



US008149173B2

(12) **United States Patent**  
**Brown**

(10) **Patent No.:** **US 8,149,173 B2**  
(45) **Date of Patent:** **Apr. 3, 2012**

- (54) **MODIFIED LOOP ANTENNA**
- (75) Inventor: **Forrest James Brown**, Carson City, NV (US)
- (73) Assignee: **DockOn AG**, Zurich (CH)
- (\* ) 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.: **12/921,124**
- (22) PCT Filed: **Mar. 26, 2009**
- (86) PCT No.: **PCT/GB2009/050296**  
§ 371 (c)(1),  
(2), (4) Date: **Sep. 3, 2010**
- (87) PCT Pub. No.: **WO2009/118565**  
PCT Pub. Date: **Oct. 1, 2009**

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- (65) **Prior Publication Data**  
US 2011/0012806 A1 Jan. 20, 2011

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- (30) **Foreign Application Priority Data**  
Mar. 26, 2008 (GB) ..... 0805393.6

*Primary Examiner* — Hoanganh Le

(74) *Attorney, Agent, or Firm* — SilverSky Group, LLC

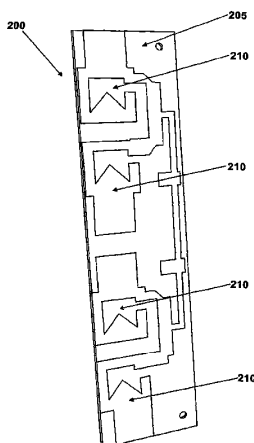
- (51) **Int. Cl.**  
**H01Q 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **343/700 MS**; 343/726
- (58) **Field of Classification Search** ..... 343/700 MS, 343/726, 725, 728, 730, 732, 742, 744, 866  
See application file for complete search history.

(57) **ABSTRACT**

Disclosed is an antenna comprising a loop element (10) and an Electric-field radiator (30), wherein the E-field radiator is electrically coupled to the loop element such that at the frequency of operation, there is a substantially 90 degree phase difference between the Electric and Magnetic fields produced by the antenna.

- (56) **References Cited**  
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**14 Claims, 4 Drawing Sheets**





US008150333B2

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

(10) **Patent No.:** **US 8,150,333 B2**  
(45) **Date of Patent:** **Apr. 3, 2012**

(54) **MULTIBAND ANTENNA AND WIRELESS COMMUNICATION DEVICE EMPLOYING THE SAME**

(75) Inventors: **Te-Chang Lin**, Tu-Cheng (TW);  
**Cho-Kang Hsu**, Tu-Cheng (TW)

(73) Assignee: **Chi Mei Communication Systems, Inc.**, Tu-Cheng, New Taipei (TW)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 317 days.

(21) Appl. No.: **12/627,048**

(22) Filed: **Nov. 30, 2009**

(65) **Prior Publication Data**  
US 2010/0330936 A1 Dec. 30, 2010

(30) **Foreign Application Priority Data**  
Jun. 25, 2009 (CN) ..... 2009 1 0303672

(51) **Int. Cl.**  
**H04B 1/44** (2006.01)

(52) **U.S. Cl.** ..... **455/78**; 455/90.1; 455/101; 455/93; 455/277.1; 455/575.7

(58) **Field of Classification Search** ..... 455/78, 455/90.1, 101, 93, 277.1, 575.7, 129  
See application file for complete search history.

(56) **References Cited**

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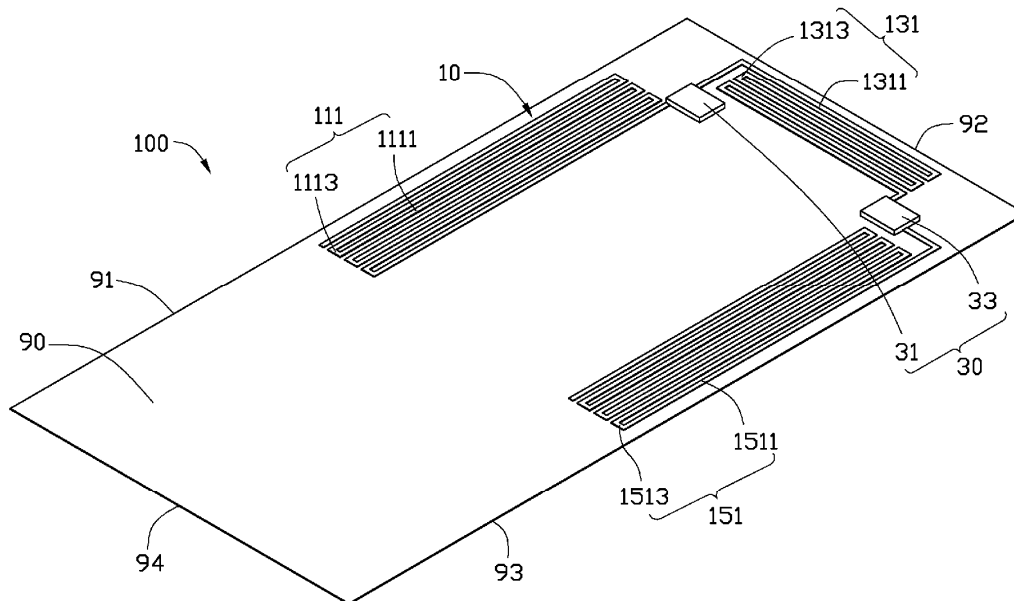
*Primary Examiner* — Sanh Phu

(74) *Attorney, Agent, or Firm* — Altis Law Group, Inc.

(57) **ABSTRACT**

An exemplary multiband antenna includes an antenna module and a switch module electrically connected to the antenna module. The antenna module includes a first antenna member, a second antenna member, and a third antenna member, which are mounted on a main board. The antenna module is electrically connected or disconnected by operating the switch module to form different antenna structures for receiving different wireless signals.

**18 Claims, 2 Drawing Sheets**





US008154459B2

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

(10) **Patent No.:** **US 8,154,459 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

- (54) **ANTENNA DEVICE HAVING MULTIPLE RESONANT FREQUENCIES AND RADIO APPARATUS**
- (75) Inventors: **Masao Teshima**, Tokyo (JP); **Hiroshi Shimasaki**, Tokyo (JP)
- (73) Assignee: **Kabushiki Kaisha Toshiba**, Tokyo (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 365 days.

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- (21) Appl. No.: **12/265,797**
- (22) Filed: **Nov. 6, 2008**
- (65) **Prior Publication Data**  
US 2009/0201210 A1 Aug. 13, 2009

*Primary Examiner* — Jacob Y Choi  
*Assistant Examiner* — Shawn Buchanan  
(74) *Attorney, Agent, or Firm* — Holtz, Holtz, Goodman & Chick, PC

- (30) **Foreign Application Priority Data**  
Feb. 12, 2008 (JP) ..... 2008-030961

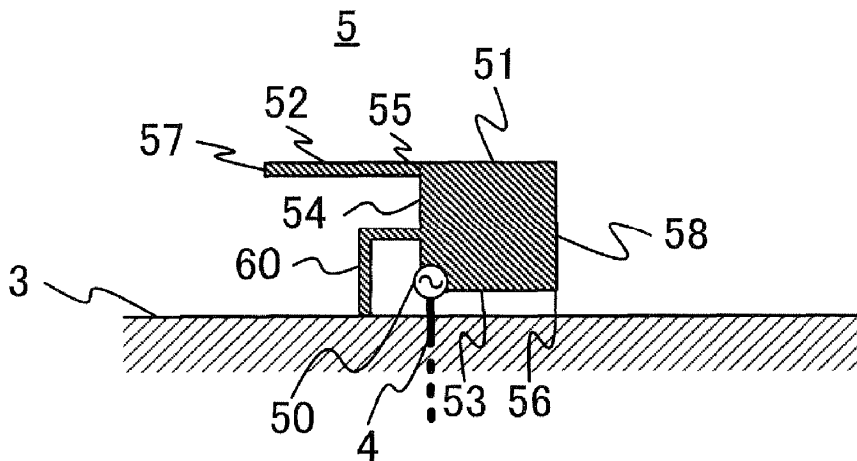
(57) **ABSTRACT**

An antenna device included in a radio apparatus having a printed board includes a ground conductor provided in the printed board, a first sub-element, a second sub-element and a short circuit element. The first sub-element is formed as an area having a first side and a second side crossing each other. The first side faces a side of the ground conductor. The first sub-element has a feed portion around a crossing of the first side and the second side. The second sub-element is formed to branch off from the first sub-element around an end of the second side being farther from the crossing, to be open-ended and to be directed at least partially in a direction opposite a direction from the crossing to an end of the first side opposite the crossing. The short circuit element short-circuits one of the first sub-element and the second sub-element with the ground conductor.

- (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, 729, 737, 913**  
See application file for complete search history.

- (56) **References Cited**  
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**9 Claims, 10 Drawing Sheets**





US008154460B2

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

(10) **Patent No.:** **US 8,154,460 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **WIRELESS COMMUNICATION APPARATUS WITH HOUSING CHANGING BETWEEN OPEN AND CLOSED STATES**

(75) Inventors: **Tsutomu Sakata**, Osaka (JP); **Atsushi Yamamoto**, Kyoto (JP); **Satoru Amari**, Osaka (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 495 days.

(21) Appl. No.: **12/504,980**

(22) Filed: **Jul. 17, 2009**

(65) **Prior Publication Data**

US 2010/0013720 A1 Jan. 21, 2010

(30) **Foreign Application Priority Data**

Jul. 18, 2008 (JP) ..... 2008-186859

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

(52) **U.S. Cl.** ..... 343/702; 343/745; 343/749; 343/750; 343/751; 343/752; 343/845; 343/846; 343/860; 343/861; 343/876

(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 729-730, 745, 749-752, 845-846, 343/850, 860-861, 876

See application file for complete search history.

(56) **References Cited**

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*Primary Examiner* — Jacob Y Choi

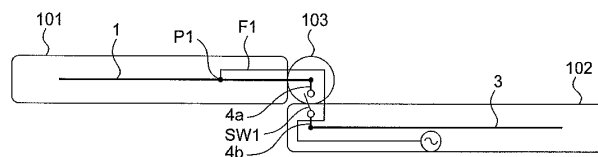
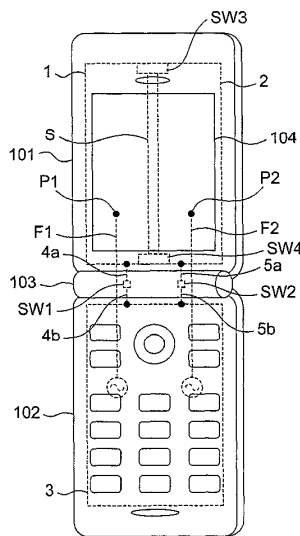
*Assistant Examiner* — Shawn Buchanan

(74) *Attorney, Agent, or Firm* — Wenderoth, Lind & Ponack, L.L.P.

(57) **ABSTRACT**

When first and second housings are in an open state, first and second switches are electrically opened, and thus, a first antenna element and a ground conductor operate as a first dipole antenna, and a second antenna element and the ground conductor operate as a second dipole antenna with isolation from the first dipole antenna by the slit. When the first and second housings are in the closed state, the first and second switches are electrically closed, and thus, the first antenna element operates as a first inverted F antenna on the ground conductor, and the second antenna element operates as a second inverted F antenna on the ground conductor with isolation from the first inverted F antenna by the slit.

**8 Claims, 27 Drawing Sheets**





US008154461B2

(12) **United States Patent  
Chang**

(10) **Patent No.: US 8,154,461 B2**  
(45) **Date of Patent: Apr. 10, 2012**

(54) **MULTI-DIRECTIONAL PANEL ANTENNA**

(75) Inventor: **Ming-Wen Chang**, Hong Kong (HK)

(73) Assignee: **San Wen (H.K.) International Co., Ltd.**, Kowloon (HK)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 426 days.

(21) Appl. No.: **12/512,051**

(22) Filed: **Jul. 30, 2009**

(65) **Prior Publication Data**

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(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, 860**

See application file for complete search history.

(56) **References Cited**

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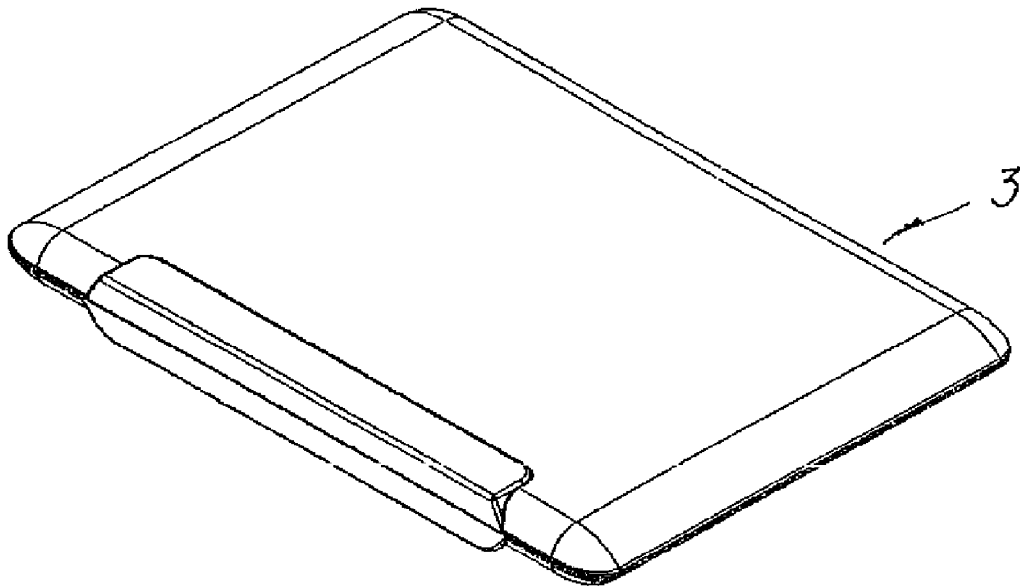
*Primary Examiner* — Tan Ho

(74) *Attorney, Agent, or Firm* — Leong C. Lei

(57) **ABSTRACT**

A multi-directional panel antenna is provided for the reception of TV broadcast VHF and UHF signals. The panel antenna's circuit board has its current path substantially covers the surface of the circuit board so as to produce multi-directional reception patterns. An iron-core winding is configured at a feed-in terminal of the panel antenna for impedance matching and signal concentration. The panel antenna also uses air to reduce dielectric loss. A MMIC signal amplification device is provided for enhanced gain. Ceramic capacitors are provided to increase the reception wavelength of the panel antenna so that it falls within a lower section of the VHF band.

**3 Claims, 7 Drawing Sheets**





US008154464B2

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

(10) **Patent No.:** **US 8,154,464 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **MAGNETIC MATERIAL ANTENNA AND FERRITE SINTERED BODY**

(75) Inventors: **Masayuki Gonda**, Saitama (JP); **Shigeo Fujii**, Saitama (JP); **Hiroyuki Aoyama**, Saitama (JP)

(73) Assignee: **Hitachi Metals, 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 548 days.

(21) Appl. No.: **12/308,661**

(22) PCT Filed: **Jun. 21, 2007**

(86) PCT No.: **PCT/JP2007/000666**

§ 371 (c)(1),  
(2), (4) Date: **Feb. 10, 2009**

(87) PCT Pub. No.: **WO2007/148438**

PCT Pub. Date: **Dec. 27, 2007**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jun. 21, 2006 (JP) ..... 2006-171429  
Jun. 8, 2007 (JP) ..... 2007-152229

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

(52) **U.S. Cl.** ..... **343/787**; 252/62.63

(58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 787, 788, 895; 252/62.6, 62.63,  
252/62.62

See application file for complete search history.

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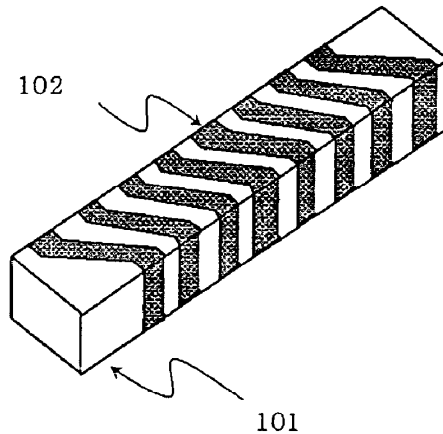
*Primary Examiner* — Michael C Wimer

(74) *Attorney, Agent, or Firm* — McGinn Intellectual Property Law Group, PLLC

(57) **ABSTRACT**

A magnetic material antenna using a ferrite sintered body comprising one or more conductors disposed at least on a surface or in internal portion of the ferrite sintered body, wherein the ferrite sintered body is a sintered body of Y-type ferrite containing BaO, CoO, and Fe<sub>2</sub>O<sub>3</sub> as main components and wherein the ferrite sintered body contains Cu and, in a cross section for the sintered body, an area rate of a cubic Co-rich phase, which has a ration of an amount of Co being higher than a Y-type ferrite phase being a mother phase, is 1% or less.

**20 Claims, 5 Drawing Sheets**





US008154467B2

(12) **United States Patent**  
**Mitsui**

(10) **Patent No.:** **US 8,154,467 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **ANTENNA APPARATUS AND WIRELESS COMMUNICATION TERMINAL**

(75) Inventor: **Tsutomu Mitsui**, Yokohama (JP)

(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 513 days.

(21) Appl. No.: **12/142,244**

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

(65) **Prior Publication Data**

US 2008/0316098 A1 Dec. 25, 2008

(30) **Foreign Application Priority Data**

Jun. 21, 2007 (JP) ..... 2007-163366

(51) **Int. Cl.**  
**H01Q 19/00** (2006.01)

(52) **U.S. Cl.** ..... **343/833; 343/817; 343/853; 343/757**

(58) **Field of Classification Search** ..... **343/700 MS, 343/817, 818, 841, 844, 853, 702, 757, 833, 343/834**

See application file for complete search history.

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*Primary Examiner* — Douglas W Owens

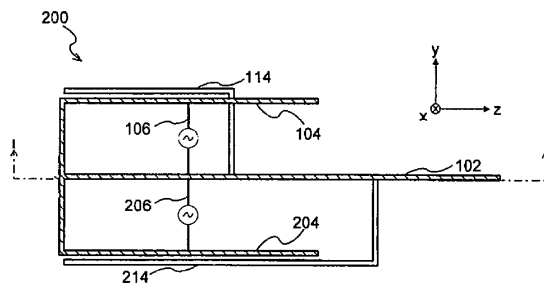
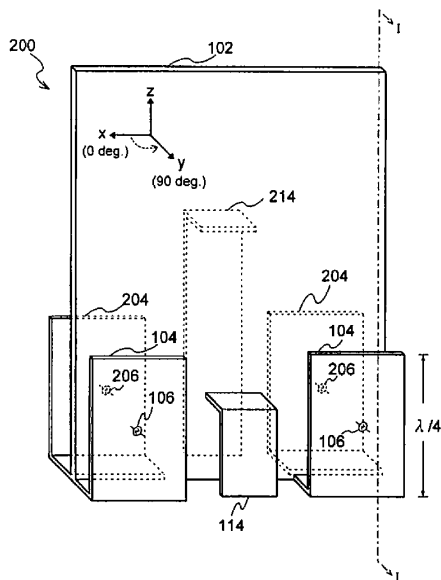
*Assistant Examiner* — Chuc D Tran

(74) *Attorney, Agent, or Firm* — Samsung Electronics Co., Ltd

(57) **ABSTRACT**

Disclosed is an antenna apparatus which can control directivity of a plurality of radiation elements using one parasitic element. The antenna apparatus includes two radiation elements arranged on a base parallel to each other, and a parasitic element disposed between the two radiation elements. Radiation directivity of the two radiation elements is controlled according to the length of the parasitic element. This configuration provides a small-sized antenna apparatus including a plurality of radiators with desired directivity.

**11 Claims, 7 Drawing Sheets**





US008154468B2

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

(10) **Patent No.:** **US 8,154,468 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **MULTI-BAND ANTENNA**

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

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 430 days.

(21) Appl. No.: **12/322,535**

(22) Filed: **Feb. 3, 2009**

(65) **Prior Publication Data**  
US 2009/0195473 A1 Aug. 6, 2009

(30) **Foreign Application Priority Data**  
Feb. 4, 2008 (TW) ..... 97104105 A

(51) **Int. Cl.**  
**H01Q 13/10** (2006.01)  
(52) **U.S. Cl.** ..... **343/846**  
(58) **Field of Classification Search** ..... 343/700 MS,  
343/846, 848, 702  
See application file for complete search history.

(56) **References Cited**

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*Primary Examiner* — Huedung Mancuso

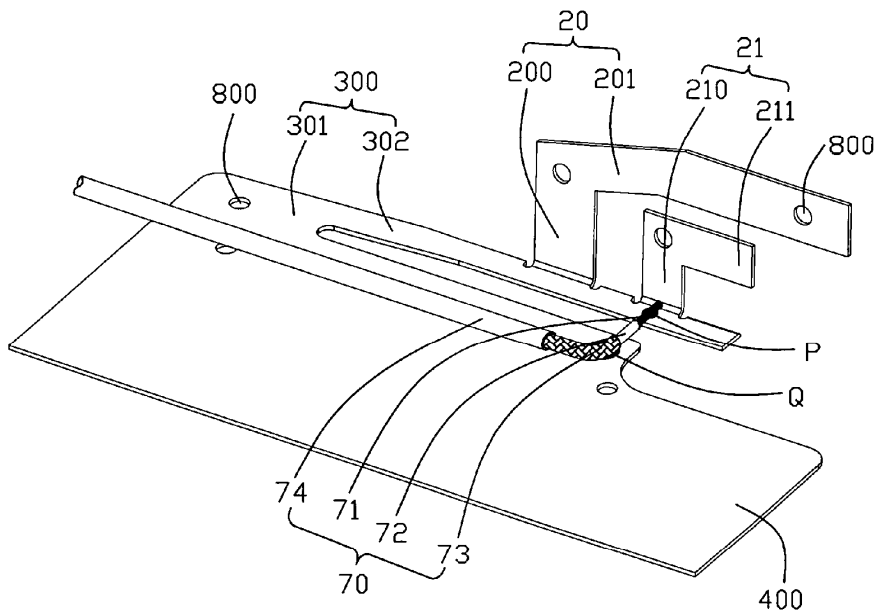
(74) *Attorney, Agent, or Firm* — Wei Te Chung; Andrew C. Cheng; Ming Chieh Chang

(57) **ABSTRACT**

A multi-band antenna includes a grounding element located on a first planar, a connecting element, a first radiating portion, and a second radiating portion. The connecting element is substantially of L-shape configuration and located on the first planar. The first radiating portion, with a free end, extends from connecting element. The second radiating portion, with a free end, extends from the connecting element and is separated from the first radiating element. The free end of the first radiating portion and the free end of the second radiating portion extend in the same direction.

**10 Claims, 3 Drawing Sheets**

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US008154470B2

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

(10) **Patent No.:** **US 8,154,470 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **ELECTRICAL CONNECTOR ASSEMBLY WITH ANTENNA FUNCTION**

(75) Inventors: **Jen-Jou Chang**, Tu-cheng (TW);  
**Yao-Pang Lu**, Tu-cheng (TW)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 729 days.

(21) Appl. No.: **12/231,520**

(22) Filed: **Sep. 2, 2008**

(65) **Prior Publication Data**  
US 2009/0079661 A1 Mar. 26, 2009

(30) **Foreign Application Priority Data**  
Sep. 3, 2007 (CN) ..... 2007 2 0046922 U

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

(52) **U.S. Cl.** ..... **343/906**; 343/700 MS; 343/841;  
439/916

(58) **Field of Classification Search** ..... 343/702,  
343/841, 906, 700 MS; 455/575.5; 439/916  
See application file for complete search history.

(56) **References Cited**

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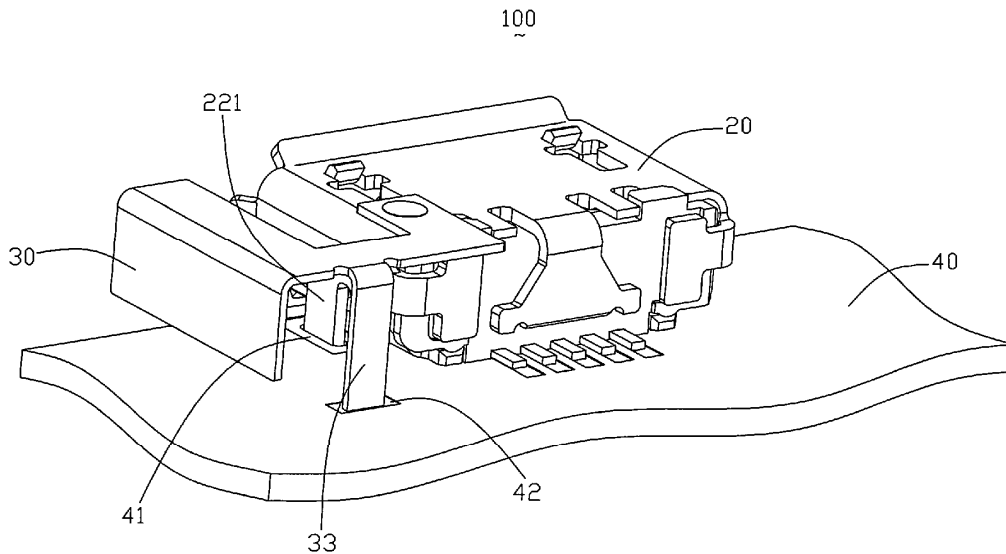
*Primary Examiner* — Dieu H Duong

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

(57) **ABSTRACT**

An electrical connector assembly (100) with antenna function comprising: an electrical connector (20) comprising a metal shell (21); a metal patch (30) connecting to the metal shell (20) and comprising a radiating element (32) and a connecting element (31); the connecting element connecting to the metal shell that serve as a grounding element; the radiating element, the connecting element, and the metal shell forming an antenna that serves as a medium for transmission and reception of electromagnetic signals.

**6 Claims, 4 Drawing Sheets**





US008155599B2

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

(10) **Patent No.:** **US 8,155,599 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **WIRELESS COMMUNICATION APPARATUS FOR SIMULTANEOUSLY PERFORMING MULTIPLE WIRELESS COMMUNICATIONS**

(75) Inventors: **Akira Kato**, Osaka (JP); **Hiroshi Iwai**, Osaka (JP); **Atsushi Yamamoto**, Kyoto (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 458 days.

(21) Appl. No.: **12/439,103**

(22) PCT Filed: **Sep. 11, 2007**

(86) PCT No.: **PCT/JP2007/067663**

§ 371 (c)(1),  
(2), (4) Date: **May 29, 2009**

(87) PCT Pub. No.: **WO2008/032710**

PCT Pub. Date: **Mar. 20, 2008**

(65) **Prior Publication Data**

US 2010/0022197 A1 Jan. 28, 2010

(30) **Foreign Application Priority Data**

Sep. 11, 2006 (JP) ..... 2006-245187

(51) **Int. Cl.**  
**H04B 1/40** (2006.01)

(52) **U.S. Cl.** ..... **455/75**; 455/11.1; 455/15; 455/20; 455/73; 455/101; 348/725; 725/81

(58) **Field of Classification Search** ..... 455/75, 455/11.1, 15, 17, 20-22, 73, 101, 150.1, 455/192.1, 193.1; 348/725, 726, 731, 732, 348/E5.108; 375/295, 316; 725/81, 64, 67, 725/68

See application file for complete search history.

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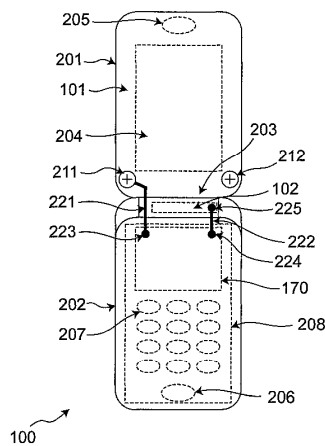
*Primary Examiner* — Shaima Q Aminzay

(74) *Attorney, Agent, or Firm* — Wenderoth, Lind & Ponack, L.L.P.

(57) **ABSTRACT**

A portable wireless communication apparatus is provided with antenna elements; a mobile phone signal processing circuit; a DTV tuner for receiving DTV low-band frequency signals and DTV high-band frequency signals; impedance matching circuits for the mobile phone signal processing circuit; and impedance matching circuits for the DTV tuner for receiving the DTV low-band frequency signals and DTV high-band frequency signals. A switch is changed to select either the DTV low-band frequency signals or the DTV high-band frequency signals, and output the selected signals to the DTV tuner. A tuner controller controls the switch to select the DTV high-band frequency signals by using the antenna element for transmission from the mobile phone signal processing circuit.

**7 Claims, 24 Drawing Sheets**





US008155607B2

(12) **United States Patent**  
**Kim**

(10) **Patent No.:** **US 8,155,607 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **ANTENNA APPARATUS OF PORTABLE TERMINAL**

(75) Inventor: **Hyung Rak Kim**, Seoul (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 350 days.

(21) Appl. No.: **12/429,010**

(22) Filed: **Apr. 23, 2009**

(65) **Prior Publication Data**

US 2009/0285262 A1 Nov. 19, 2009

(30) **Foreign Application Priority Data**

May 16, 2008 (KR) ..... 10-2008-0045327

(51) **Int. Cl.**  
**H04B 1/04** (2006.01)

(52) **U.S. Cl.** ..... **455/129; 455/575.7; 343/702**

(58) **Field of Classification Search** ..... 455/575.7,  
455/129, 121, 125; 343/702, 700, 829, 846  
See application file for complete search history.

(56) **References Cited**

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*Primary Examiner* — Lincoln Donovan

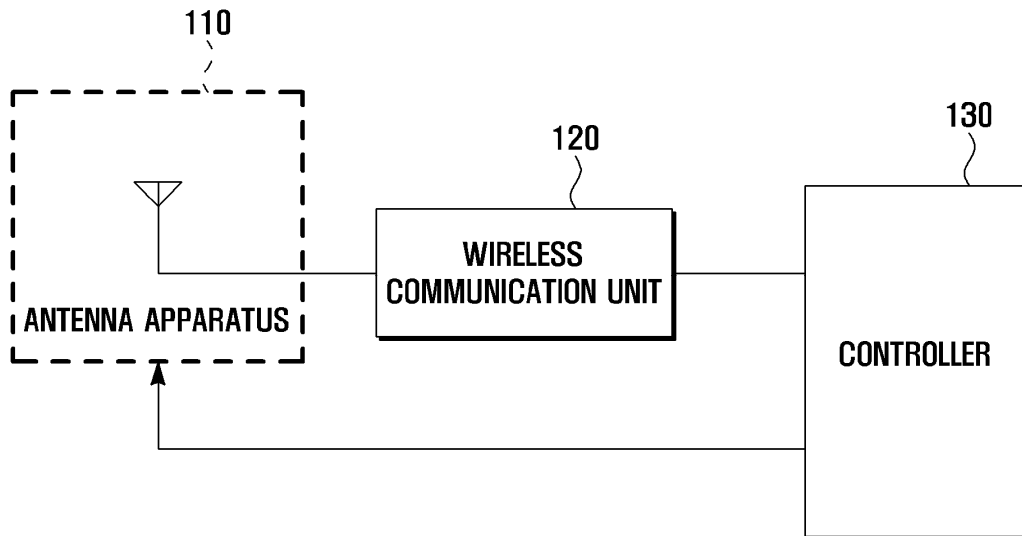
*Assistant Examiner* — Shikha Goyal

(74) *Attorney, Agent, or Firm* — Jefferson IP Law, LLP

(57) **ABSTRACT**

An antenna apparatus of a portable terminal and method for implementing characteristics of the antenna apparatus of the portable terminal are disclosed. The antenna apparatus includes a circuit board including a power feeder and a ground, a radiation unit, a power feeder connecting unit for electrically connecting the power feeder to the radiation unit and for feeding electric power to the radiation unit, and a ground connecting unit including at least two paths which have different lengths for electrically connecting the ground to and disconnecting the ground from the radiation unit selectively.

**11 Claims, 8 Drawing Sheets**





US008155616B2

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

(10) **Patent No.:** **US 8,155,616 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **REDUCTION OF NEAR FIELD  
ELECTRO-MAGNETIC SCATTERING USING  
HIGH IMPEDANCE METALLIZATION  
TERMINATIONS**

(75) Inventors: **James Gerard Hayes**, Wake Forest, NC  
(US); **Scott Ladell Vance**, Cary, NC  
(US)

(73) Assignee: **Sony 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 956 days.

(21) Appl. No.: **12/121,828**

(22) Filed: **May 16, 2008**

(65) **Prior Publication Data**  
US 2008/0214136 A1 Sep. 4, 2008

**Related U.S. Application Data**  
(62) Division of application No. 10/710,876, filed on Aug.  
10, 2004, now Pat. No. 7,376,408.

(51) **Int. Cl.**  
**H04B 1/10** (2006.01)  
**H01P 1/22** (2006.01)  
(52) **U.S. Cl.** ..... **455/300**; 333/12; 361/818  
(58) **Field of Classification Search** ..... 455/300,  
455/301; 361/760, 761, 763, 777, 816, 818;  
333/12, 167, 202  
See application file for complete search history.

(56) **References Cited**  
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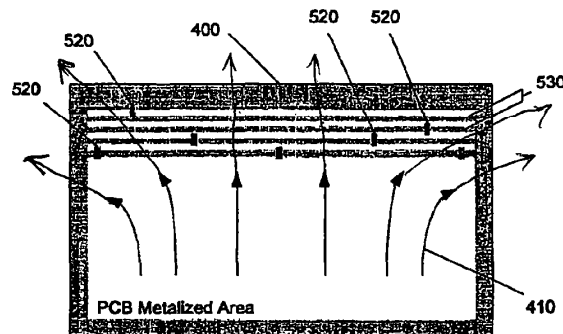
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*Primary Examiner* — Blane J Jackson  
(74) *Attorney, Agent, or Firm* — Sreenivas Vedantam;  
Moore & Van Allen, PLLC

(57) **ABSTRACT**

The present invention uses metallization termination techniques to reduce the electro-magnetic field scattering at the edges of metallized areas. The metallization termination techniques provide a gradual transition from high conductivity areas to high impedance areas. The mobile phone antenna illuminates the PCB allowing currents to flow on the PCB. When the currents reach edges of the PCB they flow through a region of increasingly high impedance without reflecting back or scattering.

**8 Claims, 3 Drawing Sheets**





US008155716B2

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

(10) **Patent No.:** **US 8,155,716 B2**  
(45) **Date of Patent:** **Apr. 10, 2012**

(54) **PORTABLE RADIO DEVICE**

(75) Inventors: **Takahiro Ochi**, Sendai (JP); **Hiroaki Kobayashi**, Sendai (JP); **Haruhiko Kakitsu**, Sendai (JP); **Kouta Aoki**, Yokohama (JP); **Shigeaki Sakurazawa**, Yokohama (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 83 days.

(21) Appl. No.: **12/681,367**

(22) PCT Filed: **Sep. 30, 2008**

(86) PCT No.: **PCT/JP2008/002742**  
§ 371 (c)(1),  
(2), (4) Date: **Apr. 1, 2010**

(87) PCT Pub. No.: **WO2009/057246**  
PCT Pub. Date: **May 7, 2009**

(65) **Prior Publication Data**  
US 2010/0216529 A1 Aug. 26, 2010

(30) **Foreign Application Priority Data**  
Oct. 31, 2007 (JP) ..... 2007-284174

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

(52) **U.S. Cl.** ..... **455/575.3; 455/575.1; 455/575.7; 455/550.1; 455/566**

(58) **Field of Classification Search** ..... **455/575.3, 455/575.1, 575.7, 550.1, 566**  
See application file for complete search history.

(56) **References Cited**

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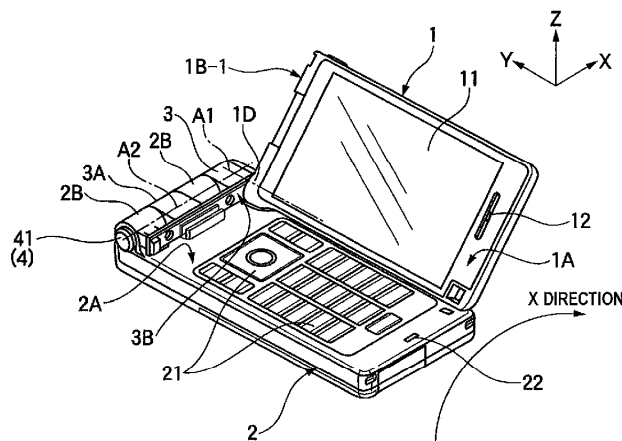
*Primary Examiner* — Kwasi Karikari

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

(57) **ABSTRACT**

A portable radio device of a type having two-direction openable and closable enclosures that can effectively lessen influence on an antenna exerted by a hinge section is provided. A horizontal hinge section **5** for rotatably joining an upper enclosure **1** to a hinge enclosure **3** around a first shaft center includes a horizontal hinge anchor **52** electrically connected to a first metal part **13** disposed in the upper enclosure **1**, a horizontal hinge plate **53** that is placed in the hinge enclosure **3** and that contains a conductive material, and a first hinge shaft **51** that electrically connects the horizontal hinge anchor **52** to the horizontal hinge plate **53** and that contains a conductive material interposed between an area from a substantial center to an end of a long side of a face along which the upper enclosure **1** and the hinge enclosure **3** face a direction of second shaft center (X). An electrical path length of the lateral hinge section **5** including the lateral hinge plate **53** and the first hinge shaft **51** corresponds to a predetermined value that is not a substantially constant multiple of  $\lambda/8$ .

**3 Claims, 6 Drawing Sheets**





US008155721B2

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

(10) **Patent No.:** **US 8,155,721 B2**  
(45) **Date of Patent:** **\*Apr. 10, 2012**

(54) **METHOD AND DEVICE FOR REDUCING UNDESIRABLE ELECTROMAGNETIC RADIATION**

484,976 A 7/1989 Marko  
(Continued)

(75) Inventors: **Steven C Shanks**, McKinney, TX (US);  
**Kevin B Tucek**, McKinney, TX (US);  
**George Leger**, Mesa, AZ (US)

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(73) Assignee: **Erchonia Corporation**, McKinney, TX (US)

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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 394 days.

European Patent Office, Extended Search Report, Apr. 1, 2010, Munich, Germany.

This patent is subject to a terminal disclaimer.

(Continued)

(21) Appl. No.: **12/455,731**

*Primary Examiner* — Tuan H Nguyen

(22) Filed: **Jun. 4, 2009**

(74) *Attorney, Agent, or Firm* — Etherton Law Group, LLC; Benjamin D. Tietgen; Sandra L. Etherton

(65) **Prior Publication Data**

US 2009/0253397 A1 Oct. 8, 2009

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 10/756,659, filed on Jan. 12, 2004, now abandoned, and a continuation-in-part of application No. 11/487,045, filed on Jul. 14, 2006, now abandoned, and a continuation-in-part of application No. 12/215,231, filed on Jun. 26, 2008, now Pat. No. 7,800,554.

(57) **ABSTRACT**

The present invention is a method and device for reducing exposure to undesirable electromagnetic radiation. The dissipation device uses a varying angle antenna design to capture radiation from an active emission source, such as a cellular telephone when it is transmitting. The device converts the captured radiation into an electric current and dissipates the collected current by spending it to operate a thermal, mechanical, or electrical device. The varying angle antenna is a printed circuit board trace antenna comprising a microstrip having several serially connected meandering segments. One or more meandering segments include 90-degree bends in the microstrip, and one or more meandering segments include bends of more and less than 90 degrees. Portions of the microstrip that are horizontally oriented are all parallel, while portions of the microstrip that are vertically oriented can be parallel or angled, depending on the bend angle. Additionally, near the center of the varying angle antenna, the microstrip segments are narrower than the microstrip segments near the ends of the antenna. In general, the meandering segments include varying angles, which maximizes the operation of the antenna for absorbing undesirable electromagnetic radiation from cellular telephones.

(51) **Int. Cl.**

**H04M 1/00** (2006.01)

(52) **U.S. Cl.** ..... **455/575.5**; 455/575.1; 455/575.6; 343/702; 343/841

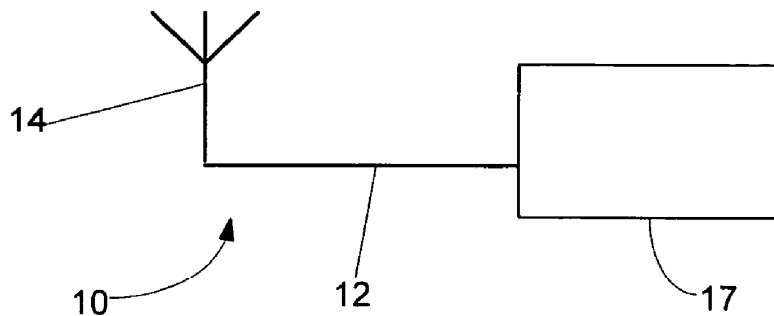
(58) **Field of Classification Search** ..... 455/550.1, 455/575.5, 575.6; 343/702, 841, 895  
See application file for complete search history.

(56) **References Cited**

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**8 Claims, 5 Drawing Sheets**





US008159400B2

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

(10) **Patent No.:** **US 8,159,400 B2**  
(45) **Date of Patent:** **\*Apr. 17, 2012**

(54) **CHIP ANTENNA AND MOBILE-COMMUNICATION TERMINAL HAVING THE SAME**

(75) Inventors: **Chang Mok Han**, Chungcheongnam-Do (KR); **Ki Won Chang**, Gyeonggi-Do (KR); **Duk Woo Lee**, Gyeonggi-Do (KR); **Dae Kyu Lee**, Gyeonggi-Do (KR); **Jeong Sik Seo**, Gyeonggi-Do (KR); **Hyun Do Park**, Gyeonggi-Do (KR)

(73) Assignee: **Samsung Electro-Mechanics Co., Ltd.**, Gyeonggi-do (KR)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 635 days.  
This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/170,999**

(22) Filed: **Jul. 10, 2008**

(65) **Prior Publication Data**  
US 2009/0015486 A1 Jan. 15, 2009

(30) **Foreign Application Priority Data**  
Jul. 12, 2007 (KR) ..... 10-2007-0070046

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

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 846, 860  
See application file for complete search history.

(56) **References Cited**

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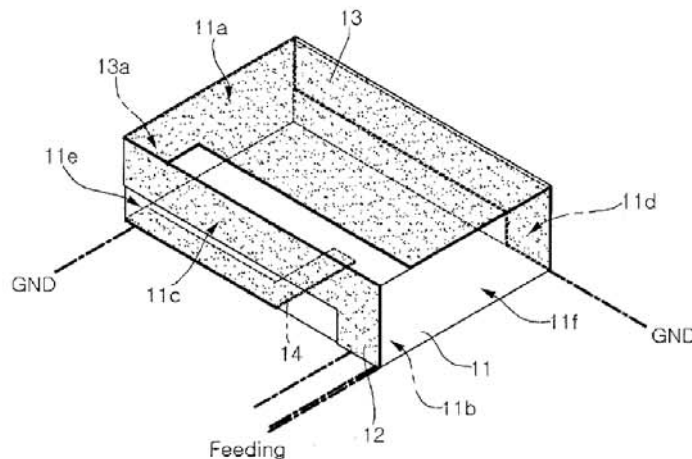
*Primary Examiner* — Michael C Wimer

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

(57) **ABSTRACT**

There are provided a chip antenna and a mobile telecommunication terminal having the chip antenna. The chip antenna includes: a dielectric block having opposing top and bottom surfaces and a plurality of side surfaces connecting the top and bottom surfaces; a first conductive pattern formed on at least one of the surfaces of the dielectric block and connected to an external feeding part; a second conductive pattern formed on at least one of the surfaces of the dielectric block to connect to the first conductive pattern, and having one end connected to an external ground part; and a third conductive pattern formed on at least one of the surfaces of the dielectric block, and spaced apart from the first and second conductive patterns, respectively, the third conductive pattern having a lower end connected to the external ground part.

**22 Claims, 5 Drawing Sheets**





US008160658B2

(12) **United States Patent**  
**Hirai**

(10) **Patent No.:** **US 8,160,658 B2**  
(45) **Date of Patent:** **Apr. 17, 2012**

- (54) **CELLULAR PHONE**
- (75) Inventor: **Yuu Hirai**, Osaka (JP)
- (73) Assignee: **KYOCERA Corporation**, Kyoto (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 263 days.

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- (21) Appl. No.: **12/446,739**
- (22) PCT Filed: **Oct. 26, 2007**
- (86) PCT No.: **PCT/JP2007/070889**  
§ 371 (c)(1),  
(2), (4) Date: **Apr. 22, 2009**
- (87) PCT Pub. No.: **WO2008/050854**  
PCT Pub. Date: **May 2, 2008**

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*Primary Examiner* — Dwayne Bost

*Assistant Examiner* — Inder Mehra

(74) *Attorney, Agent, or Firm* — Procopio, Cory, Hargreaves & Savitch LLP

- (65) **Prior Publication Data**  
US 2009/0270146 A1 Oct. 29, 2009

- (30) **Foreign Application Priority Data**  
Oct. 26, 2006 (JP) ..... 2006-291723

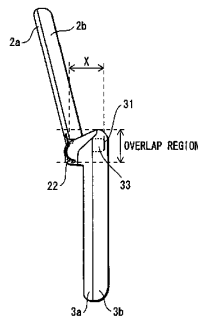
(57) **ABSTRACT**

To aim to provide a mobile telephone capable of reducing a physical space necessary for providing a reflector compared with that in conventional mobile telephones, and reducing the SAR by securing a distance between an antenna and a passive element operating as a reflector. A cabinet of a top housing 2 includes a passive element 22 in an overlap region overlapping between the top housing 2 and the bottom housing 3 in an unfolded state, and the bottom housing includes an antenna in the overlap region. This can suppress the thickness of the mobile telephone in a folded state and secure a distance between the antenna 31 and the passive element 22 operating as a reflector.

- (51) **Int. Cl.**  
**H04M 1/00** (2006.01)
- (52) **U.S. Cl.** ..... **455/575.3**; 455/575.5; 455/575.6; 455/575.7
- (58) **Field of Classification Search** ..... 455/575.1, 455/574, 575.7, 575.3, 575.5, 575.6  
See application file for complete search history.

- (56) **References Cited**  
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**9 Claims, 5 Drawing Sheets**







US008164523B2

(12) **United States Patent**  
**Betts-LaCroix**

(10) **Patent No.:** **US 8,164,523 B2**  
(45) **Date of Patent:** **Apr. 24, 2012**

(54) **COMPACT ANTENNA**

(75) Inventor: **Jonathan Betts-LaCroix**, San Mateo, CA (US)  
(73) Assignee: **Google Inc.**, Mountain View, CA (US)  
(\* ) 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.: **12/436,428**

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

(65) **Prior Publication Data**  
US 2011/0057841 A1 Mar. 10, 2011

**Related U.S. Application Data**  
(60) Provisional application No. 61/050,642, filed on May 6, 2008.

(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, 829, 846**

See application file for complete search history.

(56) **References Cited**

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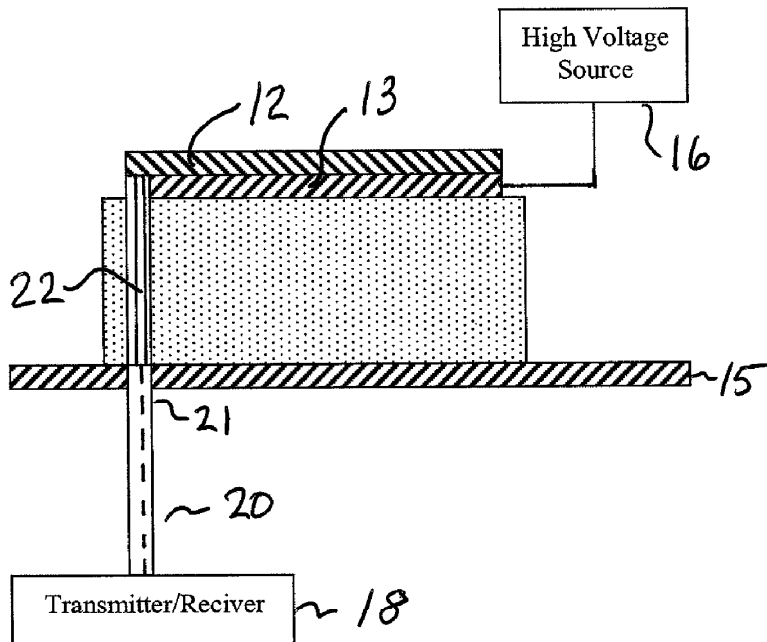
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*Primary Examiner* — Tho G Phan  
(74) *Attorney, Agent, or Firm* — Morris & Kamlay LLP

(57) **ABSTRACT**

An antenna 1 for a hand held or small radio communication device such as a cellular radio handset, laptop computer or hand held computer, or GPS device. The antenna has a resonating element 12 over a ceramic material 14, comprised of a high dielectric ceramic, such as barium strontium titanate, for example. The ceramic 14 is in contact with a ground plane 15 such as a grounded metal plate or grounded thin film that is formed on a substrate, such as an FR4 PCB substrate. The ceramic 14 is biased by a voltage source applied through an electrode plate 13 that is connected to a high voltage source 16 with respect to ground plate 15. The voltage applied through the conductor or electrode 13 is controlled to provide a predetermined bias voltage that changes the electrostatic field of the ceramic 14.

**13 Claims, 2 Drawing Sheets**





US008164524B2

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

(10) **Patent No.:** **US 8,164,524 B2**  
(45) **Date of Patent:** **Apr. 24, 2012**

- (54) **BUILT-IN STRAIGHT MOBILE ANTENNA TYPE DUAL BAND ANTENNA ASSEMBLY WITH IMPROVED HAC PERFORMANCE**
- (75) Inventors: **Chia-Lun Tang**, Pa-Te (TW); **Yan-Wen Zhao**, Chengdu (CN); **Jianliang Shen**, Chengdu (CN); **Danial Chang**, Pa-Te (TW)
- (73) Assignee: **Auden Techno Corp.**, Pa-Te, Tao-Yuan Hsien (TW)
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 381 days.

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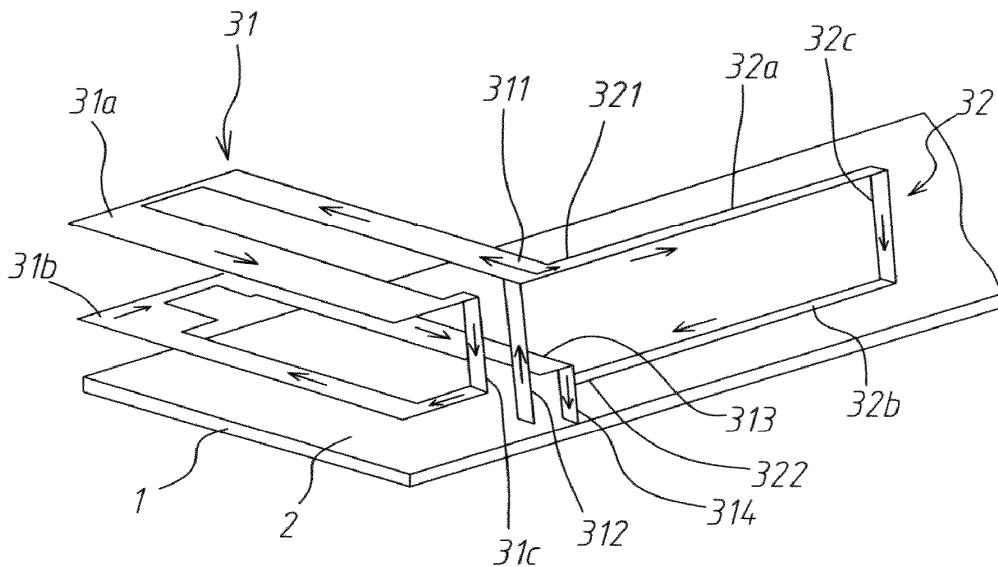
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*Primary Examiner* — Tan Ho  
(74) *Attorney, Agent, or Firm* — Guice Patents PLLC

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- (22) Filed: **Jul. 27, 2009**
- (65) **Prior Publication Data**  
US 2011/0018770 A1 Jan. 27, 2011
- (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.

(57) **ABSTRACT**  
A built-in straight mobile antenna type dual band antenna assembly includes a circuit board, a first radiator transversely arranged on one end of the circuit board and having a first resonance frequency, and a second radiator longitudinally arranged on one lateral side of the circuit board. The first radiator and the second radiator constitute an L-shaped structure for signal input through a feed end, and are connected to a ground plane on the circuit board through a common grounding lug.

**8 Claims, 7 Drawing Sheets**  
**(1 of 7 Drawing Sheet(s) Filed in Color)**





US008164525B2

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

(10) **Patent No.:** **US 8,164,525 B2**  
(45) **Date of Patent:** **Apr. 24, 2012**

(54) **MIMO ANTENNA AND COMMUNICATION DEVICE USING THE SAME**

(75) Inventors: **Se-hyun Park**, Gyeonggi-do (KR);  
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**Byung-tae Yoon**, Gyeonggi-do (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 822 days.

(21) Appl. No.: **12/112,033**

(22) Filed: **Apr. 30, 2008**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Oct. 17, 2007 (KR) ..... 10-2007-0104549

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

(52) **U.S. Cl.** ..... **343/702; 343/700 MS; 343/876**

(58) **Field of Classification Search** ..... **343/702, 343/853, 876, 700 MS**

See application file for complete search history.

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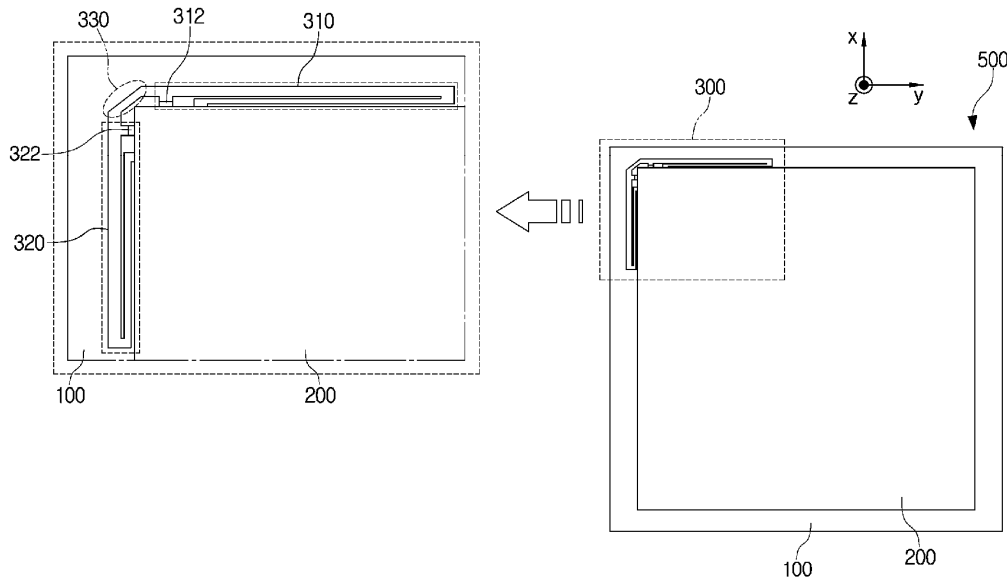
*Primary Examiner* — Tho G Phan

(74) *Attorney, Agent, or Firm* — NSIP Law

(57) **ABSTRACT**

A multiple-input multiple-output (MIMO) antenna and an antenna system using the same are provided. The MIMO antenna includes a plurality of antenna elements in which a feeding unit is formed at one end, and another end is connected to a ground, and a connection unit which connects the antenna elements.

**24 Claims, 4 Drawing Sheets**





US008164526B1

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

(10) **Patent No.:** **US 8,164,526 B1**  
(45) **Date of Patent:** **Apr. 24, 2012**

- (54) **SINGLE WIRE INTERNAL ANTENNA WITH INTEGRAL CONTACT FORCE SPRING**
- (75) Inventors: **Janne Aula**, Oulu (FI); **Mika Piisila**, Kempele (FI); **Mikko Ojala**, Oulu (FI)
- (73) Assignee: **Flextronics AP, LLC**, Broomfield, CO (US)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 820 days.
- (21) Appl. No.: **12/290,846**
- (22) Filed: **Nov. 3, 2008**  
(Under 37 CFR 1.47)
- (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* — Hoang V Nguyen

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

(57) **ABSTRACT**

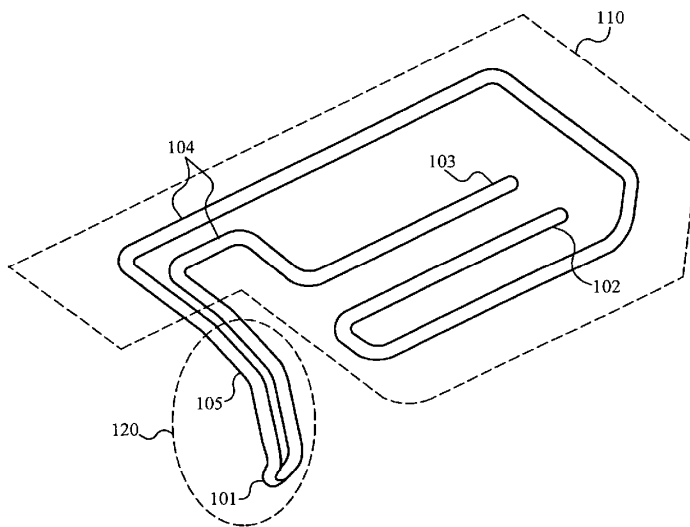
Some embodiments of the present invention are internal antennae for mobile devices. For example, an internal antenna for a mobile device that is a continuous length of wire formed into a collection of antenna features. Other embodiments relate to methods of manufacturing internal antennae for mobile devices; for example, manufacturing an internal antenna for a mobile device from a continuous length of wire. Still other embodiments relate to an iterative antenna production and re-design cycle. Preferably, antennae consistent with some embodiments of the invention include multiple radiator portions, a contact region, and integral configured to form a torsion spring of the contact region and parts of the radiator portions that reacts against displacement of the contact region toward those parts of the radiator portions.

**22 Claims, 7 Drawing Sheets**

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US008164537B2

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

(10) **Patent No.:** **US 8,164,537 B2**  
(45) **Date of Patent:** **Apr. 24, 2012**

(54) **MULTIBAND FOLDED DIPOLE TRANSMISSION LINE ANTENNA**

(75) Inventors: **Christos L. Kinezos**, Sunrise, FL (US);  
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**Lorenzo A. Ponce De Leon**, Lake Worth, FL (US)

(73) Assignee: **Mororola Mobility, Inc.**, Libertyville, IL (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 457 days.

(21) Appl. No.: **12/437,448**

(22) Filed: **May 7, 2009**

(65) **Prior Publication Data**

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

(52) **U.S. Cl.** ..... **343/803; 343/702; 343/742**

(58) **Field of Classification Search** ..... **343/700 MS, 343/702, 742, 803**

See application file for complete search history.

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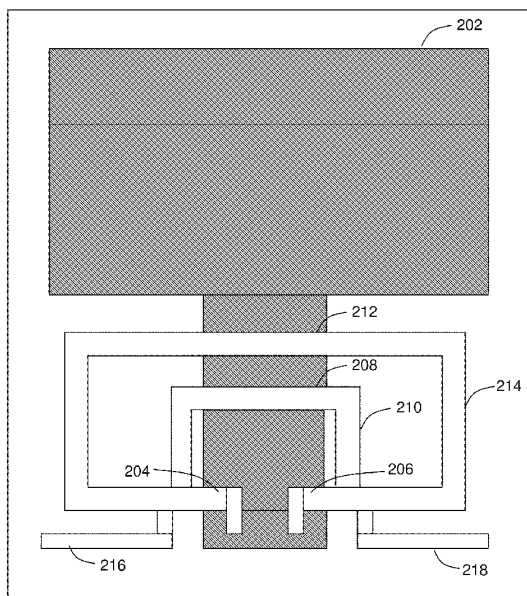
*Primary Examiner* — Tho G Phan

(74) *Attorney, Agent, or Firm* — Pablo Meles; Sylvia Chen

(57) **ABSTRACT**

A multiband folded dipole transmission line antenna (**300, 400, 500**) including a plurality of concentric-like loops (**210, 214, 508**) where each loop comprises at least one transmission line element (**204, 206**) and at least a pair of folded dipole antenna elements (**302, 304**), a first connection point and a second connection point shared among the plurality of concentric-like loops, and a first inverted L antenna element (**216**) coupled to the first connection point and a second inverted L antenna element (**218**) coupled to the second connection point. Additional embodiments are disclosed.

**21 Claims, 4 Drawing Sheets**



**200**



US008164538B2

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

(10) **Patent No.:** **US 8,164,538 B2**  
(45) **Date of Patent:** **\*Apr. 24, 2012**

(54) **MULTIMODE ANTENNA STRUCTURE**

(75) Inventors: **Mark T. Montgomery**, Melbourne Beach, FL (US); **Frank M. Caimi**, Vero Beach, FL (US); **Mark W. Kishler**, Rockledge, FL (US)

(73) Assignee: **SkyCross, Inc.**, Viera, FL (US)

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/750,196**

(22) Filed: **Mar. 30, 2010**

(65) **Prior Publication Data**

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**Related U.S. Application Data**

(63) Continuation of application No. 12/099,320, filed on Apr. 8, 2008, now Pat. No. 7,688,273, which is a continuation-in-part of application No. 11/769,565, filed on Jun. 27, 2007, now Pat. No. 7,688,275.

(60) Provisional application No. 60/925,394, filed on Apr. 20, 2007, provisional application No. 60/916,655, filed on May 8, 2007.

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

(52) **U.S. Cl.** ..... **343/820; 343/844; 343/850; 455/552.1**

(58) **Field of Classification Search** ..... **343/820, 343/822, 844, 850, 860, 893; 455/552.1, 455/553.1**

See application file for complete search history.

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*Primary Examiner* — Tho G Phan

(74) *Attorney, Agent, or Firm* — Rajesh Vallabh; Foley Hoag LLP

(57) **ABSTRACT**

One or more embodiments are directed to a multimode antenna structure for transmitting and receiving electromagnetic signals in a communications device. The communications device includes circuitry for processing signals communicated to and from the antenna structure. The antenna structure is configured for optimal operation in a given frequency range. The antenna structure includes a plurality of antenna ports operatively coupled to the circuitry, and a plurality of antenna elements, each operatively coupled to a different one of the antenna ports. Each of the plurality of antenna elements is configured to have an electrical length selected to provide optimal operation within the given frequency range. The antenna structure also includes one or more connecting elements electrically connecting the antenna elements such that electrical currents on one antenna element flow to a connected neighboring antenna element and generally bypass the antenna port coupled to the neighboring antenna element. The electrical currents flowing through the one antenna element and the neighboring antenna element are generally equal in magnitude, such that an antenna mode excited by one antenna port is generally electrically isolated from a mode excited by another antenna port at a given desired signal frequency range without the use of a decoupling network connected to the antenna ports, and the antenna structure generates diverse antenna patterns.

**22 Claims, 67 Drawing Sheets**

