



US008471768B2

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

(10) **Patent No.:** **US 8,471,768 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

(54) **METHOD AND APPARATUS FOR AN ANTENNA**
(75) Inventors: **Hanyang Wang**, Abingdon (GB); **Pekka Halme**, Espoo (FI); **Michael Holland**, Fleet (GB); **Ali Mehmed**, London (GB); **Ming Zheng**, Farnborough (GB); **Alan Johnson**, Frimley (GB); **Weiwen Liu**, Woking (GB); **Catherine Islip**, Farnborough (GB); **Niels B. Larsen**, Kgs Lyngby (DK)

(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 745 days.

(21) Appl. No.: **12/655,134**

(22) Filed: **Dec. 22, 2009**

(65) **Prior Publication Data**

US 2011/0148718 A1 Jun. 23, 2011

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 7/00 (2006.01)

(52) **U.S. Cl.**
USPC **343/700 MS: 343/702; 343/745; 343/866**

(58) **Field of Classification Search**
USPC **343/700 MS, 702, 741, 744, 745, 343/749, 866**
See application file for complete search history.

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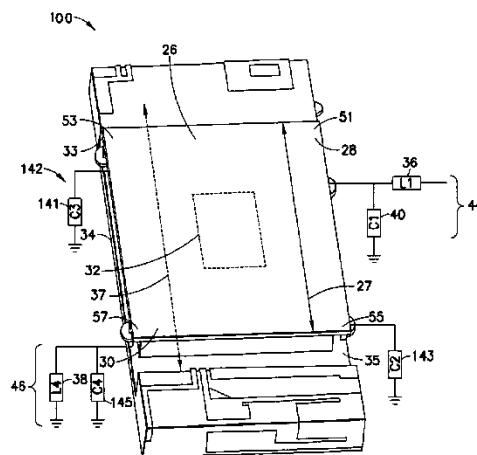
Primary Examiner — Tan Ilo

(74) *Attorney, Agent, or Firm* — Harrington & Smith

(57) **ABSTRACT**

In accordance with one example embodiment of the present invention an apparatus is disclosed. The apparatus includes a cover, a ground plane, a first inductor, and a second inductor. The cover includes a first end and an opposite second end. The cover is configured to operate as a first loop radiator portion. The ground plane is proximate the cover. The ground plane is configured to operate as a second loop radiator portion. The first inductor is proximate the first end of the cover. The second inductor is between the second end of the cover and the ground plane. The cover, the ground plane, the first inductor, and the second inductor are configured to provide a loop radiator.

18 Claims, 11 Drawing Sheets





US008471769B2

(12) **United States Patent**
Wolf

(10) **Patent No.:** **US 8,471,769 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

(54) **ANTENNA HAVING PLANAR CONDUCTING ELEMENTS, ONE OF WHICH HAS A PLURALITY OF ELECTROMAGNETIC RADIATORS AND AN OPEN SLOT**

(75) Inventor: **Forrest D. Wolf**, Reno, NV (US)

(73) Assignee: **Pinyon Technologies, Inc.**, Reno, NV (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 305 days.

(21) Appl. No.: **12/938,375**

(22) Filed: **Nov. 2, 2010**

(65) **Prior Publication Data**
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Related U.S. Application Data
(63) Continuation-in-part of application No. 12/777,103, filed on May 10, 2010.

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

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

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

(56) **References Cited**

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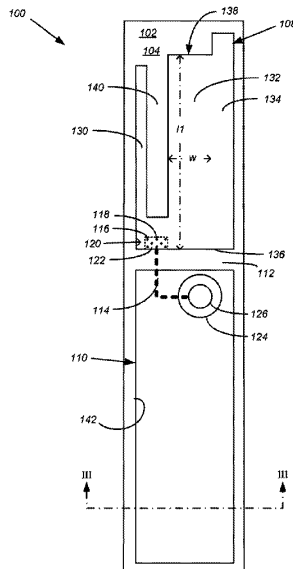
Primary Examiner — Hoang V Nguyen

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

(57) **ABSTRACT**

An antenna includes a dielectric material having i) a first side opposite a second side, and ii) a conductive via therein. A first planar conducting element is on the first side of the dielectric material and has an electrical connection to the conductive via. A second planar conducting element is also on the first side of the dielectric material. A gap electrically isolates the first and second planar conducting elements from each other. An electrical microstrip feed line on the second side of the dielectric material electrically connects to the conductive via and has a route that extends from the conductive via, to across the gap, to under the second planar conducting element. The first planar conducting element has a plurality of electromagnetic radiators, each having dimensions that cause it to resonate over a range of frequencies that differs from a range of frequencies over which an adjacent radiator resonates. At least first and second of the radiators bound an open slot in the first planar conducting element.

31 Claims, 10 Drawing Sheets





US008471770B2

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

(10) **Patent No.:** **US 8,471,770 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

(54) **ANTENNA AND A METHOD OF MANUFACTURING**

(75) Inventors: **Yugang Ma**, Singapore Science Park II (SG); **Kenichi Kawasaki**, Tokyo (JP)

(73) Assignee: **Sony Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 346 days.

(21) Appl. No.: **12/938,709**

(22) Filed: **Nov. 3, 2010**

(65) **Prior Publication Data**
US 2011/0122047 A1 May 26, 2011

(30) **Foreign Application Priority Data**
Nov. 25, 2009 (SG) 200907908-8

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
(52) **U.S. Cl.**
USPC **343/700 MS; 343/702**
(58) **Field of Classification Search**
USPC **343/700 MS, 702, 907**
See application file for complete search history.

(56) **References Cited**

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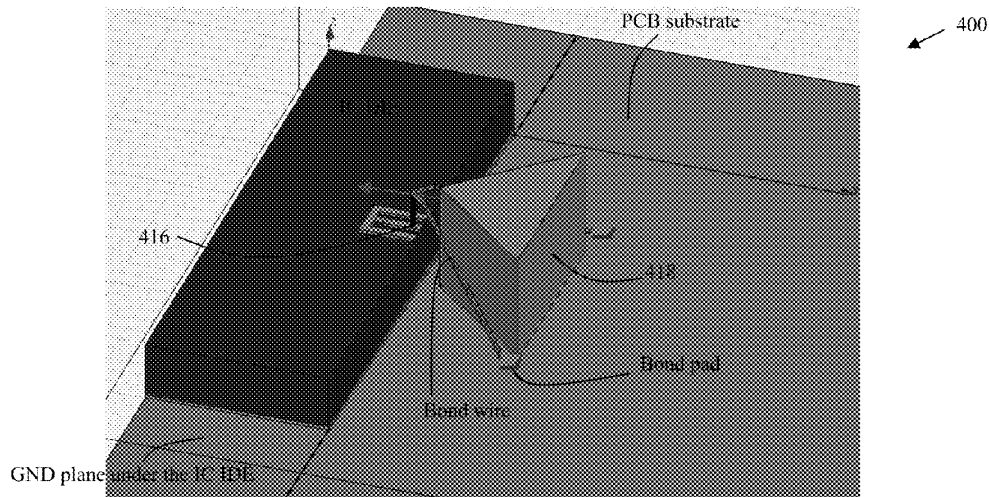
Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Sony Corporation

(57) **ABSTRACT**

A method of manufacturing an antenna comprising: providing a millimeter wave (MMW) antenna attached to a signal pad on an integrated circuit mounted on a substrate, and adjusting one or more parameters of the antenna to conform to predetermined desired thresholds, levels or ranges, wherein the adjustment is selected from the group consisting of: locating a conducting or dielectric object at a desired tuner location in proximity to the antenna to tune the central signal frequency, locating a conducting reflector at a desired reflector location in proximity to the antenna to tune the radiation direction or pattern, and selecting a conducting patch or object as a radiator/detector element to modify the bandwidth. Also a millimeter wave (MMW) antenna.

21 Claims, 25 Drawing Sheets





US008471771B2

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

(10) **Patent No.:** US 8,471,771 B2
(45) **Date of Patent:** Jun. 25, 2013

(54) **DUAL-BAND ANTENNA**

(56) **References Cited**

(75) Inventors: **Jia-hung Su**, Tu Cheng (TW); **Kai Shih**,
Tu Cheng (TW)

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8,013,796 B2 * 9/2011 Liu et al. 343/702

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

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 438 days.

Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Cheng-Ju Chiang

(21) Appl. No.: **12/950,879**

(57) **ABSTRACT**

(22) Filed: **Nov. 19, 2010**

A dual-band antenna is provided and has a feed base portion,
a low-frequency radiation portion and a high-frequency
radiation portion. A first end of the feed base portion is bent
and extended to form the low-frequency radiation portion
which has a first transverse portion, a first longitudinal por-
tion, a second transverse portion, a second longitudinal por-
tion and a third transverse portion. A second end of the feed
base portion is bent and extended to form the high-frequency
radiation portion which has a third longitudinal portion, a
fourth transverse portion and a fourth longitudinal portion.
The feed base portion is further bent and extended to form a
feed end. The dual-band antenna of the present invention has
a roundabout bent structure, so that the dual-band antenna has
a better effect for transmitting and receiving electro-magnetic
signals of two frequency bands of 900 MHz and 1800 MHz.

(65) **Prior Publication Data**

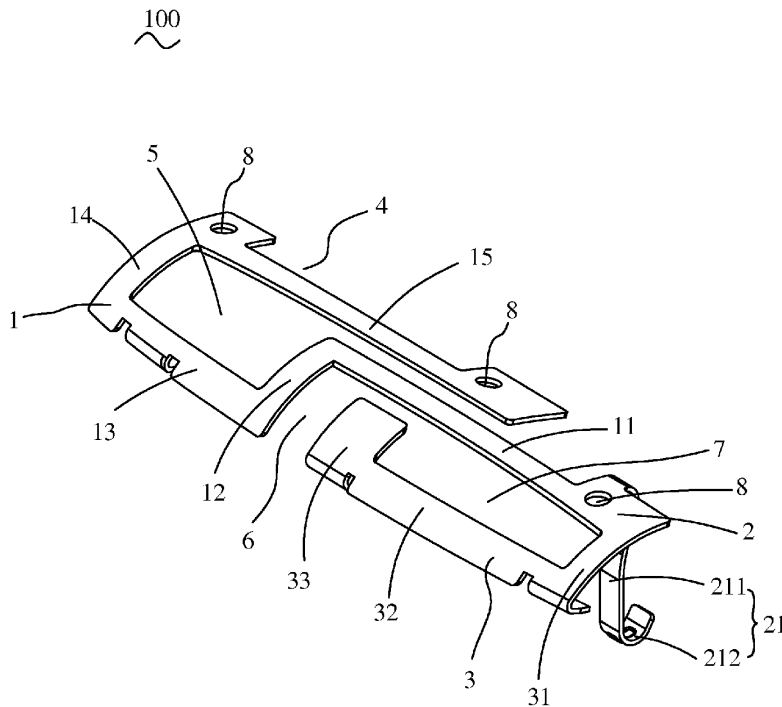
US 2012/0127059 A1 May 24, 2012

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

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

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

7 Claims, 2 Drawing Sheets





US008471777B2

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

(10) **Patent No.:** **US 8,471,777 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

(54) **ANTENNA APPARATUS**

(75) Inventors: **Junn Yi Lin**, Hsinchu County (TW); **Xin Chang Chen**, Hsinchu County (TW)

(73) Assignee: **Ralink Technology Corporation**, Jhubei, Hsinchu County (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 310 days.

(21) Appl. No.: **12/906,400**

(22) Filed: **Oct. 18, 2010**

(65) **Prior Publication Data**
US 2011/0102288 A1 May 5, 2011

(30) **Foreign Application Priority Data**
Nov. 2, 2009 (TW) 98137065 A

(51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/24 (2006.01)

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

(58) **Field of Classification Search**
USPC 343/702, 700 MS, 841, 795
See application file for complete search history.

(56) **References Cited**

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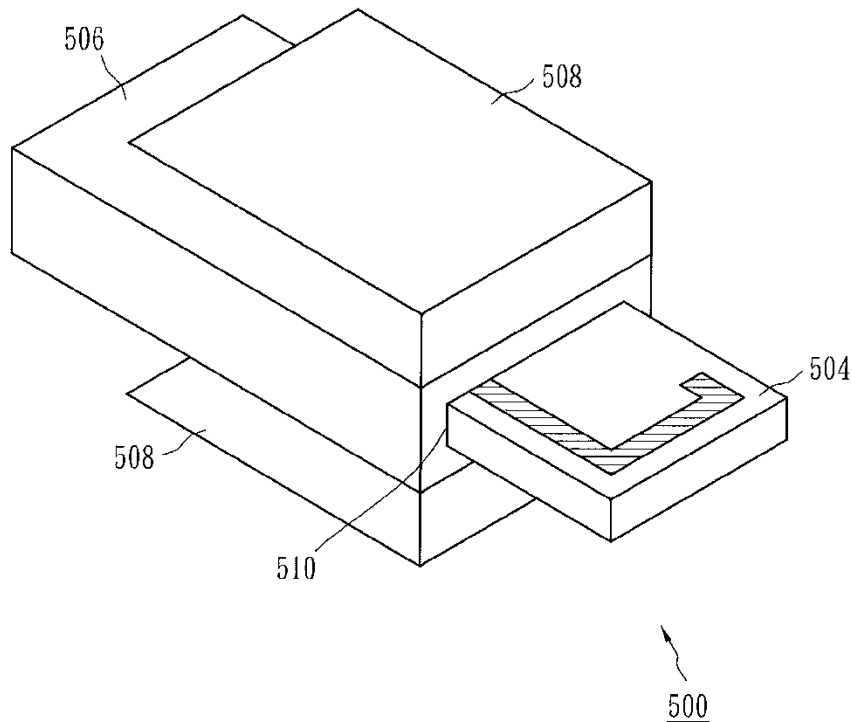
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Primary Examiner Hoanganh Le
(74) *Attorney, Agent, or Firm* — Hamre, Schumann, Mueller & Larson, P.C.

(57) **ABSTRACT**

An antenna apparatus comprises a planar monopole antenna device and an extending layer. The planar monopole antenna device includes an electromagnetic shielding box. The extending layer is composed of electric conducting material and extends outward from a feed point of the electromagnetic shielding box.

20 Claims, 5 Drawing Sheets





US008471778B2

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

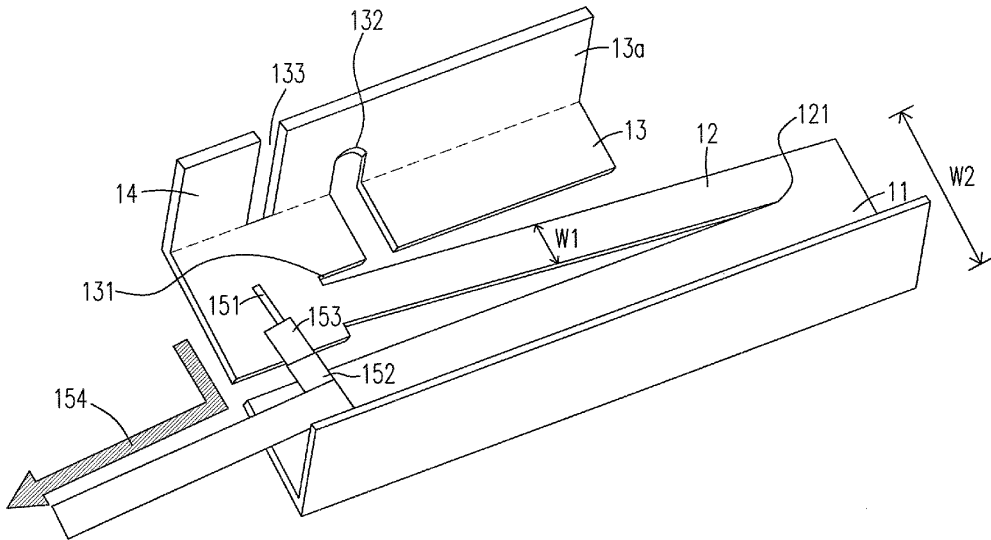
(10) **Patent No.:** **US 8,471,778 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

- (54) **SOLID DUAL-BAND ANTENNA DEVICE**
- (75) Inventors: **Chih-Yung Huang**, Dongshih Township, Taichung County (TW); **Wen-Szu Tao**, Hsinchu (TW); **Kuo-Chang Lo**, Hsinchu (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 872 days.
- (21) Appl. No.: **12/548,520**
- (22) Filed: **Aug. 27, 2009**
- (65) **Prior Publication Data**
US 2010/0079351 A1 Apr. 1, 2010
- (30) **Foreign Application Priority Data**
Sep. 9, 2008 (TW) 97134612 A
- (51) **Int. Cl.**
H01Q 1/48 (2006.01)
- (52) **U.S. Cl.**
USPC **343/846**; 343/702
- (58) **Field of Classification Search**
USPC 343/846, 702
See application file for complete search history.

- (56) **References Cited**
U.S. PATENT DOCUMENTS
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Primary Examiner — Hoang V Nguyen
Assistant Examiner — Kyana R McCain
(74) *Attorney, Agent, or Firm* — Gottlieb, Rackman & Reisman, P.C.

(57) **ABSTRACT**
A solid dual-band antenna device is provided. The solid dual-band antenna device includes a Z-shape antenna structure comprising a first turn having a first turning angle, and connected to a ground portion and a first radiating portion; and a second turn having a second turning angle, and connected to the first radiating portion and a second radiating portion; a feeding portion disposed at the second turn for feeding a signal; an extending ground portion non-coplanarly extended from an outer side of the ground portion; and an extending radiating portion non-coplanarly extended from an outer side of the second radiating portion, wherein a first slot is disposed at an arbitrary position of the second radiating portion, and a length of the first radiating portion is different from a length of the second radiating portion.

30 Claims, 5 Drawing Sheets





US008472908B2

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

(10) **Patent No.:** **US 8,472,908 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

(54) **WIRELESS PORTABLE DEVICE INCLUDING INTERNAL BROADCAST RECEIVER**

(75) Inventors: **Jaume Anguera**, Castellon (ES);
Alfonso Sanz, Barcelona (ES)

(73) Assignee: **Fractus, S.A.**, Barcelona (ES)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 971 days.

(21) Appl. No.: **12/226,024**

(22) PCT Filed: **Aug. 2, 2006**

(86) PCT No.: **PCT/EP2006/007782**

§ 371 (c)(1),

(2), (4) Date: **Nov. 14, 2008**

(87) PCT Pub. No.: **WO2007/128340**

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

(65) **Prior Publication Data**

US 2009/0156151 A1 Jun. 18, 2009

Related U.S. Application Data

(60) Provisional application No. 60/788,857, filed on Apr. 3, 2006.

(30) **Foreign Application Priority Data**

May 4, 2006 (EP) 06113473

(51) **Int. Cl.**
H04B 1/06 (2006.01)

(52) **U.S. Cl.**
USPC **455/272; 343/700; 343/702; 343/804**

(58) **Field of Classification Search**
USPC 455/272
See application file for complete search history.

(56) **References Cited**

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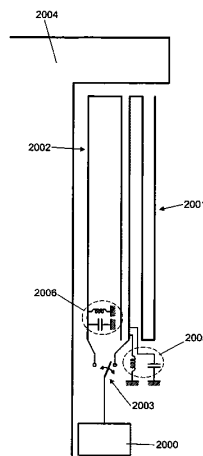
Primary Examiner — Ajibola Akinyemi

(74) *Attorney, Agent, or Firm* — Winstead PC

(57) **ABSTRACT**

The invention relates, inter alia, to a wireless portable device for radio communication, comprising at least one antenna element (1210), at least one ground-plane (1250), radio frequency communication circuitry (1310) and at least one matching network (1320). The device is arranged for communication involving, at least, receiving and processing a signal in accordance with a communication system having a bandwidth with a lower frequency limit (f_{min}) and an upper frequency limit (f_{max}). The antenna element is a non-resonant antenna element for frequencies from said lower frequency limit (f_{min}) up to said higher frequency limit (f_{min}). Another aspect of the invention involves two antenna elements (2001, 2002) tuned around two different central frequencies within a frequency band, and a switch (2003) for selectively operatively connecting one of said at least two antenna elements to a radio frequency communication circuitry (2000).

18 Claims, 29 Drawing Sheets





US008473017B2

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

(10) **Patent No.:** **US 8,473,017 B2**
(45) **Date of Patent:** **Jun. 25, 2013**

(54) **ADJUSTABLE ANTENNA AND METHODS**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Zlatoljub Milosavljevic**, Kempele (FI);
Anne Isohätälä-Lehmikangas, Kello
(FI); **Jyrki Mikkola**, Evijärvi (FI)

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(73) Assignee: **Pulse Finland Oy**, Kempele (FI)

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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 1213 days.

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(21) Appl. No.: **12/082,882**

(22) Filed: **Apr. 14, 2008**

Primary Examiner — Marceau Milord

(65) **Prior Publication Data**

US 2008/0266199 A1 Oct. 30, 2008

(74) *Attorney, Agent, or Firm* — Gazdzinski & Associates, PC

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Oct. 14, 2005 (FI) 20055554
Feb. 15, 2006 (FI) 20065116
Sep. 28, 2006 (FI) PCT/FI2006/050418

An adjustable monopole antenna especially intended for the mobile terminals. The adjusting circuit (930) of the antenna is located between the radiator (920) and the antenna port of a radio device and forms, together with the antenna feed conductor (901), a feed circuit. This circuit comprises an adjustable reactance between the feed conductor and the ground in series with the feed conductor or in both of those places. For example, the feed conductor can be connected by a multi-way switch to one of alternative transmission lines, which are typically short-circuited or open at their tail end and shorter than the quarter wave, each line acting for a certain reactance. The antenna operating band covers at a time only a part of the frequency range used by one or two radio systems, in which case the antenna matching is easier to arrange than of a real broadband antenna. The space required for both the radiator and the adjusting circuit is relatively small. There is no need to arrange a coupling to the radiator for the antenna adjusting, which means a simpler antenna structure and thus savings in production costs.

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

(52) **U.S. Cl.**
USPC 455/575.7; 455/78; 455/550.1; 455/69;
455/126; 455/271; 455/275; 343/754; 343/702;
343/722; 343/895; 343/893; 343/749

(58) **Field of Classification Search**
USPC 455/78, 69, 126, 575.5, 575.7, 550.1,
455/271, 275; 343/895, 700 MS, 840, 754,
343/702, 893, 722, 749
See application file for complete search history.

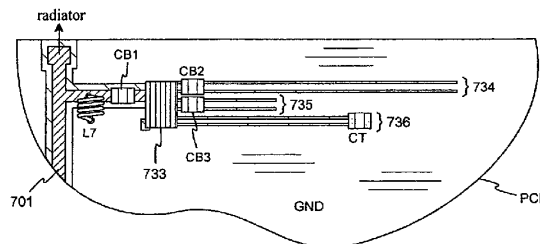
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15 Claims, 5 Drawing Sheets





US008475922B2

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

(10) **Patent No.:** **US 8,475,922 B2**
(45) **Date of Patent:** **Jul. 2, 2013**

(54) **NANOPARTICLE COMPOSITE MATERIAL AND ANTENNA DEVICE AND ELECTROMAGNETIC WAVE ABSORBER USING THE SAME**

(75) Inventors: **Tomohiro Suetsuna**, Kawasaki (JP); **Seiichi Suenaga**, Yokohama (JP); **Tomoko Eguchi**, Tokyo (JP); **Koichi Harada**, Tokyo (JP); **Maki Yonetsu**, Mitaka (JP); **Yasuyuki Hotta**, Tokyo (JP); **Toshihide Takahashi**, Yokohama (JP)

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

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(21) Appl. No.: **12/888,671**

(22) Filed: **Sep. 23, 2010**

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(30) **Foreign Application Priority Data**
Mar. 5, 2010 (JP) 2010-049551

(51) **Int. Cl.**
B32B 5/16 (2006.01)

(52) **U.S. Cl.**
USPC **428/403**; 428/842; 428/842.1; 428/842.2; 428/842.3; 428/328; 343/787; 252/62.54

(58) **Field of Classification Search**
USPC 428/842, 842.1, 842.2, 842.3, 403, 428/328; 343/787; 252/62.54
See application file for complete search history.

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Primary Examiner — Leszek Kiliman

(74) *Attorney, Agent, or Firm* — Finnegan, Henderson, Farabow, Garrett & Dunner, LLP

(57) **ABSTRACT**

According to one embodiment, there is provided a nanoparticle composite material, including nanoparticle aggregates in a shape having an average height of 20 nm or more and 2 μm or less and having an average aspect ratio of 5 or more, the nanoparticle aggregates including metal nanoparticles having an average diameter of 1 nm or more and 20 nm or less and containing at least one magnetic metals selected from the group consisting of Fe, Co and Ni and binder existing between the nanoparticle aggregates.

11 Claims, 6 Drawing Sheets



US008477069B2

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

(10) **Patent No.:** **US 8,477,069 B2**
(45) **Date of Patent:** **Jul. 2, 2013**

- (54) **PORTABLE ELECTRONIC DEVICE AND ANTENNA THEREOF**
- (75) Inventors: **Shih-Wei Hsieh**, Taipei (TW);
Shyh-Tirng Fang, Tai-Nan (TW)
- (73) Assignee: **Mediatek Inc.**, Hsin-Chu, Taiwan (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 631 days.

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- (21) Appl. No.: **12/624,539**
- (22) Filed: **Nov. 24, 2009**
- (65) **Prior Publication Data**
US 2011/0043421 A1 Feb. 24, 2011

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- (60) Provisional application No. 61/235,763, filed on Aug. 21, 2009.

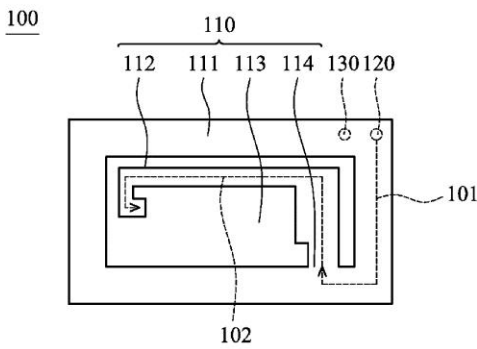
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.**
USPC **343/700 MS**; 343/843; 343/842
- (58) **Field of Classification Search**
None
See application file for complete search history.

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Primary Examiner — Trinh Dinh
(74) *Attorney, Agent, or Firm* — McClure, Qualey & Rodack, LLP

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7,504,998 B2 3/2009 Choi et al.

(57) **ABSTRACT**
An antenna is provided. The antenna includes a radiator, a feed conductor and a ground conductor. The radiator includes a body and a parasitic element. An aperture is formed on the body, and the body encloses the aperture. The parasitic element is connected to the body and extended into the aperture, wherein the parasitic element is connected to the body at a parasitic location. The feed conductor is connected to the body, wherein a signal, fed to the body by the feed conductor, travels on the body, and passes the parasitic location to the parasitic element. The ground conductor is connected to the body.

20 Claims, 6 Drawing Sheets





US008477071B2

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

(10) **Patent No.:** **US 8,477,071 B2**
(45) **Date of Patent:** **Jul. 2, 2013**

- (54) **MULTI-BAND ANTENNA**
- (75) Inventors: **Yung-Chih Tsai**, Taipei (TW);
Jia-Hung Su, Taipei (TW); **Kai Shih**,
Taipei (TW)
- (73) Assignee: **Cheng Uei Precision Industry 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 426 days.
- (21) Appl. No.: **12/980,333**
- (22) Filed: **Dec. 29, 2010**
- (65) **Prior Publication Data**
US 2012/0169563 A1 Jul. 5, 2012
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 13/10 (2006.01)
H01Q 9/00 (2006.01)
- (52) **U.S. Cl.**
USPC **343/700 MS; 343/767; 343/749**

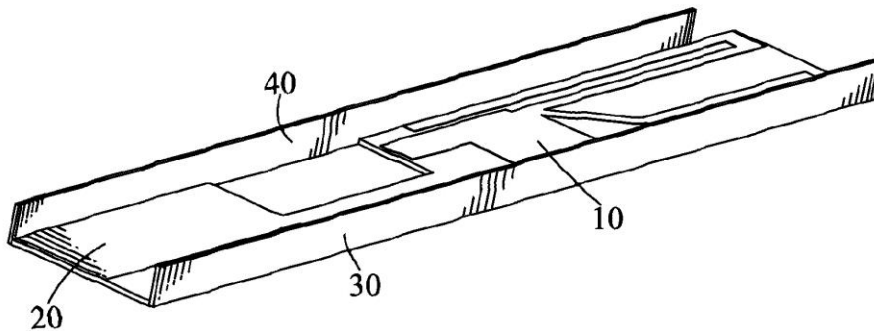
(58) **Field of Classification Search**
USPC 343/700 MS, 749, 767
See application file for complete search history.

Primary Examiner — Douglas W Owens
Assistant Examiner — Jae Kim

(57) **ABSTRACT**
A multi-band antenna mounted on a circuit board includes a ground plate perpendicularly connected to one side edge of the circuit board, a radiating plate perpendicularly connected to the other side edge of the circuit board, and a planar antenna element includes a high frequency radiating portion, a lower frequency radiating portion, a base plate, a capacitance portion and an inductance portion. The high frequency radiating portion and the lower frequency radiating portion are located at two ends of the circuit board, respectively, and both connected to the radiating plate. The base plate is connected to the radiating plate and located between the high and lower frequency radiating portions. The capacitance portion is parallel with the ground plate to form a capacitive coupling therebetween. The inductance portion is soldered to the ground plate. A simulation inductance is formed by the inductance portion.

9 Claims, 2 Drawing Sheets

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US008477073B2

(12) **United States Patent**
Kim

(10) **Patent No.:** **US 8,477,073 B2**
(45) **Date of Patent:** **Jul. 2, 2013**

(54) **INTERNAL WIDE BAND ANTENNA USING SLOW WAVE STRUCTURE**

(75) Inventor: **Byong-Nam Kim**, Kyeonggi-do (KR)

(73) Assignee: **Ace Technologies Corporation**, Incheon-si (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 260 days.

(21) Appl. No.: **12/989,928**

(22) PCT Filed: **Mar. 30, 2009**

(86) PCT No.: **PCT/KR2009/001609**

§ 371 (c)(1),
(2), (4) Date: **Oct. 27, 2010**

(87) PCT Pub. No.: **WO2009/134013**

PCT Pub. Date: **Nov. 5, 2009**

(65) **Prior Publication Data**

US 2011/0043412 A1 Feb. 24, 2011

(30) **Foreign Application Priority Data**

Apr. 30, 2008 (KR) 10-2008-0040878

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

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

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

(56) **References Cited**

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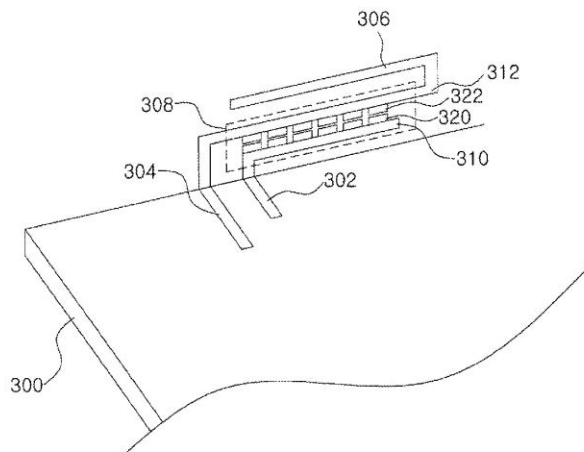
Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Duane Morris LLP

(57) **ABSTRACT**

Disclosed is a wide-band internal antenna that uses a slow-wave structure. The antenna includes an impedance matching/power feed part, which includes a first conductive element that extends from a power feed line and a second conductive element that is separated by a particular distance from the first conductive element and is electrically connected with a ground, and at least one radiator extending from the impedance matching/power feed part. Here, the first conductive element and the second conductive element of the impedance matching/power feed part form a slow-wave structure. By applying a slow-wave structure to coupling matching, the antenna provides the advantage of resolving the problem of narrow band characteristics found in inverted-F antennas while maintaining a low profile.

10 Claims, 10 Drawing Sheets





US008480000B2

(12) **United States Patent**
Chen

(10) **Patent No.:** **US 8,480,000 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **PACKING BAG WITH RADIO FREQUENCY IDENTIFICATION FUNCTION AND MANUFACTURING METHOD THEREOF**

(75) Inventor: **Yung-Shun Chen, Chung Li (TW)**

(73) Assignee: **Taiwan Lamination Industries, Inc. (TW)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 188 days.

(21) Appl. No.: **13/064,395**

(22) Filed: **Mar. 23, 2011**

(65) **Prior Publication Data**
US 2011/0259776 A1 Oct. 27, 2011

(30) **Foreign Application Priority Data**
Apr. 22, 2010 (TW) 99112639 A

(51) **Int. Cl.**
G06K 19/06 (2006.01)

(52) **U.S. Cl.**
USPC **235/492; 235/375; 235/451**

(58) **Field of Classification Search**
USPC 235/492, 380, 487, 451, 375
See application file for complete search history.

(56) **References Cited**

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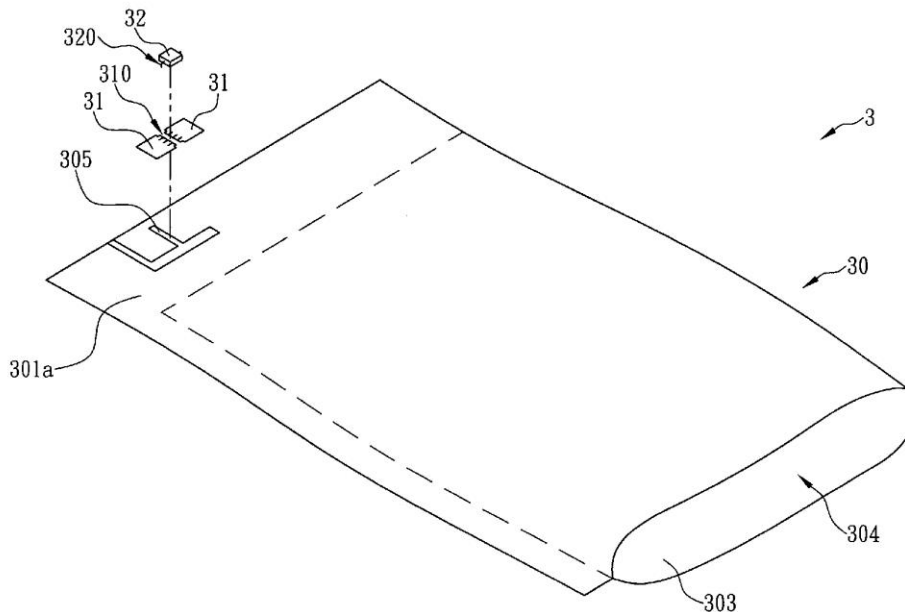
Primary Examiner — Edwyn Labaze

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

(57) **ABSTRACT**

The present invention is to provide a packing bag with a RFID function, which comprises a bag body, two conductive films and a RFID chip. The metal layer includes a first slot formed at a position proximate to an edge of the bag body and is used as a slot antenna. A second slot is formed between the two conductive films, and has a size capable for fixing the pins on two corresponding sides of the RFID chip onto the two conductive films respectively. The two conductive films are fixed on an external surface of an insulating layer of the bag body at a position corresponding to the first slot, such that the two conductive films can be coupled to two feed-in points of the slot antenna respectively, and the RFID chip can receive and transmit electromagnetic signals through the slot antenna (or the metal layer) accordingly.

19 Claims, 11 Drawing Sheets





US008482464B2

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

(10) **Patent No.:** **US 8,482,464 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **MOBILE COMMUNICATION DEVICE**

OTHER PUBLICATIONS

(75) Inventors: **Kin-Lu Wong**, Tapei Hsien (TW);
Shu-Chuan Chen, Tapei Hsien (TW)

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(73) Assignee: **Acer Inc.**, Taipei Hsien (TW)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 614 days.

Primary Examiner — Jacob Y Choi

Assistant Examiner — Graham Smith

(21) Appl. No.: **12/761,443**

(74) *Attorney, Agent, or Firm* — Alan Kamrath; Kamrath IP Lawfirm, P.A.

(22) Filed: **Apr. 16, 2010**

(65) **Prior Publication Data**

US 2011/0156958 A1 Jun. 30, 2011

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Dec. 31, 2009 (TW) 98146591 A

A mobile communication device includes a ground plane, a dielectric substrate, and an antenna. The antenna is disposed on one surface of the dielectric substrate and includes a radiating portion, a feeding portion, and a shorting portion. The radiating portion includes a first radiating portion and a second radiating portion. The first radiating portion has at least one bending. One end of the first radiating portion is left open. The second radiating portion is a shunt metal strip. Both ends of the second radiating portion are electrically connected to the first radiating portion such that the second radiating portion forms a closed loop with a segment of the first radiating portion. The feeding portion couples the electromagnetic energy to the radiating portion through a coupling gap, and one end of the feeding portion is the antenna's feeding point. One end of the shorting portion is electrically connected to the radiating portion, and the other end of the shorting portion is electrically connected to the ground plane.

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/48 (2006.01)

(52) **U.S. Cl.**
USPC **343/700 MS; 343/845; 343/846**

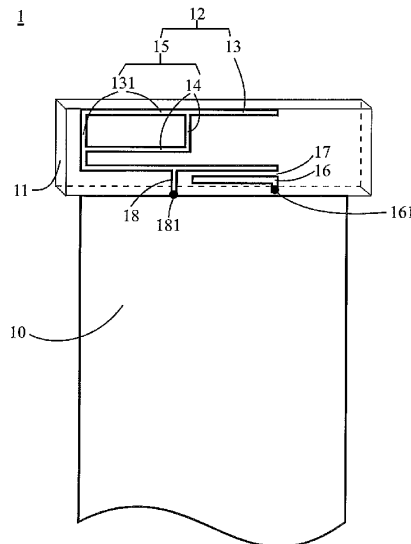
(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

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10 Claims, 5 Drawing Sheets





US008482466B2

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

(10) **Patent No.:** **US 8,482,466 B2**
(45) **Date of Patent:** ***Jul. 9, 2013**

(54) **LOW PROFILE ANTENNA ASSEMBLIES**

(75) Inventors: **Cheikh T. Thiam**, Grand Blanc, MI (US); **Andreas D. Fuchs**, Lake Orion, MI (US); **John V. Kowalewicz**, Ortonville, MI (US); **Ralf Lindackers**, Royal Oak, MI (US)

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(73) Assignee: **Laird Technologies, Inc.**, Earth City, MO (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 0 days.

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This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **13/552,320**

Low Profile Integrated GPS and Cellular Antenna; by Nathan P. Cummings, Oct. 31, 2001, 88 pages.

(22) Filed: **Jul. 18, 2012**

(Continued)

(65) **Prior Publication Data**

US 2012/0280888 A1 Nov. 8, 2012

Primary Examiner — Huedung Mancuso

Related U.S. Application Data

(63) Continuation of application No. 12/572,716, filed on Oct. 2, 2009, now Pat. No. 8,228,238.

(74) *Attorney, Agent, or Firm* — Harness, Dickey & Pierce, P.L.C.

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

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

(58) **Field of Classification Search**
USPC 343/702, 700 MS, 767, 895
See application file for complete search history.

(57) **ABSTRACT**

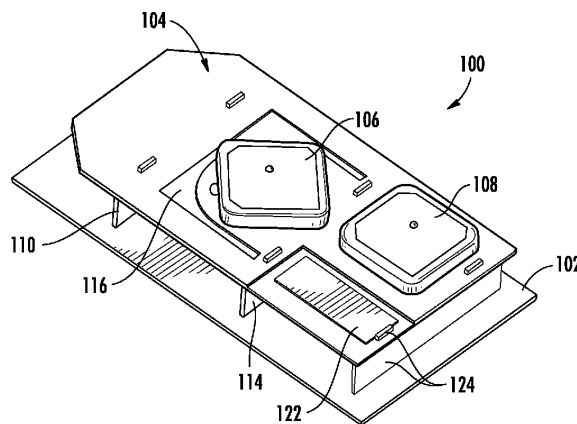
An antenna assembly including a ground plane and a radiator supported above the ground plane is disclosed. The radiator may include a slot to configure the radiator to be resonant in at least two frequency ranges and a grounding point coupled to the ground plane. The radiator may be a dual-band planar inverted F antenna (PIFA) having an upper surface opposite the ground plane. First and second antenna modules may be coupled to the upper surface of the PIFA. The first and second antenna modules may be patch antennas, such as stacked patch antennas.

(56) **References Cited**

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19 Claims, 8 Drawing Sheets





US008482467B2

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

(10) **Patent No.:** **US 8,482,467 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **CUSTOMIZABLE ANTENNA STRUCTURES FOR ADJUSTING ANTENNA PERFORMANCE IN ELECTRONIC DEVICES**

(75) Inventors: **Daniel W. Jarvis**, Sunnyvale, CA (US);
Dean F. Darnell, Santa Clara, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 400 days.

(21) Appl. No.: **12/823,929**

(22) Filed: **Jun. 25, 2010**

(65) **Prior Publication Data**

US 2011/0316751 A1 Dec. 29, 2011

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

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

(58) **Field of Classification Search**
CPC H01Q 1/243
USPC 343/702, 700 MS
See application file for complete search history.

(56) **References Cited**

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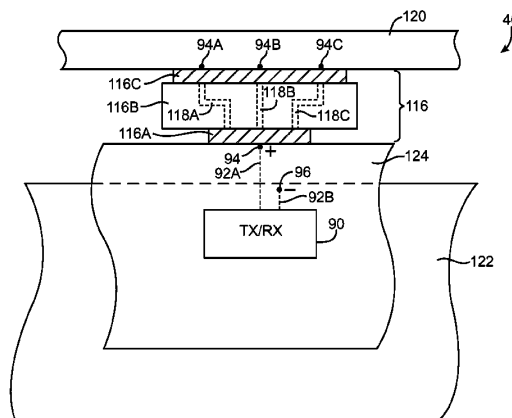
Primary Examiner — Vibol Tan

(74) *Attorney, Agent, or Firm* — Treyz Law Group; G. Victor Treyz; Michael H. Lyons

(57) **ABSTRACT**

Custom antenna structures may be used to compensate for manufacturing variations in electronic device antennas. An electronic device antenna may have an antenna feed and conductive structures such as portions of a peripheral conductive electronic device housing member and other conductive antenna structures. The custom antenna structures compensate for manufacturing variations in the conductive antenna structures that could potentially lead to undesired variations in antenna performance. The custom antenna structures may make customized alterations to antenna feed structures or conductive paths within an antenna. An antenna may be formed from a conductive housing member that surrounds an electronic device. Custom antenna structures may be interposed between an antenna feed terminal and the conductive housing member to adjust the effective location of the antenna feed. Custom antenna structures may include springs and custom paths on dielectric supports.

20 Claims, 18 Drawing Sheets





US008482469B2

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

(10) **Patent No.:** **US 8,482,469 B2**
(45) **Date of Patent:** ***Jul. 9, 2013**

(54) **ANTENNAS AND ANTENNA CARRIER STRUCTURES FOR ELECTRONIC DEVICES**

(75) Inventors: **Enrique Ayala**, Watsonville, CA (US); **Gregory Allen Springer**, Sunnyvale, CA (US); **Douglas B. Kough**, San Jose, CA (US); **Matthew Ian McDonald**, San Jose, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, 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.
This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/607,575**

(22) Filed: **Sep. 7, 2012**

(65) **Prior Publication Data**

US 2013/0002494 A1 Jan. 3, 2013

Related U.S. Application Data

(63) Continuation of application No. 12/142,744, filed on Jun. 19, 2008, now Pat. No. 8,264,412.

(60) Provisional application No. 61/019,218, filed on Jan. 4, 2008.

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

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

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

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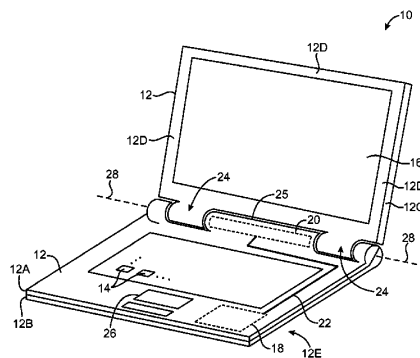
Primary Examiner — Hoanganh Le

(74) *Attorney, Agent, or Firm* — Treyz Law Group; G. Victor Treyz; David C. Kellogg

(57) **ABSTRACT**

Antenna support structures and antennas are provided for wireless electronic devices such as portable electronic devices. Antenna resonating elements may be formed from conductive coatings on two-shot molded interconnect device dielectric antenna support structures. The conductive coatings may be formed from wet-plated copper or other conductive materials. The antenna support structure may have tabs that electrically connect antenna resonating elements to the case of a wireless electronic device that serves as an antenna ground plane. The antenna support structure may be curved about its longitudinal axis so that the antenna resonating elements on the support structure protrude upwards to enhance antenna performance. In a portable electronic device such as a portable computer, the antenna support structure may be mounted within a dielectric portion of the computer housing that is located between the display portion of the housing and the base of the housing.

23 Claims, 11 Drawing Sheets





US008482470B2

(12) **United States Patent**
Abe

(10) **Patent No.:** **US 8,482,470 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **ELECTRIC DEVICE WITH AN ANTENNA DEVICE AND A SOLAR PANEL**

FOREIGN PATENT DOCUMENTS

(75) Inventor: **Kazuaki Abe**, Iruma (JP)
(73) Assignee: **Casio Computer 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 242 days.

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(21) Appl. No.: **13/014,274**
(22) Filed: **Jan. 26, 2011**

Japanese Office Action for Japanese Application No. 2010-018081 mailed on Aug. 21, 2012.
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(65) **Prior Publication Data**
US 2011/0187609 A1 Aug. 4, 2011

Primary Examiner — Hoanganh Le
(74) *Attorney, Agent, or Firm* — Turocy & Watson, LLP

(30) **Foreign Application Priority Data**
Jan. 29, 2010 (JP) 2010-018081

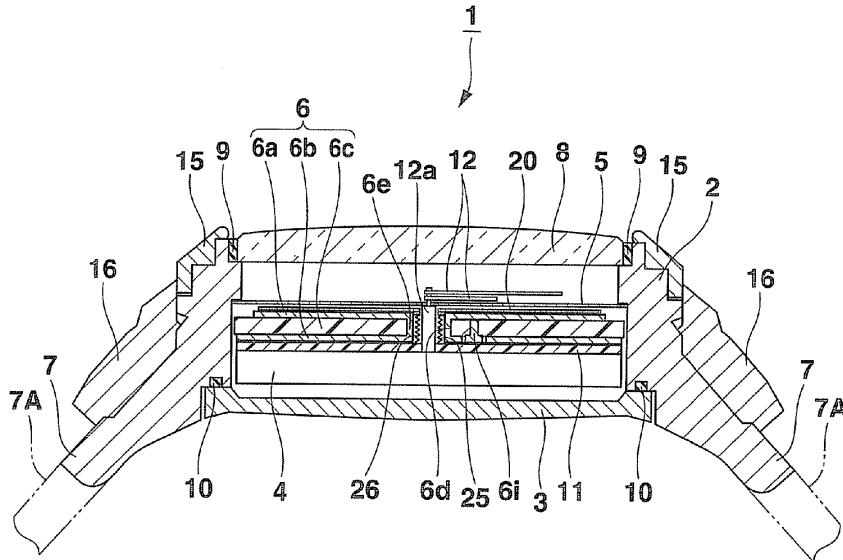
(57) **ABSTRACT**

An electronic apparatus includes an antenna device, a solar panel disposed on a front side of the antenna device and a circuit board disposed on a back side of the antenna device. The antenna device includes a plate-shaped dielectric, a plate-shaped radiation conductor disposed on a front side of the dielectric and a plate-shaped grounding conductor disposed on a back side of the dielectric. The dielectric has a through hole formed therein, and the solar panel has electrode pads on a back side thereof, electrode pads being exposed within the through hole in the dielectric. The circuit board has conductive patterns at positions thereon facing the electrode pads, and the conductive patterns are electrically connected to the electrode pads by electric connection members disposed within the through hole in the dielectric.

(51) **Int. Cl.**
H01Q 1/12 (2006.01)
(52) **U.S. Cl.**
USPC **343/718; 343/700 MS**
(58) **Field of Classification Search**
USPC **343/702, 700 MS, 718**
See application file for complete search history.

(56) **References Cited**
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4 Claims, 10 Drawing Sheets





US008482471B2

(12) **United States Patent**
Su

(10) **Patent No.:** **US 8,482,471 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **HYBRID MULTIPLE-INPUT
MULTIPLE-OUTPUT ANTENNA MODULE
AND SYSTEM OF USING THE SAME**

(75) Inventor: **Saou-Wen Su**, Keelung (TW)

(73) Assignees: **Lite-On Electronics (Guangzhou)
Limited**, Guangzhou (CN); **Lite-On
Technology Corporation**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 284 days.

(21) Appl. No.: **13/004,977**

(22) Filed: **Jan. 12, 2011**

(65) **Prior Publication Data**
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(30) **Foreign Application Priority Data**
Apr. 2, 2010 (CN) 2010 2 0176740 U

(51) **Int. Cl.**
H01Q 11/12 (2006.01)
H01Q 1/38 (2006.01)

(52) **U.S. Cl.**
USPC **343/742**; 343/700 MS; 343/728;
343/848; 343/893

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

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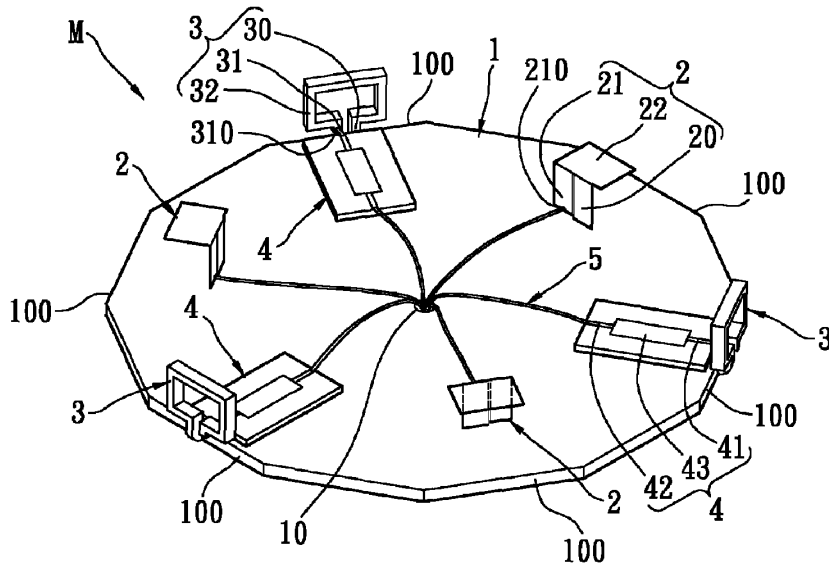
Primary Examiner — Trinh Dinh

(74) Attorney, Agent, or Firm — Rabin & Berdo, P.C.

(57) **ABSTRACT**

The hybrid multiple-input multiple-output antenna module includes a grounding unit, a plurality of radiating units, loop units and filter units. The radiating units and the loop units are arranged around a geometric center of the grounding unit and are alternately and symmetrically arranged on the grounding unit. The loop units are arranged along the outer peripheral side of the grounding unit. The filter units are respectively electrically connected to the loop units. The present invention not only has some advantages such as small size, low profile, good isolation, high antenna gain and good radiation properties, but also can replace the external dual-band access-point antenna of the prior art for 2.4/5 GHz operation with no need of an extra diplexer. In addition, the hybrid multiple-input multiple-output antenna module can be hidden in the wireless communication device in order to enhance the appearance of the product.

20 Claims, 8 Drawing Sheets





US008482473B2

(12) **United States Patent**
Huang

(10) **Patent No.:** **US 8,482,473 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **PLANAR RECONFIGURABLE ANTENNA**

FOREIGN PATENT DOCUMENTS

(75) Inventor: **Huan-Chu Huang**, Taoyuan County (TW)

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

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 737 days.

"Search Report of European counterpart application", issued on Oct. 21, 2009, p. 1-p. 5.

(21) Appl. No.: **12/549,337**

"Office Action of Japan Counterpart Application", issued on Nov. 15, 2011, p. 1-p. 2, in which the listed references were cited.

(22) Filed: **Aug. 27, 2009**

"Office Action of Taiwan Counterpart Application", issued on Jun. 14, 2012, p. 1-p. 4, in which the listed references were cited.

(65) **Prior Publication Data**

US 2011/0012805 A1 Jan. 20, 2011

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(30) **Foreign Application Priority Data**

Jul. 16, 2009 (TW) 98124138 A

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(51) **Int. Cl.**
H01Q 9/28 (2006.01)

Primary Examiner — Hoang V Nguyen

(52) **U.S. Cl.**
USPC 343/795; 343/815; 343/818

Assistant Examiner — Kyana R McCain

(58) **Field of Classification Search**
USPC 343/700 MS, 833, 795, 815, 817, 343/818, 819, 834
See application file for complete search history.

(74) *Attorney, Agent, or Firm* — Jianq Chyun IP Office

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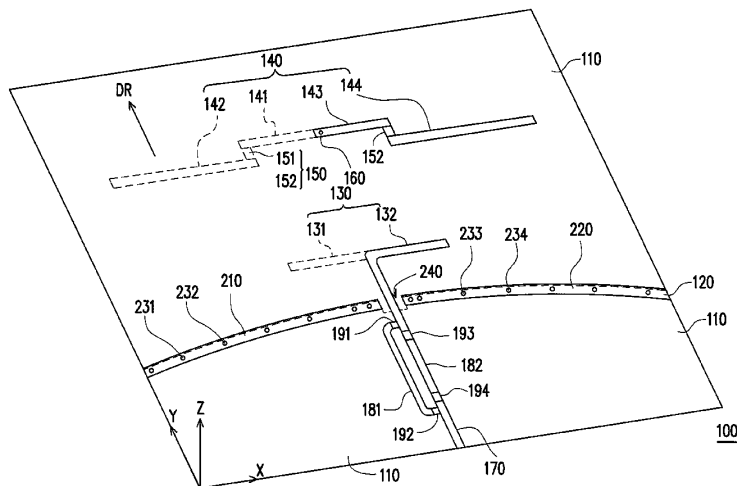
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(57) **ABSTRACT**

A planar reconfigurable antenna including a substrate, a metal layer, a master antenna, an auxiliary antenna and a switch set is provided. The substrate has a first surface and a second surface. The metal layer is disposed on the first surface of the substrate and the upper edge of the metal layer is in a convex arc shape. The master antenna is disposed on the substrate and partially overlaps the metal layer on a vertical plane of projection. The auxiliary antenna is disposed on the substrate and is placed opposite to the master antenna. The switch set is also disposed on the substrate and changes a connection relation of a plurality of directional devices in the auxiliary antenna to switch scanning directions of main beams generated from the planar reconfigurable antenna.

18 Claims, 5 Drawing Sheets





US008482474B2

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

(10) **Patent No.:** **US 8,482,474 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

- (54) **ANTENNA APPARATUS**
- (75) Inventors: **Junnei Baba**, Fukuoka (JP); **Masatoshi Ootsuka**, Fukuoka (JP); **Tetsuya Ashizuka**, Fukuoka (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.: **12/992,058**
- (22) PCT Filed: **May 11, 2009**
- (86) PCT No.: **PCT/JP2009/002048**
§ 371 (c)(1),
(2), (4) Date: **Feb. 9, 2011**
- (87) PCT Pub. No.: **WO2009/139143**
PCT Pub. Date: **Nov. 19, 2009**

(65) **Prior Publication Data**
US 2011/0122039 A1 May 26, 2011

(30) **Foreign Application Priority Data**
May 12, 2008 (JP) P2008-124318
Jun. 20, 2008 (JP) P2008-161338

(51) **Int. Cl.**
H01Q 9/28 (2006.01)
(52) **U.S. Cl.**
USPC **343/795**; 343/816; 343/820; 343/821
(58) **Field of Classification Search**
USPC 343/795, 797, 803, 804, 816, 820, 343/821

See application file for complete search history.

- (56) **References Cited**
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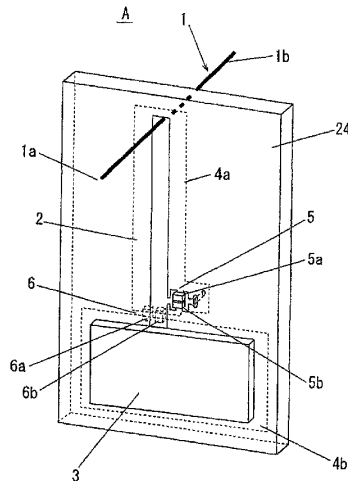
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Primary Examiner — Tho G Phan
(74) *Attorney, Agent, or Firm* — Dickinson Wright PLLC

(57) **ABSTRACT**
An antenna apparatus that can be miniaturized without causing inference caused by antenna currents to be occurred if the high band of a dual band wireless system is close to the band of another wireless system in a wireless communication apparatus incorporating the dual band wireless system and another wireless system is provided. A first switch **5** blocks passage of a signal of a high band (first frequency) and allows passage of a signal of a low band (second frequency). A second switch **6** blocks passage of a signal of the low band (second frequency) and allows passage of a signal of the high band (first frequency). Accordingly, the antenna apparatus operates as a dipole antenna with no antenna current flowing into a feeder line at the first frequency and operates as a monopole antenna wherein a radiation element and a feeder line making up the dipole antenna becomes a radiation element at the second frequency lower than the first frequency.

25 Claims, 25 Drawing Sheets





US008483415B2

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

(10) **Patent No.:** **US 8,483,415 B2**
(45) **Date of Patent:** **Jul. 9, 2013**

(54) **ANTENNA SYSTEM WITH PARASITIC ELEMENT FOR HEARING AID COMPLIANT ELECTROMAGNETIC EMISSION**

(75) Inventors: **Narendra Pulimi**, Round Lake, IL (US); **Hugh Smith**, Palatine, IL (US); **Istvan Szini**, Grayslake, IL (US)

(73) Assignee: **Motorola Mobility LLC**, 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 334 days.

(21) Appl. No.: **12/818,288**

(22) Filed: **Jun. 18, 2010**

(65) **Prior Publication Data**
US 2011/0312393 A1 Dec. 22, 2011

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/04 (2006.01)
H01Q 19/00 (2006.01)
H04B 1/04 (2006.01)
H04M 1/00 (2006.01)
H04R 25/00 (2006.01)

(52) **U.S. Cl.**
USPC **381/312**; 343/700 MS; 343/702;
343/833; 343/846; 455/129; 455/550.1; 455/575.7

(58) **Field of Classification Search**
USPC 381/312; 455/575.7; 343/833, 700 MS,
343/702

See application file for complete search history.

(56) **References Cited**

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Primary Examiner — David Warren

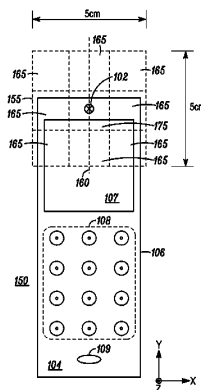
Assistant Examiner — Christina Russell

(74) *Attorney, Agent, or Firm* — Daniel R. Collopy; Ingrassia Fisher & Lorenz, PC; Sylvia Chen

(57) **ABSTRACT**

A system for production of an electromagnetic (EM) field having EM emissions mitigated at one or more predetermined locations within a Hearing Aid Compliant (HAC) measurement plane is provided. The EM field mitigation system includes a ground plane, an antenna element, and a parasitic resonator element. The antenna element is coupled to the ground plane and resonates within at least one predetermined frequency band for transmitting and receiving the radio frequency (RF) signals modulated at one or more frequencies within the at least one predetermined first frequency band. The parasitic resonator element includes at least a first leg and a second leg connected to the ground plane and located a predetermined distance from the antenna element for mitigation of the EM emissions of the antenna element at the one or more predetermined locations within the HAC measurement plane. The first leg of the parasitic resonator element is connected to the ground plane on a first side of an effective electric field mid-line laterally dividing the ground plane and the second leg of the parasitic antenna element is connected to the ground plane on a second side of the effective electric field mid-line of the ground plane.

14 Claims, 36 Drawing Sheets





US008483751B2

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

(10) **Patent No.:** **US 8,483,751 B2**
(45) **Date of Patent:** ***Jul. 9, 2013**

(54) **SPLIT BAND DIVERSITY ANTENNA ARRANGEMENT**

(75) Inventors: **Greg Black**, Vernon Hills, IL (US);
Vijay Asrani, Round Lake, IL (US);
Nicholas Matthew McDonnell,
Schaumburg, IL (US); **Deven Mohan Patel**,
Antioch, IL (US)

(73) Assignee: **Motorola Mobility LLC**, 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 919 days.

This patent is subject to a terminal dis-
claimer.

(21) Appl. No.: **12/505,040**

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

(65) **Prior Publication Data**

US 2011/0014958 A1 Jan. 20, 2011

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

(52) **U.S. Cl.**
USPC **455/552.1**; 455/575.1; 455/575.7;
343/702; 343/751

(58) **Field of Classification Search**

USPC 455/552.1, 575.1, 575.7; 343/702,
343/751, 816, 853, 876

See application file for complete search history.

(56) **References Cited**

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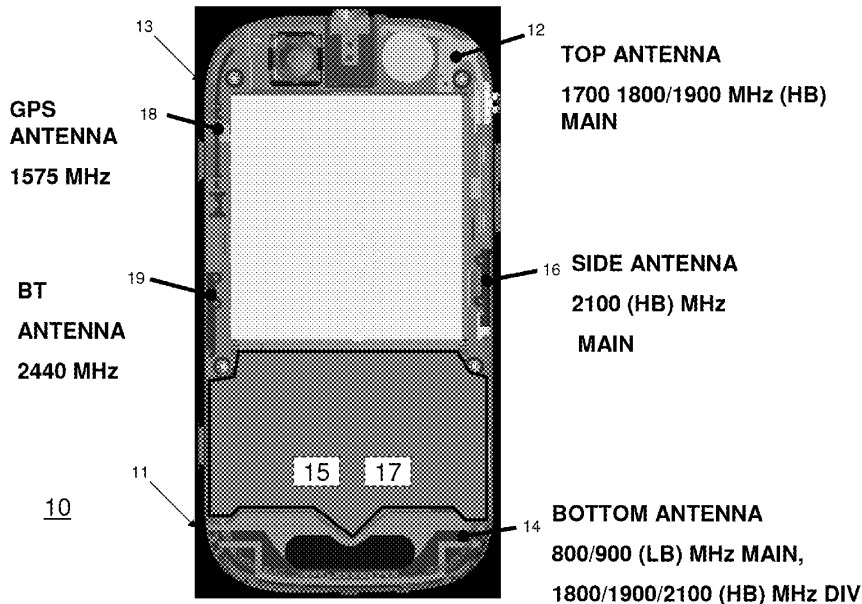
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Primary Examiner — Tuan H Nguyen

(57) **ABSTRACT**

A wireless communication device or a split band diversity antenna arrangement (10, 20, 30 or 41) has a first multi-band antenna (22 or 14) located at a bottom portion (11) of the wireless communication device and selectively coupled to a diversity receiver (26), a second multi-band antenna (24 or 12) located at a top portion (13) of the wireless communication device and selectively coupled to a dual band transceiver (28), a band splitter (25) splitting an input from the first antenna into a first output and a second output where the first output serves as an input to the diversity receiver, and a band combiner (27) that combines the second output of the band splitter with a signal from the second antenna to provide an input signal to the dual band transceiver.

19 Claims, 8 Drawing Sheets





US008483838B2

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

(10) **Patent No.:** **US 8,483,838 B2**
(45) **Date of Patent:** ***Jul. 9, 2013**

(54) **ANTENNA ARRANGEMENTS FOR IMPLANTABLE THERAPY DEVICE**

(75) Inventors: **David Nghiem**, Shoreview, MN (US);
Scott Anthony Lambert, East Bethel, MN (US); **Jason William Sprain**, Shoreview, MN (US)

(73) Assignee: **EnteroMedics Inc.**, St. Paul, MN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 221 days.

This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **13/036,614**

(22) Filed: **Feb. 28, 2011**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. 12/108,225, filed on Apr. 23, 2008, now Pat. No. 7,917,226.

(51) **Int. Cl.**
A61N 1/00 (2006.01)

(52) **U.S. Cl.**
USPC **607/60; 607/36**

(58) **Field of Classification Search**
USPC **607/30, 32, 36, 60**
See application file for complete search history.

(56) **References Cited**

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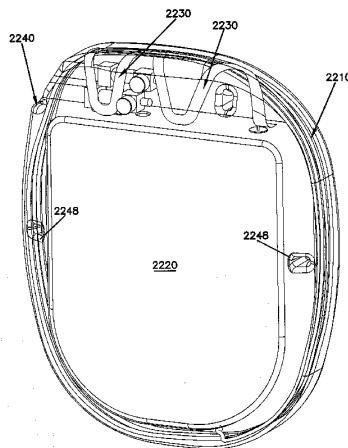
Primary Examiner — Brian T Gedeon

(74) *Attorney, Agent, or Firm* — Merchant & Gould, P.C.

(57) **ABSTRACT**

Embodiments of an implantable medical device includes a loop antenna wound about an inner housing. The loop antenna may form a partial winding, a complete winding, or multiple windings about the inner housing. One or more additional antennae may be capacitively coupled to the loop antenna external to the inner housing to increase efficiency and decrease Return Loss Response of the implantable device. The additional antenna may be balanced or unbalanced antennae.

20 Claims, 24 Drawing Sheets





US008487814B2

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

(10) **Patent No.:** **US 8,487,814 B2**
(45) **Date of Patent:** **Jul. 16, 2013**

(54) **BROADBAND ANTENNA APPLIED TO MULTIPLE FREQUENCY BAND**

(75) Inventors: **Chun-Chieh Wang**, Taipei (TW); **Chih-Hsin Chiu**, Ji-An Township, Hualien County (TW); **Chih-Ming Su**, Taipei (TW); **Chung-Ta Yu**, Keelung (TW)

(73) Assignee: **Inpaq Technology Co., Ltd.**, Miaoli County (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 790 days.

(21) Appl. No.: **12/727,059**

(22) Filed: **Mar. 18, 2010**

(65) **Prior Publication Data**
US 2011/0227805 A1 Sep. 22, 2011

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/48 (2006.01)

(52) **U.S. Cl.**
USPC **343/700 MS; 343/848**

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

(56) **References Cited**

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Primary Examiner — Robert Karacsony

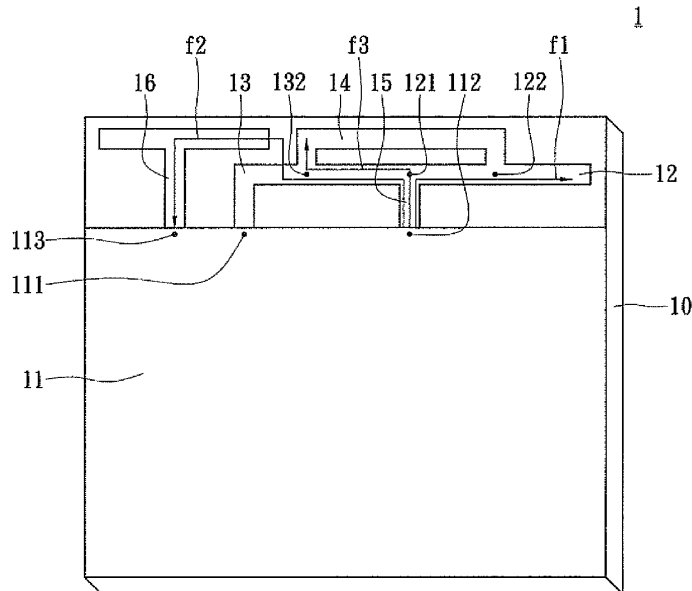
Assistant Examiner — Hasan Islam

(74) *Attorney, Agent, or Firm* — Houtteman Law LLC

(57) **ABSTRACT**

A broadband antenna includes a substrate, a ground plane, a radiating path, a shorting path, a first connection path, a second connection path and a coupling path. The ground plane has a shorting point, a first grounding point and a second grounding point. The radiating path has a feeding point and a first connecting point. Two ends of the shorting path are respectively electrically connected with the shorting point and the feeding point, and the shorting path has a second connecting point. Two ends of the first connection path are respectively connected with the first connecting point and the second connecting point. Two ends of the second connection path are respectively connected with the first grounding point and the feeding point. One end of the coupling path is connected to the second grounding point and another end of the coupling path is separated from the shorting path.

9 Claims, 4 Drawing Sheets





US008487815B2

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

(10) **Patent No.:** **US 8,487,815 B2**
(45) **Date of Patent:** ***Jul. 16, 2013**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE ANTENNA ASSEMBLY WITH ANTENNA ELEMENT AND FLOATING DIRECTOR ELEMENT ON FLEXIBLE SUBSTRATE AND RELATED METHODS**

(58) **Field of Classification Search**
USPC 343/700 MS, 702, 872, 878
See application file for complete search history.

(75) Inventors: **Yihong Qi**, St. Agatha (CA); **Ying Tong Man**, Waterloo (CA); **Adrian Cooke**, Kitchener (CA)

(56) **References Cited**

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

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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 278 days.

This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **12/901,641**

(22) Filed: **Oct. 11, 2010**

(65) **Prior Publication Data**
US 2011/0025567 A1 Feb. 3, 2011

Primary Examiner — Shawki Ismail
Assistant Examiner — Dylan White
(74) *Attorney, Agent, or Firm* — Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

Related U.S. Application Data

(63) Continuation of application No. 11/863,324, filed on Sep. 28, 2007, now Pat. No. 7,812,773.

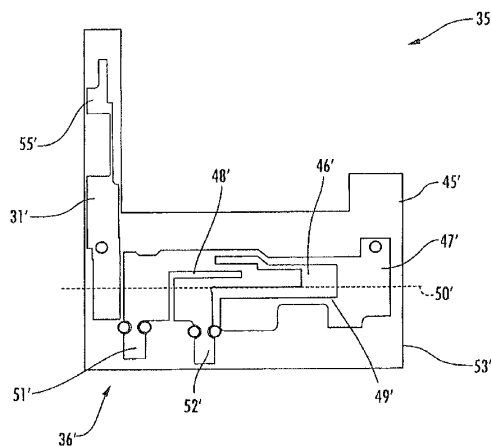
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 5/00 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/26 (2006.01)
H01Q 1/42 (2006.01)

(57) **ABSTRACT**

A mobile wireless communications device may include a portable housing, a circuit board carried by the portable housing and having a ground plane thereon, wireless communications circuitry carried by the circuit board, and an antenna assembly carried by the housing. More particularly, the antenna assembly may include a flexible substrate, an electrically conductive antenna element on the flexible substrate and connected to the wireless communications circuitry and the ground plane, and a floating, electrically conductive director element on the flexible substrate for directing a beam pattern of the antenna element.

(52) **U.S. Cl.**
USPC **343/700 MS**; 343/872; 343/878; 343/701; 343/702

20 Claims, 7 Drawing Sheets





US008487818B2

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

(10) **Patent No.:** **US 8,487,818 B2**
(45) **Date of Patent:** **Jul. 16, 2013**

(54) **INTERNAL ANTENNA AND PORTABLE COMMUNICATION TERMINAL USING THE SAME**

(75) Inventors: **Joon-II Kim**, Seoul (KR); **Se-Ho Park**, Suwon-si (KR); **Woo-Ram Lee**, Gimpo-si (KR); **Young-Min Lee**, Yongin-si (KR); **Ki-Hyun Kim**, Suwon-si (KR); **Seok-Myong Kang**, Yongin-si (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 593 days.

(21) Appl. No.: **12/757,360**

(22) Filed: **Apr. 9, 2010**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

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Jun. 1, 2009 (KR) 10-2009-0048220

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

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

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

(56) **References Cited**

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Primary Examiner — Tho G Phan

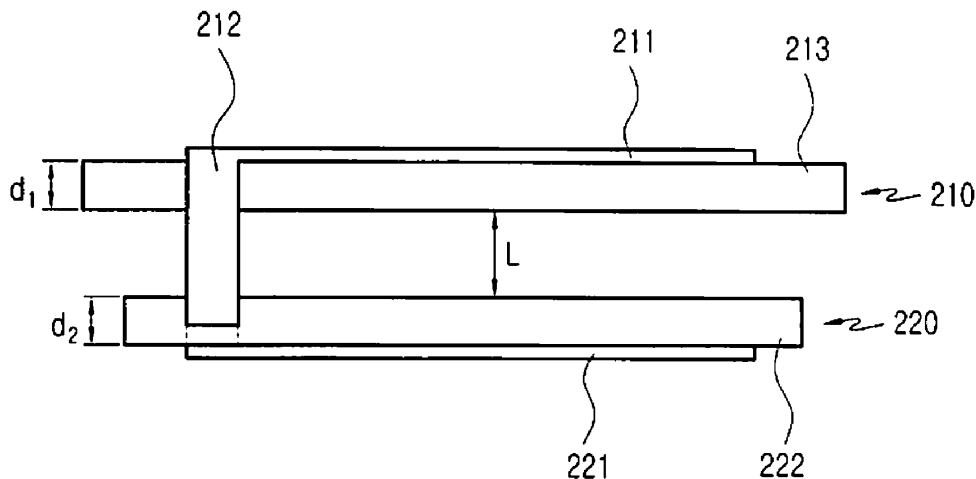
(74) *Attorney, Agent, or Firm* — The Farrell Law Firm, P.C.

(57) **ABSTRACT**

An internal antenna is provided that includes a first antenna having a first antenna pattern formed on a first dielectric layer, and a second antenna having a second antenna pattern formed on a second dielectric layer. The second dielectric layer has a higher dielectric constant than the first dielectric layer. The first and second antenna patterns are electrically connected to each other.

12 Claims, 9 Drawing Sheets

200





US008487819B2

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

(10) **Patent No.:** **US 8,487,819 B2**
(45) **Date of Patent:** ***Jul. 16, 2013**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE INCLUDING AN ELECTRICALLY CONDUCTIVE, ELECTRICALLY FLOATING ELEMENT AND RELATED METHODS**

(75) Inventors: **Yihong Qi**, Waterloo (CA); **Ying Tong Man**, Waterloo (CA); **Krystyna Bandurska**, 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.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/584,060**

(22) Filed: **Aug. 13, 2012**

(65) **Prior Publication Data**

US 2012/0306706 A1 Dec. 6, 2012

Related U.S. Application Data

(63) Continuation of application No. 13/304,887, filed on Nov. 28, 2011, now Pat. No. 8,274,438, which is a continuation of application No. 12/901,633, filed on Oct. 11, 2010, now Pat. No. 8,068,061, which is a continuation of application No. 11/467,955, filed on Aug. 29, 2006, now Pat. No. 7,812,770.

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 19/00 (2006.01)

(52) **U.S. Cl.**
USPC **343/702**; 343/833; 343/817; 343/818;
343/834

(58) **Field of Classification Search**

None
See application file for complete search history.

(56) **References Cited**

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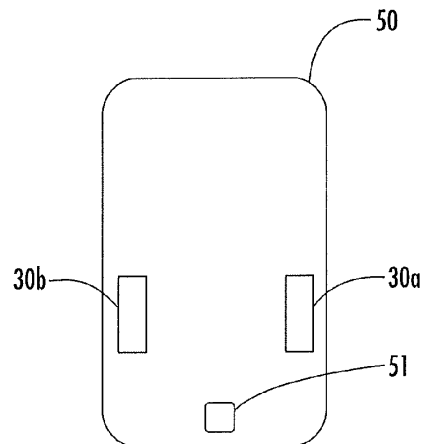
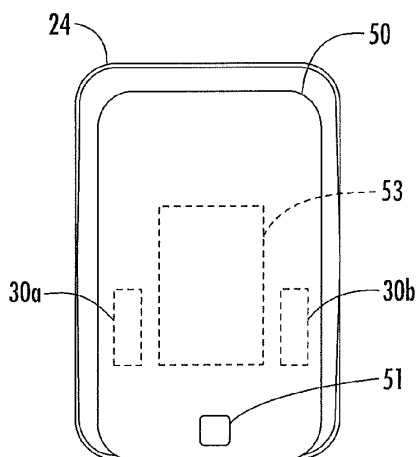
Primary Examiner — Trinh Dinh

(74) *Attorney, Agent, or Firm* — Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A mobile wireless communications device may include a portable housing having a surface, a printed circuit board (PCB) carried by the portable housing, and wireless transceiver circuitry carried by the PCB. The device may further include an antenna connected to the transceiver, and at least one electrically floating, electrically conductive, antenna beam shaping element secured to the surface of the portable housing for directing a beam pattern of the antenna.

20 Claims, 4 Drawing Sheets





US008487825B2

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

(10) **Patent No.:** **US 8,487,825 B2**
(45) **Date of Patent:** **Jul. 16, 2013**

(54) **COMMUNICATION DEVICE AND SYSTEM INCLUDING THE SAME**

(75) Inventors: **Masahiro Yanagi**, Shinagawa (JP);
Shigemi Kurashima, Shinagawa (JP);
Takashi Arita, Shinagawa (JP)

(73) Assignee: **Fujitsu Component Limited**, 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.: **13/592,737**

(22) Filed: **Aug. 23, 2012**

(65) **Prior Publication Data**

US 2012/0319921 A1 Dec. 20, 2012

Related U.S. Application Data

(62) Division of application No. 12/422,331, filed on Apr. 13, 2009, now Pat. No. 8,279,126.

(30) **Foreign Application Priority Data**

Aug. 27, 2008 (JP) 2008-217587

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 21/00 (2006.01)

(52) **U.S. Cl.**
USPC 343/767; 343/725; 343/728; 343/702

(58) **Field of Classification Search**
USPC 343/767, 770, 725, 728, 805, 702
See application file for complete search history.

(56) **References Cited**

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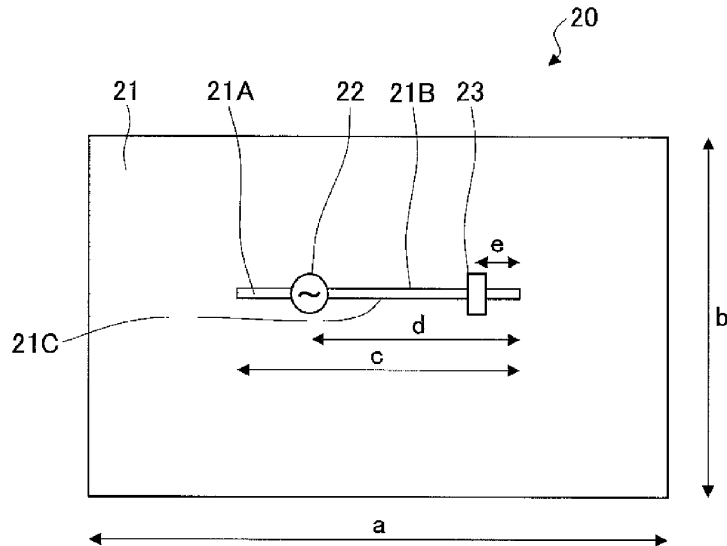
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Primary Examiner — Hoang V Nguyen
(74) *Attorney, Agent, or Firm* — IPUSA, PLLC

(57) **ABSTRACT**

A communication device is disclosed that includes an antenna apparatus including a feeding portion, a looped antenna element connected to the feeding portion, and a resistor inserted into the looped antenna element, and a communication circuit configured to process data that is transmitted and received via the antenna apparatus.

4 Claims, 11 Drawing Sheets





US008487828B2

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

(10) **Patent No.:** **US 8,487,828 B2**
(45) **Date of Patent:** **Jul. 16, 2013**

- (54) **SHIELDED CONTACTLESS ELECTRONIC DOCUMENT**
- (75) Inventors: **Bart Bombay**, Austin, TX (US); **Neville Pattinson**, Austin, TX (US); **Ksheerabdh Krishna**, Austin, TX (US); **Jean-Pierre Lafon**, Chatillon (FR); **Joseph Leibenguth**, Meudon Cedex (FR); **Denis Groeninck**, Meudon Cedex (FR); **Yves Reignoux**, Meudon Cedex (FR); **Severine Cheramy**, Meudon Cedex (FR)
- (73) Assignee: **Gemalto, SA**, Meudon Cedex (FR)
- (*) 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.: **12/703,556**
- (22) Filed: **Feb. 10, 2010**
- (65) **Prior Publication Data**
US 2010/0141547 A1 Jun. 10, 2010

- Related U.S. Application Data**
- (63) Continuation of application No. 11/629,763, filed as application No. PCT/IB2005/000861 on Apr. 1, 2005, now Pat. No. 7,701,408.
- (60) Provisional application No. 60/622,819, filed on Oct. 28, 2004.

- (30) **Foreign Application Priority Data**
Jun. 16, 2004 (EP) 04291520
Sep. 6, 2004 (EP) 04292139
- (51) **Int. Cl.**
H01Q 1/52 (2006.01)
H01Q 1/36 (2006.01)

- (52) **U.S. Cl.**
USPC **343/841**; 343/895; 343/700 MS; 343/829; 343/846; 235/492
- (58) **Field of Classification Search**
None
See application file for complete search history.

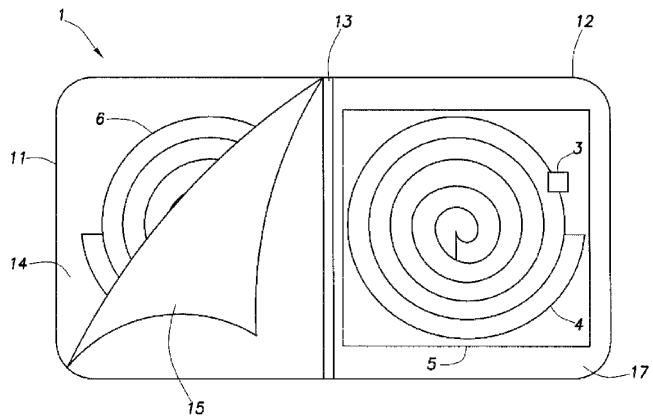
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Primary Examiner — Trinh Dinh
(74) *Attorney, Agent, or Firm* — Osha Liang LLP

(57) **ABSTRACT**
A document with a cover having a first cover part, a second cover part, at least one internal page located between the two cover parts when the document is closed, a radiofrequency microcontroller, an antenna electrically connected to the radiofrequency microcontroller, and an electromagnetic shield capable of disrupting, at least partially, the wireless communication with the radiofrequency microcontroller when the document is closed and not disrupting the wireless communication when the document is opened. The electromagnetic shield is a wire grid. The wire mesh distance between each two adjacent wires of the wire grid is smaller than a radio-frequency wavelength used for communicating with the radiofrequency microcontroller, and is at least 0.1 millimeters and at most 40 millimeters.

9 Claims, 4 Drawing Sheets





US008487831B2

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

(10) **Patent No.:** **US 8,487,831 B2**
(45) **Date of Patent:** **Jul. 16, 2013**

(54) **WIRELESS COMMUNICATION-IMPROVING SHEET MEMBER, WIRELESS IC TAG, ANTENNA, AND WIRELESS COMMUNICATION SYSTEM USING THE SAME**

(75) Inventors: **Takahiko Yoshida**, Yamatokooryama (JP); **Masato Matsushita**, Yamatokooryama (JP); **Haruhide Okamura**, Yamatokooryama (JP); **Shinichi Sato**, Yamatokooryama (JP); **Hiroaki Kogure**, Tokyo (JP); **Toshiharu Shimai**, Yamatokooryama (JP)

(73) Assignee: **Nitta 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 412 days.

(21) Appl. No.: **12/450,499**

(22) PCT Filed: **Mar. 31, 2008**

(86) PCT No.: **PCT/JP2008/056446**

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

(87) PCT Pub. No.: **WO2008/123515**

PCT Pub. Date: **Oct. 16, 2008**

(65) **Prior Publication Data**

US 2010/0035539 A1 Feb. 11, 2010

(30) **Foreign Application Priority Data**

Mar. 30, 2007 (JP) P2007-095524
Oct. 31, 2007 (JP) P2007-284599

(51) **Int. Cl.**
H01Q 1/00 (2006.01)
H01Q 1/38 (2006.01)
G06K 19/06 (2006.01)

(52) **U.S. Cl.**
USPC **343/904**; 343/700 MS; 235/492;
235/487

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

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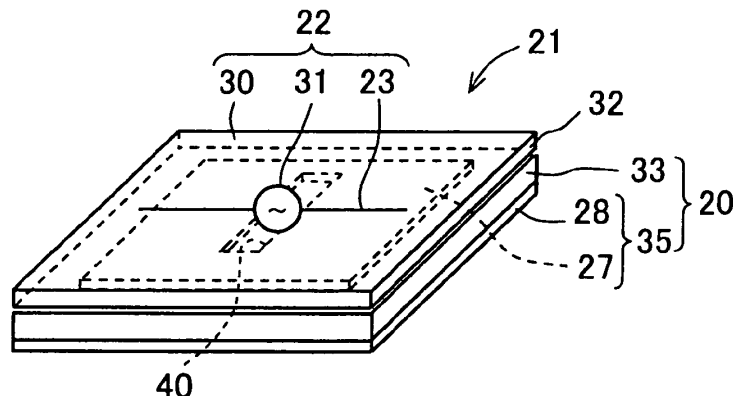
Primary Examiner — Trinh Dinh

(74) *Attorney, Agent, or Firm* — Harness, Dickey & Pierce, P.L.C.

(57) **ABSTRACT**

In one embodiment of the present invention, an object of the invention is to provide a wireless communication-improving sheet member capable of increasing a possible communication distance of an IC tag for wireless communication, a wireless IC tag, an antenna, and a wireless communication system. A first spacer includes an arrangement face on which the wireless IC tag is disposed without a wired connection, and an auxiliary antenna is disposed on the first spacer on an opposite side to the arrangement face, the auxiliary antenna resonating with electromagnetic waves used in the wireless communication. The auxiliary antenna includes a first conductor layer as a resonant layer and a second spacer. The second spacer is disposed on an opposite side to the first spacer with the first conductor layer interposed therebetween. A discontinuous area is disposed in the first conductor layer of the auxiliary antenna. Thus, it is possible to not only eliminate influence of a communication-jamming member, but also increase received electrical power of a wireless IC tag (antenna), and ensure a long communication distance.

20 Claims, 25 Drawing Sheets





US008488703B2

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

(10) **Patent No.:** **US 8,488,703 B2**

(45) **Date of Patent:** **Jul. 16, 2013**

(54) **METHOD FOR DETERMINING MIMO TRANSMISSION TECHNIQUES, BASE STATION AND MOBILE TERMINAL**

(75) Inventors: **Thorsten Wild**, Stuttgart (DE); **Cornelis Hoek**, Tamm (DE)

(73) Assignee: **Alcatel Lucent**, Paris (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 926 days.

(21) Appl. No.: **12/046,392**

(22) Filed: **Mar. 11, 2008**

(65) **Prior Publication Data**
US 2008/0232502 A1 Sep. 25, 2008

(30) **Foreign Application Priority Data**
Mar. 21, 2007 (EP) 07300887

(51) **Int. Cl.**
H04B 7/02 (2006.01)

(52) **U.S. Cl.**
USPC **375/267; 375/316**

(58) **Field of Classification Search**
USPC **375/267**
See application file for complete search history.

(56) **References Cited**
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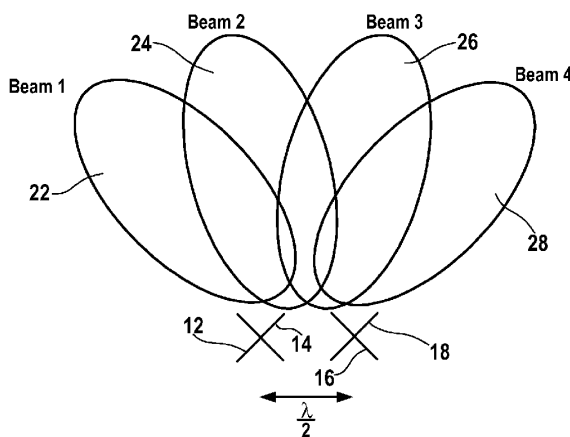
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Primary Examiner — Kenneth Lam
Assistant Examiner — Michael Neff
(74) *Attorney, Agent, or Firm* — Fay Sharpe LLP

(57) **ABSTRACT**

The present invention relates to a method for determining the appropriate combination of at least two MIMO transmission techniques for a radio link in between a transmitter (10) and a receiver (20). The MIMO transmission techniques use at least two antennas (12, 14, 16, 18) with at least two polarizations. According to the invention the appropriate combination is the combination of beamforming and at least one of polarization time coding, closed loop coherent combination of polarization beams and polarization multiplexing. The appropriate combination is chosen dependent on at least one of radio conditions of the radio link (20) and relative velocity in between the transmitter (10) and the receiver (30). The invention further relates to a method for receiving a transmission of a radio link (20) in between a transmitter (10) and a receiver (30). The invention also relates to a base station comprising a transmitter, a mobile terminal comprising a receiver and a communication network.

15 Claims, 2 Drawing Sheets





US008489160B2

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

(10) **Patent No.:** **US 8,489,160 B2**
(45) **Date of Patent:** **Jul. 16, 2013**

(54) **SLIDE-TYPE MOBILE TERMINAL AND SIGNAL PROCESSING METHOD THEREOF**

(75) Inventors: **Yu Xiao**, Shenzhen (CN); **Shougang Cheng**, Shenzhen (CN)

(73) Assignee: **ZTE Corporation**, Shenzhen, Guangdong Province (CN)

(*) 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.: **13/500,914**

(22) PCT Filed: **Apr. 8, 2010**

(86) PCT No.: **PCT/CN2010/071631**

§ 371 (c)(1),
(2), (4) Date: **Apr. 8, 2012**

(87) PCT Pub. No.: **WO2010/145270**

PCT Pub. Date: **Dec. 23, 2010**

(65) **Prior Publication Data**

US 2012/0206212 A1 Aug. 16, 2012

(30) **Foreign Application Priority Data**

Oct. 26, 2009 (CN) 2009 1 0236563

(51) **Int. Cl.**
H04M 1/00 (2006.01)
H04M 1/02 (2006.01)

(52) **U.S. Cl.**
CPC **H04M 1/0235** (2013.01)
USPC **455/575.4; 455/575.7**

(58) **Field of Classification Search**
CPC H04M 1/0235
USPC 455/550.1, 575.1, 575.3, 575.4, 575.7,
455/90.1, 90.3, 347, 351

See application file for complete search history.

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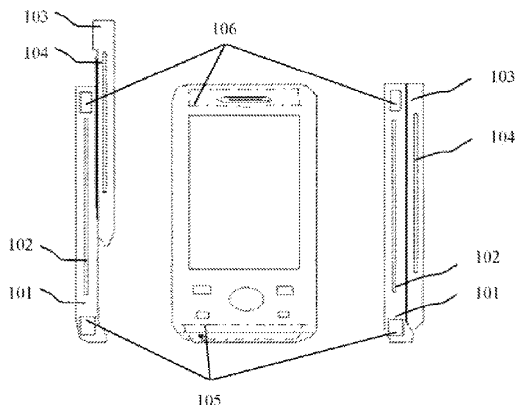
Primary Examiner — Thanh Le

(74) *Attorney, Agent, or Firm* — Stephen Yang; Ling Wu; Ling and Yang Intellectual Property

(57) **ABSTRACT**

A slide type mobile terminal and a method for processing signals thereof are disclosed in the present invention, wherein, a built-in auxiliary antenna is installed in an upper slide portion (10) of the slide type mobile terminal, meanwhile corresponding signal conversion modules (122, 312) are added to the upper slide portion (10) and a lower slide portion (30) respectively, which is used for converting an external high-frequency signal received by the built-in auxiliary antenna or an internal high-frequency signal generated by a main printed circuit board (PCB) from a single-ended signal to a differential signal, which are transmitted between the upper slide portion (10) and the lower slide portion (30) by a flexible printed circuit board (FPC) (20), so that the high-frequency signal is transmitted between the upper slide portion (10) and the lower slide portion (30) in form of differential signal.

8 Claims, 5 Drawing Sheets





US008489162B1

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

(10) **Patent No.:** **US 8,489,162 B1**
(45) **Date of Patent:** **Jul. 16, 2013**

(54) **SLOT ANTENNA WITHIN EXISTING DEVICE COMPONENT**

(75) Inventors: **Weiping Dou**, San Jose, CA (US);
James Samuel Bowen, Cupertino, CA (US)

(73) Assignee: **Amazon Technologies, Inc.**, Reno, NV (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 71 days.

(21) Appl. No.: **12/858,335**

(22) Filed: **Aug. 17, 2010**

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

(52) **U.S. Cl.**
USPC **455/575.7**; 455/562.1; 455/129; 343/771; 343/746

(58) **Field of Classification Search**
USPC 455/562.1, 575.5, 575.7, 575.8, 90.3, 455/129, 269; 343/702, 746, 767-771
See application file for complete search history.

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Primary Examiner — Edward Urban

Assistant Examiner — Rui Hu

(74) *Attorney, Agent, or Firm* — Lowenstein Sandler LLP

(57) **ABSTRACT**

A user device having a slot antenna formed in metallic material of a structural member is described.

23 Claims, 18 Drawing Sheets

