



US008279121B2

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

(10) **Patent No.:** **US 8,279,121 B2**
(45) **Date of Patent:** **Oct. 2, 2012**

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

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(75) Inventors: **Kenichi Ishizuka**, Yokohama (JP);
Kazunari Kawahata, Yokohama (JP);
Nobuhito Tsubaki, Yokohama (JP);
Shigeyuki Fujieda, Hakusan (JP);
Shinichi Nakano, Sagamihara (JP)

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(73) Assignee: **Murata Manufacturing Co., Ltd.**,
Kyoto (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 446 days.

Official Communication issued in corresponding Japanese Patent Application No. 2008-528266, mailed on Jul. 21, 2010.

(Continued)

(21) Appl. No.: **12/504,367**

Primary Examiner — Tho G Phan

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

(74) *Attorney, Agent, or Firm* — Keating & Bennett, LLP

(65) **Prior Publication Data**

US 2009/0273531 A1 Nov. 5, 2009

(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2007/071427, filed on Nov. 2, 2007.

A compact and low-cost antenna device in which no interference occurs even when many antenna units corresponding to various systems are mounted close together in a small area, and a wireless communication apparatus including the antenna device. An antenna device includes plural antenna units mounted on a single dielectric base. A first antenna unit having a lowest fundamental frequency is disposed at a left end of a non-ground region, a second antenna unit having a highest fundamental frequency of the plurality of the antenna units is disposed at a right end of the non-ground region, and a third antenna unit having a fundamental frequency between those of the first antenna unit and the second antenna unit is disposed between the first and second antenna units. A current-density control coil is connected between a first radiation electrode and a power feeder of the first antenna unit, while a reactance circuit is disposed in the middle of the first radiation electrode. Notches may be disposed between the first radiation electrode and a second radiation electrode and between the first radiation electrode and a third radiation electrode.

(30) **Foreign Application Priority Data**

Jan. 19, 2007 (JP) 2007-010139

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

(52) **U.S. Cl.** **343/700 MS; 343/750; 343/751**

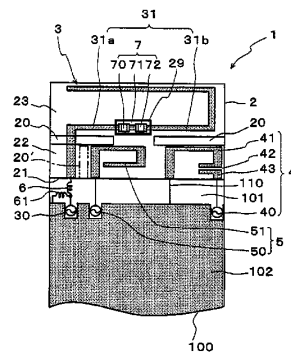
(58) **Field of Classification Search** **343/722-723, 343/750-752, 852, 861, 702, 700 MS**
See application file for complete search history.

(56) **References Cited**

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8 Claims, 10 Drawing Sheets





US008279125B2

(12) **United States Patent**
Bellows

(10) **Patent No.:** **US 8,279,125 B2**
(45) **Date of Patent:** **Oct. 2, 2012**

(54) **COMPACT CIRCULAR POLARIZED MONOPOLE AND SLOT UHF RFID ANTENNA SYSTEMS AND METHODS**

(75) Inventor: **David E. Bellows**, Wantagh, NY (US)

(73) Assignee: **Symbol Technologies, Inc.**, Holtsville, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 403 days.

(21) Appl. No.: **12/643,206**

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

(65) **Prior Publication Data**

US 2011/0148722 A1 Jun. 23, 2011

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

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

(58) **Field of Classification Search** **343/725, 343/729, 767, 770**

See application file for complete search history.

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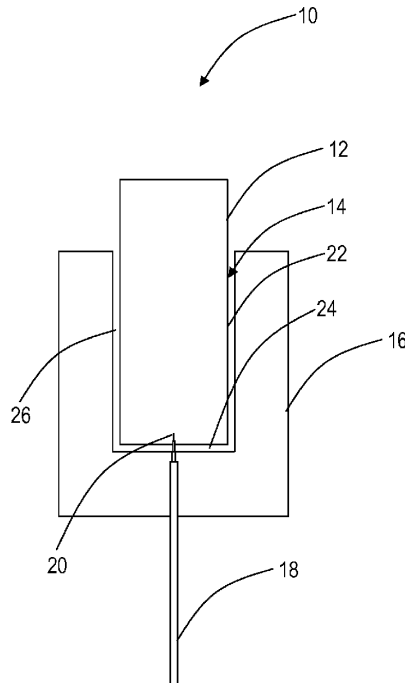
Primary Examiner — Tan Ho

(74) *Attorney, Agent, or Firm* — Terri Hughes Smith; Kenneth A. Haas

(57) **ABSTRACT**

The present disclosure relates to a combined and compact monopole and slot antenna providing circular polarization for various applications, such as ultra high frequency (UHF) radio frequency identification (RFID). The antenna of the present invention combines a slot antenna with a monopole antenna using a single feed to drive both, effectively resulting in a circular polarized antenna. In an exemplary embodiment, the antenna may be integrated internally to a mobile device and printed on a flex or a printed circuit board (PCB), made from sheet metal, etc. Advantageously, the design of the antenna provides performance similar to circular polarized patch antennas while avoiding the size, weight, and cost.

14 Claims, 4 Drawing Sheets





US008279126B2

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

(10) **Patent No.:** **US 8,279,126 B2**
(45) **Date of Patent:** **Oct. 2, 2012**

(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 383 days.

(21) Appl. No.: **12/422,331**

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

(65) **Prior Publication Data**
US 2010/0053000 A1 Mar. 4, 2010

(30) **Foreign Application Priority Data**
Aug. 27, 2008 (JP) 2008-217587

(51) **Int. Cl.**
H01Q 11/12 (2006.01)
H01Q 7/00 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/741; 343/866; 343/702**

(58) **Field of Classification Search** **343/741, 343/744, 866, 732, 702**

See application file for complete search history.

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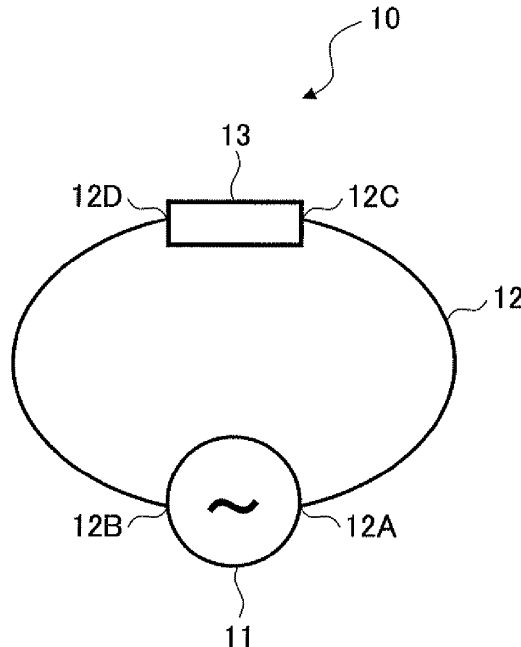
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Primary Examiner — Hoang V Nguyen
(74) *Attorney, Agent, or Firm* — IPUSA, PLLC

(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.

13 Claims, 11 Drawing Sheets





US008279128B2

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

(10) **Patent No.:** **US 8,279,128 B2**

(45) **Date of Patent:** **Oct. 2, 2012**

(54) **TAPERED SLOT ANTENNA**

(56) **References Cited**

(75) Inventors: **Matthew M. McQuaid**, Hudson, NH (US); **Michael J. O'Brien**, Nashua, NH (US)

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(73) Assignee: **BAE Systems Information and Electronic Systems Integration Inc.**, Nashua, NH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 328 days.

Primary Examiner — Hoanganh Le

(74) *Attorney, Agent, or Firm* — Sand & Sebolt; Rodney E. Haven

(21) Appl. No.: **12/775,894**

(57) **ABSTRACT**

(22) Filed: **May 7, 2010**

Methods, antennas and other embodiments associated with impedance matching an antenna feed slot are based on a fractal shape. A slot antenna includes a planar metal sheet. A feed slot opening is formed in the metal sheet. The feed slot has a first end and a second end. A tapered opening is formed in the metal sheet. Adjacent sides of the tapered opening touch the first end of the feed slot. An impedance matching fractal shaped opening is formed in the metal. The impedance matching fractal shaped opening touches the second end of the feed slot.

(65) **Prior Publication Data**

US 2011/0273349 A1 Nov. 10, 2011

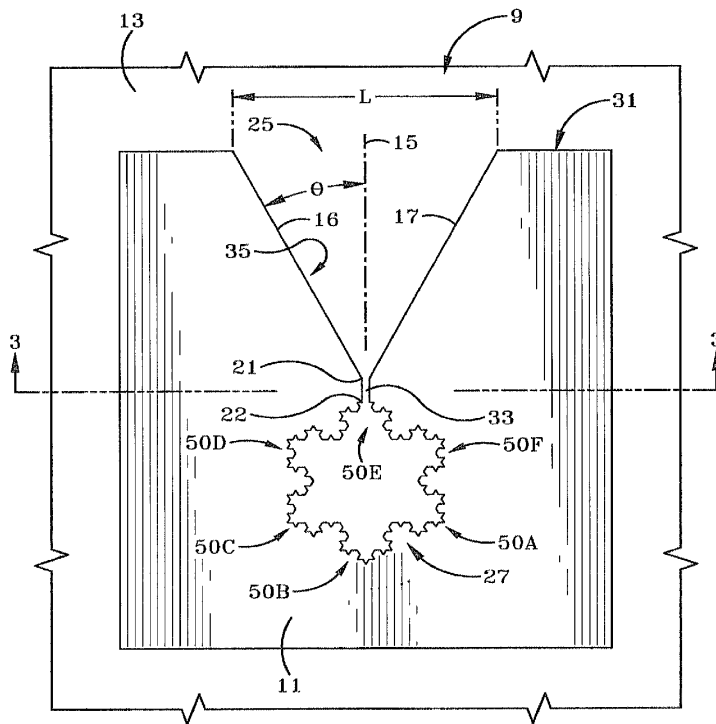
(51) **Int. Cl.**
H01Q 13/10 (2006.01)

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

(58) **Field of Classification Search** **343/767, 343/768, 769, 700 MS**

See application file for complete search history.

20 Claims, 8 Drawing Sheets





US008279133B2

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

(10) **Patent No.:** **US 8,279,133 B2**
(45) **Date of Patent:** **Oct. 2, 2012**

- (54) **ANTENNA DEVICE**
- (75) Inventors: **Hideaki Shimoda**, Tokyo (JP); **Tetsuya Shibata**, Tokyo (JP); **Kei Suzuki**, Tokyo (JP)
- (73) Assignee: **TDK 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 274 days.

(21) Appl. No.: **12/712,503**

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

(65) **Prior Publication Data**
US 2010/0220030 A1 Sep. 2, 2010

(30) **Foreign Application Priority Data**
Feb. 27, 2009 (JP) 2009-047386

- (51) **Int. Cl.**
H01Q 1/50 (2006.01)
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/860**; 343/700 MS; 343/702; 343/829; 343/846
- (58) **Field of Classification Search** None
See application file for complete search history.

- (56) **References Cited**
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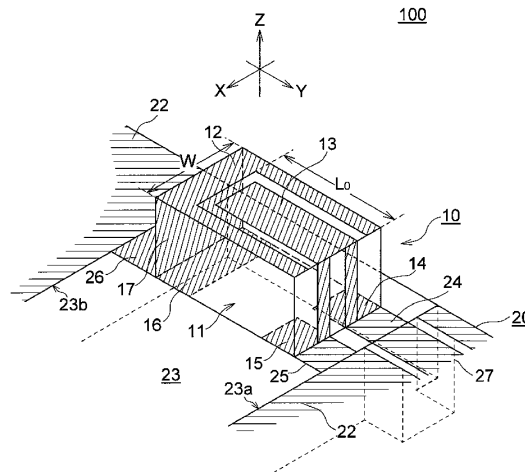
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Primary Examiner — Trinh Dinh
(74) *Attorney, Agent, or Firm* — McDermott Will & Emery LLP

(57) **ABSTRACT**
An antenna device is provided with an antenna element including a base, an inductance adjustment pattern that is formed on the upper surface and a side surface of the base and has a substantially U-shape, a capacitance adjustment pattern that is formed on the upper surface of the base and is placed to face the inductance adjustment pattern, and first to third terminal electrodes provided on the bottom surface of the base. The antenna element is installed between the first side and the second side of the ground pattern that form the two facing sides of the antenna mounting region. One end of the inductance adjustment pattern is connected to the feed line, the other end of the inductance adjustment pattern is connected to the first side of the ground pattern, and the third terminal electrode is connected to the second side of the ground pattern.

9 Claims, 12 Drawing Sheets





US008280525B2

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

(10) **Patent No.:** **US 8,280,525 B2**
(45) **Date of Patent:** **Oct. 2, 2012**

- (54) **DYNAMICALLY MATCHED MICROWAVE ANTENNA FOR TISSUE ABLATION**
- (75) Inventors: **Christopher T. Rusin**, Golden, CO (US); **Joseph Brannan**, Boulder, CO (US)
- (73) Assignee: **Vivant Medical, Inc.**, Boulder, CO (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 931 days.
- (21) Appl. No.: **12/265,024**
- (22) Filed: **Nov. 5, 2008**

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

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(60) Provisional application No. 60/988,699, filed on Nov. 16, 2007.

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- (51) **Int. Cl.**
A61F 2/00 (2006.01)
A61N 1/06 (2006.01)
 - (52) **U.S. Cl.** 607/101; 607/154; 607/156
 - (58) **Field of Classification Search** 606/27-28; 607/101, 154, 156
- See application file for complete search history.

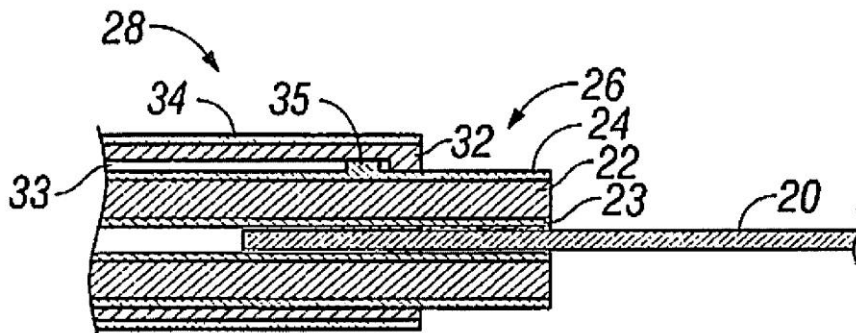
Primary Examiner — Linda Dvorak
Assistant Examiner — Jaymi Della

(57) **ABSTRACT**

A microwave ablation probe for providing microwave energy to tissue is disclosed. The probe includes a feedline having an inner conductor, a secondary inner conductor, an insulating spacer, and an outer conductor. The inner conductor is slidably disposed within the secondary inner conductor. The feedline also includes a radiating portion having an extruded portion of the inner conductor centrally disposed therein, wherein longitudinal movement of the inner conductor relative to the feedline tunes the radiating portion.

11 Claims, 2 Drawing Sheets

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US008284001B2

(12) **United States Patent**
Bourtoutian

(10) **Patent No.:** **US 8,284,001 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

(54) **DIFFERENTIAL FILTERING DEVICE WITH COPLANAR COUPLED RESONATORS AND FILTERING ANTENNA FURNISHED WITH SUCH A DEVICE**

(75) **Inventor:** **Raffi Bourtoutian**, Rueil-Malmaison (FR)

(73) **Assignee:** **Commissariat à l'Énergie Atomique**, Paris (FR)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 439 days.

(21) **Appl. No.:** **12/610,742**

(22) **Filed:** **Nov. 2, 2009**

(65) **Prior Publication Data**
US 2010/0117765 A1 May 13, 2010

(30) **Foreign Application Priority Data**
Nov. 7, 2008 (FR) 08 06219

(51) **Int. Cl.**
H01P 1/20 (2006.01)
(52) **U.S. Cl.** **333/204; 333/161; 343/895**
(58) **Field of Classification Search** **343/741, 343/742, 816, 895; 333/161, 204, 205**
See application file for complete search history.

(56) **References Cited**
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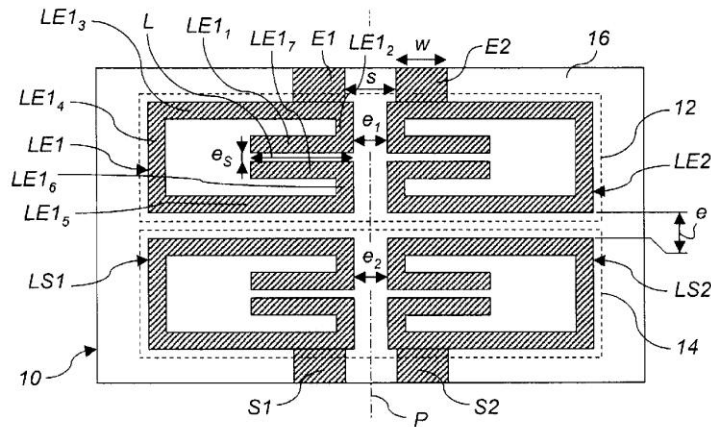
Primary Examiner — Tho G Phan

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

(57) **ABSTRACT**

A differential filtering device with coupled resonators, including: a pair of coupled resonators disposed on one and the same face of a dielectric substrate, each resonator including two conducting strips positioned in a symmetric manner with respect to a plane perpendicular to the face on which the resonator is disposed, these two conducting strips being joined respectively to two conductors of a bi-strip port for connection to a line for transmitting a differential signal, wherein each conducting strip of each resonator is folded back on itself so as to form a capacitive coupling between its two ends, and wherein the two resonators of the pair are coupled by the disposition opposite one another of their respective conducting strips disposed on the same side with respect to the symmetry plane, over respective portions of length of these folded-back conducting strips.

9 Claims, 5 Drawing Sheets





US008284104B2

(12) **United States Patent**
Carr

(10) **Patent No.:** **US 8,284,104 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

- (54) **MULTIPLE-RESONATOR ANTENNA**
- (76) Inventor: **William N. Carr**, Montclair, NJ (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 537 days.

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- (21) Appl. No.: **12/535,768**
- (22) Filed: **Aug. 5, 2009**

- (65) **Prior Publication Data**
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- (60) **Related U.S. Application Data**
Provisional application No. 61/207,467, filed on Feb. 13, 2009, provisional application No. 61/207,909, filed on Feb. 19, 2009, provisional application No. 61/214,200, filed on Apr. 22, 2009.

- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 9/00 (2006.01)
H01Q 9/04 (2006.01)
- (52) **U.S. Cl.** **343/700 MS**; 343/749; 343/825
- (58) **Field of Classification Search** 343/700 MS, 343/853, 857, 858, 893, 749, 825
See application file for complete search history.

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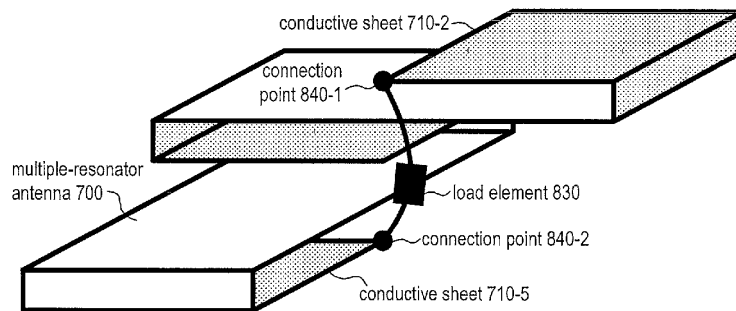
Primary Examiner — Jacob Y Choi
Assistant Examiner — Hasan Islam
(74) *Attorney, Agent, or Firm* — Kaplan Breyer Schwarz & Ottesen LLP

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5,341,148 A 8/1994 Walter et al.

(57) **ABSTRACT**
A Radio-Frequency IDentification (RFID) receiver is disclosed that comprises a plurality of resonant structures arranged to form an antenna. The resonant structures are interconnected in series and are arranged, relative to one another, so as to achieve a received electrical signal with an increased voltage, when the antenna is exposed to an incident electromagnetic signal. This occurs for a majority of all possible incident electromagnetic signals and, therefore, an RFID receiver based on such an antenna provides, in a majority of cases, an improved performance.

16 Claims, 4 Drawing Sheets

Multiple-resonator antenna with load element 800





US008284105B2

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

(10) **Patent No.:** **US 8,284,105 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

- (54) **MULTI-BAND MICROSTRIP MEANDER-LINE ANTENNA**
- (75) Inventors: **Shau-Gang Mao**, Taipei (TW);
Wei-Kung Deng, Taipei (TW)
- (73) Assignee: **RichWave Technology Corp.**, NeiHu District, Taipei (TW)

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

(21) Appl. No.: **12/606,168**
(22) Filed: **Oct. 26, 2009**

(65) **Prior Publication Data**
US 2011/0025576 A1 Feb. 3, 2011

(30) **Foreign Application Priority Data**
Jul. 30, 2009 (TW) 98125670 A

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
(52) **U.S. Cl.** **343/700 MS**; 343/895
(58) **Field of Classification Search** 343/700,
343/843, 895
See application file for complete search history.

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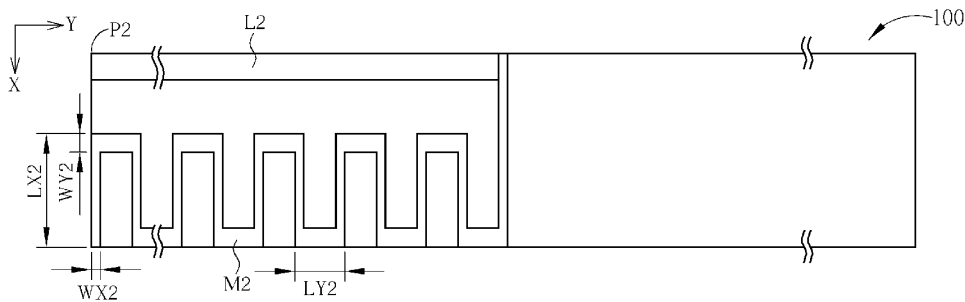
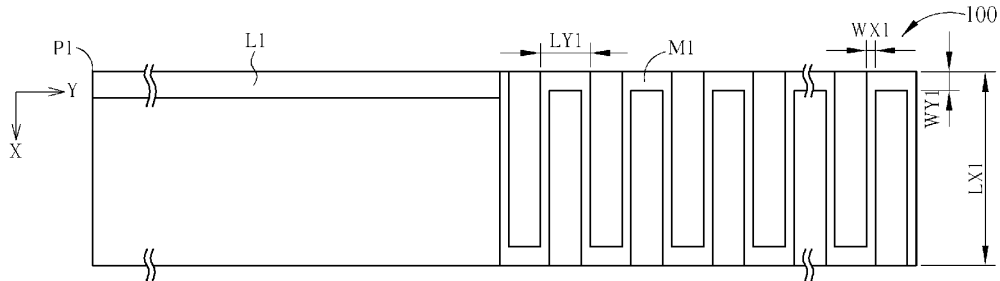
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Primary Examiner — Tho G Phan
(74) *Attorney, Agent, or Firm* — Winston Hsu; Scott Margo

(57) **ABSTRACT**

A multi-band microstrip meander-line antenna includes a substrate, two meander-shaped conductors, and two feed lines. The first meander-shaped conductor is disposed on the substrate in a first reciprocating bend manner for providing a resonant frequency band corresponding to a first operating frequency. The second meander-shaped conductor is disposed on the substrate in a second reciprocating bend manner for providing a resonant frequency band corresponding to a second operating frequency. The first feed line includes the first end electrically connected to a first feed point of the antenna and the second end electrically connected to the end of the first meander-shaped conductor. The second feed line includes the first end electrically connected to the second feed point of the antenna and the second end electrically connected to the end of the second meander-shaped conductor.

55 Claims, 14 Drawing Sheets





US008284106B2

(12) **United States Patent**
Guan

(10) **Patent No.:** **US 8,284,106 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

- (54) **ANTENNA AND WIRELESS COMMUNICATION DEVICE**
- (75) Inventor: **Ning Guan**, Chiba (JP)
- (73) Assignee: **Fujikura 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 226 days.

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- (21) Appl. No.: **12/812,680**
- (22) PCT Filed: **Jan. 21, 2009**
- (86) PCT No.: **PCT/JP2009/050816**
§ 371 (c)(1),
(2), (4) Date: **Jul. 13, 2010**
- (87) PCT Pub. No.: **WO2009/093591**
PCT Pub. Date: **Jul. 30, 2009**
- (65) **Prior Publication Data**
US 2010/0289709 A1 Nov. 18, 2010

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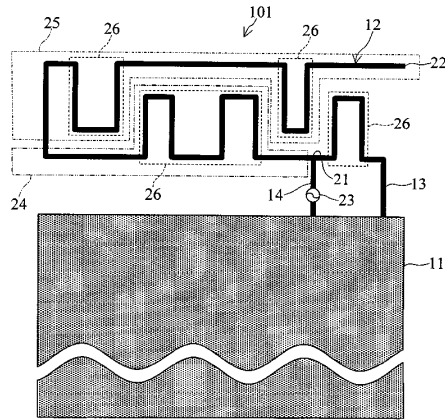
- (30) **Foreign Application Priority Data**
Jan. 21, 2008 (JP) 2008-010471
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/36 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/895; 343/702**
- (58) **Field of Classification Search** None
See application file for complete search history.

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

- (56) **References Cited**
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7,733,271 B2* 6/2010 Moon et al. 343/700 MS

(57) **ABSTRACT**
An antenna that is small in size, has such input characteristics as to secure consistency in each band, and is capable of maintaining omnidirectionality. An antenna includes a grounded conductor, a shorting pin that is formed with a conductor, and a radiation conductor that has one end connected to the grounded conductor via the shorting pin, has the other end left open, and receives power supplied from a feeding point located at the one end. The radiation conductor is folded at a portion between the one end and the other end, and forms a lower arm closer to the grounded conductor and a folded upper arm, with at least part of the lower arm and the upper arm having a meandered portion.

7 Claims, 17 Drawing Sheets





US008284111B2

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

(10) **Patent No.:** **US 8,284,111 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

(54) **MULTIPART ANTENNA WITH CIRCULAR POLARIZATION**

(75) Inventors: **Guy-Aymar Chakam**, Regensburg (DE); **Andreas Schäfer**, München (DE); **Martin Weinberger**, München (DE)

(73) Assignee: **Continental Automotive GmbH**, Hannover (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 354 days.

(21) Appl. No.: **12/672,716**

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

(86) PCT No.: **PCT/EP2008/059987**

§ 371 (c)(1),
(2), (4) Date: **Mar. 12, 2010**

(87) PCT Pub. No.: **WO2009/019177**

PCT Pub. Date: **Feb. 12, 2009**

(65) **Prior Publication Data**
US 2010/0194659 A1 Aug. 5, 2010

(30) **Foreign Application Priority Data**
Aug. 9, 2007 (DE) 10 2007 037 614

(51) **Int. Cl.**
H01Q 11/12 (2006.01)
H01Q 21/00 (2006.01)

(52) **U.S. Cl.** **343/742; 343/867; 343/895**

(58) **Field of Classification Search** **343/741, 343/742, 866, 867, 895**

See application file for complete search history.

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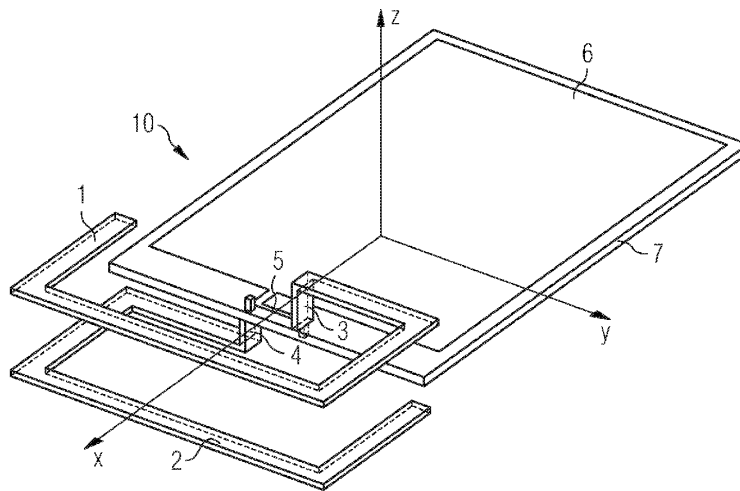
Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Laurence A. Greenberg; Werner H. Stemer; Ralph E. Locher

(57) **ABSTRACT**

An antenna apparatus has a first antenna branch and a second antenna branch. Both the first and the second antenna branch are in the form of a conductor loop which is not closed, and the first antenna branch is arranged at a distance from the second antenna branch in a direction which is substantially at right angles to the surface bounded by the respective conductor loop, such that the first loop direction, which is defined from the foot point to the free end of the first antenna branch, is arranged in the opposite direction to the second loop direction, which is defined from the foot point to the free end of the second antenna branch.

21 Claims, 5 Drawing Sheets





US008284113B2

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

(10) **Patent No.:** **US 8,284,113 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

(54) **WIDEBAND ANTENNAS**

(75) Inventors: **Jean-François Pintos**, Bourgarre (FR);
Philippe Chambelin, Chateaugiron
(FR); **Ali Louzir**, Rennes (FR)

(73) Assignee: **Thomson Licensing**, Boulogne,
Billancourt (FR)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 331 days.

(21) Appl. No.: **12/156,882**

(22) Filed: **Jun. 5, 2008**

(65) **Prior Publication Data**

US 2009/0002251 A1 Jan. 1, 2009

(30) **Foreign Application Priority Data**

Jun. 6, 2007 (FR) 07 55502

(51) **Int. Cl.**
H01Q 9/28 (2006.01)
H01Q 9/16 (2006.01)

(52) **U.S. Cl.** **343/795; 343/793**

(58) **Field of Classification Search** **343/795,**
343/793, 794, 700 MS, 767

See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Douglas W Owens

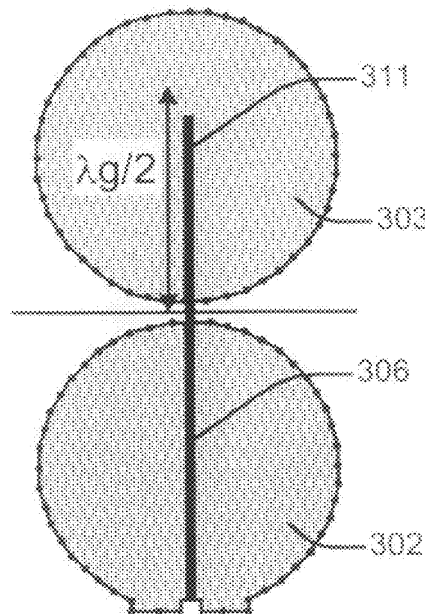
Assistant Examiner — Jennifer F Hu

(74) *Attorney, Agent, or Firm* — Jeffrey D. Carter

(57) **ABSTRACT**

The invention relates to a dipole type wideband antenna comprising a substrate presenting two faces, a first conductive arm, a second conductive arm placed on the substrate, a feeder line supplying the second arm passing under the first arm. In this case, the feeder line extending by a line element placed under the second arm, this element being dimensioned to filter a given frequency.

8 Claims, 2 Drawing Sheets





US008284116B2

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

(10) **Patent No.:** **US 8,284,116 B2**
(45) **Date of Patent:** **Oct. 9, 2012**

(54) **ANTENNA APPARATUS FOR INTERNAL IMPEDANCE MATCHING**

(75) Inventors: **Soon Ho Hwang**, Seoul (KR); **Joon Ho Byun**, Yongin-si (KR); **Tae Sik Yang**, Suwon-si (KR); **Sung Koo Park**, Suwon-si (KR); **Austin Kim**, Seongnam-si (KR); **Kyung Kyun Kang**, Suwon-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 370 days.

(21) Appl. No.: **12/647,128**

(22) Filed: **Dec. 24, 2009**

(65) **Prior Publication Data**

US 2010/0156748 A1 Jun. 24, 2010

(30) **Foreign Application Priority Data**

Dec. 24, 2008 (KR) 10-2008-0132997

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

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

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

(56) **References Cited**

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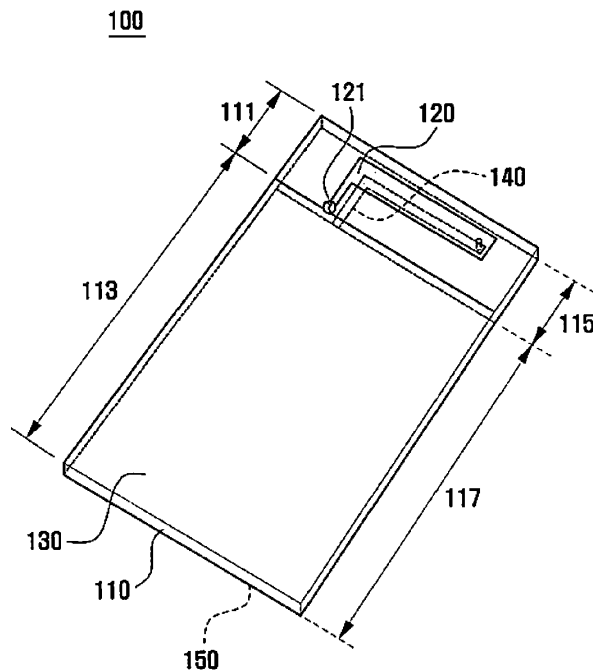
Primary Examiner — Tan Ho

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

(57) **ABSTRACT**

An antenna apparatus allows for internal impedance matching by employing an internal matching device therein. The antenna apparatus includes a board body formed of a dielectric material and having a flat structure. The antenna apparatus also includes an antenna device disposed on an upper surface of the board body, and the internal matching device disposed on a lower surface of the board body. The antenna device extends from a feed point and has a first impedance. The internal matching device is connected to the antenna device and has a second impedance used for matching the first impedance with a reference impedance. The antenna device and the internal matching device resonate at the reference impedance in a specific frequency band when a voltage is supplied through the feed point.

14 Claims, 12 Drawing Sheets





US008289215B2

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

(10) **Patent No.:** **US 8,289,215 B2**
(45) **Date of Patent:** **Oct. 16, 2012**

(54) **RECEIVING DEVICE FOR GLOBAL POSITIONING SYSTEM AND ANTENNA STRUCTURE THEREOF**

(75) Inventors: **Hsi-Hsing Hsu**, Taoyuan County (TW); **Kai-Ta Wang**, Taoyuan County (TW); **Chin-Lin Chang**, Taoyuan County (TW); **Chuan-Ku Liu**, Taoyuan County (TW); **Kuei-Chiang Huang**, Taoyuan County (TW); **Kuo-Cheng Chen**, Taoyuan County (TW)

(73) Assignee: **HTC Corporation**, Taoyuan, 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 37 days.

(21) Appl. No.: **12/176,483**

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

(65) **Prior Publication Data**

US 2009/0033551 A1 Feb. 5, 2009

(30) **Foreign Application Priority Data**

Jul. 30, 2007 (TW) 96127852 A

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

(52) **U.S. Cl.** **343/702; 343/828**

(58) **Field of Classification Search** **343/700 MS, 343/702, 846, 825, 828**

See application file for complete search history.

(56) **References Cited**

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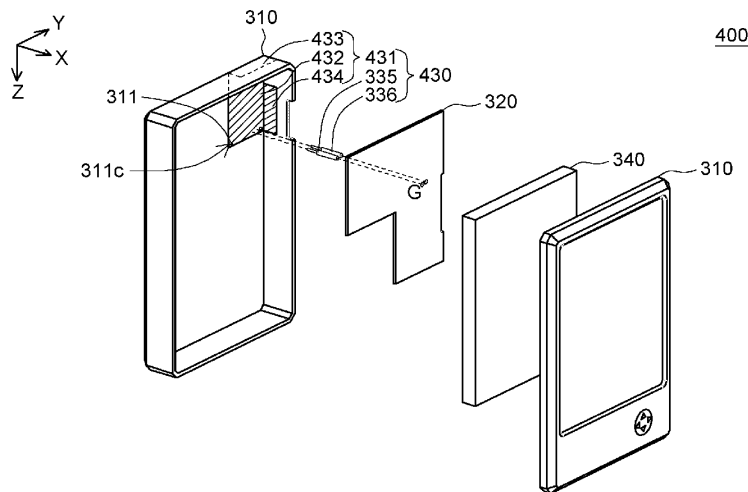
Primary Examiner — Michael C Wimer

(74) *Attorney, Agent, or Firm* — Thomas|Kayden

(57) **ABSTRACT**

A receiving device for a global positioning system and an antenna structure thereof. The receiving device includes a housing, a circuit board and the antenna structure. The circuit board is disposed inside the housing and has a ground portion and a signal feeding portion. The antenna structure is disposed inside the housing and includes a metal plate, a first electric conducting element and a second electric conducting element. The metal plate is used for receiving a GPS signal. The first electric conducting element has one end coupled to the metal plate, and the other end coupled to the ground portion of the circuit board. The second electric conducting element for feeding the GPS signal to the circuit board has one end coupled to the metal plate, and the other end coupled to the signal feeding portion of the circuit board.

8 Claims, 11 Drawing Sheets





US008289216B2

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

(10) **Patent No.:** **US 8,289,216 B2**
(45) **Date of Patent:** **Oct. 16, 2012**

(54) **ANTENNA-EMBEDDED CASE FOR MOBILE COMMUNICATIONS TERMINAL, METHOD OF MANUFACTURING THE SAME, AND MOBILE COMMUNICATIONS TERMINAL**

(75) Inventors: **Sung Eun Cho**, Gyunggi-do (KR); **Jae Gyu Go**, Gyunggi-do (KR); **Yong Shik Na**, Gyunggi-do (KR); **Dae Kyu Lee**, Gyunggi-do (KR); **Chan Gwang An**, Gyunggi-do (KR); **Hyun Kil Nam**, Seoul (KR); **Byung Hwa Lee**, Gyunggi-do (KR); **Dae Seong Jeon**, Gyunggi-do (KR); **Ha Ryong Hong**, Gyunggi-do (KR); **Jae Suk Sung**, Gyunggi-do (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 395 days.

(21) Appl. No.: **12/608,874**

(22) Filed: **Oct. 29, 2009**

(65) **Prior Publication Data**
US 2010/0220028 A1 Sep. 2, 2010

(30) **Foreign Application Priority Data**
Feb. 27, 2009 (KR) 10-2009-0016644

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/873**
(58) **Field of Classification Search** **343/702, 343/872, 873**
See application file for complete search history.

(56) **References Cited**

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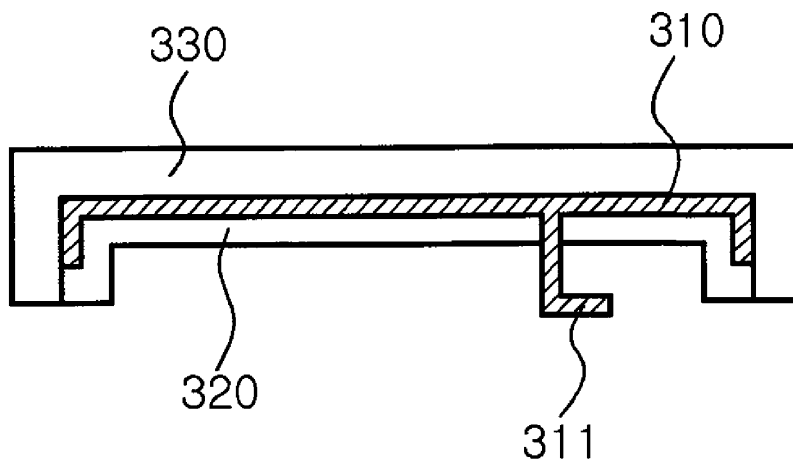
Primary Examiner — Tho G Phan

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

(57) **ABSTRACT**

A method of manufacturing an antenna-embedded case for a mobile communications terminal includes providing an antenna pattern, forming a first injection-molded member covering one surface of the antenna pattern, and disposing the first injection-molded member, provided with the antenna pattern on one surface thereof, in a second mold with the antenna pattern disposed in a space inside the second mold, and injection-molding a second injection-molded member covering the other surface of the antenna pattern to embed the antenna pattern between the first injection-molded member and the second injection-molded member.

10 Claims, 4 Drawing Sheets





US008289219B2

(12) **United States Patent**
Breiter

(10) **Patent No.:** **US 8,289,219 B2**
(45) **Date of Patent:** **Oct. 16, 2012**

- (54) **ANTENNA ARRANGEMENT**
- (75) Inventor: **Richard Breiter**, Frederiksberg C (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 0 days.

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- (21) Appl. No.: **12/597,923**
- (22) PCT Filed: **May 2, 2007**
- (86) PCT No.: **PCT/IB2007/001821**
§ 371 (c)(1),
(2), (4) Date: **Jan. 11, 2010**
- (87) PCT Pub. No.: **WO2008/135802**
PCT Pub. Date: **Nov. 13, 2008**

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- (65) **Prior Publication Data**
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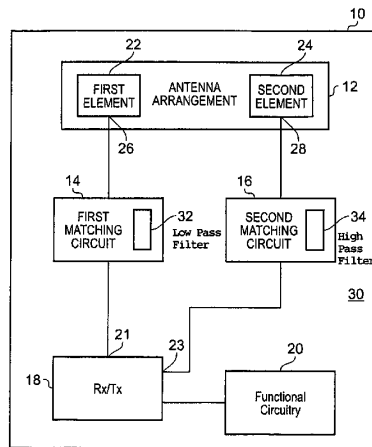
- (51) **Int. Cl.**
H01Q 1/00 (2006.01)
- (52) **U.S. Cl.** **343/729; 343/853**
- (58) **Field of Classification Search** **343/700 MS**,
343/852, 729, 725, 771, 722, 768, 802, 778,
343/872, 749, 753, 719, 713, 703, 846, 702,
343/727, 730, 742, 795, 829, 770, 895, 844,
343/708, 715, 792.5, 754, 850, 853, 860
See application file for complete search history.

Primary Examiner — Jacob Y Choi
Assistant Examiner — Robert Karacsony
(74) *Attorney, Agent, or Firm* — Harrington & Smith

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6,476,769 B1 11/2002 Lehtola 343/702

- (57) **ABSTRACT**
An antenna arrangement including a first element operable in a first resonant mode at a first resonant frequency band; and a second element arranged to couple with the first element to enable the first element to resonate in a second resonant mode having a second resonant frequency band, the second element having a second resonant frequency band, the second element having an impedance at the first resonant frequency band which substantially suppresses coupling between the first element and the second element.

19 Claims, 7 Drawing Sheets





US008289225B2

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

(10) **Patent No.:** **US 8,289,225 B2**
(45) **Date of Patent:** **Oct. 16, 2012**

(54) **MULTI-RESONANT ANTENNA HAVING DIELECTRIC BODY**

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(75) Inventors: **Mie Shimizu**, Kanagawa-ken (JP);
Kazuhiko Kubota, Kyoto-fu (JP)

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(73) Assignee: **Murata Manufacturing Co., Ltd.** (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 37 days.

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(74) *Attorney, Agent, or Firm* — Studebaker & Brackett PC; Tim L. Brackett, Jr.; John E. Guay

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(57) **ABSTRACT**

The antenna includes a power-feeding radiation electrode and a non-power-feeding radiation electrode are provided adjacent to each other with a gap therebetween on the flexible substrate, which also is bendable. The power-feeding radiation electrode is used to perform antenna operation in a basic mode in which resonant operation is performed at a basic frequency and antenna operation in a high-order mode in which resonant operation is performed at a frequency higher than the basic frequency. The power-feeding radiation electrode includes a loop path configured such that the power-feeding radiation electrode first extends in a direction away from a power-feeding end and an open end is bent toward the power-feeding end. The non-power-feeding radiation electrode has one end serving as a ground-side end and the other end serving as an open end. A dielectric body having permittivity higher than the bendable, flexible substrate is provided on a front surface or a back surface of the power-feeding radiation electrode provided in a region including a portion in which voltage of a resonant frequency in the high-order mode is zero potential and a region in the vicinity of that portion.

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

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

(58) **Field of Classification Search** 343/700 MS, 343/702, 741-742, 846, 866-867, 873, 895, 343/700 M

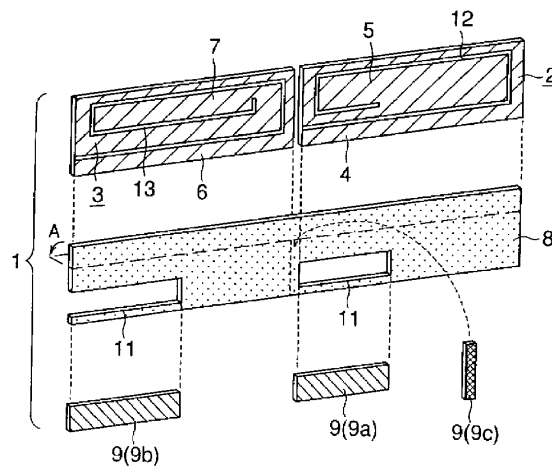
See application file for complete search history.

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17 Claims, 9 Drawing Sheets





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Takahashi

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- (54) **MOBILE ELECTRONIC DEVICE**
- (75) Inventor: **Shin Takahashi**, Yokohama (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 115 days.
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- (22) Filed: **Mar. 26, 2010**
- (65) **Prior Publication Data**
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- (30) **Foreign Application Priority Data**
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- (51) **Int. Cl.**
H04M 1/00 (2006.01)
- (52) **U.S. Cl.** **455/575.3; 455/571; 455/572**
- (58) **Field of Classification Search** **455/13.4, 455/39, 127.1, 343.1, 571, 572, 575.3**
See application file for complete search history.

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- Primary Examiner* — Tuan H Nguyen
- (74) *Attorney, Agent, or Firm* — Duane Morris LLP; Richard C. Kim

(57) **ABSTRACT**

A system and method for a mobile electronic device operable to receive signals having a plurality of frequencies using an antenna comprising a plurality of conductors is disclosed. A first conductor operable to resonant with a first frequency band is coupled to a second conductor operable to resonant with a second frequency band. The second conductor is coupled to a ground, if the first conductor is coupled to a power supply. The second conductor is coupled to the power supply, if the first conductor is coupled to the ground.

20 Claims, 5 Drawing Sheets

