US007598912B2

(12) **United States Patent**
Lee

(10) **Patent No.: US 7,598,912 B2**
(45) **Date of Patent: Oct. 6, 2009**

(54) **PLANAR ANTENNA STRUCTURE**

(75) Inventor: **Gwo-Yun Lee**, Taipei (TW)

(73) Assignee: **Compal Electronics, Inc.**, 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.: **11/309,199**

(22) Filed: **Jul. 13, 2006**

(65) **Prior Publication Data**

US 2007/0126640 A1 Jun. 7, 2007

(30) **Foreign Application Priority Data**

Dec. 7, 2005 (TW) ..... 94143096 A

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

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

(58) **Field of Classification Search** ..... 343/702, 343/700 MS, 767, 769, 770
See application file for complete search history.

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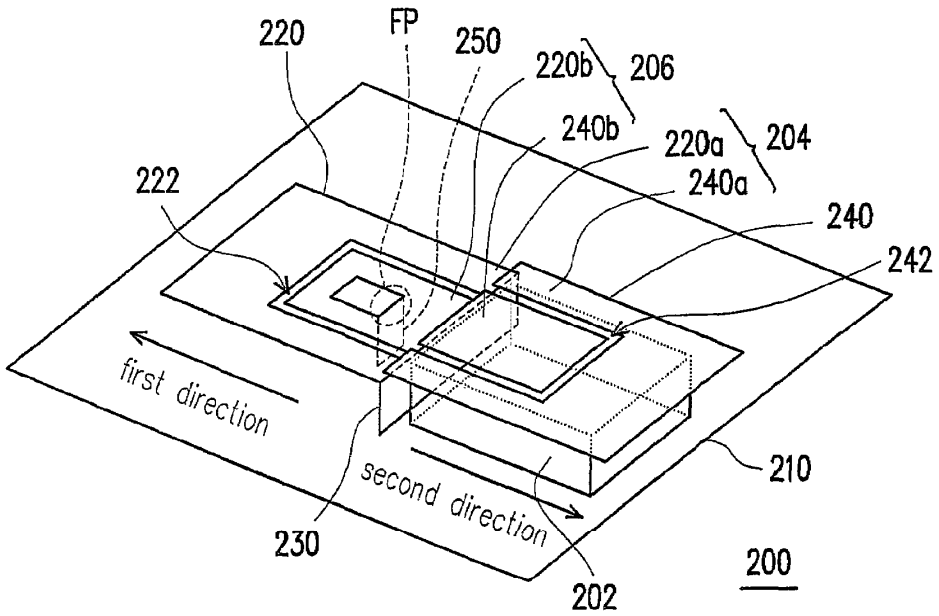
Primary Examiner—Hoang V Nguyen
Assistant Examiner—Robert Karacsony
(74) *Attorney, Agent, or Firm*—Jianq Chyun IP Office

(57) **ABSTRACT**

A planar antenna structure including a ground conductor, a first radiating patch, a shorting patch and a second radiating patch is provided. The first radiating patch is disposed above the ground conductor. One end of the shorting patch is connected with the ground conductor, and the other end thereof is connected with one side of the first radiating patch. A projection of the first radiating patch on the ground conductor is located on one side of a projection of the shorting patch on the ground conductor. The second radiating patch is disposed above the ground conductor and the first radiating. A projection of the second radiating patch on the ground conductor traverses both sides of the projection of the shorting patch on the ground conductor. The projection of the second radiating patch on the ground conductor partially overlaps with the projection of the first radiating patch on the ground conductor.

5 Claims, 7 Drawing Sheets



US007598913B2

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

(10) **Patent No.: US 7,598,913 B2**
(45) **Date of Patent: Oct. 6, 2009**

(54) **SLOT-LOADED MICROSTRIP ANTENNA AND RELATED METHODS**

(75) Inventors: **Qinjiang Rao**, Waterloo (CA); **Geyi Wen**, Waterloo (CA); **Dong Wang**, Waterloo (CA); **Mark Pecen**, Waterloo (CA)

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

(*) 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.: **11/737,878**

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

(65) **Prior Publication Data**

US 2008/0258989 A1 Oct. 23, 2008

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

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/767, 770, 829, 846, 848, 702
See application file for complete search history.

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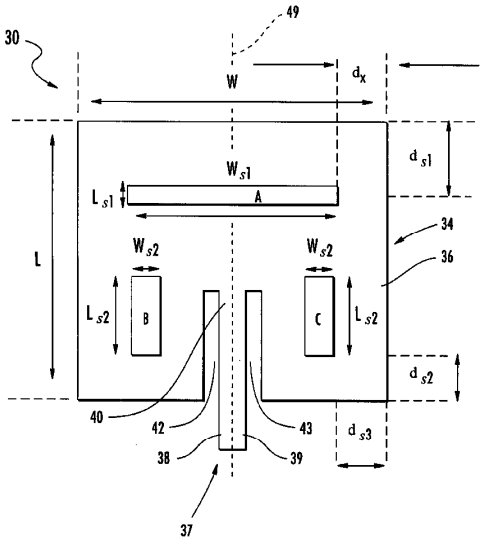
(Continued)

Primary Examiner—Tho G Phan
(74) *Attorney, Agent, or Firm*—Yee & Associates, P.C.

(57) **ABSTRACT**

A microstrip antenna may include an electrically conductive ground plane layer, a dielectric layer adjacent the electrically conductive ground plane layer, and an electrically conductive patch layer adjacent the dielectric layer on a side thereof opposite the electrically conducive ground plane layer. The electrically conductive patch layer may be electrically floating with respect to the electrically conductive ground plane layer and may comprise a body portion and a feed strip extending outwardly from an interior medial portion of the body portion. The feed strip may have opposing first and second sides and an end electrically connected to the body portion. The body portion may have spaced apart first and second slots adjacent respective ones of the first and second opposite sides of the feed strip, and a third slot adjacent the end of the feed strip and spaced from the first and second slots.

26 Claims, 13 Drawing Sheets



US007598914B2

(12) **United States Patent**
Chang

(10) **Patent No.: US 7,598,914 B2**
(45) **Date of Patent: Oct. 6, 2009**

(54) **WIDE BAND CO-PLANAR WAVEGUIDE FEEDING CIRCULARLY POLARIZED ANTENNA**

(75) Inventor: **The-Nan Chang**, Taipei (TW)

(73) Assignees: **Tatung Company** (TW); **Tatung University** (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.: **12/061,817**

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

(65) **Prior Publication Data**

US 2009/0073074 A1 Mar. 19, 2009

(30) **Foreign Application Priority Data**

Sep. 14, 2007 (TW) ..... 96134566 A

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 9/16 (2006.01)

(52) **U.S. Cl.** ..... **343/700 MS**; 343/822

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

(56) **References Cited**

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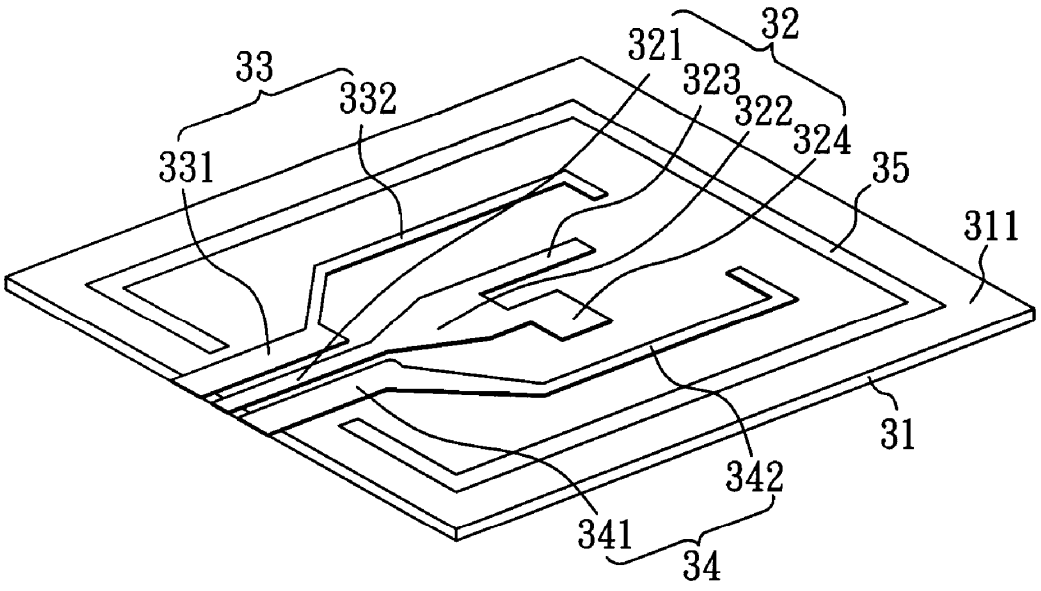
Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—Lowe Hauptman Ham & Berner, LLP

(57) **ABSTRACT**

A wide band co-planar waveguide feeding circularly polarized antenna is disclosed. The wide band co-planar waveguide feeding circularly polarized antenna comprises: a substrate having a surface; a signal feeding unit located on the surface and comprising a feeding bar, a matching portion, a first extended portion, and a second extended portion; a first ground unit located on the surface and having a first ground bar; and a second ground unit located on the surface and having a second ground bar; wherein, the first extended portion and the second extended portion are respectively extended from the matching portion. Besides, the matching portion is electrically connected with the feeding bar, the first extended portion and the second extended portion. Moreover, the feeding bar is located between the first ground bar and the second ground bar.

19 Claims, 16 Drawing Sheets



US007598924B2

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

(10) **Patent No.: US 7,598,924 B2**
(45) **Date of Patent: Oct. 6, 2009**

(54) **DISCONNECTABLE ELECTRICAL CONNECTION**

(75) Inventors: **Chris Hynes**, Burnaby (CA); **Heikki Lehtola**, Tampere (FI); **Youngdae Park**, Coquitlam (CA); **Michael Trevorrow**, Delta (CA)

(73) Assignee: **Nokia Corporation**, Espoo (FI)

(*) 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.: **12/070,994**

(22) Filed: **Feb. 21, 2008**

(65) **Prior Publication Data**

US 2009/0213030 A1 Aug. 27, 2009

(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/906**; 343/702

(58) **Field of Classification Search** 343/906, 343/702; 439/66, 862

See application file for complete search history.

(56) **References Cited**

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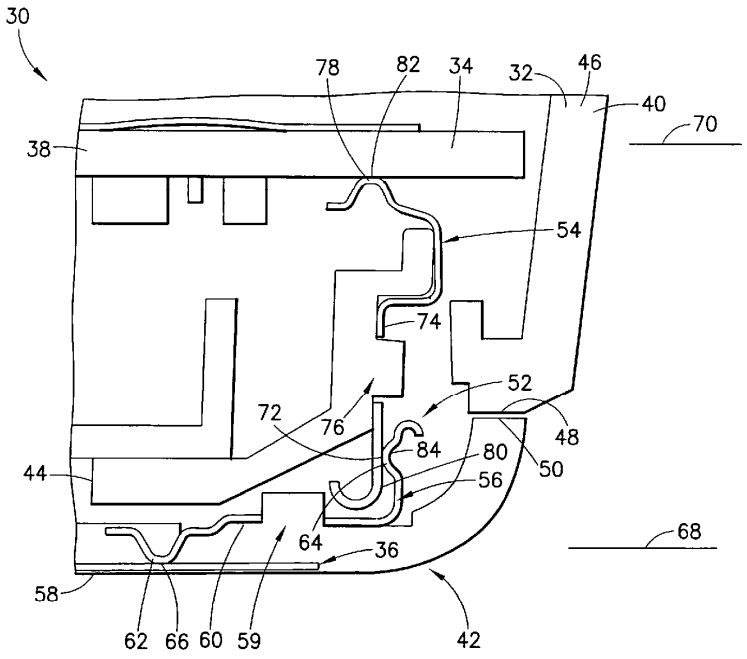
Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Harrington & Smith, PC

(57) **ABSTRACT**

An apparatus including an antenna; a printed wiring board (PWB); and a connection system electrically connecting the antenna to the PWB. The connection system includes a first spring contact and a second spring contact. The first and second spring contacts are removably resiliently biased against each other. The first spring contact is directly connected to the antenna. The second spring contact is electrically connected to the PWB.

27 Claims, 5 Drawing Sheets



US007602341B2

(12) **United States Patent**
Wei-Shan et al.

(10) **Patent No.: US 7,602,341 B2**
(45) **Date of Patent: Oct. 13, 2009**

(54) **MULTI-BAND ANTENNA**

(75) Inventors: **Chang Wei-Shan**, Taipei Hsien (TW); **Wang Chih-Ming**, Taipei Hsien (TW); **Cheng Pi-Hsi**, Taipei Hsien (TW)

(73) Assignee: **Wistron NeWeb Corp.**, Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 6 days.

(21) Appl. No.: **12/003,447**

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

(65) **Prior Publication Data**

US 2008/0180330 A1 Jul. 31, 2008

(30) **Foreign Application Priority Data**

Jan. 25, 2007 (TW) ..... 96201502 U

(51) **Int. Cl.**
H01Q 5/00 (2006.01)
H01Q 1/24 (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.

(56) **References Cited**

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7,446,717 B2 * 11/2008 Hung et al. 343/702

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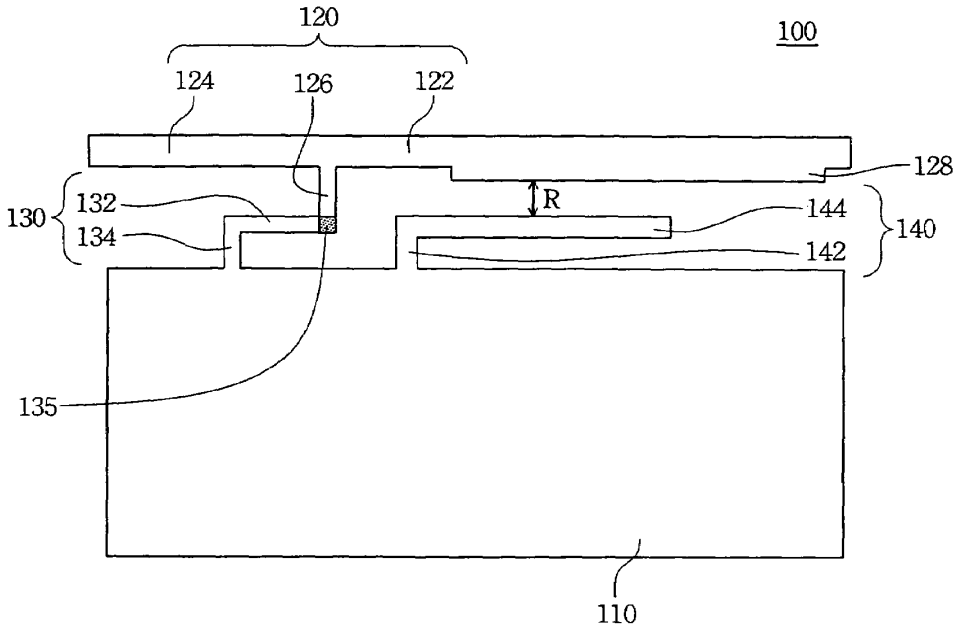
Primary Examiner—Daniel D Chang
(74) *Attorney, Agent, or Firm*—Muncy, Geissler, Olds & Lowe, PLLC

(57) **ABSTRACT**

A multi-band antenna includes a ground, an asymmetric T-shaped radiation element, an inverted L-shaped conduction element, and a parasitic element. The asymmetric T-shaped radiation element has a first radiation part, a second radiation part, and a first conduction part. The length of the second radiation part is shorter than that of the first radiation part. The inverted L-shaped conduction element has a second conduction part and a third conduction part. The second conduction part is connected to the first conduction part, and arranged between the second radiation part and the ground. The parasitic element has a fourth conduction part and a third radiation part. The fourth conduction part is connected approximately perpendicular to the ground. The third radiation part is arranged between the first radiation part and the ground.

20 Claims, 8 Drawing Sheets



US007602342B2

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

(10) **Patent No.: US 7,602,342 B2**
(45) **Date of Patent: Oct. 13, 2009**

(54) **FOLDABLE MOBILE TELEPHONE TERMINAL WITH ANTENNA AND GROUND PLANE MADE IN ONE PIECE**

(75) Inventors: **Göran Schack**, Åhus (SE); **Pernilla Jonsson**, Malmö (SE); **Olof Simonsson**, Malmö (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 141 days.

(21) Appl. No.: **10/591,818**

(22) PCT Filed: **Feb. 16, 2005**

(86) PCT No.: **PCT/EP2005/001557**

§ 371 (c)(1),
(2), (4) Date: **Sep. 6, 2006**

(87) PCT Pub. No.: **WO2005/096436**

PCT Pub. Date: **Oct. 13, 2005**

(65) **Prior Publication Data**

US 2007/0200771 A1 Aug. 30, 2007

Related U.S. Application Data

(60) Provisional application No. 60/554,282, filed on Mar. 18, 2004.

(30) **Foreign Application Priority Data**

Mar. 12, 2004 (EP) 04005861

(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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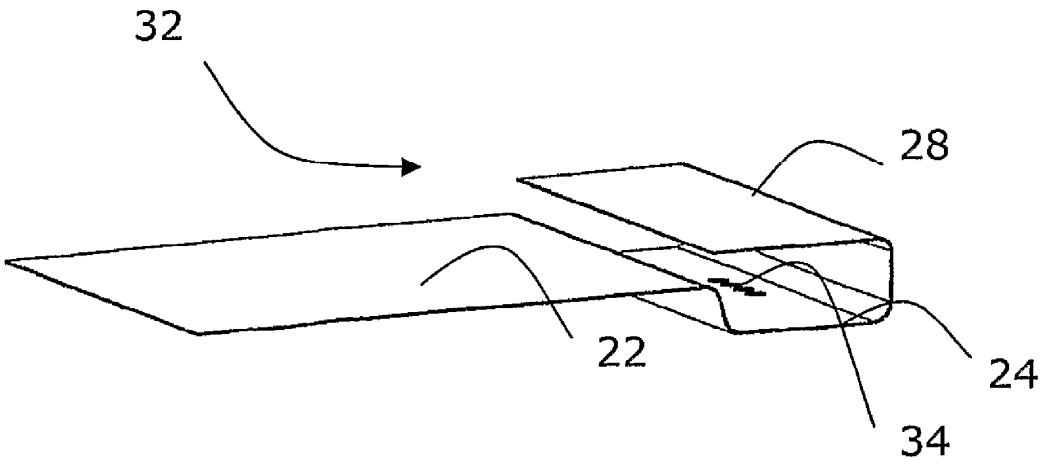
Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec, PA

(57) **ABSTRACT**

The present invention relates to a portable communication device and an antenna system. The device comprises an antenna feeding circuit and at least a first part having a hollow interior where different electrical elements are provided and provided with a main section having a certain width, length and a first height, and an antenna system. The antenna system comprises a ground plane (**22**, **24**) located within and extending along essentially the whole width and length of at least the main section and an antenna element (**28**) located within the first part. The ground plane is provided in one piece and the only electrical elements of the first part being electrically connected to say ground plane are radio transmission elements.

9 Claims, 2 Drawing Sheets



US007602343B2

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

(10) **Patent No.: US 7,602,343 B2**
(45) **Date of Patent: Oct. 13, 2009**

(54) **ANTENNA**

(75) Inventors: **Yoshinao Takada**, Tokyo (JP); **Daisuke Nozue**, Kanagawa (JP); **Hiroshi Ikeda**, Kanagawa (JP)

(73) Assignee: **Tyco Electronics AMP K.K.**, Kanagawa-ken (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 167 days.

(21) Appl. No.: **11/937,251**

(22) Filed: **Nov. 8, 2007**

(65) **Prior Publication Data**

US 2008/0111745 A1 May 15, 2008

(30) **Foreign Application Priority Data**

Nov. 9, 2006 (JP) 2006-303832

(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

See application file for complete search history.

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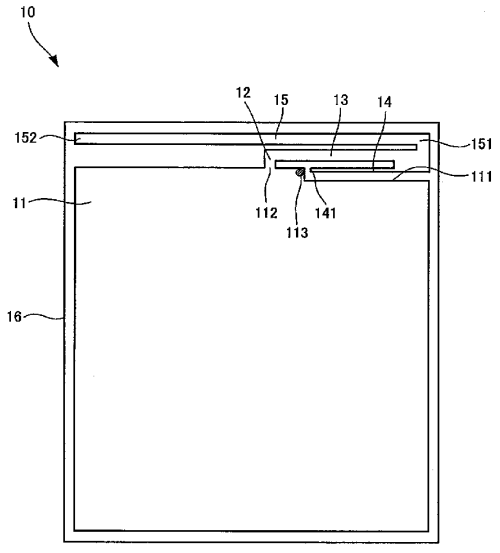
Primary Examiner—Trinh V Dinh
Assistant Examiner—Dieu Hien T Duong
(74) *Attorney, Agent, or Firm*—Barley Snyder, LLC

(57) **ABSTRACT**

An antenna having a ground plane having an edge and a first antenna element extending substantially parallel to the edge is disclosed. A ground element electrically connects the first antenna element with the ground plane. A second antenna element extends substantially parallel to the first antenna element and is disposed between the edge and the first antenna element and is connected at one end of the second antenna element to the first antenna element with the remaining end of the second antenna element located closer to the ground element. A third antenna element is disposed so that the first antenna element is between the second antenna element and the third antenna element and the third antenna element at extends substantially parallel to the first antenna element, with a rear end electrically connected with the first antenna element and a remaining end of the third antenna element is electrically open.

24 Claims, 12 Drawing Sheets



US007605759B2

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

(10) **Patent No.: US 7,605,759 B2**
(45) **Date of Patent: Oct. 20, 2009**

(54) **MONOPOLE ANTENNA HAVING MATCHING FUNCTION**

(75) Inventors: **Young-min Moon**, Yongin-si (KR); **Se-hyun Park**, Yongin-si (KR); **Young-eil Kim**, Yongin-si (KR); **Kyeong-sik Min**, Yongin-si (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 17 days.

(21) Appl. No.: **11/708,632**

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

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Aug. 18, 2006 (KR) 10-2006-0078323

(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, 343/846, 829
See application file for complete search history.

(56) **References Cited**

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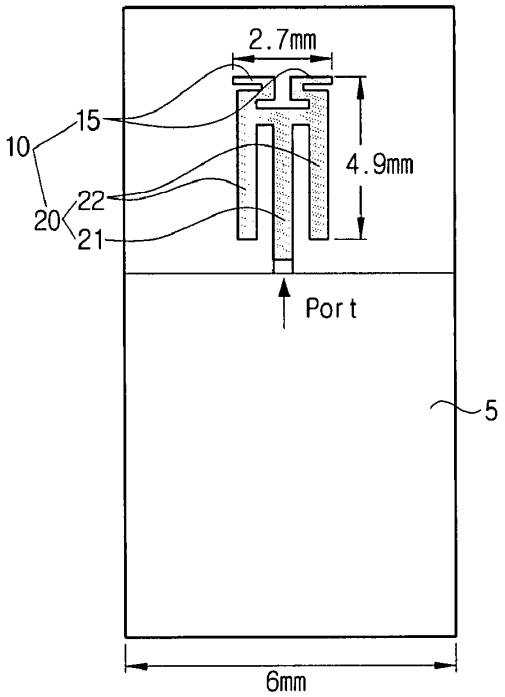
Primary Examiner—Tho G Phan
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

A monopole antenna having a matching function includes a ground; and a radiator having a first radiation part which is connected to a first side of the ground in a strip shape perpendicularly to the ground, and at least one second radiation part which is bent from a first end of the first radiation part at least once.

9 Claims, 5 Drawing Sheets



US007605764B2

(12) **United States Patent**
Ishimiya

(10) **Patent No.: US 7,605,764 B2**
(45) **Date of Patent: Oct. 20, 2009**

(54) **FOLDED DIPOLE ANTENNA DEVICE AND MOBILE RADIO TERMINAL**

(75) Inventor: **Katsunori Ishimiya**, Tokyo (JP)

(73) Assignee: **Sony Ericsson Mobile Communications Japan, Inc.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 363 days.

(21) Appl. No.: **11/588,289**

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

(65) **Prior Publication Data**

US 2007/0115200 A1 May 24, 2007

(30) **Foreign Application Priority Data**

Nov. 18, 2005 (JP) 2005-333783

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 9/26 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/803

(58) **Field of Classification Search** 343/702, 343/741, 803, 804, 846

See application file for complete search history.

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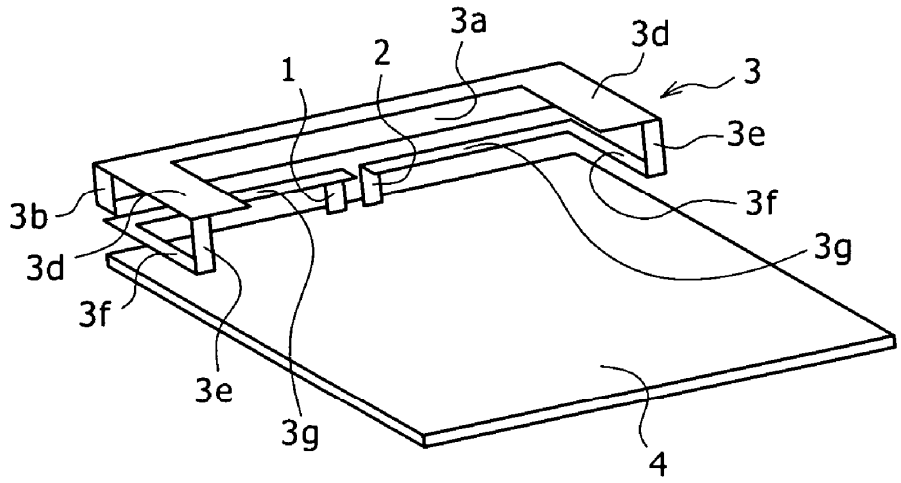
Primary Examiner—Michael C Wimer
(74) *Attorney, Agent, or Firm*—Rader, Fishman & Grauer PLLC

(57) **ABSTRACT**

Disclosed is a folded dipole antenna device which is of an unbalanced feed type and includes an antenna element of approximately plate-like loop structure, connected to an antenna feed point and an antenna ground provided on a base plate. In the folded dipole antenna device, the antenna element of loop structure includes a pair of first element sections which extend approximately parallel to the base plate, a second element section formed by merging element sections that are folded back from both ends of the first element sections and extend approximately parallel to the first element sections, and a third element section which extends from a folded top part of the second element section toward the first element sections and an end part thereof is close to the first element sections.

6 Claims, 11 Drawing Sheets



US007605766B2

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

(10) **Patent No.: US 7,605,766 B2**
(45) **Date of Patent: Oct. 20, 2009**

(54) **MULTI-BAND ANTENNA DEVICE FOR RADIO COMMUNICATION TERMINAL AND RADIO COMMUNICATION TERMINAL COMPRISING THE MULTI-BAND ANTENNA DEVICE**

(75) Inventors: **Anders Dahlström**, Vellinge (SE); **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 0 days.

(21) Appl. No.: **11/997,576**

(22) PCT Filed: **Aug. 3, 2006**

(86) PCT No.: **PCT/EP2006/065041**

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

(87) PCT Pub. No.: **WO2007/017465**

PCT Pub. Date: **Feb. 15, 2007**

(65) **Prior Publication Data**

US 2009/0002243 A1 Jan. 1, 2009

Related U.S. Application Data

(60) Provisional application No. 60/709,270, filed on Aug. 18, 2005.

(30) **Foreign Application Priority Data**

Aug. 5, 2005 (EP) 05017143

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

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

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

(56) **References Cited**

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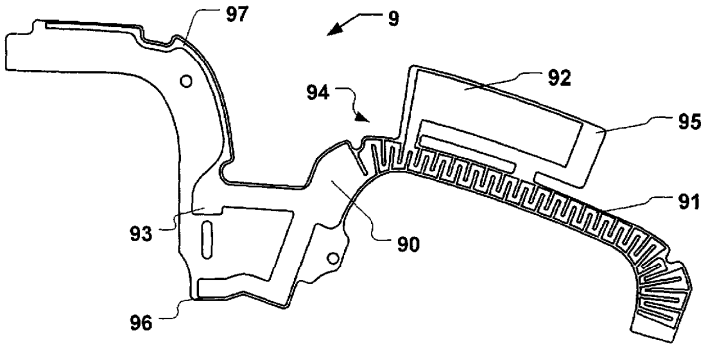
Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—Renner, Otto, Boiselle & Sklar, LLP

(57) **ABSTRACT**

A multi-band radio antenna device (**1**) for a radio communication terminal is disclosed. The antenna device comprises a substrate and a radiating antenna element thereon having a radio signal feeding point (**13**), wherein the radiating element comprises a continuous trace of conductive material. The continuous trace has a first radiating portion connected to said radio signal feeding point comprising a at least partly meandered radiating portion (**11**) arranged distal from said radio signal feeding point (**13**) and connected to an elongate radiating portion (**10**) arranged proximal to and connected to said signal feeding point, and a second radiating portion (**12**) connected as a branch to said first radiating portion at a branching position (**14**) thereof arranged distal from said radio signal feeding point (**13**). The antenna device offers a minimized number of necessary contacts and improved antenna efficiency.

20 Claims, 9 Drawing Sheets



US007605769B2

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

(10) **Patent No.: US 7,605,769 B2**
(45) **Date of Patent: Oct. 20, 2009**

(54) **MULTI-BAN U-SLOT ANTENNA**

(75) Inventors: **Jae Chan Lee**, Gyunggi-Do (KR); **Jong Won Yu**, Daejeon (KR); **Wang Sang Lee**, Daejeon (KR); **Hyun Hak Kim**, Gyunggi-Do (KR)

(73) Assignee: **Samsung Electro-Mechanics Co., Ltd.**, Suwon, Gyunggi-Do (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 106 days.

(21) Appl. No.: **11/735,868**

(22) Filed: **Apr. 16, 2007**

(65) **Prior Publication Data**

US 2007/0247386 A1 Oct. 25, 2007

(30) **Foreign Application Priority Data**

Apr. 19, 2006 (KR) 10-2006-0035340

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 15/24 (2006.01)

(52) **U.S. Cl.** **343/770**; 343/767; 343/846; 343/909

(58) **Field of Classification Search** ..... 343/700 MS, 343/770, 767, 846, 909
See application file for complete search history.

(56) **References Cited**

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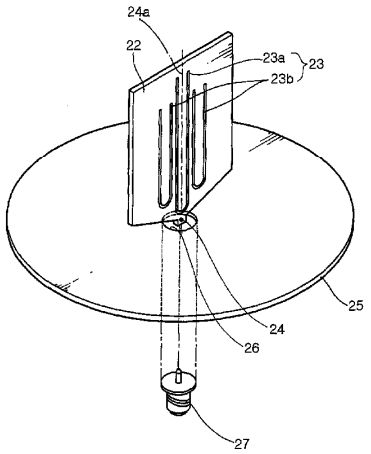
Primary Examiner—Douglas W Owens
Assistant Examiner—Jennifer F Hu
(74) *Attorney, Agent, or Firm*—Lowe Hauptman Ham & Berner

(57) **ABSTRACT**

In a multi-band U-slot planar antenna, a limited ground plane is provided. A connector includes a ground terminal connected to the ground plane and a feeding terminal for feeding a signal. A planar radiation device includes a feeding point connected to the feeding terminal, a central U-slot having a symmetrical configuration about a central axis thereof, the central axis extending vertically from the feeding point, and at least one pair of auxiliary U-slots symmetrical with each other about the central axis. In the multi-band U-slot planar antenna, alternatively, at least one auxiliary U-slot may have a symmetrical configuration about the central axis.

4 Claims, 8 Drawing Sheets



US007609209B2

(12) **United States Patent**
Shih

(10) **Patent No.: US 7,609,209 B2**
(45) **Date of Patent: Oct. 27, 2009**

(54) **ANTENNA DEVICE**

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

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 265 days.

(21) Appl. No.: **11/615,948**

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

(65) **Prior Publication Data**

US 2008/0012775 A1 Jan. 17, 2008

(30) **Foreign Application Priority Data**

Jul. 14, 2006 (TW) ..... 95125813 A

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

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 747, 829, 846, 848
See application file for complete search history.

(56) **References Cited**

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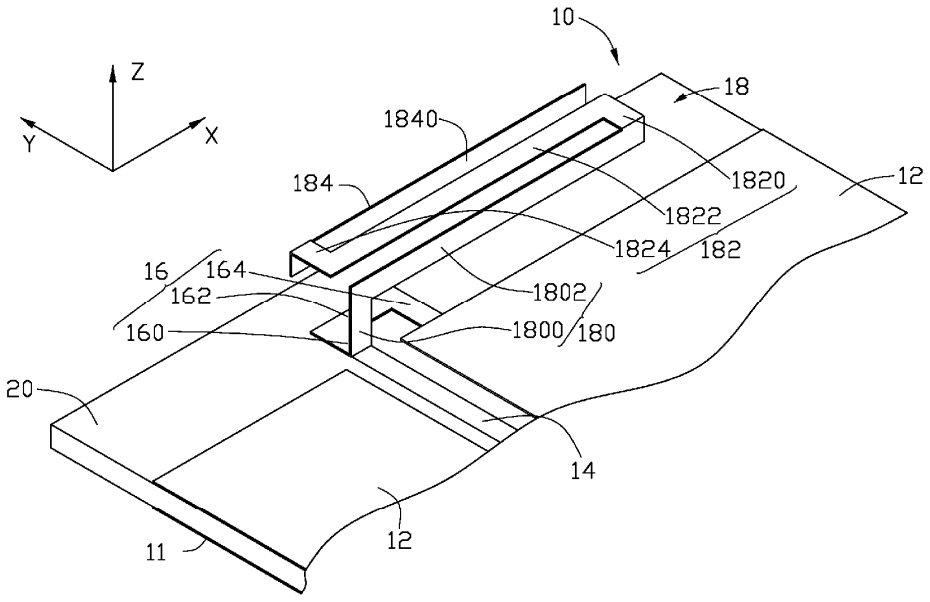
Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

An antenna device disposed on a substrate includes a feed part, a body part, at least one ground plane, and a matching part. The feed part is for feeding electromagnetic signals. The body part for radiating and receiving the electromagnetic signals is electronically connected to the feed part. The body part includes a first radiation part located on a first plane, a second radiation part located on a second plane, and a third radiation part located on a third plane. The second radiation part is electronically connected between the first radiation part and the third radiation part. The ground plane for grounding is disposed on one surface of the substrate. The matching part for impedance matching includes one end electronically connected to one end of the body part and one end of the feed part, and another end electronically connected to the ground plane.

15 Claims, 6 Drawing Sheets



US007609211B2

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

(10) **Patent No.: US 7,609,211 B2**
(45) **Date of Patent: Oct. 27, 2009**

(54) **HIGH-DIRECTIVITY MICROSTRIP ANTENNA**

(75) Inventors: **Chieh-Sheng Hsu**, Taipei Hsien (TW); **Chang-Hsiu Huang**, Taipei Hsien (TW)

(73) Assignee: **Wistron Corp.**, Hsinchu (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.: **11/812,973**

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

(65) **Prior Publication Data**

US 2008/0238782 A1 Oct. 2, 2008

(30) **Foreign Application Priority Data**

Apr. 2, 2007 (TW) ..... 96205320 U

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

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

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

See application file for complete search history.

(56) **References Cited**

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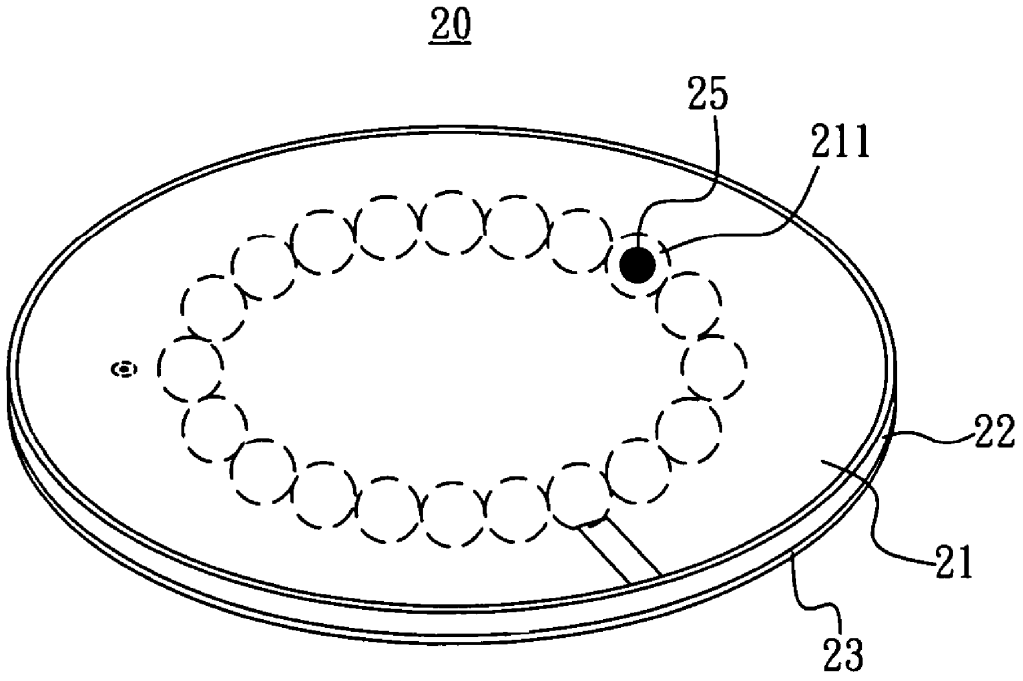
Primary Examiner—Tho G Phan

(57) **ABSTRACT**

A high-directivity microstrip antenna comprising a dielectric layer with a first surface and a second surface that respectively connects to a metal patch and a ground metal layer, wherein the dielectric layer has a through-hole with a metal element connecting to the first surface and the second surface, and the metal element is positioned at the interior of the through-hole, wherein the two ends of the metal element respectively electrically connects to the metal patch and the ground metal layer for having higher directivity when the antenna is designed in a fixed dimension; also, for saving cost by selecting a dielectric layer with various coefficients.

17 Claims, 4 Drawing Sheets



US007609212B2

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

(10) **Patent No.: US 7,609,212 B2**
(45) **Date of Patent: Oct. 27, 2009**

(54) **PORTABLE WIRELESS UNIT**

(75) Inventors: **Kenichi Sato**, Miyagi (JP); **Yukinari Takahashi**, Miyagi (JP); **Satoshi Watanabe**, 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 357 days.

(21) Appl. No.: **11/718,165**

(22) PCT Filed: **Nov. 8, 2005**

(86) PCT No.: **PCT/JP2005/020771**

§ 371 (c)(1),
(2), (4) Date: **Apr. 27, 2007**

(87) PCT Pub. No.: **WO2006/049342**

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

(65) **Prior Publication Data**

US 2009/0066585 A1 Mar. 12, 2009

(30) **Foreign Application Priority Data**

Nov. 8, 2004 (JP) 2004-323379

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

(52) **U.S. Cl.** **343/702**; 343/876; 455/575.3

(58) **Field of Classification Search** 343/702, 343/725, 876; 455/557, 575.3, 575.7
See application file for complete search history.

(56) **References Cited**

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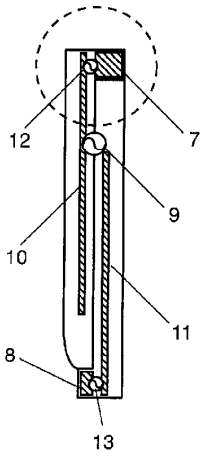
Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—RatnerPrestia

(57) **ABSTRACT**

A portable wireless unit having high antenna performance, which comprises: a first case having a first antenna element, a second antenna element and a second feeding section; a second case having a third antenna element, a third feeding section and a circuit board provided with a ground pattern; and a coupling section consisting of first and second electrically connected conductive coupling elements and coupling the first case and the second case to be extended and housed freely. The second coupling element is provided in the first case while being connected electrically with the first antenna element, the first coupling element is provided in the second case while being connected electrically with the first feeding section, and the first antenna element, the coupling section, and the ground pattern are operated as a dipole antenna.

7 Claims, 6 Drawing Sheets



US007609213B2

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

(10) **Patent No.: US 7,609,213 B2**
(45) **Date of Patent: Oct. 27, 2009**

(54) **TWO-BRANCH BROADBAND ANTENNA**

(75) Inventors: **Kin-Lu Wong**, Kao-Hsiung (TW); **Yu-Chan Yang**, Taipei (TW); **Wei-Yu Li**, Yilan County (TW); **Saou-Wen Su**, Taipei (TW); **Jui-Hung Chou**, Tai-Chung (TW)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 92 days.

(21) Appl. No.: **11/830,855**

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

(65) **Prior Publication Data**

US 2009/0033584 A1 Feb. 5, 2009

(51) **Int. Cl.**

H01Q 1/24	(2006.01)
H01Q 11/12	(2006.01)
H01Q 7/00	(2006.01)
H01Q 9/26	(2006.01)
H01Q 9/38	(2006.01)
H01Q 1/48	(2006.01)

(52) **U.S. Cl.** **343/702**; 343/846; 343/847; 343/829; 343/803; 343/842; 343/741; 343/744; 343/748

(58) **Field of Classification Search** ..... 343/702, 343/700 MS, 846, 847, 829, 803, 842, 741, 343/744, 748

See application file for complete search history.

(56) **References Cited**

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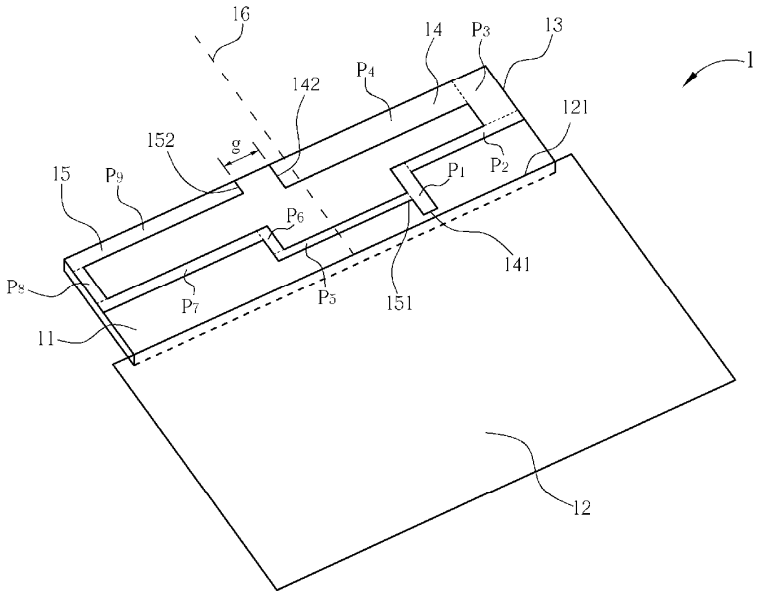
Primary Examiner—Douglas W Owens
Assistant Examiner—Jennifer F Hu
(74) *Attorney, Agent, or Firm*—Kile Goekjian Reed & McManus PLLC

(57) **ABSTRACT**

A broadband antenna is capable of generating an upper resonant mode (at about 700 MHz) from a first radiating arm and a lower resonant mode (at about 500 MHz) from a second radiating arm. The first and second radiating arms are bent at least one time. An open end of the second radiating arm is extended toward an open end of the first radiating arm with a predefined distance there between. The predefined distance can be adjusted to improve the impedance matching of lower resonant mode, which can be further combined with the upper resonant mode to achieve a broad bandwidth covering the complete spectrum of digital TV channels (470-862 MHz).

6 Claims, 7 Drawing Sheets



US007609217B2

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

(10) **Patent No.: US 7,609,217 B2**
(45) **Date of Patent: Oct. 27, 2009**

(54) **ANTENNA DEVICE**

(75) Inventors: **Junichi Noro**, Akita (JP); **Satoshi Kohno**, Akita (JP)

(73) Assignee: **Mitsumi Electric Co., 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.: **11/954,326**

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

(65) **Prior Publication Data**

US 2008/0180332 A1 Jul. 31, 2008

(30) **Foreign Application Priority Data**

Jan. 25, 2007 (JP) P2007-014800

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

(52) **U.S. Cl.** **343/713**; 343/711

(58) **Field of Classification Search** ..... 343/711, 343/713, 700 MS, 702
See application file for complete search history.

(56) **References Cited**

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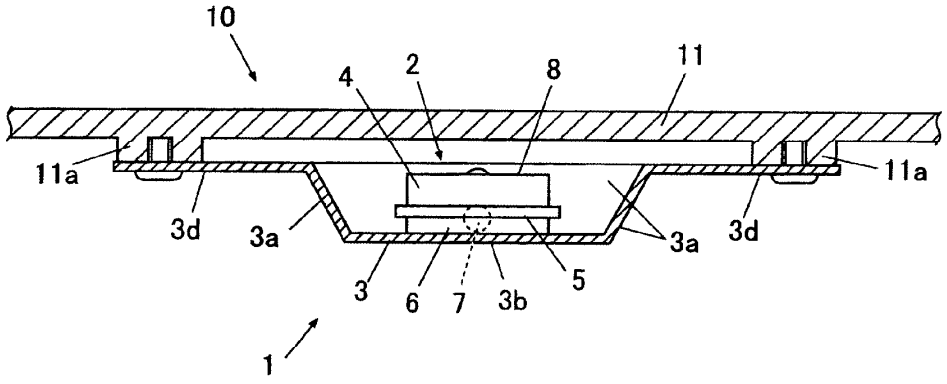
Primary Examiner—HoangAnh T Le
(74) *Attorney, Agent, or Firm*—Whitham Curtis Christofferson & Cook, PC

(57) **ABSTRACT**

An antenna device attachable to a bottom surface of a resin or glass body of a vehicle, the antenna device includes: an antenna element that has a receiver for receiving radio waves; a circuit board that has a circuit surface having a circuit formed thereon to amplify signals inputted from the antenna element; a shield cover that covers the circuit surface of the circuit board to shield the circuit from interference waves and that is grounded; a coaxial cable that is inserted into the shield cover, that supplies a driving power to the circuit formed on the circuit board, that connects the circuit to a GND, and that outputs signals from the circuit; and a metallic bracket that has a lateral wall surrounding a lateral side of the antenna element and a bottom wall supporting a bottom of the antenna element.

5 Claims, 3 Drawing Sheets



US007609221B2

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

(10) **Patent No.: US 7,609,221 B2**
(45) **Date of Patent: Oct. 27, 2009**

(54) **ANTENNA ASSEMBLY AND PORTABLE TERMINAL HAVING THE SAME**

(75) Inventors: **Kyung-Ho Chung**, Seoul (KR); **Jung-Ho Yoon**, Seoul (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 75 days.

(21) Appl. No.: **11/855,716**

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

(65) **Prior Publication Data**

US 2008/0074341 A1 Mar. 27, 2008

(30) **Foreign Application Priority Data**

Sep. 27, 2006 (KR) 10-2006-0094121

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

(52) **U.S. Cl.** ..... **343/841**; 343/700 MS; 343/702

(58) **Field of Classification Search** ..... 343/841, 343/702, 700 MS, 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**

An antenna assembly, and a portable terminal having the same. The antenna assembly according to an embodiment comprises: a circuit board having a ground plane at a predetermined region; first and second antenna conductors spaced from each other at one side of the ground plane; and a shielding wall disposed between the ground plane and the antenna conductors, for reducing a coupling between the first and second antenna conductors. Since a plurality of antennas are mounted at a small space inside the portable terminal with maintaining their functions, an isolation characteristic between the antennas is enhanced, and a mutual coupling between the antennas is minimized.

21 Claims, 7 Drawing Sheets