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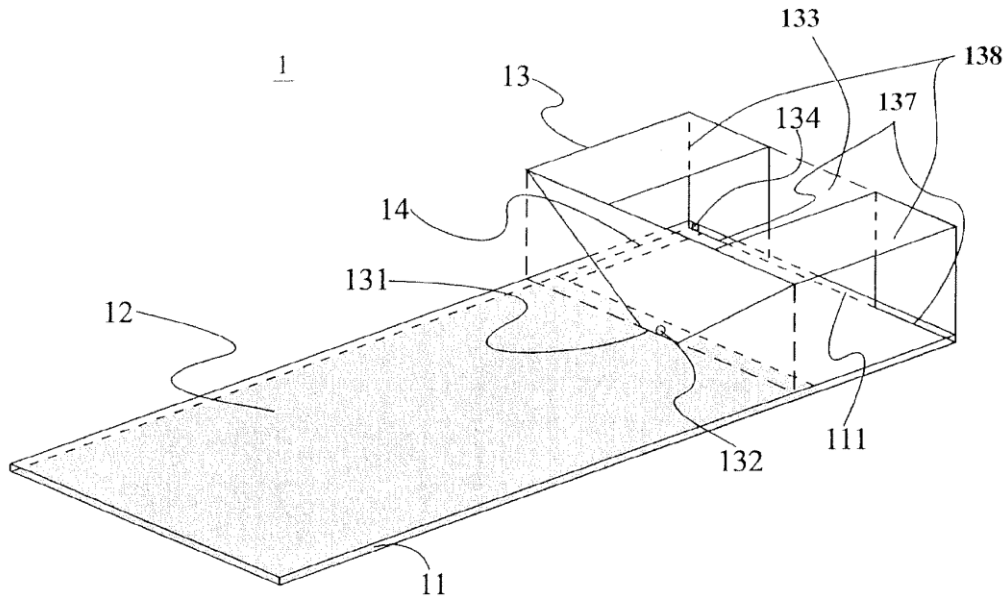
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Primary Examiner—Hoang V Nguyen
Assistant Examiner—Robert Karacsony

(57) **ABSTRACT**

An ultra-wideband antenna structure is provided. The ultra-wideband antenna structure includes a substrate with an edge, a first surface and a second surface opposite to the first surface; a ground surface mounted on the first surface; a radiating element mounted on the second surface and near the edge, and being a bent metal piece; and a short-circuited metal unit mounted on the first surface having a first end and a second end, wherein the first end is electrically connected to the ground surface and the second end is electrically connected to the radiating element.

12 Claims, 10 Drawing Sheets





US007649502B2

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

(10) **Patent No.:** **US 7,649,502 B2**
(45) **Date of Patent:** **Jan. 19, 2010**

(54) **MULTI-BAND ANTENNA**

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7,352,326 B2 * 4/2008 Korva et al. 343/700 MS

(75) Inventors: **Chen-Ta Hung**, Tu-Cheng (TW);
Yun-Long Ke, Tu-Cheng (TW);
Po-Kang Ku, Tu-Cheng (TW)

(73) Assignee: **Hon Hai Precision Ind. Co., Ltd**, 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 173 days.

Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Wei Te Chung; Andrew C.
Cheng; Ming Chieh Chang

(21) Appl. No.: **11/799,764**

(57) **ABSTRACT**

(22) Filed: **May 1, 2007**

(65) **Prior Publication Data**

US 2007/0257848 A1 Nov. 8, 2007

(30) **Foreign Application Priority Data**

May 2, 2006 (TW) 95115547 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.

A multi-band antenna used in a portable electrical device can work in WWAN and GPS at the same time. The multi-band antenna includes a PCB having a through hole, a first antenna body comprising a first radiating element and a first grounding element formed on a first surface of the PCB, a second antenna body formed on a second surface of the PCB, and a feeding line having an inner conductor electrically connecting to the first radiating element and an outer conductor electrically connecting to the first grounding element. The second antenna body comprises a second radiating element, a second grounding element, and a connecting element connecting the second radiating element and the second grounding element. The first radiating element and the second radiating element electrically connect with each other via the through hole of the PCB.

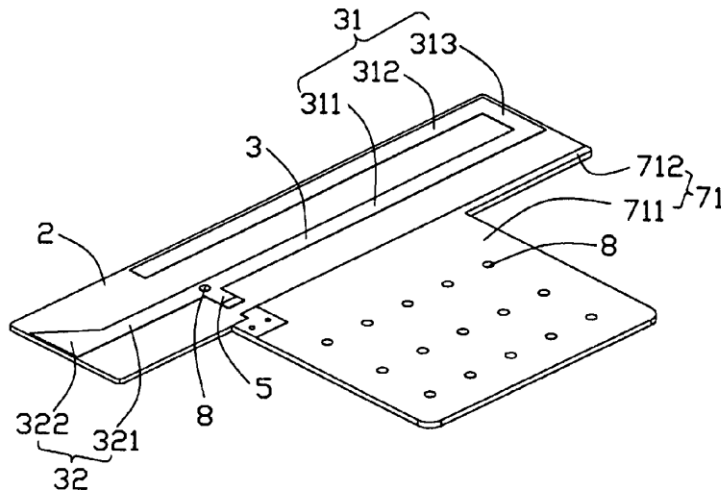
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18 Claims, 3 Drawing Sheets

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US007652629B2

(12) **United States Patent**
Teshima

(10) **Patent No.:** **US 7,652,629 B2**
(45) **Date of Patent:** **Jan. 26, 2010**

(54) **ANTENNA DEVICE AND RADIO APPARATUS HAVING A BROADBAND CHARACTERISTIC**

7,187,331 B2* 3/2007 Chen et al. 343/702

(75) Inventor: **Masao Teshima**, Tokyo (JP)

FOREIGN PATENT DOCUMENTS

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

JP 2002-64324 A 2/2002
JP 2005-94501 A 4/2005
WO WO 2005/004282 A1 1/2005

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

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(21) Appl. No.: **12/072,345**

Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, P.C.

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2009/0213016 A1 Aug. 27, 2009

An antenna device including a ground plane, a plane conductor and a line conductor is provided. The plane conductor is shaped like a polygon having a first side, a second side and an angle between the first side and the second side. The plane conductor is arranged almost on a same plane as the ground plane. The plane conductor has a feed portion around the angle. The first side faces a side of the ground plane. The line conductor is arranged almost on the same plane as the ground plane. The line conductor has a first end and a second end. The first end is connected to an end of the second side being opposite the feed portion.

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

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

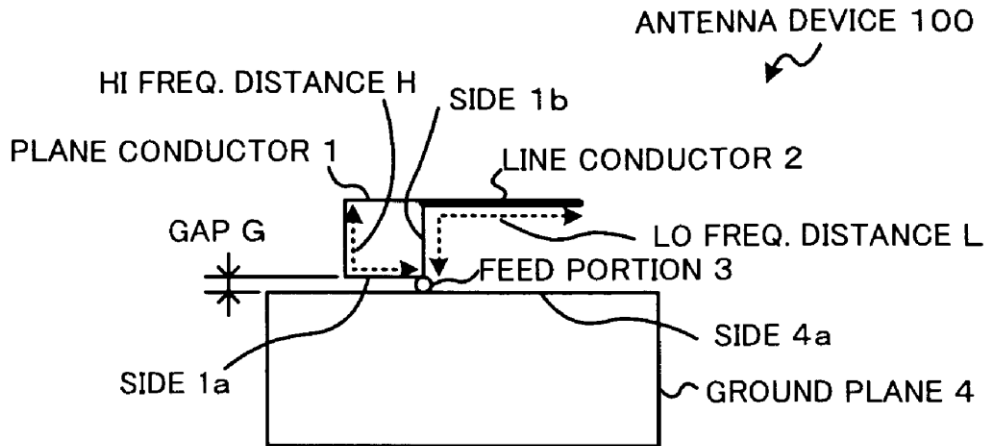
(58) **Field of Classification Search** **343/702, 343/700 MS, 725, 846**
See application file for complete search history.

(56) **References Cited**

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13 Claims, 7 Drawing Sheets





US007652633B2

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

(10) **Patent No.:** **US 7,652,633 B2**
(45) **Date of Patent:** **Jan. 26, 2010**

(54) **ANTENNA FOR GPS**

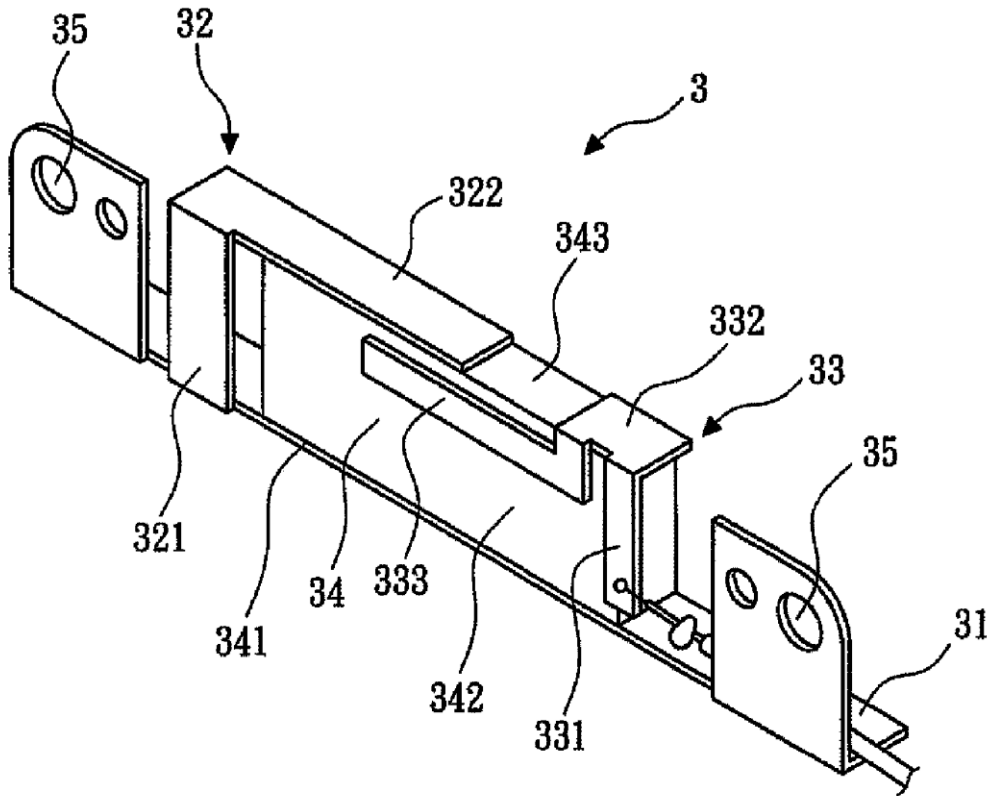
(75) Inventors: **Ching-Chia Mai**, Kaohsiung (TW);
Cheng-Han Lee, Kaohsiung (TW);
Chi-Yueh Wang, Kaohsiung (TW);
Boon-Tiong Chua, Kaohsiung (TW)
(73) Assignee: **Yageo Corporation**, Kaohsiung (TW)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 117 days.

(21) Appl. No.: **11/849,393**
(22) Filed: **Sep. 4, 2007**
(65) **Prior Publication Data**
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(30) **Foreign Application Priority Data**
Dec. 28, 2006 (TW) 95149568 A
(51) **Int. Cl.**
H01Q 1/38 (2006.01)
(52) **U.S. Cl.** **343/833; 343/702; 343/846**
(58) **Field of Classification Search** **343/700 MS, 343/833, 846, 702, 834**
See application file for complete search history.

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

(57) **ABSTRACT**
This invention relates to an antenna for GPS. The antenna of the invention comprises a ground metal plate, a parasitic metal plate, a radiation metal plate and at least one supporting element. The parasitic metal plate is disposed above the ground metal plate and connects to the ground metal plate. The radiation metal plate is an independent metal plate and is disposed above the ground metal plate. The parasitic metal plate cooperates with the radiation metal plate to induce a resonance mode. The supporting element is disposed on the ground metal plate and is used to support the radiation metal plate. Whereby, the problems of large size and limited receiving angle of signal according to a conventional circular polarization antenna for GPS could be improved.

22 Claims, 9 Drawing Sheets





US007653421B2

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

(10) **Patent No.:** **US 7,653,421 B2**
(45) **Date of Patent:** **Jan. 26, 2010**

(54) **PORTABLE WIRELESS APPARATUS**

(75) Inventors: **Hiromichi Suzuki**, Hamura (JP);
Hiroyuki Hotta, Oume (JP); **Takashi Amano**, Souka (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 539 days.

(21) Appl. No.: **11/657,756**

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

(65) **Prior Publication Data**

US 2008/0081657 A1 Apr. 3, 2008

(30) **Foreign Application Priority Data**

Sep. 28, 2006 (JP) P2006-265555

(51) **Int. Cl.**
H04M 1/00 (2006.01)
H04B 7/00 (2006.01)

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

(58) **Field of Classification Search** 455/101,
455/272, 575.3; 373/702, 700 MS

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Lee Nguyen

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

(57) **ABSTRACT**

According to an aspect of the invention, a portable wireless apparatus comprises a first housing and a second housing. The first housing comprises a first board having a first feeding portion; and a first antenna element connected to the first feeding portion and provided on a side of a first surface of the first board. The second housing foldably connected to the first housing comprises a second board having a surface opposite to the first surface of the first board when the second housing is unfolded with respect to the first housing. The second board comprises a second feeding portion. A second antenna element is connected to the second feeding portion and provided on a side of the surface of the second board.

20 Claims, 8 Drawing Sheets

