



US008212721B2

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

(10) **Patent No.:** **US 8,212,721 B2**
(45) **Date of Patent:** ***Jul. 3, 2012**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE COMPRISING A SATELLITE POSITIONING SYSTEM ANTENNA AND ELECTRICALLY CONDUCTIVE DIRECTOR ELEMENT THEREFOR**

(75) Inventors: **Yihong Qi**, Waterloo (CA); **Ying Tong Man**, Kitchener (CA); **Perry Jarmuszewski**, Waterloo (CA); **Adrian Cooke**, Kitchener (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 116 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/617,335**

(22) Filed: **Nov. 12, 2009**

(65) **Prior Publication Data**
US 2010/0056212 A1 Mar. 4, 2010

Related U.S. Application Data

(63) Continuation of application No. 11/753,424, filed on May 24, 2007, now Pat. No. 7,705,776, which is a continuation of application No. 11/140,826, filed on May 31, 2005, now Pat. No. 7,239,270.

(51) **Int. Cl.**
G01S 19/25 (2010.01)
H01Q 19/10 (2006.01)

(52) **U.S. Cl.** **342/357.64; 343/818**

(58) **Field of Classification Search** **342/354, 342/357.64, 357.76; 701/213, 215, 412; 343/818; 455/556.1, 575.7**

See application file for complete search history.

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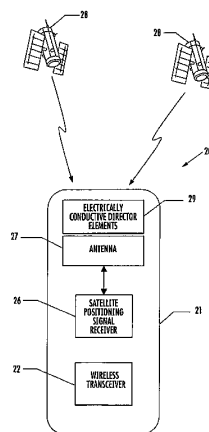
Primary Examiner — Dao Phan

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

(57) **ABSTRACT**

A portable mobile wireless communications device may include a portable housing, and at least one wireless transceiver carried by the portable housing. The portable mobile wireless communications device may also include a satellite positioning signal receiver carried by the portable housing and an antenna carried by the portable housing and coupled to the satellite positioning signal receiver. The portable wireless communications device may further include a passive antenna beam pattern director associated with the antenna and may include at least one electrically conductive director element carried by the portable housing in spaced apart relation from the antenna and inductively coupled thereto.

22 Claims, 6 Drawing Sheets





US008212726B2

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

(10) **Patent No.:** **US 8,212,726 B2**
(45) **Date of Patent:** **Jul. 3, 2012**

(54) **SPACE-FILLING MINIATURE ANTENNAS**

(56) **References Cited**

(75) Inventors: **Carles Puente Baliarda**, Barcelona (ES); **Edouard Jean Louis Rozan**, Barcelona (ES); **Jaume Anguera Pros**, Barcelona (ES)

(73) Assignee: **Fractus, SA**, Barcelona (ES)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 220 days.

(21) Appl. No.: **12/347,462**

(22) Filed: **Dec. 31, 2008**

(65) **Prior Publication Data**
US 2009/0109101 A1 Apr. 30, 2009

Related U.S. Application Data

(60) Continuation of application No. 11/686,804, filed on Mar. 15, 2007, which is a division of application No. 11/179,250, filed on Jul. 12, 2005, now Pat. No. 7,202,822, which is a continuation of application No. 11/110,052, filed on Apr. 20, 2005, now Pat. No. 7,148,850, which is a continuation of application No. 10/182,635, filed as application No. PCT/EP00/00411 on Jan. 19, 2000, now abandoned.

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

(52) **U.S. Cl.** **343/700 MS; 343/702; 343/767; 343/866**

(58) **Field of Classification Search** **343/700 MS, 343/702, 767, 866, 795, 792.5, 806**
See application file for complete search history.

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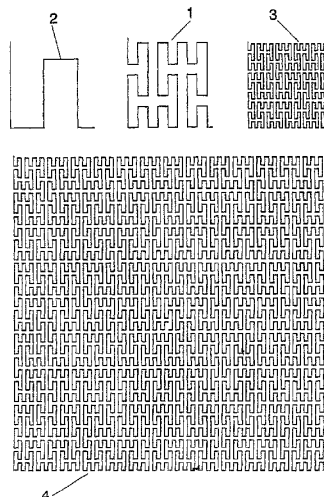
Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Howison & Arnott, L.L.P.

(57) **ABSTRACT**

A novel geometry, the geometry of Space-Filling Curves (SFC) is defined in the present invention and it is used to shape a part of an antenna. By means of this novel technique, the size of the antenna can be reduced with respect to prior art, or alternatively, given a fixed size the antenna can operate at a lower frequency with respect to a conventional antenna of the same size.

127 Claims, 25 Drawing Sheets





US008212727B2

(12) **United States Patent**
Hsu

(10) **Patent No.:** **US 8,212,727 B2**
(45) **Date of Patent:** **Jul. 3, 2012**

(54) **ANTENNA AND WIRELESS TRANSCEIVER USING THE SAME**

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(75) Inventor: **Chia-Jui Hsu**, Hsinchu (TW)

(73) Assignee: **Ralink 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 445 days.

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Primary Examiner — Michael C Wimer

(21) Appl. No.: **12/427,120**

(74) *Attorney, Agent, or Firm* — Peter F. Corless; Steven M. Jensen; Edwards Wildman Palmer LLP

(22) Filed: **Apr. 21, 2009**

(65) **Prior Publication Data**

US 2010/0265141 A1 Oct. 21, 2010

(30) **Foreign Application Priority Data**

Apr. 21, 2008 (TW) 97114435 A

(57) **ABSTRACT**

An antenna and a wireless transceiver are provided. The antenna includes: a substrate having first and second surfaces with circuits thereon; and two shield boxes located on the first and second surfaces for covering the circuits thereon. The shield boxes each comprise an antenna section and a shield section. The antenna sections are disposed at one side of the shield section and aligned with a margin of the substrate, and include signal ends electrically connected to the circuits and grounding ends electrically connected to the shield sections. The first antenna section is disposed on a diagonal opposite of the second antenna section flush with substrate margin or aligned with the substrate margin, thereby maximizing the distance between the two antennas disposed on the substrate, and preventing the two antennas from electromagnetic interference. The antennas are disposed on sides of the shield sections flush with substrate margins and thereby are space-saving.

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

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

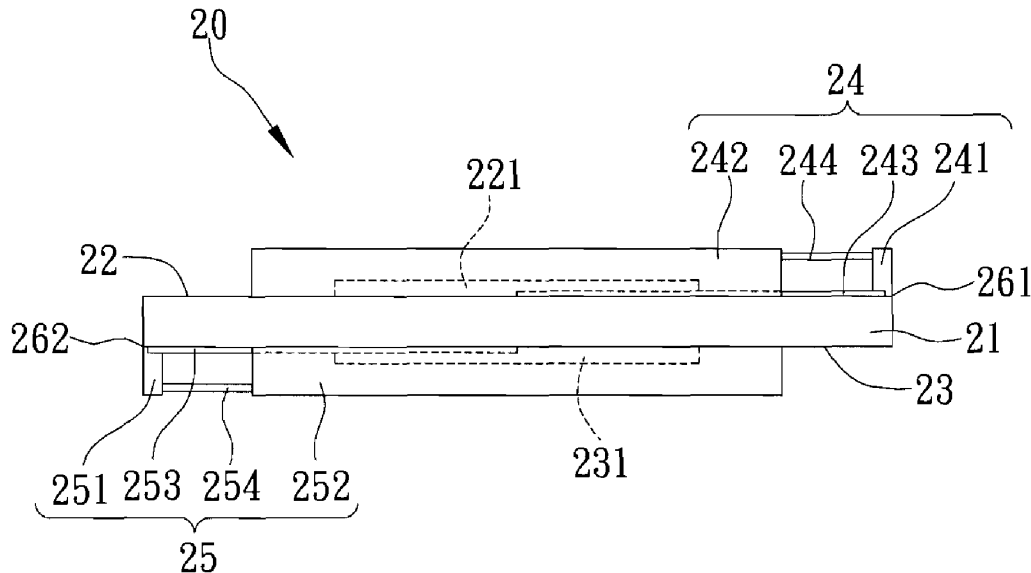
(58) **Field of Classification Search** 343/700 MS, 343/702, 846, 841; 455/575.7
See application file for complete search history.

(56) **References Cited**

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16 Claims, 4 Drawing Sheets





US008212729B2

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

(10) **Patent No.:** **US 8,212,729 B2**
(45) **Date of Patent:** **Jul. 3, 2012**

(54) **MECHANICALLY TUNABLE ANTENNA FOR COMMUNICATION DEVICES**

(75) Inventors: **Jussi Rahola**, Espoo (FI); **Jani Ollikainen**, Helsinki (FI); **Keniche Hashizume**, Gunma (JP); **Matti Ryyänen**, Helsinki (FI)

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

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

(21) Appl. No.: **12/803,094**

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

(65) **Prior Publication Data**
US 2010/0259454 A1 Oct. 14, 2010

Related U.S. Application Data
(62) Division of application No. 11/478,839, filed on Jun. 30, 2006, now Pat. No. 7,755,547.

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

(56) **References Cited**
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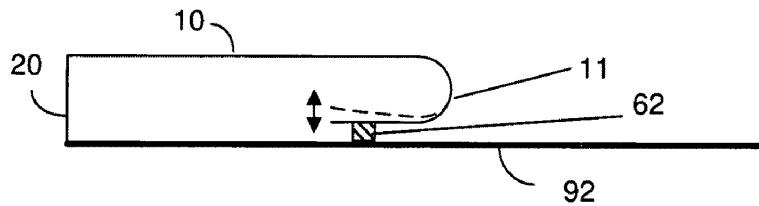
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Primary Examiner — Hoanganh Le
(74) *Attorney, Agent, or Firm* — Alston & Bird LLP

(57) **ABSTRACT**
A radio antenna assembly for use in a communication device has an antenna element disposed adjacent to a ground plane to form a physical relationship with the ground plane. A mechanical device is used to change the physical relationship for changing the operating impedance of the antenna element or shifting the frequency band of the antenna assembly. The physical relationship can be changed by mechanically changing the shape of the antenna element. When the antenna element comprises a first radiating element and a second radiating element disposed at a lateral distance from the first radiating element, the physical relationship can be changed by changing the distance. When a physical object is disposed between the antenna element and the ground plane, the physical relationship can be changed by moving or twisting the physical object. The object can be electrically conducting, dielectric or magnetic.

10 Claims, 15 Drawing Sheets





US008212730B2

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

(10) **Patent No.:** **US 8,212,730 B2**
(45) **Date of Patent:** ***Jul. 3, 2012**

- (54) **LOW PROFILE FULL WAVELENGTH MEANDERING ANTENNA**
- (75) Inventors: **Yihong Qi**, Waterloo (CA); **Perry Jarmuszewski**, Waterloo (CA); **Ying Tong Man**, Kitchener (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.: **13/042,489**
- (22) Filed: **Mar. 8, 2011**
- (65) **Prior Publication Data**
US 2011/0156968 A1 Jun. 30, 2011

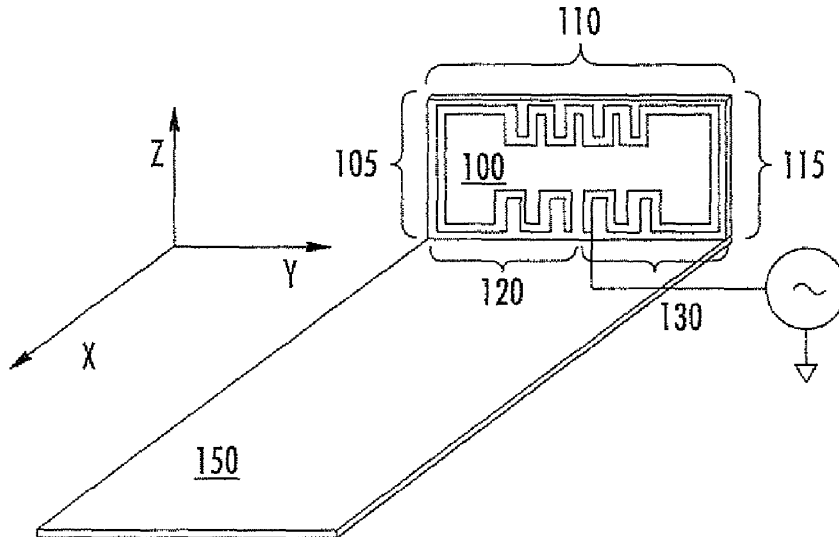
- Related U.S. Application Data**
- (63) Continuation of application No. 12/337,690, filed on Dec. 18, 2008, now Pat. No. 7,936,308, which is a continuation of application No. 11/014,287, filed on Dec. 16, 2004, now Pat. No. 7,486,241.
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702; 343/741; 343/806; 343/828**
- (58) **Field of Classification Search** **343/700 MS, 343/702, 731, 741, 744, 806, 825, 828, 895**
See application file for complete search history.

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Primary Examiner — Michael C Wimer
(74) *Attorney, Agent, or Firm* — Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

- (57) **ABSTRACT**
- A low profile antenna has a meander length based on the full electrical wavelength of the signal being transmitted or received. The antenna can have either an open-loop structure or a closed-loop structure with a matching network. The low profile enables the antenna to be used in a card for a device such as a personal computer, personal digital assistant, wireless telephone and so on with minimal risk of the antenna breaking off, as compared with a prior art antenna having a higher height and thus more likelihood of being broken from its card.

17 Claims, 13 Drawing Sheets





US008212731B2

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

(10) **Patent No.:** **US 8,212,731 B2**
(45) **Date of Patent:** **Jul. 3, 2012**

(54) **ANTENNA DEVICE AND COMMUNICATION APPARATUS**

(75) Inventors: **Akihiro Bungo**, Tokyo (JP); **Takao Yokoshima**, Tokyo (JP); **Shinsuke Yukimoto**, Tokyo (JP); **Toshiaki Edamatsu**, Chichibu-gun (JP)

(73) Assignee: **Mitsubishi Materials 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 0 days.

(21) Appl. No.: **12/788,175**

(22) Filed: **May 26, 2010**

(65) **Prior Publication Data**

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Related U.S. Application Data

(62) Division of application No. 10/596,812, filed as application No. PCT/JP2004/019337 on Dec. 24, 2004, now Pat. No. 7,777,677.

(30) **Foreign Application Priority Data**

Dec. 25, 2003	(JP)	2003-430022
Mar. 12, 2004	(JP)	2004-070875
Mar. 12, 2004	(JP)	2004-071513
Aug. 4, 2004	(JP)	2004-228157
Aug. 31, 2004	(JP)	2004-252435
Oct. 18, 2004	(JP)	2004-302924

(51) **Int. Cl.**
H01Q 9/00 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/749; 343/700 MS; 343/702; 343/895; 343/750**

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

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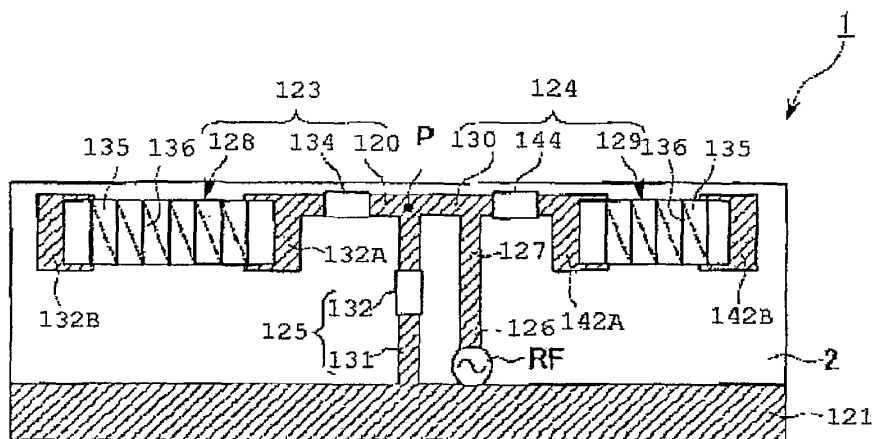
Primary Examiner — Trinh Dinh

(74) *Attorney, Agent, or Firm* — Leason Ellis LLP.

(57) **ABSTRACT**

There is provided an antenna device including a substrate, an earth section which is disposed on a portion of the substrate, a feed point which is disposed on the substrate, a loading section disposed on the substrate and constructed with a line-shaped conductor pattern which is formed in a longitudinal direction of an elementary body made of a dielectric material, an inductor section which connects one end of the conductor pattern to the earth section, and a feed point which feeds a current to a connection point of the one end of the conductor pattern and the inductor section, wherein a longitudinal direction of the loading section is arranged to be parallel to an edge side of the earth section.

8 Claims, 28 Drawing Sheets





US008212732B2

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

(10) **Patent No.:** **US 8,212,732 B2**
(45) **Date of Patent:** **Jul. 3, 2012**

(54) **DUAL POLARIZED ANTENNA WITH NULL-FILL**

(56) **References Cited**

(75) Inventors: **Sven Petersson**, Sävedalen (SE);
Anders Derneryd, Göteborg (SE);
Ulrika Engström, Floda (SE); **Martin Johansson**, Mölndal (SE); **Lars Manholm**, Göteborg (SE)

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(73) Assignee: **Telefonaktiebolaget L M Ericsson (Publ)**, Stockholm (SE)

Primary Examiner — Hoanganh Le
(74) *Attorney, Agent, or Firm* — Roger S. Burleigh

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 455 days.

(57) **ABSTRACT**

(21) Appl. No.: **12/598,817**

The present invention relates to a dual polarized array antenna comprising at least two dual polarized antenna elements being arranged for radiating electromagnetic energy having a first polarization, constituting a first antenna radiation pattern, via a connection to a first antenna port, and electromagnetic energy having a second polarization, constituting a second antenna radiation pattern, via a connection to a second antenna port, the second polarization being orthogonal to the first polarization, the first antenna radiation pattern and second antenna radiation pattern each having a main beam and a number of side-lobes with nulls. The array antenna comprises at least one further dual polarized antenna element arranged for radiating electromagnetic energy having two mutually orthogonal polarizations, constituting further antenna radiation patterns, via respective connections to the first antenna port and the second antenna port, where the polarization of said at least one further dual polarized antenna element that is associated with the first antenna port deviates from the first polarization such that said at least one null of the first antenna pattern is at least partly filled.

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(86) PCT No.: **PCT/SE2007/050302**

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

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PCT Pub. Date: **Nov. 13, 2008**

(65) **Prior Publication Data**

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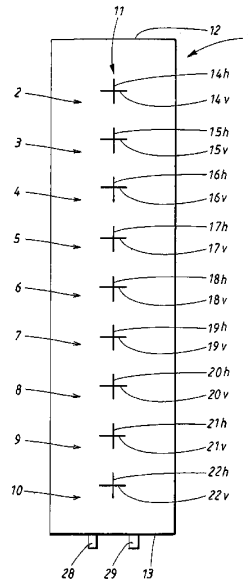
(51) **Int. Cl.**
H01Q 13/10 (2006.01)

(52) **U.S. Cl.** **343/770; 343/797; 343/700 MS**

(58) **Field of Classification Search** **343/700 MS, 343/770, 797, 893**

See application file for complete search history.

9 Claims, 4 Drawing Sheets





US008212736B2

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

(10) **Patent No.:** **US 8,212,736 B2**
(45) **Date of Patent:** **Jul. 3, 2012**

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

(75) Inventors: **Hiroshi Satoh**, Ishikawa (JP); **Yoshio Koyanagi**, Kanagawa (JP)

(73) Assignee: **Panasonic Corporation**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 246 days.

(21) Appl. No.: **12/746,491**

(22) PCT Filed: **Dec. 4, 2007**

(86) PCT No.: **PCT/JP2007/073417**

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

(87) PCT Pub. No.: **WO2009/072189**

PCT Pub. Date: **Jun. 11, 2009**

(65) **Prior Publication Data**

US 2010/0277395 A1 Nov. 4, 2010

(51) **Int. Cl.**
H01Q 3/24 (2006.01)

(52) **U.S. Cl.** **343/876**

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

See application file for complete search history.

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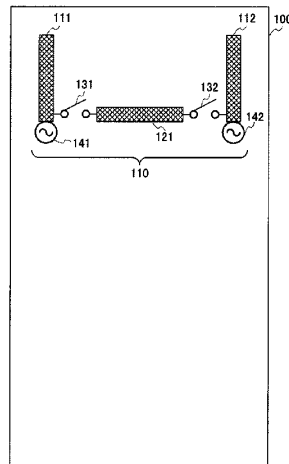
Primary Examiner — Huedung Mancuso

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

(57) **ABSTRACT**

An antenna device and a communication device capable of changing over polarization characteristics of an antenna to improve transmission capacity in various kinds of polarization environments and used configuration by preventing reduction of the communication capacity for a reception signal degrading or varying depending on momentarily changing polarization conditions between a base station and a terminal. The antenna device (110) includes a plurality of first antenna elements (111,112) for a first polarizing direction, a second antenna element (121) provided in the direction orthogonal to the first polarizing direction, a plurality of switches (131,132) for switching connection between the plurality of first antenna elements (111,112) and the second antenna element (121), and power supply parts (141,142) respectively provided on the plurality of first antenna elements (111,112).

4 Claims, 15 Drawing Sheets





US008215561B2

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

(10) **Patent No.:** **US 8,215,561 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

- (54) **ANTENNA AND READER/WRITER DEVICE**
- (75) Inventors: **Manabu Kai**, Kawasaki (JP); **Teruhisa Ninomiya**, Kawasaki (JP)
- (73) Assignee: **Fujitsu Limited**, Kawasaki (JP)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 447 days.
- (21) Appl. No.: **12/458,026**

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Primary Examiner — Ahshik Kim
 (74) *Attorney, Agent, or Firm* — Fujitsu Patent Center

- (22) Filed: **Jun. 29, 2009**
- (65) **Prior Publication Data**
US 2010/0078486 A1 Apr. 1, 2010
- (30) **Foreign Application Priority Data**
Sep. 30, 2008 (JP) 2008-255312
- (51) **Int. Cl.**
G06K 19/06 (2006.01)
- (52) **U.S. Cl.** **235/492; 340/572.7**
- (58) **Field of Classification Search** **235/492; 340/572.7; 343/732, 866**
See application file for complete search history.

(56) **References Cited**

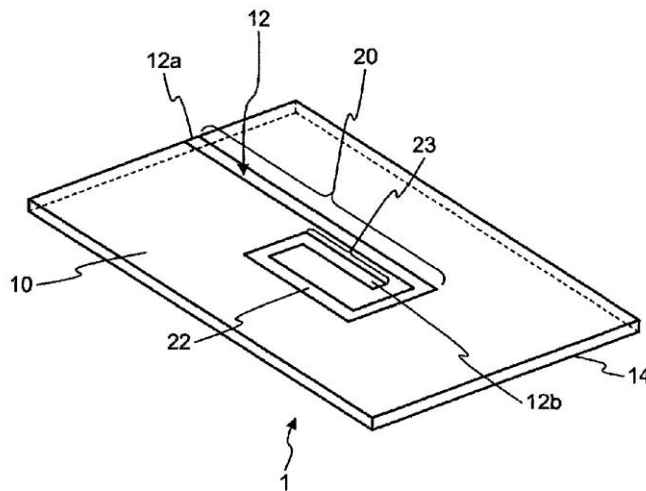
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(57) **ABSTRACT**

An antenna includes a substrate made of a dielectric substance, and a conductor pattern formed on the substrate and including a feeding point, an open end, an extension part extending from the feeding point, and a spiral part extending spirally from an opposite end of the extension part to the open end. The spiral part includes a part juxtaposed with the extension part. A distance along length directions of the conductor pattern, from a zero point at which a current is zero in the part upon feeding power to the feeding point, to a point at which a line perpendicular to the part and passing through the zero point intersects the extension part, is set to a second distance at which an electric field strength generated as a combination of electric fields generated at these points upon the feeding of power enables communications with the wireless tag.

5 Claims, 5 Drawing Sheets





US008217840B2

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

(10) **Patent No.:** **US 8,217,840 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

- (54) **DUAL-BAND ANTENNA ASSEMBLY**
- (75) Inventors: **Min Chen**, Shanghai (CN); **Cho-Ju Chung**, Taipei Hsien (TW)
- (73) Assignees: **Ambit Microsystems (Shanghai) Ltd.**, Shanghai (CN); **Hon Hai Precision Industry Co., Ltd.**, 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 399 days.

- (21) Appl. No.: **12/627,014**
- (22) Filed: **Nov. 30, 2009**
- (65) **Prior Publication Data**
US 2011/0050538 A1 Mar. 3, 2011
- (30) **Foreign Application Priority Data**
Aug. 26, 2009 (CN) 2009 2 0308926 U
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/893; 343/895; 343/853**
- (58) **Field of Classification Search** None
See application file for complete search history.

- (56) **References Cited**
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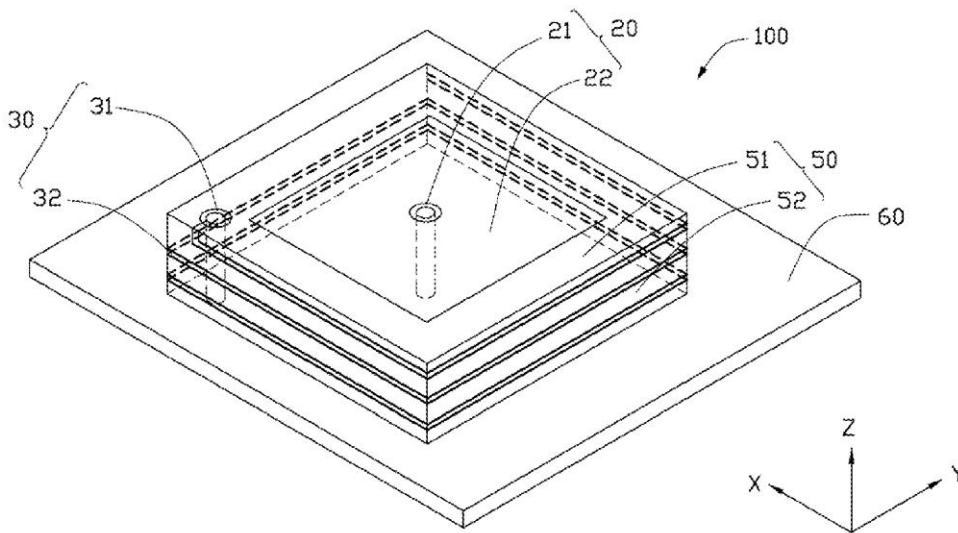
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Primary Examiner — Trinh Dinh
(74) *Attorney, Agent, or Firm* — Altis Law Group, Inc.

(57) **ABSTRACT**

A dual-band antenna assembly is positioned on a substrate, and includes an insulation body, a plane antenna and a microstrip antenna. The insulation body includes a plane surface paralleled to the substrate, and a side surface perpendicularly extending from edges of the plane surface to the substrate. The plane antenna includes a first feed portion and a first radiator. The first feed portion passes through the substrate to the plane surface of the insulation body. The first radiator is substantially positioned on a center of the plane surface of the insulation body, and electrically connected to the first feed portion. The microstrip antenna includes a second feed portion and a second radiator. The second radiator is a microstrip, electrically connected to the second feed portion and positioned on the side surface of the insulation body.

9 Claims, 4 Drawing Sheets





US008217841B2

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

(10) **Patent No.:** **US 8,217,841 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

(54) **FREQUENCY TUNABLE ANTENNA**

(56) **References Cited**

(75) Inventors: **Golam Sorwar Hossain**, Kawasaki (JP);
Takashi Yamagajo, Kawasaki (JP)

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(73) Assignee: **Fujitsu Limited**, Kawasaki (JP)

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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 349 days.

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Primary Examiner — Hoanganh Le

(21) Appl. No.: **12/696,729**

(74) *Attorney, Agent, or Firm* — Westerman, Hattori, Daniels & Adrian, LLP

(22) Filed: **Jan. 29, 2010**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2010/0245201 A1 Sep. 30, 2010

There is provided an antenna for tuning a resonant frequency. The antenna includes a first and a second arms connected to the antenna feeding portion at a common end thereof. The second arm has each of the plurality of branches including a switch for selecting a length of an electrical loop formed by the second arm and an end of a ground plane, each of the switches is connected to the ground plane. A first resonant frequency performed by the first arm is higher than a second resonant frequency by the second arm when each of the switches is open, and the first resonant frequency is lower than a third resonant frequency by the second arm when one of the switches is selected to connect the second arm and the ground plane so that the length of the electrical loop is maximum.

(30) **Foreign Application Priority Data**

Mar. 30, 2009 (JP) 2009-082770

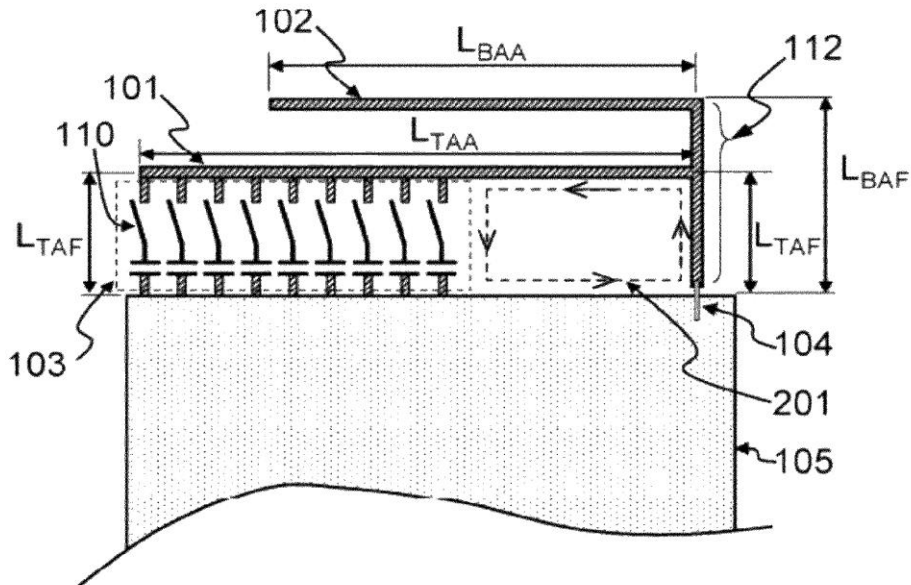
10 Claims, 9 Drawing Sheets

(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, 846, 848**

See application file for complete search history.





US008217844B2

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

(10) **Patent No.:** **US 8,217,844 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

(54) **ANTENNA FOR RECEIVING ELECTRIC WAVES, A MANUFACTURING METHOD THEREOF, AND AN ELECTRONIC DEVICE WITH THE ANTENNA**

(75) Inventors: **Chih-Ming Wang**, Taipei (TW);
Kuan-Hsueh Tseng, Taipei (TW);
Chiu-Hui Wu, Taipei (TW); **Yuh-Yuh Chiang**, Taipei (TW); **Shang-Ching Tseng**, Taipei (TW)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 372 days.

(21) Appl. No.: **12/578,264**

(22) Filed: **Oct. 13, 2009**

(65) **Prior Publication Data**
US 2010/0103056 A1 Apr. 29, 2010

(30) **Foreign Application Priority Data**
Oct. 28, 2008 (TW) 97141374 A

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/700 MS**
(58) **Field of Classification Search** **343/702, 343/700 MS**

See application file for complete search history.

(56) **References Cited**

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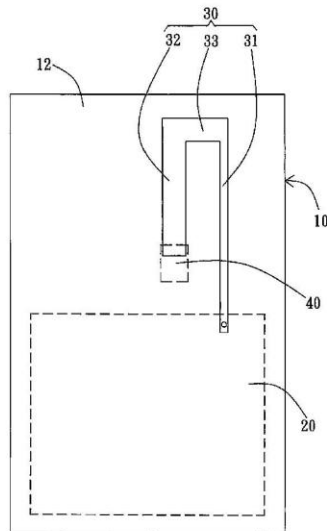
Primary Examiner — Dieu H Duong

(74) *Attorney, Agent, or Firm* — Muncy, Geissler, Olds & Lowe, PLLC

(57) **ABSTRACT**

An antenna for receiving electric waves, a manufacturing method thereof, and an electronic device with the antenna are provided. The antenna includes a substrate, a grounding unit, a radiator, a coupling unit, and a signal transmission line. The substrate has a first surface and a second surface which are opposite to each other. The grounding unit is disposed on the first surface of the substrate. The radiator is disposed on the second surface of the substrate and connected to the grounding unit. The coupling unit is disposed on the first surface of the substrate and partially overlaps the projection of the radiator. The signal transmission line includes a signal line and a ground line, the signal line being connected to the coupling unit while the ground line being connected to the grounding unit.

24 Claims, 7 Drawing Sheets





US008217851B2

(12) **United States Patent
Cheng**

(10) **Patent No.: US 8,217,851 B2**
(45) **Date of Patent: Jul. 10, 2012**

- (54) **DUAL BAND ANTENNA**
- (75) Inventor: **Pi-Hsi Cheng, Zhubei (TW)**
- (73) Assignee: **Arcadyan Technology Corp., Hsinchu (TW)**
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 107 days.

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- (21) Appl. No.: **12/152,511**
- (22) Filed: **May 14, 2008**
- (65) **Prior Publication Data**
US 2009/0073050 A1 Mar. 19, 2009

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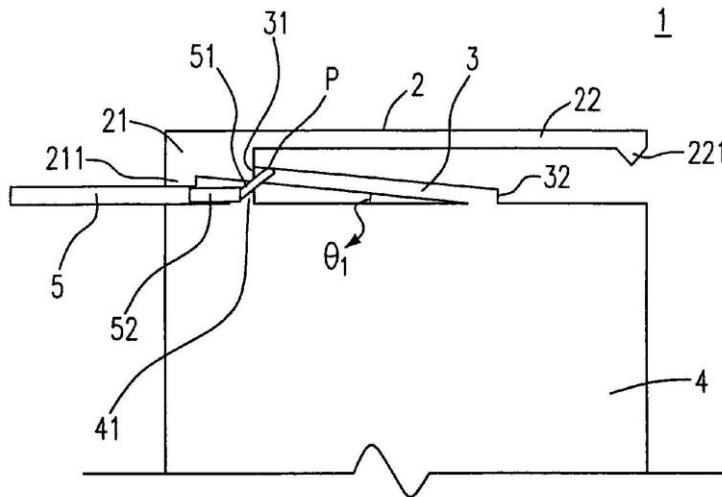
- (30) **Foreign Application Priority Data**
Sep. 14, 2007 (TW) 96134599 A
- (51) **Int. Cl.**
H01Q 1/36 (2006.01)
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/846; 343/702**
- (58) **Field of Classification Search** 343/700 MS, 343/702, 846, 848
See application file for complete search history.

Primary Examiner — Michael C Wimer
(74) *Attorney, Agent, or Firm* — Haverstock & Owens LLP

- (56) **References Cited**
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6,222,496 B1 4/2001 Liu

(57) **ABSTRACT**
A dual band antenna is provided. The dual band antenna includes a radiating element, a grounding element, and a connection element. The radiating element has a first radiating portion and a second radiating portion, wherein the second radiating portion extends from the first radiating portion in a first direction parallel to the grounding element. The connecting element extends in a second direction and is connected between the radiating element and the grounding element, wherein the connecting element has a first end connected to the radiating element and a second end connected to the grounding element with an including angle between 0° and 90°, and a configuration including the connecting element, the radiating element and the grounding element has a Z-like shape.

13 Claims, 5 Drawing Sheets





US008217853B2

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

(10) **Patent No.:** **US 8,217,853 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

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

(75) Inventors: **Lung-Sheng Tai**, Tu-cheng (TW);
Wen-Fong Su, Tu-cheng (TW);
Hsieh-Sheng Tseng, 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 780 days.

(21) Appl. No.: **12/319,081**

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

(65) **Prior Publication Data**
US 2009/0167631 A1 Jul. 2, 2009

(30) **Foreign Application Priority Data**
Dec. 31, 2007 (TW) 96151059 A

(51) **Int. Cl.**
H01Q 1/50 (2006.01)
(52) **U.S. Cl.** **343/906**; 343/700 MS
(58) **Field of Classification Search** 343/700 MS, 343/702, 841, 906; 439/607, 916
See application file for complete search history.

(56) **References Cited**

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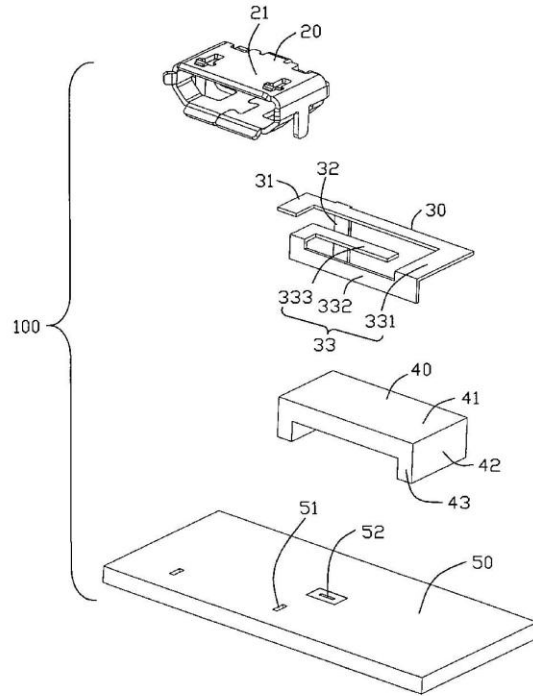
Primary Examiner — Tan Ho

(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: a PCB (50) comprising a feeding circuit and a grounding circuit; an electrical connector (20) installed on the PCB comprising a metal shell (21) electrically connecting to the grounding circuit; a metal patch (30) connecting to the metal shell comprising a radiating element (33) and a connecting element (31); the radiating element electrical connecting to the feeding circuit; the connecting element connecting the radiating element and the metal shell; 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.

17 Claims, 4 Drawing Sheets





US008219143B2

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

(10) **Patent No.:** **US 8,219,143 B2**
(45) **Date of Patent:** ***Jul. 10, 2012**

- (54) **MOBILE RADIO DEVICE**
- (75) Inventors: **Kenji Waku**, Kanagawa (JP); **Tadashi Koyama**, Kanagawa (JP); **Kunihiko Watanabe**, Kanagawa (JP); **Masato Harikae**, Kanagawa (JP); **Shin Takahashi**, Kanagawa (JP); **Daisuke Togashi**, Kanagawa (JP); **Yoshiaki Hiraoka**, Kanagawa (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 328 days.

This patent is subject to a terminal disclaimer.

- (21) Appl. No.: **12/443,456**
- (22) PCT Filed: **Sep. 28, 2007**
- (86) PCT No.: **PCT/JP2007/069081**
§ 371 (c)(1),
(2), (4) Date: **Dec. 16, 2009**
- (87) PCT Pub. No.: **WO2008/041652**
PCT Pub. Date: **Apr. 10, 2008**

(65) **Prior Publication Data**
US 2010/0093390 A1 Apr. 15, 2010

(30) **Foreign Application Priority Data**

Sep. 28, 2006	(JP)	2006-265215
Jan. 25, 2007	(JP)	2007-015537
Feb. 27, 2007	(JP)	2007-047209
Jun. 28, 2007	(JP)	2007-169905

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

(52) **U.S. Cl.** **455/552.1; 455/77; 455/78; 340/572.1; 343/702; 343/722**

(58) **Field of Classification Search** **455/77; 455/78; 552.1, 575.7; 343/702, 722, 876; 340/572.1**
See application file for complete search history.

(56) **References Cited**

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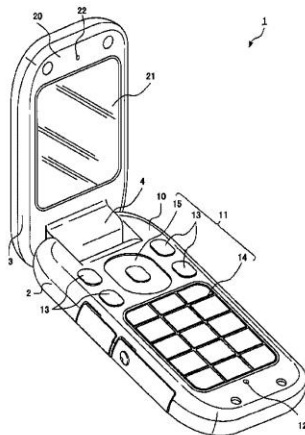
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Primary Examiner — Tuan H Nguyen
(74) *Attorney, Agent, or Firm* — DLA Piper LLP (US)

(57) **ABSTRACT**

A portable wireless device includes a first communication unit having a loop antenna that communicates with external devices using a first usable frequency band, and an RFID chip that performs predetermined processing with respect to information communicated by the loop antenna. A second communication unit includes a main antenna that communicates by a second usable frequency band that is higher than the first usable frequency band, and a communication processing unit that performs predetermined processing with respect to information communicated by the main antenna. A reactance component of the loop antenna is adjusted such that a high-order secondary resonance point of the first usable frequency band does not overlap the second usable frequency band.

10 Claims, 11 Drawing Sheets





US008219161B2

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

(10) **Patent No.:** **US 8,219,161 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

(54) **PORTABLE TERMINAL**

(75) Inventors: **Michiaki Hiraoka**, Kanagawa (JP);
Hiroshi Tsukiji, Kanagawa (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 478 days.

(21) Appl. No.: **12/088,675**

(22) PCT Filed: **Sep. 29, 2006**

(86) PCT No.: **PCT/JP2006/319521**

§ 371 (c)(1),
(2), (4) Date: **Sep. 30, 2009**

(87) PCT Pub. No.: **WO2007/037404**

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

(65) **Prior Publication Data**

US 2010/0016040 A1 Jan. 21, 2010

(30) **Foreign Application Priority Data**

Sep. 29, 2005 (JP) 2005-285663

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

(52) **U.S. Cl.** **455/575.4; 455/575.5; 455/575.3;**
455/556.1; 343/763; 343/880; 343/883; 343/702

(58) **Field of Classification Search** 455/575.4
See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Marivelisse Santiago Cordero

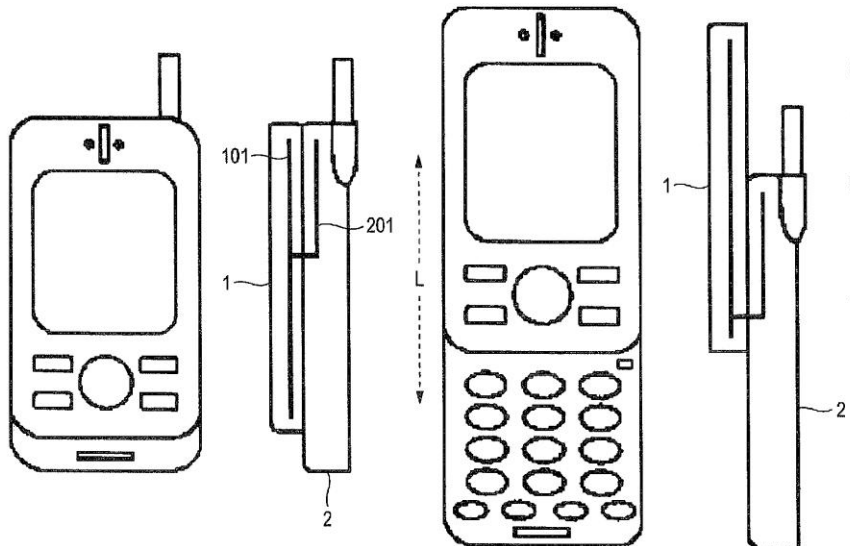
Assistant Examiner — Jean Chang

(74) *Attorney, Agent, or Firm* — DLA Piper LLP (US)

(57) **ABSTRACT**

A portable terminal, which is small sized, excellent in portability, and having high operability for various functions other than a call function, is provided. Two housings are connected such that they can be extended in directions different from each other. The housings have a retraction state, a first extension state, a second extension state, and a third extension state that is a state achieved by further sliding the housings from the second extension into another state. Broadcast receiving conditions are improved by changing the length of an antenna for receiving digital broadcast reception in the second extension state and the third extension state.

1 Claim, 28 Drawing Sheets





US008219164B2

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

(10) **Patent No.:** **US 8,219,164 B2**
(45) **Date of Patent:** **Jul. 10, 2012**

(54) **APPARATUS AND METHOD FOR SUPPORTING MULTIPLE ANTENNA SERVICE IN A WIRELESS COMMUNICATION SYSTEM**

(75) Inventors: **Myeon-Kyun Cho**, Seongnam-si (KR);
In-Soo Hwang, Yongin-si (KR);
Eun-Seok Ko, Suwon-si (KR);
Young-Ho Jung, Suwon-si (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 883 days.

(21) Appl. No.: **12/183,023**

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

(65) **Prior Publication Data**
US 2009/0036183 A1 Feb. 5, 2009

(30) **Foreign Application Priority Data**
Jul. 31, 2007 (KR) 10-2007-0076763

(51) **Int. Cl.**
H04B 7/08 (2006.01)
H04B 7/00 (2006.01)
H04M 1/00 (2006.01)

(52) **U.S. Cl.** **455/575.7**; 455/575.1; 455/132;
455/509; 455/550.1; 455/553.1

(58) **Field of Classification Search** 455/90.3,
455/101, 132, 140, 143, 425, 509, 553.1,
455/550.1, 561, 562.1, 575.1, 575.7; 370/329,
370/334, 341, 431
See application file for complete search history.

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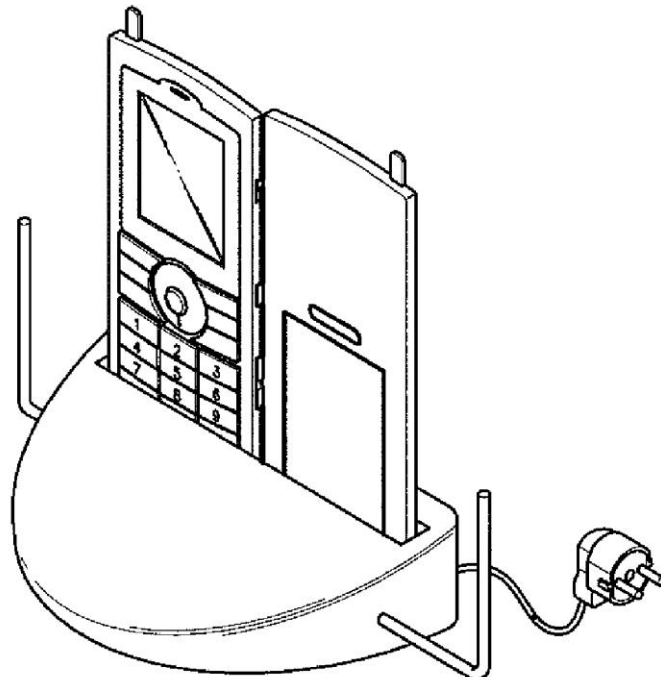
Primary Examiner — Wesley Kim

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

(57) **ABSTRACT**

An apparatus and method for supporting a multiple antenna service in a wireless communication system are provided. The apparatus includes at least one antenna, a form determining unit for determining a form of an MS, and an antenna constructing unit for constructing an antenna structure according to the form of the MS using the at least one antenna.

7 Claims, 5 Drawing Sheets





US008223075B2

(12) **United States Patent**
Pan

(10) **Patent No.:** **US 8,223,075 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **MULTIBAND ANTENNA**

(56) **References Cited**

(75) Inventor: **Jun-Liang Pan**, 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 465 days.

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(21) Appl. No.: **12/503,735**

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Primary Examiner — Jacob Y Choi
Assistant Examiner — Shawn Buchanan
(74) *Attorney, Agent, or Firm* — Altis Law Group, Inc.

(22) Filed: **Jul. 15, 2009**

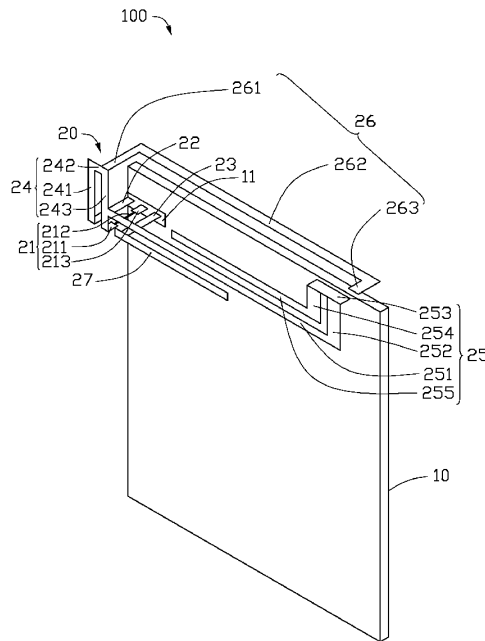
(65) **Prior Publication Data**
US 2010/0026585 A1 Feb. 4, 2010

(57) **ABSTRACT**
A multiband antenna includes a base board, a feed member, a first grounding connector, a second grounding connector, a first radio member, a second radio member, a third radio member and a fourth radio member. The feed member, the first grounding connector and the second grounding connector are all electronically connected to the base board. The first radio member is electronically connected to the feed member and the first grounding connector. The second radio member is electronically connected to the first radio member. The third radio member is electronically connected to the first radio member. The fourth radio member is electronically connected to the second grounding connector. In use, the multiband antenna sends/receives wireless signals in different working frequencies by the radio members.

(30) **Foreign Application Priority Data**
Jul. 30, 2008 (CN) 2008 1 0303208

(51) **Int. Cl.**
H01Q 5/00 (2006.01)
(52) **U.S. Cl.** **343/700 MS; 343/702; 343/845; 343/846; 343/872**
(58) **Field of Classification Search** **343/700 MS, 343/702, 845-846, 872**
See application file for complete search history.

14 Claims, 3 Drawing Sheets





US008223076B2

(12) **United States Patent**
Huang

(10) **Patent No.:** **US 8,223,076 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **MINIFIED DUAL-BAND PRINTED MONOPOLE ANTENNA**

(58) **Field of Classification Search** 343/700 MS, 343/702, 850, 852, 860, 862
See application file for complete search history.

(75) **Inventor:** **Chih-Yung Huang**, Taichung County (TW)

(56) **References Cited**

(73) **Assignee:** **Arcady An Technology Corporation**, Hsinchu (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 371 days.

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(21) **Appl. No.:** **12/645,785**

Primary Examiner — Tan Ho

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

(74) *Attorney, Agent, or Firm* — WPAT, P.C.; Justin King

(65) **Prior Publication Data**

US 2010/0164828 A1 Jul. 1, 2010

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

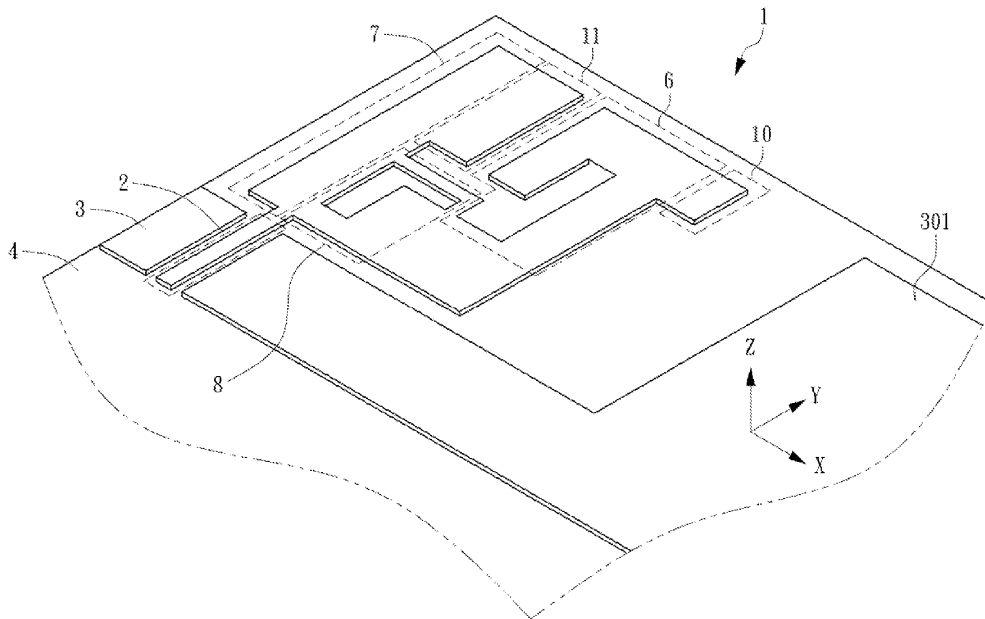
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A dual-band printed monopole antenna is disclosed. The antenna is in a rectangular structure and comprising: a first radiating unit; a second radiating unit; a matching unit; a first matching unit; a second matching unit; a signal feed-in terminal, and a feed-in signal grounding terminal, whereby its size is effectively minified so as to meet the demand for the application of the minified modern wireless apparatus.

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

(52) **U.S. Cl.** **343/700 MS; 343/852; 343/860**

29 Claims, 18 Drawing Sheets





US008223077B2

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

(10) **Patent No.:** **US 8,223,077 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **MULTISECTOR PARALLEL PLATE ANTENNA FOR ELECTRONIC DEVICES**

(75) Inventors: **Bing Chiang**, Cupertino, CA (US);
Gregory A. Springer, Sunnyvale, CA (US);
Douglas B. Kough, 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 564 days.

(21) Appl. No.: **12/401,601**

(22) Filed: **Mar. 10, 2009**

(65) **Prior Publication Data**
US 2010/0231476 A1 Sep. 16, 2010

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 13/00 (2006.01)
(52) **U.S. Cl.** **343/702; 343/780; 343/772**
(58) **Field of Classification Search** **343/772, 343/786, 780, 776, 784, 783, 702**
See application file for complete search history.

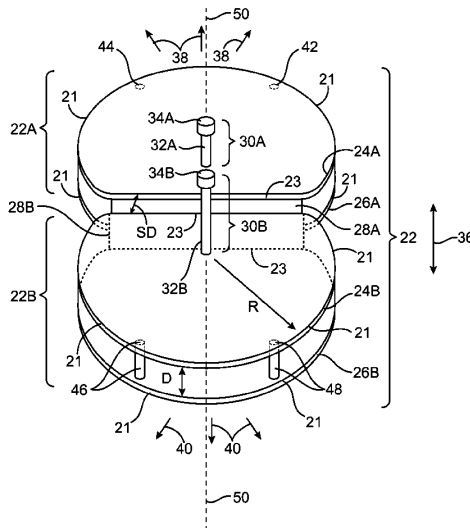
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Primary Examiner — Hoanganh Le
(74) *Attorney, Agent, or Firm* — Treyz Law Group; G. Victor Treyz; David C. Kellogg

(57) **ABSTRACT**
Electronic device antennas with multiple parallel plate sectors are provided for handling multiple-input-multiple-output wireless communications. Each antenna sector in a multisector parallel plate antenna may have upper and lower parallel plates with curved outer edges and a straight inner edge. A vertical rear wall may be used to connect the upper and lower parallel plates in each antenna sector along the straight inner edge. Each antenna sector may have an antenna probe. The antenna probe may be formed from a monopole antenna loaded with a planar patch. The planar loading patch may be provided in the form of a conductive disk that is connected to the end of a conductive antenna feed member. The conductive member may be coupled to the center conductor of a transmission line that is used to convey radio-frequency signals between the antenna probe and radio-frequency transceiver circuitry. The antenna sectors may have interplate dielectric structures.

18 Claims, 11 Drawing Sheets





US008223081B2

(12) **United States Patent**
Tu

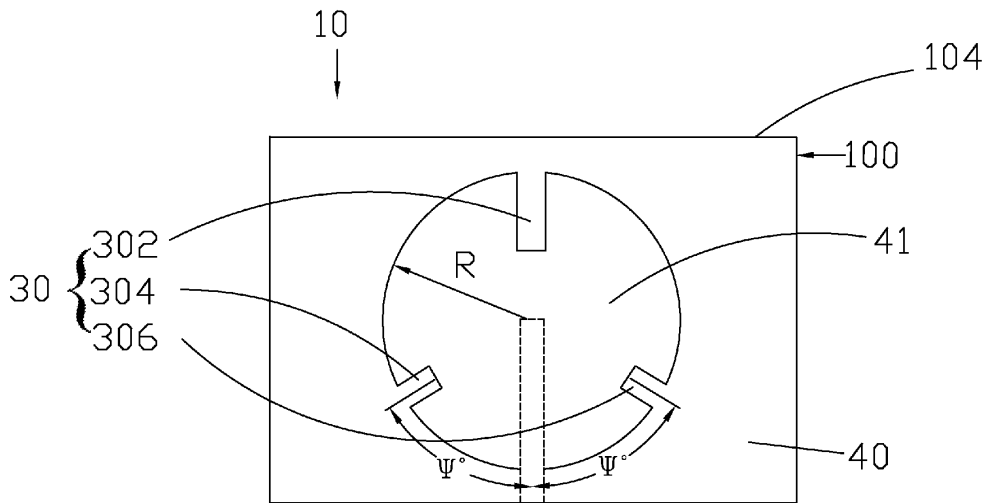
(10) **Patent No.:** **US 8,223,081 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

- (54) **SLOT ANTENNA**
- (75) Inventor: **Hsin-Lung Tu**, Taipei Hsien (TW)
- (73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
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 380 days.
- (21) Appl. No.: **12/641,576**
- (22) Filed: **Dec. 18, 2009**
- (65) **Prior Publication Data**
US 2010/0321264 A1 Dec. 23, 2010
- (30) **Foreign Application Priority Data**
Jun. 18, 2009 (CN) 2009 1 0303410
- (51) **Int. Cl.**
H01Q 13/10 (2006.01)
- (52) **U.S. Cl.** **343/767; 343/769**
- (58) **Field of Classification Search** 343/767,
343/769, 846
See application file for complete search history.

- (56) **References Cited**
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2006/0132359 A1 6/2006 Chang et al.
* cited by examiner
Primary Examiner — Tan Ho
(74) *Attorney, Agent, or Firm* — Altis Law Group, Inc.

(57) **ABSTRACT**
A slot antenna located on a substrate with a first surface and a second surface opposite to the first surface includes a feeding portion, a grounding portion and a radiating portion. The feeding portion is located on the first surface of the substrate to feed electromagnetic signals. The grounding portion is rectangular and located on the second surface of the substrate, and defines a circular clearance in a substantial center portion thereof. The radiating portion is located on the second surface of the substrate and comprises at least one elongated microstrip with one end connected to the grounding portion and the other end extending towards the center of the circular clearance, wherein the feeding portion interacts with the radiating portion to transmit the electromagnetic signals.

9 Claims, 7 Drawing Sheets





US008223082B2

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

(10) **Patent No.:** **US 8,223,082 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **SLOT ANTENNAS FOR ELECTRONIC DEVICES**

(75) Inventors: **Bing Chiang**, Cupertino, CA (US);
Douglas Blake Kough, San Jose, CA (US);
Enrique Ayala Vazquez, Watsonville, 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.

(21) Appl. No.: **13/286,845**

(22) Filed: **Nov. 1, 2011**

(65) **Prior Publication Data**

US 2012/0044116 A1 Feb. 23, 2012

Related U.S. Application Data

(62) Division of application No. 12/101,121, filed on Apr. 10, 2008, now Pat. No. 8,077,096.

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

(52) **U.S. Cl.** **343/767; 343/700 MS; 343/846**

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

(56) **References Cited**

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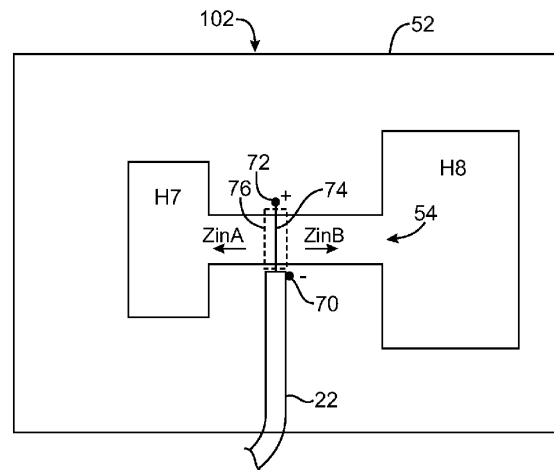
Primary Examiner — Tho G Phan

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

(57) **ABSTRACT**

Slot antennas are provided for electronic devices such as portable electronic devices. The slot antennas may have a dielectric-filled slot that is formed in a ground plane element. The ground plane element may be formed from part of a conductive device housing. The slot may have one or more holes at its ends. The holes may affect the impedance characteristics of the slot antennas so that the length of the slot antennas may be reduced. For example, the holes can be used to synthesize the impedance of the slot antennas so that the slot antennas have a resonant frequency that is different from their natural resonant frequency. The holes may affect the impedance of the slot antennas in multiple radio-frequency bands.

18 Claims, 10 Drawing Sheets





US008223083B2

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

(10) **Patent No.:** **US 8,223,083 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **MULTIBAND MONOPOLE SLOT ANTENNA**

OTHER PUBLICATIONS

- (75) Inventors: **Kin-Lu Wong**, Taipei Hsien (TW);
Li-Chun Lee, Tapei Hsien (TW)
- (73) Assignee: **ACER Inc.**, Tapei Hsien (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 329 days.

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(21) Appl. No.: **12/269,924**

(22) Filed: **Nov. 13, 2008**

(65) **Prior Publication Data**

US 2010/0045556 A1 Feb. 25, 2010

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(30) **Foreign Application Priority Data**

Aug. 20, 2008 (TW) 97131769 A

Primary Examiner — Jacob Y Choi
Assistant Examiner — Graham Smith
 (74) *Attorney, Agent, or Firm* — Alan Kamrath; Kamrath IP Lawfirm, PA

- (51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)
- (52) **U.S. Cl.** **343/770; 343/702; 343/846**
- (58) **Field of Classification Search** 343/770, 343/702, 846
 See application file for complete search history.

(57) **ABSTRACT**

A multiband monopole slot antenna includes a ground plane, a dielectric substrate, a radiating portion, and a microstrip feedline. The dielectric substrate is connected to an edge of the ground plane and extends toward the opposite direction of the ground plane. The radiating portion is on the metal surface of the dielectric substrate and includes a first monopole slot, a second monopole slot and a third monopole slot. The microstrip feedline is on the surface opposite to the metal surface of the dielectric substrate. A first end of the microstrip feedline is connected to a signal source, and a second end of the microstrip feedline is an open end. The microstrip feedline passes over the first, second, and third monopole slots. A section of the microstrip feedline which passes over the third monopole slot is parallel to the third monopole slot, and the microstrip feedline is generally of a step shape.

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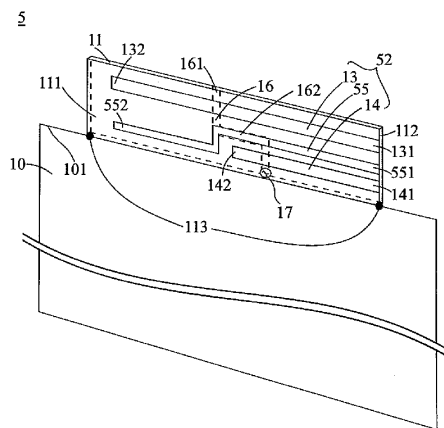
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18 Claims, 3 Drawing Sheets





US008223084B2

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

(10) **Patent No.:** **US 8,223,084 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

- (54) **ANTENNA ELEMENT**
- (75) Inventors: **Kazuya Tani**, Osaka (JP); **Yoshio Koyanagi**, Yokohama (JP)
- (73) Assignee: **Panasonic Corporation**, Osaka (JP)

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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 345 days.

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- (21) Appl. No.: **12/676,008**
- (22) PCT Filed: **Sep. 6, 2007**
- (86) PCT No.: **PCT/JP2007/067433**
 § 371 (c)(1),
 (2), (4) Date: **Mar. 2, 2010**
- (87) PCT Pub. No.: **WO2009/031229**
 PCT Pub. Date: **Mar. 12, 2009**

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Primary Examiner — Hoang V Nguyen
 (74) *Attorney, Agent, or Firm* — Seed IP Law Group PLLC

- (65) **Prior Publication Data**
 US 2010/0171676 A1 Jul. 8, 2010

(57) **ABSTRACT**

It is made possible to realize both miniaturization and a wider band in an antenna element. An antenna element includes a first conductor wire part 11A; a second conductor wire part 11B crossing the first conductor wire part 11A and connected; a third conductor wire part 11C crossing the second conductor wire part 11B and connected, and parallel to the first conductor wire part 11A; a fourth conductor wire part 11D crossing the third conductor wire part 11C and connected; and a first conductor flat plate 12 connected to one or two of the first conductor wire part 11A, the second conductor wire part 11B, the third conductor wire part 11C, and the fourth wire part 11D and disposed in the area surrounded by any three of the first conductor wire part 11A, the second conductor wire part 11B, the third conductor wire part 11C, and the fourth wire part 11D. An end part of the first conductor flat plate 12 is parallel with the first conductor 11A not connected to the first conductor flat plate 12.

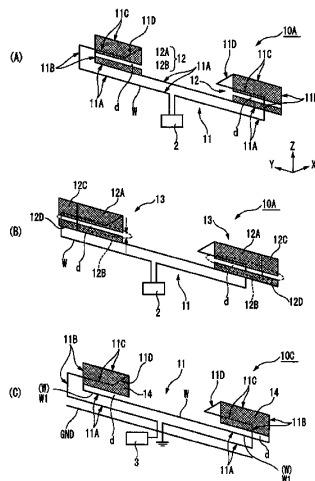
- (51) **Int. Cl.**
H01Q 9/26 (2006.01)
- (52) **U.S. Cl.** **343/803**
- (58) **Field of Classification Search** **343/802, 804, 806, 820, 821**
 See application file for complete search history.

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10 Claims, 13 Drawing Sheets





US008223086B2

(12) **United States Patent**
Hansen

(10) **Patent No.:** **US 8,223,086 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

- (54) **DISK MONOPOLE ANTENNA STRUCTURE**
- (75) Inventor: **Thomas Hansen**, Hildesheim (DE)
- (73) Assignee: **Robert Bosch GmbH**, Stuttgart (DE)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1101 days.

- (21) Appl. No.: **11/793,119**
- (22) PCT Filed: **Nov. 18, 2005**
- (86) PCT No.: **PCT/EP2005/056064**
§ 371 (c)(1),
(2), (4) Date: **Nov. 6, 2007**

- (87) PCT Pub. No.: **WO2006/063916**
PCT Pub. Date: **Jun. 22, 2006**
- (65) **Prior Publication Data**
US 2008/0094285 A1 Apr. 24, 2008

- (30) **Foreign Application Priority Data**
Dec. 13, 2004 (DE) 10 2004 059 916
- (51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 1/38 (2006.01)
H01Q 5/00 (2006.01)
H01Q 9/04 (2006.01)

- (52) **U.S. Cl.** **343/846**; 343/700 MS
- (58) **Field of Classification Search** 343/700 MS, 343/702, 846, 908, 829, 750, 752
See application file for complete search history.

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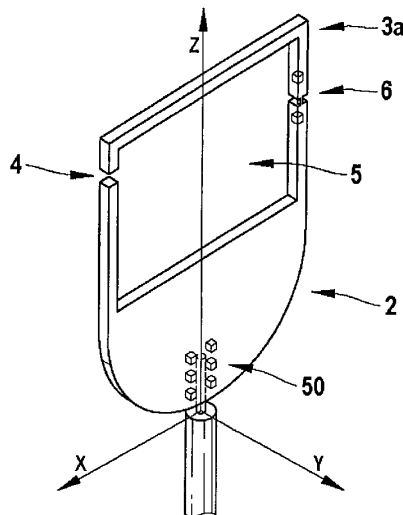
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Primary Examiner — Douglas W Owens
Assistant Examiner — Jennifer F Hu
(74) *Attorney, Agent, or Firm* — Kenyon & Kenyon LLP

(57) **ABSTRACT**

In a disk monopole antenna structure, a semicircular region is provided, as well as an oppositely disposed, second frame-type region, which faces away from the semicircular region and forms a cut-out in the antenna structure.

10 Claims, 7 Drawing Sheets





US008224003B2

(12) **United States Patent**
Reithinger

(10) **Patent No.:** **US 8,224,003 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **HEARING APPARATUS USING AN
INDUCTIVE SWITCHING CONTROLLER AS
A RADIO TRANSMITTER**

(58) **Field of Classification Search** 381/312-331
See application file for complete search history.

(75) Inventor: **Jürgen Reithinger**, Neunkirchen am
Brand (DE)

(56) **References Cited**

(73) Assignee: **Siemens Medical Instruments Pte.
Ltd.**, Singapore (SG)

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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 872 days.

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(21) Appl. No.: **12/288,055**

Primary Examiner — David Vu
Assistant Examiner — Jonathan Han

(22) Filed: **Oct. 16, 2008**

(65) **Prior Publication Data**

US 2009/0110221 A1 Apr. 30, 2009

Related U.S. Application Data

(60) Provisional application No. 60/982,769, filed on Oct.
26, 2007.

(57) **ABSTRACT**

The installation size of hearing apparatuses and in particular
of hearing devices is to be reduced. Provision is thus made for
a hearing apparatus with a transmitting facility including an
antenna for the wireless, electromagnetic transmission of
data and a switching controller including an inductor, which
is used to supply energy to the hearing apparatus and the
transmitting facility, with the inductor of the switching con-
troller being identical to the antenna of the transmitting facil-
ity. This multiple use of the inductor can save on installation
space. In order to avoid mutual interference of the transmit-
ting facility and the switching controller, the signals thereof
are modulated independently of one another.

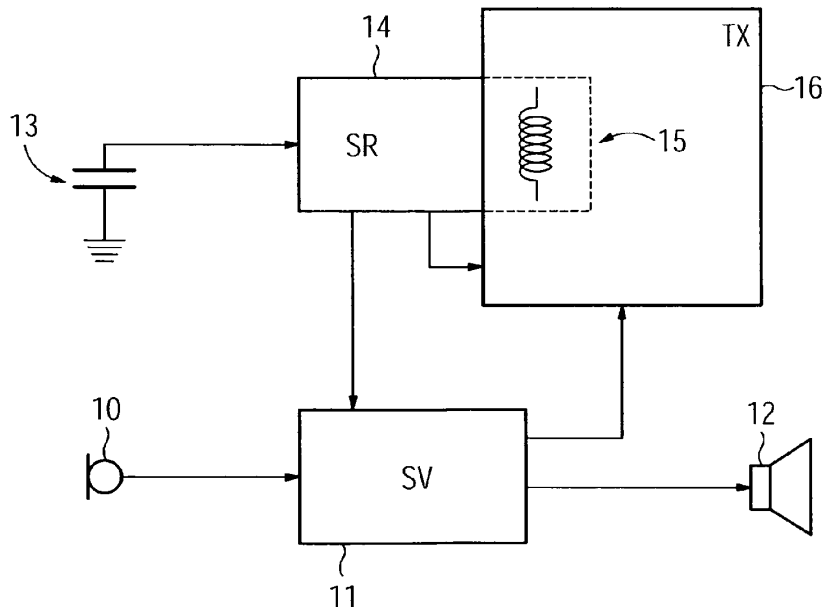
(30) **Foreign Application Priority Data**

Oct. 26, 2007 (DE) 10 2007 051 307

(51) **Int. Cl.**
H04R 25/00 (2006.01)

(52) **U.S. Cl.** **381/312; 336/200; 336/232; 336/223;**
336/226; 381/117

6 Claims, 2 Drawing Sheets





US008224271B2

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

(10) **Patent No.:** **US 8,224,271 B2**
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **ELECTRONIC DEVICE WITH AN IMPROVED ANTENNA ARRANGEMENT**

(75) Inventors: **Patrik Persson**, Gråbo (SE); **Martin Nils Johansson**, Mölndal (SE); **Anders Stjernman**, Lindome (SE); **Sven Anders Gösta Derneryd**, Göteborg (SE); **Jonas Fridén**, Mölndal (SE)

(73) Assignee: **Telefonaktiebolaget L M Ericsson (Publ)**, Stockholm (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 112 days.

(21) Appl. No.: **12/810,059**

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

(86) PCT No.: **PCT/EP2007/064437**

§ 371 (c)(1),

(2), (4) Date: **Jun. 22, 2010**

(87) PCT Pub. No.: **WO2009/080110**

PCT Pub. Date: **Jul. 2, 2009**

(65) **Prior Publication Data**

US 2010/0297971 A1 Nov. 25, 2010

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

(52) **U.S. Cl.** **455/127.2; 455/129; 455/575.7; 455/562.1; 342/378; 342/382; 342/383**

(58) **Field of Classification Search** **455/127.2, 455/129, 575.7, 562.1; 342/378, 383, 382**

See application file for complete search history.

(56) **References Cited**

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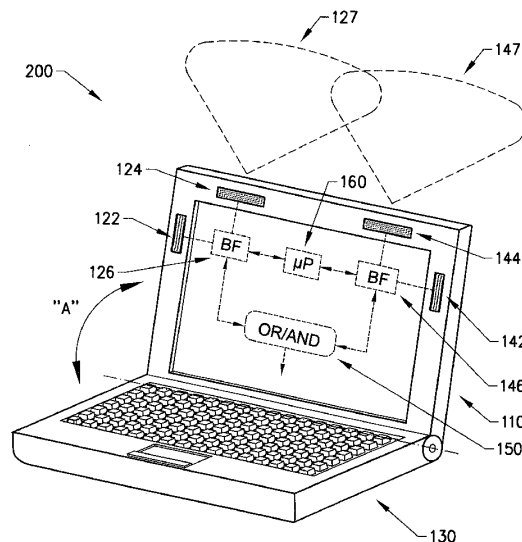
Primary Examiner — Sanh Phu

(74) *Attorney, Agent, or Firm* — Roger S. Burleigh

(57) **ABSTRACT**

An electronic device (200,300) comprising an antenna arrangement with first and second antenna groups with first (122, 142) and a second (124, 144) radiation elements. The first and second radiation elements in each group have first and second respective polarizations and gain, and said groups also comprise a beam forming network (126, 146) connected to the radiation elements of the group and to an output selector (150). The beam forming network (126, 146) of each antenna group uses the radiation elements (122, 124; 142, 144) in the group to create a radiation pattern (127, 147) with a polarization which is a composite of the first and second polarizations of the elements in the group, so that a first (127) and a second (147) radiation pattern of composite polarization is created. The output selector (150) selects or combines signals received by the two antenna groups as its output.

18 Claims, 4 Drawing Sheets





US008227732B2

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

(10) **Patent No.:** **US 8,227,732 B2**
(45) **Date of Patent:** **Jul. 24, 2012**

(54) **LIGHT SOURCE DEVICE HAVING A POWER SUPPLY ANTENNA DISPOSED AT ONE FOCAL POINT OF AN ELLIPTICAL RESONATOR, AND PROJECTOR**

(58) **Field of Classification Search** 250/205, 250/239, 208.1; 353/122, 75, 85-87; 315/34-39, 315/248; 362/296.06
See application file for complete search history.

(75) **Inventors:** **Satoshi Kito**, Chino (JP); **Junichi Suzuki**, Chino (JP); **Norio Imaoka**, Takamori-machi (JP); **Satoshi Fujii**, Sanda (JP)

(56) **References Cited**

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Primary Examiner — Que T Le

(74) *Attorney, Agent, or Firm* — Oliff & Berridge, PLC

(73) **Assignee:** **Seiko Epson 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 415 days.

(21) **Appl. No.:** **12/637,503**

(22) **Filed:** **Dec. 14, 2009**

(65) **Prior Publication Data**

US 2010/0214542 A1 Aug. 26, 2010

(30) **Foreign Application Priority Data**

Feb. 25, 2009 (JP) 2009-042300

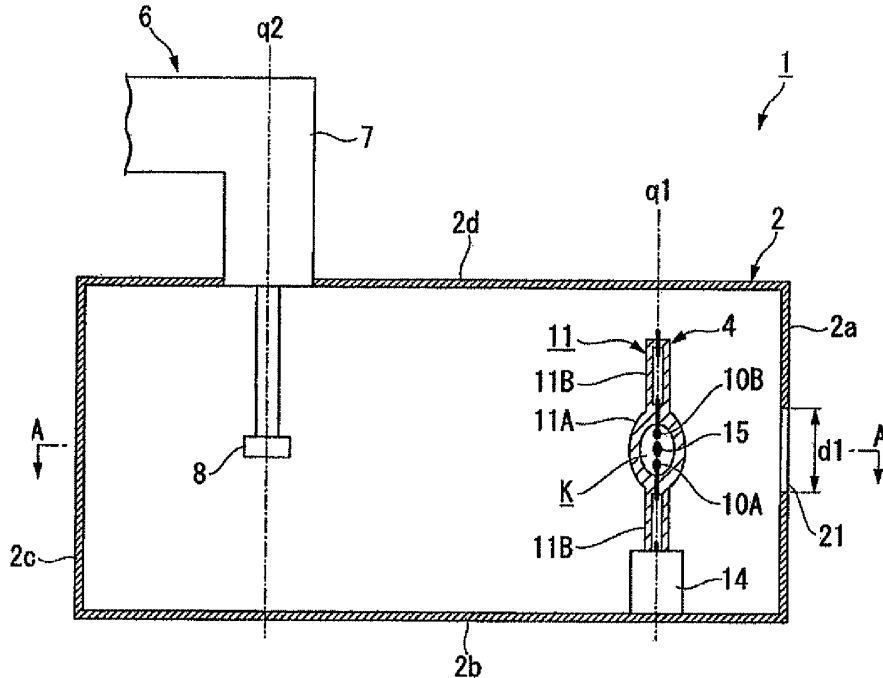
(51) **Int. Cl.**
G01J 1/32 (2006.01)

(52) **U.S. Cl.** 250/205; 353/85

(57) **ABSTRACT**

A light source device includes an elliptical resonator, an electric discharge lamp that has an electric discharge tube and an electrode connected to the electric discharge tube and is disposed at one of two confocal points of the elliptical resonator, and a power supply antenna that supplies a microwave to the electric discharge lamp and is disposed at the other confocal point.

14 Claims, 4 Drawing Sheets





US008228237B2

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

(10) **Patent No.:** **US 8,228,237 B2**
(45) **Date of Patent:** **Jul. 24, 2012**

- (54) **ANTENNA WITH DOUBLE GROUNDINGS**
- (75) Inventors: **Pei-Ling Teng**, Taoyuan County (TW);
Yi-Chun Chen, Taoyuan County (TW)
- (73) Assignee: **HTC Corporation**, Taoyuan County (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 511 days.

(56) **References Cited**

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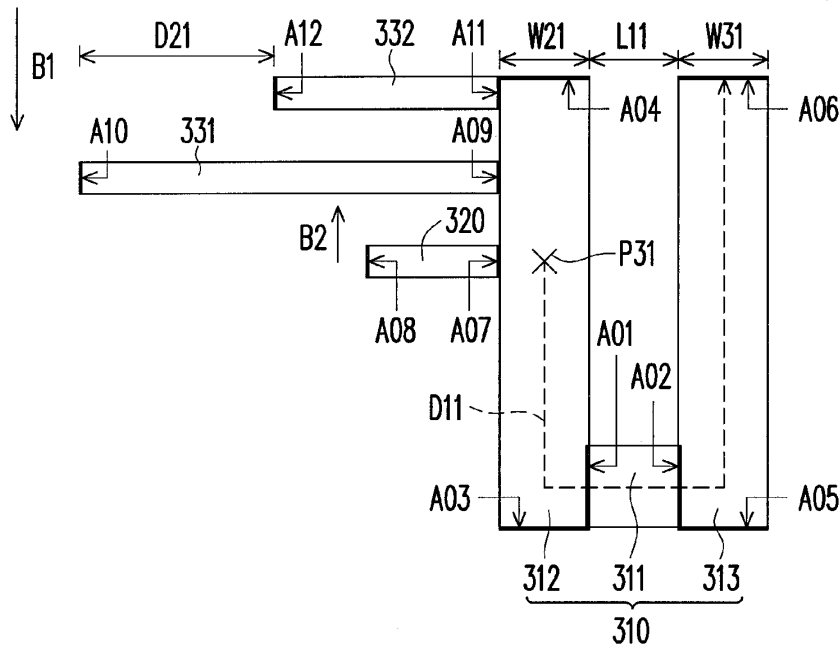
Primary Examiner — Hoanganh Le
(74) *Attorney, Agent, or Firm* — Jianq Chyun IP Office

- (21) Appl. No.: **12/484,252**
 - (22) Filed: **Jun. 15, 2009**
 - (65) **Prior Publication Data**
US 2010/0214191 A1 Aug. 26, 2010
 - (30) **Foreign Application Priority Data**
Feb. 23, 2009 (TW) 98105651 A
 - (51) **Int. Cl.**
H01Q 1/38 (2006.01)
 - (52) **U.S. Cl.** **343/700 MS; 343/702**
 - (58) **Field of Classification Search** 343/702,
343/700 MS, 846, 848
- See application file for complete search history.

(57) **ABSTRACT**

An antenna with double groundings, including a body part, a feeding part, a first grounding part, and a second grounding part, is provided. The body part is electrically connected to the feeding part, the first grounding part, and the second grounding part respectively. The body part is corresponding to a resonance length to transmit and receive a radiation wave with a wavelength at an operating frequency. Wherein, a current path from the first grounding part to the feeding part along the body part is $\frac{1}{2}$ times of the wavelength at the operating frequency, and a relative distance between the second grounding part and the first grounding part is $\frac{1}{4}$ times of the wavelength at the operating frequency.

22 Claims, 11 Drawing Sheets





US008228239B2

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

(10) **Patent No.:** **US 8,228,239 B2**
(45) **Date of Patent:** **Jul. 24, 2012**

(54) **HEAT-DISSIPATING WIRELESS COMMUNICATION SYSTEM**

(75) Inventors: **Isaac Lagnado**, Houston, TX (US);
Timothy Neill, Houston, TX (US);
Mark S. Tracy, Houston, TX (US);
Jeffrey A. Lev, Houston, TX (US);
Walter G. Fry, Houston, TX (US)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1220 days.

(21) Appl. No.: **11/344,296**

(22) Filed: **Jan. 31, 2006**

(65) **Prior Publication Data**
US 2007/0176831 A1 Aug. 2, 2007

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702**
(58) **Field of Classification Search** **343/702;**
361/687

See application file for complete search history.

(56) **References Cited**

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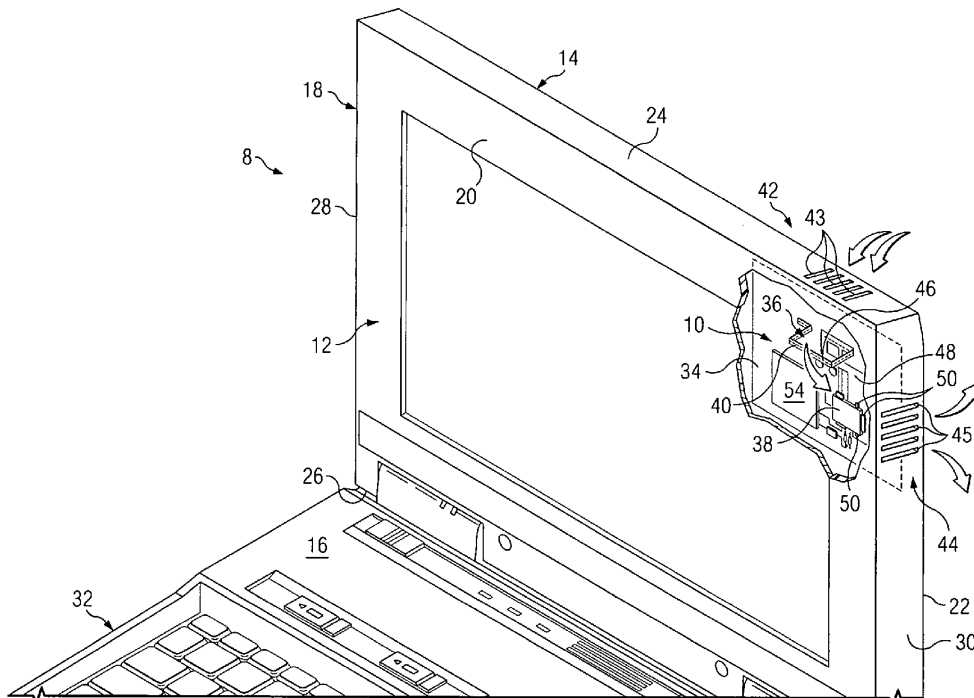
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Primary Examiner — Jacob Y Choi
Assistant Examiner — Robert Karacsony

(57) **ABSTRACT**

A heat-dissipating wireless communication system for a computer device comprises an antenna configured for wireless communications, the antenna configured to dissipate heat generated by the computer device.

17 Claims, 2 Drawing Sheets





US008228244B2

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

(10) **Patent No.:** **US 8,228,244 B2**
(45) **Date of Patent:** **Jul. 24, 2012**

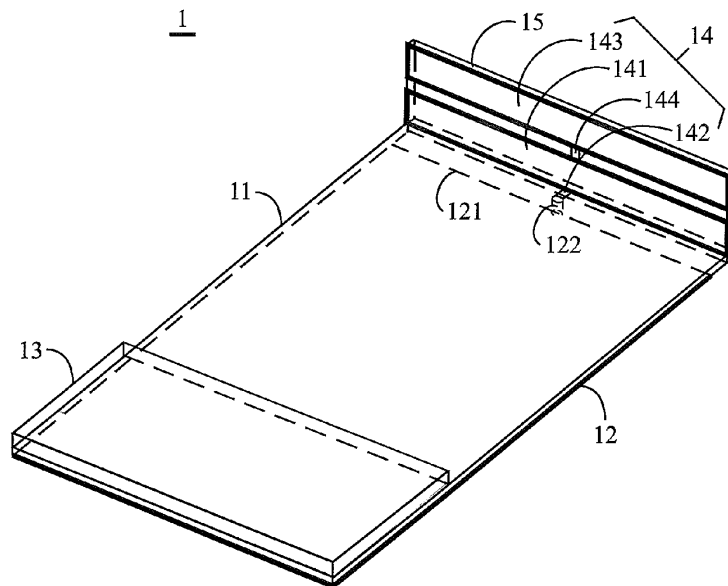
- (54) **DUAL-BAND MOBILE COMMUNICATION DEVICE AND ANTENNA STRUCTURE THEREOF**
- (75) Inventors: **Kin-Lu Wong**, Tapei Hsien (TW);
Chih-Hua Chang, Tapei Hsien (TW)
- (73) Assignee: **Acer Inc.**, Taipei Hsien (TW)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 308 days.
- (21) Appl. No.: **12/775,578**
- (22) Filed: **May 7, 2010**
- (65) **Prior Publication Data**
US 2011/0187606 A1 Aug. 4, 2011
- (30) **Foreign Application Priority Data**
Feb. 1, 2010 (TW) 99102889 A
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/702**; 343/700 MS
- (58) **Field of Classification Search** 343/702,
343/700 MS, 846, 848
See application file for complete search history.

- (56) **References Cited**
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- Primary Examiner* — Hoanganh Le
- (74) *Attorney, Agent, or Firm* — Alan Kamrath; Kamrath IP Lawfirm, PA

(57) **ABSTRACT**

A dual-band mobile communication device includes a circuit board, a ground plane, an antenna element, and a dual-band inductively-coupled element. The ground plane has an edge. The antenna element is located on the circuit board or adjacent to the circuit board. The antenna element has a first operating band and a second operating band. The dual-band inductively-coupled element is located at the edge of the ground plane. The dual-band inductively-coupled element excites two different resonant modes at two specific frequencies corresponding to the first and the second operating bands of the antenna element, respectively. The dual-band inductively-coupled element comprises a connection element, an inductive element, a first metal plate, and a second metal plate. The first metal plate is electrically connected to the ground plane through the connection element. The second metal plate is electrically connected to the inductive element.

11 Claims, 6 Drawing Sheets





US008228245B2

(12) **United States Patent**
Quintero Illera et al.

(10) **Patent No.:** **US 8,228,245 B2**
(45) **Date of Patent:** **Jul. 24, 2012**

- (54) **MULTIBAND ANTENNA**
- (75) Inventors: **Ramiro Quintero Illera**, Barcelona (ES); **Carles Puerlte Baliarda**, 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 0 days.
- (21) Appl. No.: **12/910,016**
- (22) Filed: **Oct. 22, 2010**
- (65) **Prior Publication Data**
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Related U.S. Application Data

- (63) Continuation of application No. 12/229,483, filed on Aug. 22, 2008, now Pat. No. 7,920,097, which is a continuation of application No. 11/702,791, filed on Feb. 6, 2007, now Pat. No. 7,439,923, which is a continuation of application No. 10/823,257, filed on Apr. 13, 2004, now Pat. No. 7,215,287, which is a continuation of application No. PCT/EP01/11912, filed on Oct. 16, 2001.

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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, 829, 846**

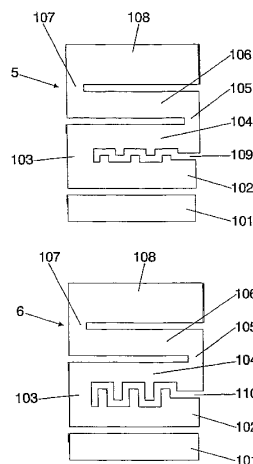
Primary Examiner — Tho G Phan
(74) *Attorney, Agent, or Firm* — Winstead PC

(57) **ABSTRACT**

A multiband antenna includes at least two polygons. The at least two polygons are spaced by means of a non-straight gap shaped as a space-filling curve, in such a way that the whole gap length is increased yet keeping its size and the same overall antenna size allowing for an effective tuning of frequency bands of the antenna.

- (56) **References Cited**
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20 Claims, 7 Drawing Sheets





US008228246B2

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

(10) **Patent No.:** **US 8,228,246 B2**
(45) **Date of Patent:** **Jul. 24, 2012**

- (54) **ELECTRONIC DEVICE**
- (75) Inventors: **Kiyokuni Arima**, Nagano (JP); **Takeshi Kaeriyama**, Nagano (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 0 days.

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- (21) Appl. No.: **13/008,603**
- (22) Filed: **Jan. 18, 2011**
- (65) **Prior Publication Data**
US 2011/0109517 A1 May 12, 2011

Primary Examiner — Dieu H Duong
(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

Related U.S. Application Data

- (63) Continuation of application No. 12/121,221, filed on May 15, 2008, now Pat. No. 7,956,813.

Foreign Application Priority Data

- (30) May 16, 2007 (JP) 2007-130720

(57) **ABSTRACT**

An electronic device includes multiple first antennas; at least one second antenna used in a different wireless communication system therefrom; a display panel for displaying an image; a panel casing covering the display panel, including the display panel; a placement frame having an upper-face portion disposed on the outer perimeter of the panel casing, and extended horizontally, and a pair of side-face portions, each protruding from a different side-edge portion of the upper-face portion in the direction orthogonal thereto; and an outer frame for covering the outer perimeter and the placement frame of the display panel from the display surface side of the display panel; wherein at least one first antenna is disposed on each of the upper-face portion and one side-face portion of the placement frame; and wherein at least one second antenna is disposed on the upper-face portion or the other side-face portion of the placement frame.

- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702**; 343/872; 361/679.26; 361/679.27
- (58) **Field of Classification Search** 343/702, 343/872; 361/679.26, 679.27
See application file for complete search history.

- (56) **References Cited**
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7 Claims, 34 Drawing Sheets

