



US008031122B2

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

(10) **Patent No.:** **US 8,031,122 B2**
(45) **Date of Patent:** **Oct. 4, 2011**

(54) **PROTECTIVE CIRCUIT MODULE AND
SECONDARY BATTERY PACK INCLUDING
THE SAME**

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(75) Inventors: **Youngcheol Jang**, Yongin-si (KR);
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(73) Assignee: **Samsung SDI Co., Ltd.**, Yongin-si (KR)
(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 424 days.

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(21) Appl. No.: **12/246,763**

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(65) **Prior Publication Data**
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(30) **Foreign Application Priority Data**
Oct. 30, 2007 (KR) 10-2007-0109726

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 11/12 (2006.01)
(52) **U.S. Cl.** **343/700 MS; 343/741; 343/866**
(58) **Field of Classification Search** **343/702,**
343/700 MS, 741, 866, 895
See application file for complete search history.

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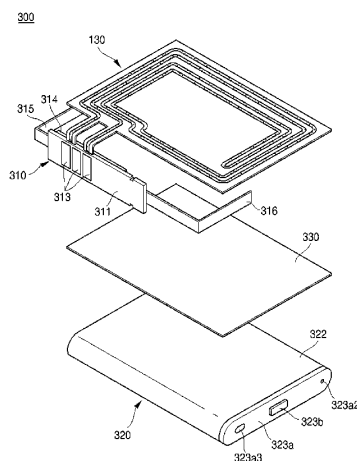
Primary Examiner — Hoang V Nguyen

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LLP

(57) **ABSTRACT**

A protective circuit module including a layered insulating
substrate, a printed circuit pattern disposed within the insu-
lating substrate, and a loop antenna electrically connected to
the printed circuit pattern. Ends of the loop antenna can be
inserted into the insulating substrate and connected to the
printed circuit pattern. Portions of the printed circuit pattern
may extend out of the insulating substrate, and may be con-
nected to the loop antenna. The protective circuit module can
be included in a secondary battery pack comprising a second-
ary battery. The loop antenna can be adhered to the secondary
battery.

20 Claims, 7 Drawing Sheets



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US008031126B2

(12) **United States Patent**
Cunningham

(10) **Patent No.:** **US 8,031,126 B2**
(45) **Date of Patent:** **Oct. 4, 2011**

(54) **DUAL POLARIZED ANTENNA**

(75) Inventor: **Patrick W. Cunningham**, McKinney,
TX (US)

(73) Assignee: **Raytheon Company**, Waltham, MA
(US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
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(21) Appl. No.: **11/939,300**

(22) Filed: **Nov. 13, 2007**

(65) **Prior Publication Data**

US 2009/0121967 A1 May 14, 2009

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

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

(58) **Field of Classification Search** **343/767,**
343/770, 771, 772, 893, 908

See application file for complete search history.

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Primary Examiner — Jacob Y Choi

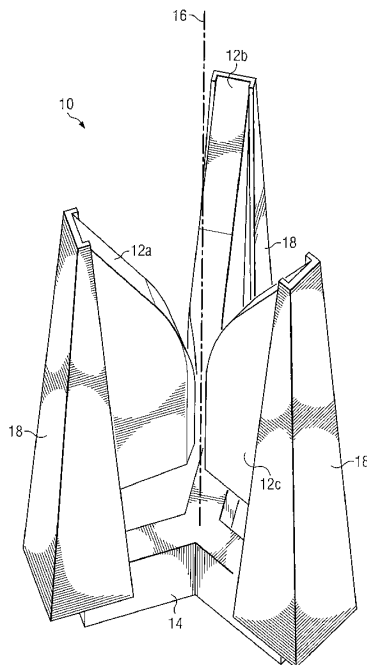
Assistant Examiner — Robert Karacsony

(74) *Attorney, Agent, or Firm* — Baker Botts L.L.P.

(57) **ABSTRACT**

In one embodiment according to the teachings of the present
disclosure, an antenna generally includes a first, second, and
third elements. The first and second elements form a first
electro-magnetic radiator that is operable to transmit or
receive a first signal having a first sense of polarization. The
first and third elements form a second electro-magnetic radi-
ator that is operable to transmit or receive a second signal
having a second sense of polarization that is different than the
first sense of polarization.

25 Claims, 3 Drawing Sheets



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US008035563B2

(12) **United States Patent**
Ishimiya

(10) **Patent No.:** **US 8,035,563 B2**

(45) **Date of Patent:** **Oct. 11, 2011**

(54) **MULTIBAND ANTENNA DEVICE AND COMMUNICATION TERMINAL DEVICE**

(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 387 days.

(21) Appl. No.: **12/089,922**

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

(86) PCT No.: **PCT/JP2006/318859**

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

(87) PCT Pub. No.: **WO2007/049414**

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(65) **Prior Publication Data**

US 2009/0231213 A1 Sep. 17, 2009

(30) **Foreign Application Priority Data**

Oct. 25, 2005 (JP) 2005-309345

(51) **Int. Cl.**
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.

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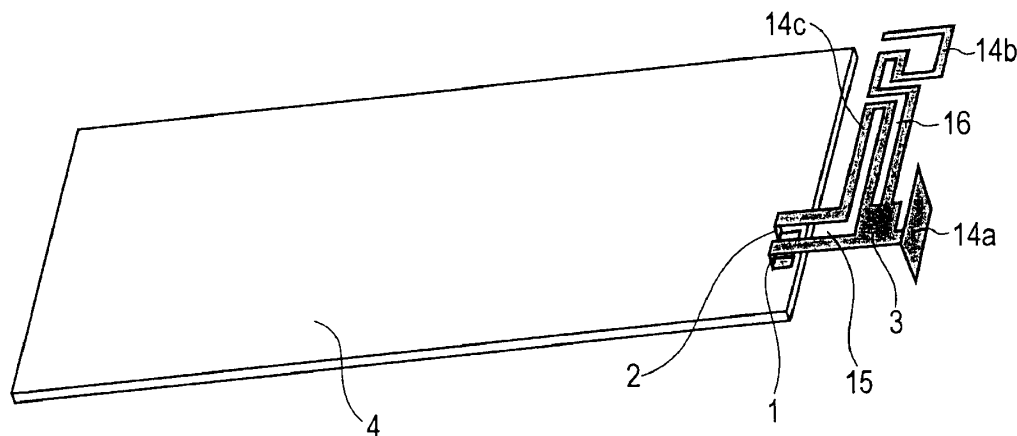
Primary Examiner — David G Phan

(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

A slit (15) is formed between a feed point and GND point of an inverted-F antenna to make the points electrically distant from each other, and at least three antenna elements (14a, 14b, and 14c) are formed. The at least three antenna elements (14a, 14b, and 14c) generate at least three resonance points. An antenna radiating plate (3) projects outwardly so that at least a major part thereof does not face a ground plate (4). Therefore, a multi-band antenna device capable of achieving a wider bandwidth without using a parasitic element, and a communication terminal apparatus are provided.

4 Claims, 10 Drawing Sheets



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US008035564B2

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

(10) **Patent No.:** **US 8,035,564 B2**
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **SURFACE MOUNTED PLANAR ANTENNA APPARATUS**

(75) Inventors: **Tsai-Yi Yang**, Tainan Hsien (TW);
Ching-wen Wu, Tainan Hsien (TW);
Wei-Hung Hsu, Tainan Hsien (TW);
Te-Yi Chu, Tainan Hsien (TW)

(73) Assignee: **Cirotech Technology Corp.**, Tainan (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 352 days.

(21) Appl. No.: **12/325,481**

(22) Filed: **Dec. 1, 2008**

(65) **Prior Publication Data**

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/713

See application file for complete search history.

(56) **References Cited**

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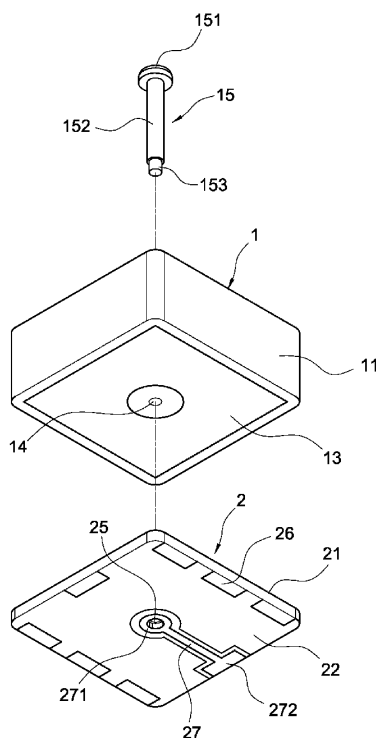
Primary Examiner — Tan Ho

(74) *Attorney, Agent, or Firm* — Chun-Ming Shih; HDLS IPR Services

(57) **ABSTRACT**

A surface mounted planar antenna apparatus includes an antenna and a circuit board. The antenna includes a base, a radiation metal plate arranged on a top face of the base, and a ground metal plate arranged on a bottom face of the base. A through hole is defined from the radiation metal plate and passed through the base to the ground metal plate. A signal feeder is arranged in the through hole and electrically connected to the radiation metal plate but electrically insulated with the ground metal plate. The circuit board is attached on the bottom face of the base and includes an upper face and a lower face, the upper face includes an area for binding with the ground metal plate on the bottom face of the base, and the lower face includes a first pad and a signal feeding trace electrically connected with the signal feeder.

7 Claims, 7 Drawing Sheets



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US008035565B2

(12) **United States Patent**
Gamand

(10) **Patent No.:** **US 8,035,565 B2**

(45) **Date of Patent:** **Oct. 11, 2011**

(54) **ANTENNA DEVICE AND RF COMMUNICATION EQUIPMENT**

(75) Inventor: **Patrice Gamand**, Douvres la Delivrande (FR)

(73) Assignee: **NXP B.V.**, Eindhoven (NL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 513 days.

(21) Appl. No.: **12/293,415**

(22) PCT Filed: **Mar. 14, 2007**

(86) PCT No.: **PCT/IB2007/050864**

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(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

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H01Q 1/24 (2006.01)

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

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

See application file for complete search history.

(56) **References Cited**

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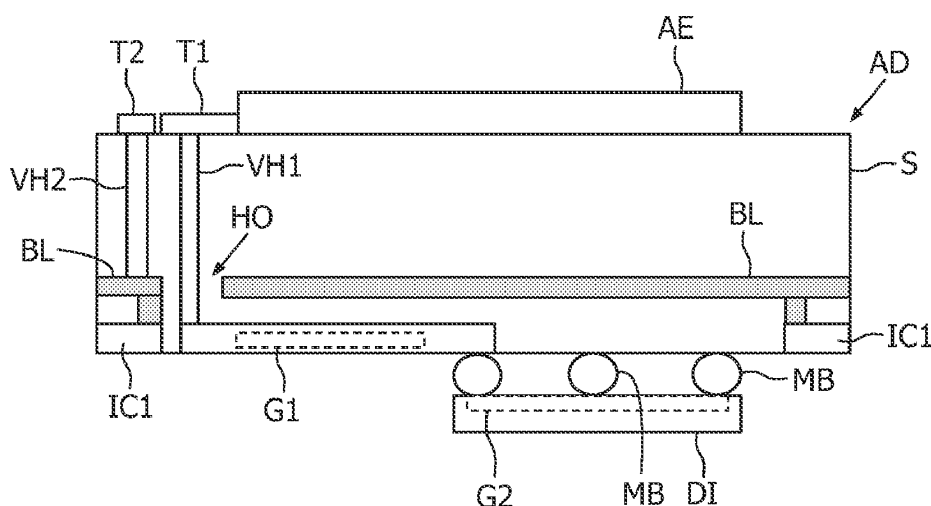
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Primary Examiner — David G Phan

(57) **ABSTRACT**

An antenna device (AD) for a RF communication equipment, comprises i) a substrate (S) comprising front (FS) and back (BS) sides, ii) a planar antenna element (AE) fixed to the substrate back side (BS), iii) a group of at least one component (G1) fixed to the substrate front side (FS), in an area located under the antenna element (AE), and connected to the antenna element (AE) through at least a first connecting means (VH 1) passing through the substrate (S), and a low resistivity layer (BL) buried into the substrate (S) for connecting to ground in order to isolate at least the group of component(s) from electromagnetic disturbances induced by the antenna element (AE).

17 Claims, 2 Drawing Sheets



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US008035566B2

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

(10) **Patent No.:** **US 8,035,566 B2**
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **MULTI-BAND ANTENNA**

(56) **References Cited**

(75) Inventors: **Yung-Chih Tsai**, Tu-Cheng (TW);
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(21) Appl. No.: **12/436,125**

(22) Filed: **May 6, 2009**

(65) **Prior Publication Data**
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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, 829, 846
See application file for complete search history.

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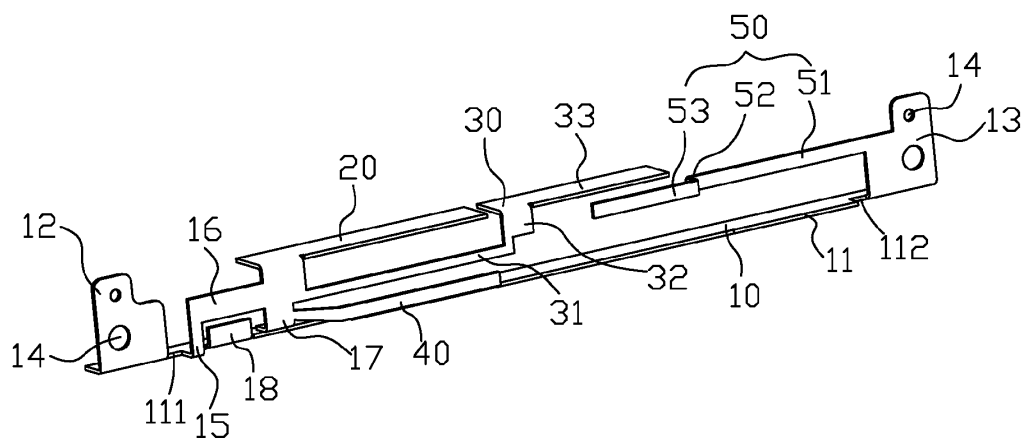
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Primary Examiner — Tho G Phan

(57) **ABSTRACT**

A multi-band antenna has a grounding plate with a first end and a second end defined at a longer side thereof. The longer side has an upward first connecting portion adjacent to the first end and a vertical second connecting portion. A feeding portion extends downwards from a lower edge of the second connecting portion. A first antenna radiator extends towards a same direction with respect to the second connecting portion along the grounding plate from an upper side of the second connecting portion. A second antenna radiator includes a first radiating portion, a second radiating portion and a third radiating portion. A third antenna radiator extends parallel to the first radiating portion from a side of the feeding portion. A coupling component includes a first section, a second section and a third section extending opposite to the first section from an end of the second section.

6 Claims, 6 Drawing Sheets



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US008035567B2

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

(10) **Patent No.:** **US 8,035,567 B2**
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **MOBILE ANTENNA UNIT AND
ACCOMPANYING COMMUNICATION
APPARATUS**

(75) Inventors: **Takeshi Asano**, Atsugi (JP); **Shohhei Fujio**, Machida (JP)

(73) Assignee: **LENOVO (Singapore) Pte 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 0 days.

(21) Appl. No.: **12/781,973**

(22) Filed: **May 18, 2010**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Feb. 27, 2003 (JP) 2003-050328

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

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

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

See application file for complete search history.

(56) **References Cited**

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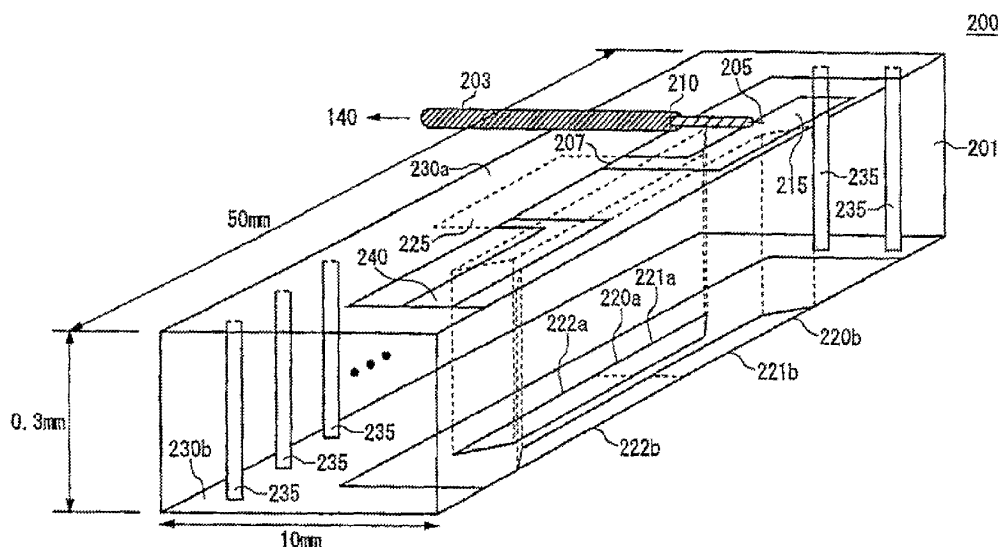
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Primary Examiner — David G Phan

(57) **ABSTRACT**

An antenna unit is provided with an inverted F-type antenna element provided with a feeding point and a ground connection point, and a non-feed antenna element configured so as to resonate with the inverted F-type antenna element through electrical coupling. In addition, the antenna unit may also be provided with a ground part which is grounded to the earth and connected to the ground connection point provided on one edge of the inverted F-type antenna element, and a resonance element, one edge of which is connected to the ground part, resonated by the non-feed antenna element through electrical coupling.

7 Claims, 4 Drawing Sheets



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US008035570B2

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

(10) **Patent No.:** **US 8,035,570 B2**
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **HIGH-STRENGTH MICROWAVE ANTENNA ASSEMBLIES**

(75) Inventors: **Mani N. Prakash**, Boulder, CO (US); **Francesca Rossetto**, Longmont, CO (US); **Anthony C. Lee**, San Francisco, CA (US); **Steven Kim**, Los Altos, CA (US); **Ted Su**, Sunnyvale, CA (US); **Jonathan L. Glassman**, Cambridge, MA (US)

(73) Assignee: **Vivant Medical, Inc.**, Boulder, CO (US)

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(22) Filed: **Apr. 7, 2009**

(65) **Prior Publication Data**
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Related U.S. Application Data

(63) Continuation of application No. 11/493,392, filed on Jul. 26, 2006, now Pat. No. 7,527,623, which is a continuation of application No. 10/961,994, filed on Oct. 7, 2004, now Pat. No. 7,147,632, which is a continuation of application No. 10/052,848, filed on Nov. 2, 2001, now Pat. No. 6,878,147.

(51) **Int. Cl.**
H01Q 9/04 (2006.01)

(52) **U.S. Cl.** **343/790**; 606/33; 606/41; 607/101

(58) **Field of Classification Search** **343/790**,
343/791, 792; 606/33, 41; 607/101, 102
See application file for complete search history.

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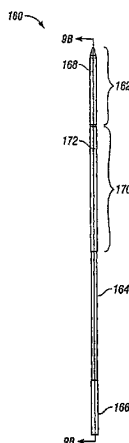
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Primary Examiner — David G Phan

(57) **ABSTRACT**

Various high-strength microwave antenna assemblies are described herein. The microwave antenna has a radiating portion connected by a feedline to a power generating source, e.g., a generator. The antenna is a dipole antenna with the distal end of the radiating portion being tapered and terminating at a tip to allow for direct insertion into tissue. Antenna rigidity comes from placing distal and proximal radiating portions in a pre-stressed state, assembling them via threaded or overlapping joints, or fixedly attaching an inner conductor to the distal portion. The inner conductor is affixed to the distal portion by, e.g., welding, brazing, soldering, or by adhesives. A junction member made from a hard dielectric material, e.g., ceramic, can be placed between the two portions and can have uniform or non-uniform shapes to accommodate varying antenna designs. Electrical chokes may also be used to contain returning currents to the distal end of the antenna.

8 Claims, 18 Drawing Sheets



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US008035571B2

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

(10) **Patent No.:** **US 8,035,571 B2**
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **ANTENNA DEVICE AND SIGNAL
RECEIVING METHOD**

(75) Inventors: **Masaki Nishio**, Tokyo (JP); **Takayoshi Ito**, Yokohama (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 437 days.

(21) Appl. No.: **12/222,920**

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

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Aug. 29, 2007 (JP) 2007-223133

(51) **Int. Cl.**
H01Q 11/00 (2006.01)

(52) **U.S. Cl.** **343/843**; 343/793; 343/810

(58) **Field of Classification Search** 343/767,
343/792.5, 753, 793, 745, 705, 859, 810,
343/850, 843, 708, 756; 342/373; 257/728;
324/326; 333/126, 318, 24 R; 340/572.7
See application file for complete search history.

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Primary Examiner — Douglas W Owens

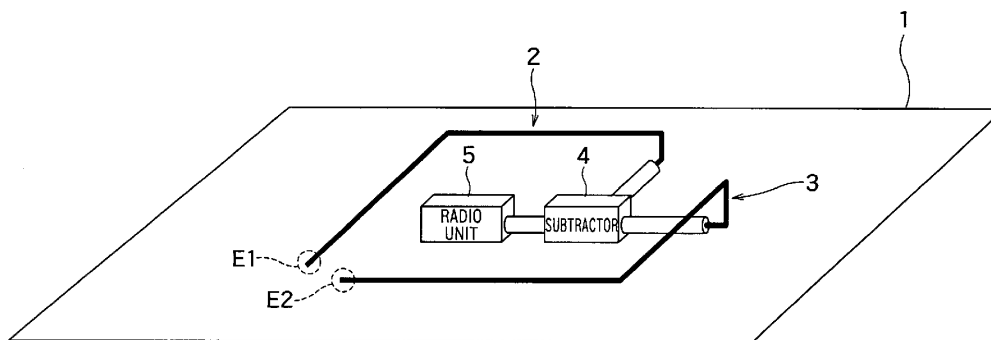
Assistant Examiner — Jae Kim

(74) *Attorney, Agent, or Firm* — Nixon & Vanderhye, P.C.

(57) **ABSTRACT**

An example antenna device includes a conductive ground plane and first and second antenna elements connected to the conductive ground plane through first and second feeding points, respectively. Directivities of the first and second antenna elements are arranged to be approximately perpendicular to each other. A phase adjusting circuit is configured to provide a phase difference of approximately 180 degrees between first and second received signals by the first and second antenna elements, respectively and a combining circuit is configured to combine the first and second received signals having a phase difference of approximately 180 degrees therebetween to obtain a combined signal. A radio unit is configured to process the combined signal.

8 Claims, 19 Drawing Sheets



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US008035572B2

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

(10) **Patent No.:** **US 8,035,572 B2**

(45) **Date of Patent:** **Oct. 11, 2011**

(54) **H-TYPE MONOPOLE ISOLATION ANTENNA**

(56) **References Cited**

(75) Inventors: **Je-hoon Yun**, Daejeon (KR);
Joung-myoun Kim, Daejeon (KR);
Ung-hee Park, Daejeon (KR); **Soon-ik Jeon**, Daejeon (KR)

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2002/0135523 A1 9/2002 Romero et al.

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

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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 1056 days.

EP 1071160 1/2001

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(21) Appl. No.: **11/722,248**

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(22) PCT Filed: **Dec. 21, 2005**

(86) PCT No.: **PCT/KR2005/004428**

§ 371 (c)(1),

(2), (4) Date: **Jun. 20, 2007**

(Continued)

(87) PCT Pub. No.: **WO2006/068418**

PCT Pub. Date: **Jun. 29, 2006**

Primary Examiner — Tan Ho

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

(65) **Prior Publication Data**

US 2010/0001922 A1 Jan. 7, 2010

(30) **Foreign Application Priority Data**

Dec. 21, 2004 (KR) 10-2004-0109404

(51) **Int. Cl.**
H01Q 21/00 (2006.01)

(52) **U.S. Cl.** **343/879; 343/890**

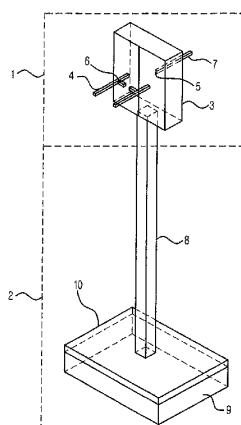
(58) **Field of Classification Search** 343/878,
343/879, 890, 891

See application file for complete search history.

(57) **ABSTRACT**

Provided is an H-type monopole isolation antenna. The antenna provides an H-type monopole isolation antenna which can gain a high bi-directional transmitting/receiving isolation between a transmitting antenna and a receiving antenna of co-channel/co-polarization by including an antenna symmetrically positioned in right/left sides based on a covering means. A transmitting/receiving isolation antenna for maintaining high isolation between a transmitting signal and a receiving signal includes a cover which includes a conductor; and first and second antennas which are bisymmetrically positioned in right and left parts of the covering means and separately operated as a transmitting antenna or a receiving antenna. The antenna is used in a co-channel bi-direction repeater system.

16 Claims, 5 Drawing Sheets



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US008036288B2

(12) **United States Patent**
Quagliaro

(10) **Patent No.:** **US 8,036,288 B2**

(45) **Date of Patent:** **Oct. 11, 2011**

(54) **ULTRA-WIDEBAND COMMUNICATION
SYSTEM PROVIDED WITH A FREQUENCY
CONTROLLED DISPERSIVE ANTENNA**

(75) Inventor: **Gilles Quagliaro**, Corneilles En Parisis
(FR)

(73) Assignee: **Thales** (FR)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 552 days.

(21) Appl. No.: **12/092,728**

(22) PCT Filed: **Nov. 10, 2006**

(86) PCT No.: **PCT/EP2006/068332**

§ 371 (c)(1),
(2), (4) Date: **Oct. 15, 2008**

(87) PCT Pub. No.: **WO2007/054559**

PCT Pub. Date: **May 18, 2007**

(65) **Prior Publication Data**

US 2009/0122840 A1 May 14, 2009

(30) **Foreign Application Priority Data**

Nov. 10, 2005 (FR) 05 11456

(51) **Int. Cl.**
H04L 27/28 (2006.01)
H04B 1/00 (2006.01)

(52) **U.S. Cl.** **375/260; 375/130**

(58) **Field of Classification Search** 375/130-131,
375/219, 260, 285, 295; 340/870.18, 870.24,
340/870.26

See application file for complete search history.

(56) **References Cited**

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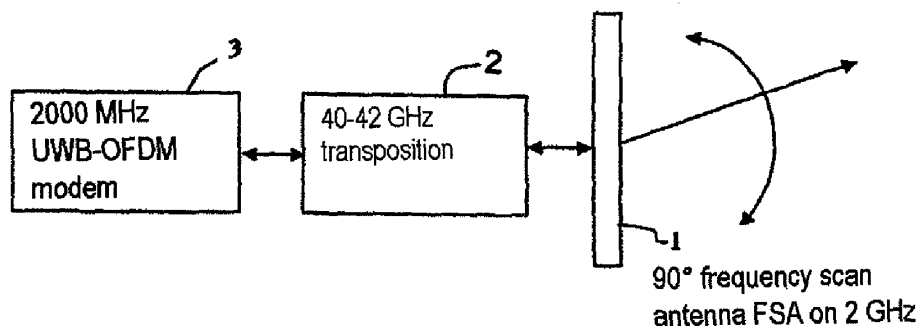
Primary Examiner — Khanh C Tran

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

(57) **ABSTRACT**

Radiocommunication equipment and method comprising at least the following elements: at least one frequency scan antenna connected to a modem adapted to generate a spectrum OFDM modulation-based waveform by increasing the duration of an OFDM symbol by reproducing the FFT pattern.

12 Claims, 6 Drawing Sheets



Acrobat Document



US008040283B2

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

(10) **Patent No.:** **US 8,040,283 B2**

(45) **Date of Patent:** ***Oct. 18, 2011**

(54) **DUAL BAND ANTENNA**

(56) **References Cited**

(75) Inventors: **Pi-Hsi Cheng**, Hsinchu County (TW);
Chang-Jung Lee, Taoyuan County (TW)

(73) Assignee: **Arcadyan Technology Corporation**,
Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 384 days.

This patent is subject to a terminal dis-
claimer.

(21) Appl. No.: **12/289,933**

(22) Filed: **Nov. 7, 2008**

(65) **Prior Publication Data**

US 2009/0128420 A1 May 21, 2009

(30) **Foreign Application Priority Data**

Nov. 16, 2007 (TW) 96143571 A

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/700 MS; 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 — Hoang V Nguyen

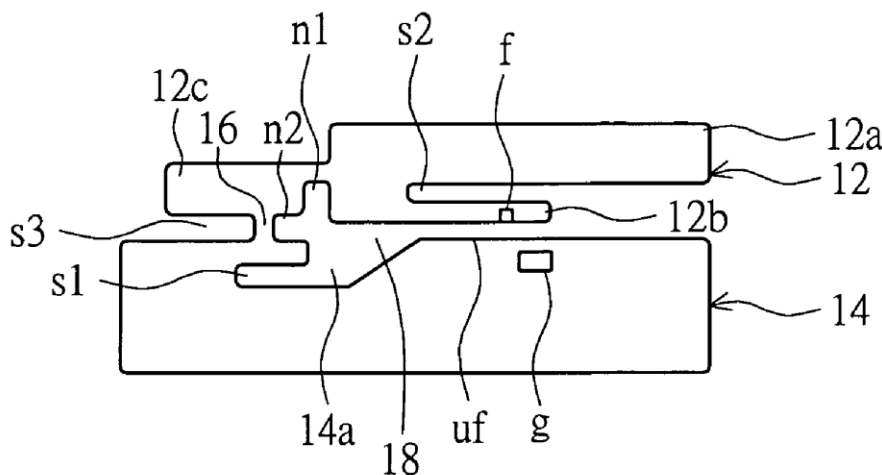
(74) *Attorney, Agent, or Firm* — Bacon & Thomas, PLLC

(57) **ABSTRACT**

An antenna applied in a communication device is provided. The antenna includes a conductive supporting portion, a radiator and a grounding portion. The radiator operates in a first frequency band. The grounding portion is connected to the radiator through the conductive supporting portion. The grounding portion includes a cavity extended from a top surface of the grounding portion into the interior of the grounding portion. A resonant cavity operating in a second frequency band is formed between the radiator and the cavity.

24 Claims, 3 Drawing Sheets

10



Acrobat Document



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

(54) **HANDSET DEVICE**

(75) Inventors: **Pei-Ling Teng**, Taoyuan County (TW);
Yi-Chun Chen, Taoyuan County (TW)

(73) Assignee: **HTC Corporation**, Taoyuan County
(TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 323 days.

(21) Appl. No.: 12/371,633

(22) Filed: **Feb. 16, 2009**

(65) **Prior Publication Data**

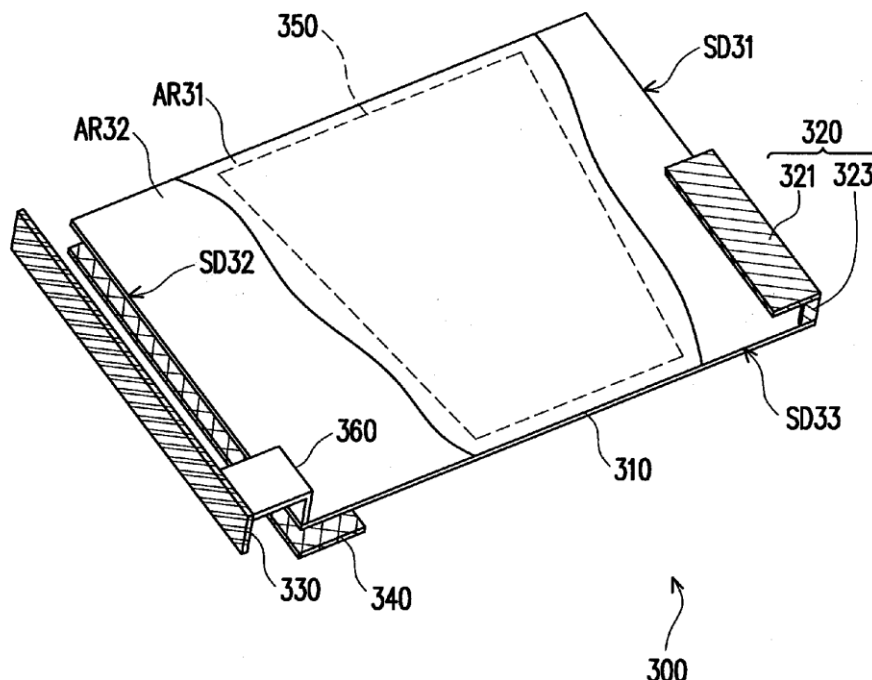
US 2010/0052998 A1 Mar. 4, 2010

(30) **Foreign Application Priority Data**

Sep. 3, 2008 (TW) 97133801 A

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01O 1/48 (2006.01)

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





US008040289B2

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

(10) **Patent No.:** **US 8,040,289 B2**
(45) **Date of Patent:** **Oct. 18, 2011**

(54) **LOW-PROFILE WIDE-BANDWIDTH RADIO
FREQUENCY ANTENNA**

(75) Inventors: **Dean Kitchener**, Brentwood (GB);
Andrew Urquhart, Hertfordshire (GB)

(73) Assignee: **Nortel Networks Limited**, Mississauga,
Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 362 days.

(21) Appl. No.: **12/415,604**

(22) Filed: **Mar. 31, 2009**

(65) **Prior Publication Data**

US 2009/0273536 A1 Nov. 5, 2009

Related U.S. Application Data

(60) Provisional application No. 61/050,028, filed on May
2, 2008.

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

(52) **U.S. Cl.** **343/860; 343/700 MS**

(58) **Field of Classification Search** 343/850,
343/860, 700 MS
See application file for complete search history.

(56) **References Cited**

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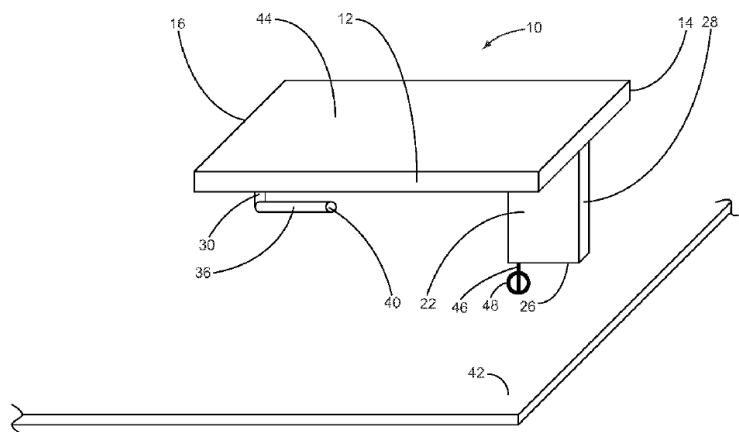
Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Withrow & Terranova
PLLC

(57) **ABSTRACT**

The present invention relates to an RF antenna structure that
includes a planar structure and a loading plate, such that the
planar structure is mounted between a ground plane and the
loading plate to form an RF antenna. The loading plate may be
about parallel to the ground plane and the planar structure
may be about perpendicular to the loading plate and the
ground plane. The loading plate may allow the height of the
RF antenna structure above the ground plane to be relatively
small. For example, the height may be significantly less than
one-quarter of a wavelength of RF signals of interest. The
planar structure may include two conductive matching ele-
ments to help increase the bandwidth of the RF antenna
structure.

28 Claims, 29 Drawing Sheets





US008041324B2

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

(10) **Patent No.:** **US 8,041,324 B2**
(45) **Date of Patent:** **Oct. 18, 2011**

(54) **ANTENNA APPARATUS**

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

(73) Assignee: **Mitsumi Electric Co., Ltd.**, Tama-shi, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 712 days.

(21) Appl. No.: **11/901,579**

(22) Filed: **Sep. 18, 2007**

(65) **Prior Publication Data**

US 2008/0070513 A1 Mar. 20, 2008

(30) **Foreign Application Priority Data**

Sep. 20, 2006 (JP) 2006-254467

(51) **Int. Cl.**
H04B 1/38 (2006.01)

(52) **U.S. Cl.** **455/269**; 343/700 MS

(58) **Field of Classification Search** 455/73,
455/80, 550.1, 562.1, 575.1, 269; 343/700 MS,
343/702, 846

See application file for complete search history.

(56) **References Cited**

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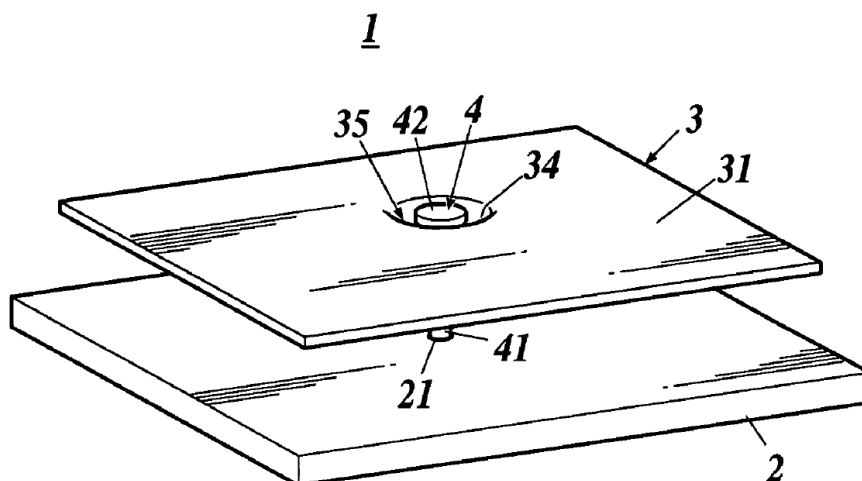
Primary Examiner — Thanh C Le

(74) *Attorney, Agent, or Firm* — Holtz, Holtz, Goodman & Chick, PC

(57) **ABSTRACT**

An antenna apparatus, including: a power supply pin; a circuit substrate having a first through hole through which the power supply pin passes; and an antenna element having a second through hole which faces with the first through hole and through which the power supply pin passes, the antenna element being disposed at a distance from the circuit substrate; wherein the second through hole is formed smaller than a shaft diameter of the power supply pin and is widened by the power supply pin; and a periphery of the second through hole of the antenna element is curved to be convex toward the circuit substrate, and the power supply pin is fixedly nipped by a tip end of the periphery.

2 Claims, 1 Drawing Sheet





US008044860B2

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

(10) **Patent No.:** **US 8,044,860 B2**
(45) **Date of Patent:** **Oct. 25, 2011**

(54) **INTERNAL ANTENNA FOR MOBILE DEVICE**

(75) Inventors: **Chia-Lun Tang**, Miaoli (TW); **Kin-Lu Wong**, Kaohsiung (TW); **Saou-wen Su**, Taipei (TW)

(73) Assignees: **Industrial Technology Research Institute**, Chutung, Hsinchu (TW); **National Sun Yatsen University**, Chutung, Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 119 days.

(21) Appl. No.: **11/279,588**

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

(65) **Prior Publication Data**

US 2007/0115179 A1 May 24, 2007

Related U.S. Application Data

(60) Provisional application No. 60/739,628, filed on Nov. 23, 2005.

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

(52) **U.S. Cl.** **343/700 MS**; 343/702; 343/798;
343/806; 343/895

(58) **Field of Classification Search** 343/700 MS,
343/702, 806, 895, 846, 848
See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Douglas W Owens

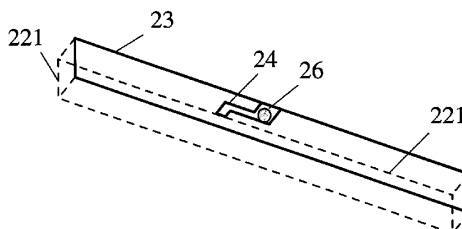
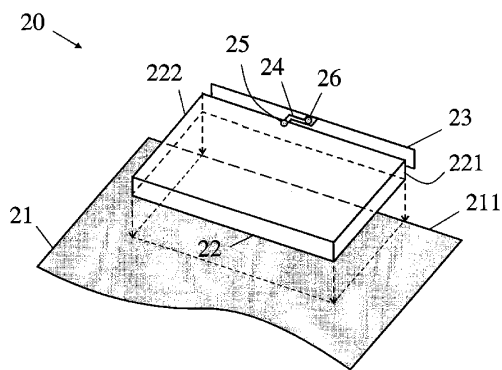
Assistant Examiner — Chuc Tran

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

(57) **ABSTRACT**

A mobile device includes a ground plane, a conductive housing disposed on the ground plane including a sidewall, a first conductive strip spaced apart from the conductive housing, and a second conductive strip electrically connecting the first conductive strip to the conductive housing.

13 Claims, 10 Drawing Sheets



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US008044863B2

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

(10) **Patent No.:** **US 8,044,863 B2**
(45) **Date of Patent:** **Oct. 25, 2011**

(54) **LOW PROFILE, FOLDED ANTENNA ASSEMBLY FOR HANDHELD COMMUNICATION DEVICES**

(75) Inventors: **Shirook M. Ali**, Mississauga (CA);
Houssam Kanj, 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 546 days.

(21) Appl. No.: **12/323,664**

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

(65) **Prior Publication Data**

US 2010/0127938 A1 May 27, 2010

(51) **Int. Cl.**
H01Q 5/00 (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 — Jacob Y Choi

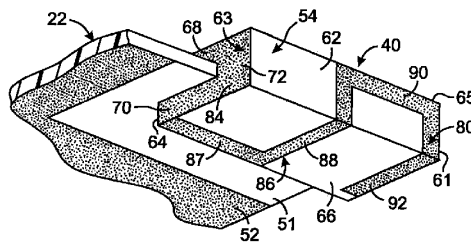
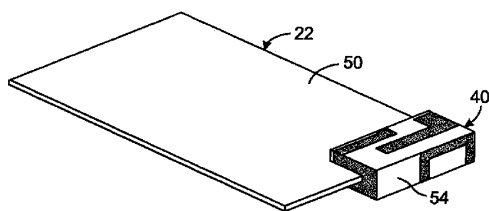
Assistant Examiner — Shawn Buchanan

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

(57) **ABSTRACT**

An antenna assembly is formed on a rectangular polyhedron support that has two sections projecting away from opposite sides of an electrically non-conductive substrate. An electrically conductive stripe wraps around the support and comprises a plurality of segments on different surfaces of the support. A conductive patch is located on two surfaces of the support to provide impedance matching between the antenna and a radio frequency circuit. By placing sections of the antenna assembly on both sides of the substrate and wrapping the conductive stripe around those sections, the space required to accommodate the antenna assembly within a housing of a communication device is reduced, as compared to some prior antenna designs.

18 Claims, 4 Drawing Sheets



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US008044867B2

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

(10) **Patent No.:** **US 8,044,867 B2**
(45) **Date of Patent:** **Oct. 25, 2011**

(54) **COMMUNICATION TERMINAL APPARATUS**

(75) Inventors: **Hironori Kikuchi**, Miyagi (JP); **Kenichi Sato**, 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 75 days.

(21) Appl. No.: **12/162,837**

(22) PCT Filed: **Jan. 30, 2007**

(86) PCT No.: **PCT/JP2007/051513**

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(2), (4) Date: **Oct. 28, 2009**

(87) PCT Pub. No.: **WO2007/091452**

PCT Pub. Date: **Aug. 16, 2007**

(65) **Prior Publication Data**

US 2010/0149045 A1 Jun. 17, 2010

(30) **Foreign Application Priority Data**

Feb. 10, 2006 (JP) P. 2006-034059

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

(52) **U.S. Cl.** **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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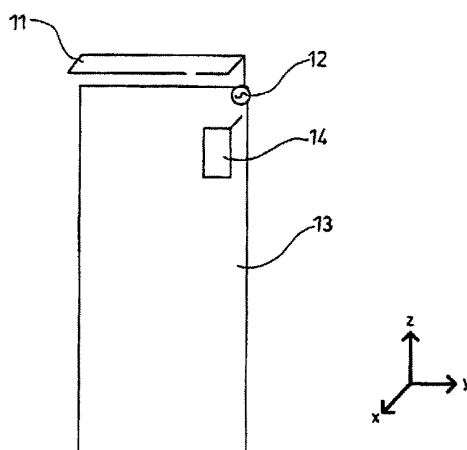
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(57) **ABSTRACT**

A problem of the invention is to provide a small-size communication terminal apparatus capable of reducing an SAR and also widening a band of an antenna and further achieving thinning.

The communication terminal apparatus has a substrate (13) disposed inside a housing, a power feeding part (12) disposed in the substrate (13), a monopole antenna (11) having plural elements of multi-frequency sharing, the monopole antenna for feeding power by electrically connecting one end to the power feeding part, and a ground wire (14) electrically connected to a wireless ground of the substrate (13), and the monopole antenna (11) having the plural elements is arranged in a direction vertical to a surface of the substrate (13) and in a back surface direction of the housing so as to be opposed to a human body at the time of a call.

6 Claims, 12 Drawing Sheets



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US008044876B2

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

(10) **Patent No.:** **US 8,044,876 B2**

(45) **Date of Patent:** **Oct. 25, 2011**

(54) **SUBSTRATE PROVIDED WITH AN
ELECTROCONDUCTIVE ELEMENT HAVING
AN ANTENNA FUNCTION**

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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 543 days.

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PCT Pub. Date: **Oct. 4, 2007**

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H01Q 1/40

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(52) **U.S. CL.** **343/873**; 343/700 MS; 343/713

(58) **Field of Classification Search** 343/700 MS,
343/713, 873

See application file for complete search history.

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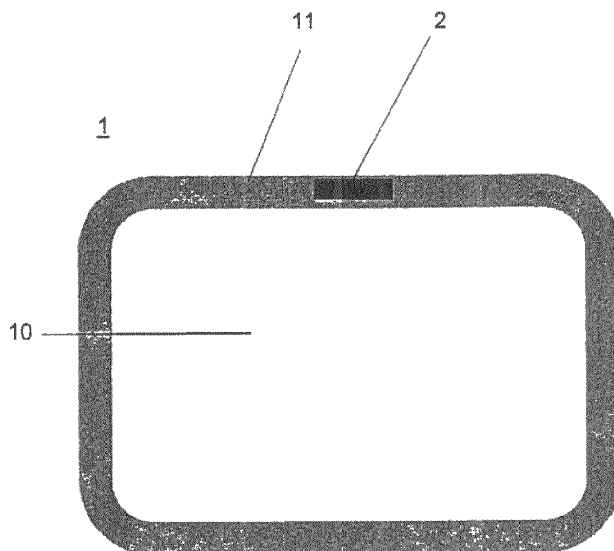
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McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

A rigid substrate including at least one electrically conduct-
ing element that provides an antenna function to transmit
and/or receive electromagnetic signals, the electrically con-
ducting element having a pattern with a fractal geometry. The
electrically conducting element is formed from an electrically
conductive ink or enamel that is printed directly on the sub-
strate.

23 Claims, 2 Drawing Sheets



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US00D646669S

(12) **United States Design Patent**
Suleiman

(10) **Patent No.:** **US D646,669 S**

(45) **Date of Patent:** **** Oct. 11, 2011**

(54) **OMNI-DIRECTIONAL ANTENNA**

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(**) Term: **14 Years**

(21) Appl. No.: **29/382,482**

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(51) **LOC (9) Cl.** **14-03**

(52) **U.S. Cl.** **D14/234**

(58) **Field of Classification Search** D14/230-238,
D14/299; 343/700 R, 840, 841, 908; 455/3.02,
455/FOR. 215, 575.2

See application file for complete search history.

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(74) *Attorney, Agent, or Firm* — Dorr, Carson & Birney, P.C.

(57) **CLAIM**

The ornamental design for an omni-directional antenna, as shown and described.

DESCRIPTION

FIG. 1 is a front elevational view of an omni-directional antenna showing my new design, the rear elevational view being the same as FIG. 1.

FIG. 2 is a right side elevational view thereof, with the left side elevational view being the same as FIG. 2.

FIG. 3 is a bottom plan view thereof; and,

FIG. 4 is a top plan view thereof.

1 Claim, 1 Drawing Sheet

