US007671804B2

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

(10) **Patent No.: US 7,671,804 B2**
(45) **Date of Patent: Mar. 2, 2010**

(54) **TUNABLE ANTENNAS FOR HANDHELD DEVICES**

(75) Inventors: **Zhijun Zhang**, Santa Clara, CA (US); **Ruben Caballero**, 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 668 days.

(21) Appl. No.: **11/516,433**

(22) Filed: **Sep. 5, 2006**

(65) **Prior Publication Data**

US 2008/0055164 A1 Mar. 6, 2008

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

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

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

See application file for complete search history.

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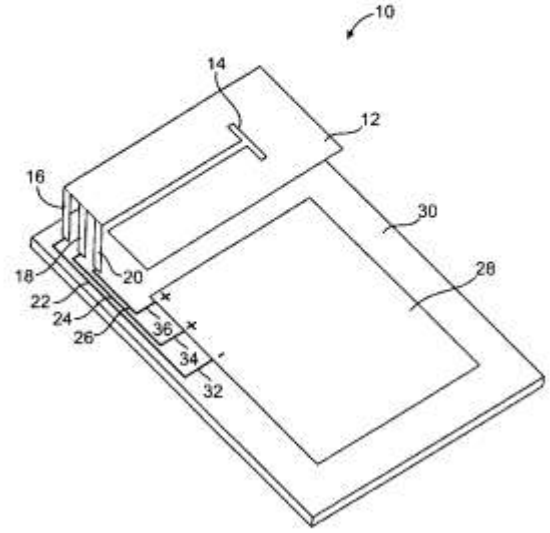
Primary Examiner—Tan Ho
(74) *Attorney, Agent, or Firm*—Treyz Law Group; G. Victor Treyz

(57) **ABSTRACT**

A compact tunable antenna for a handheld electronic device and methods for calibrating and using compact tunable antennas are provided. The antenna can have multiple ports. Each port can have an associated feed and ground. The antenna design can be implemented with a small footprint while covering a large bandwidth. The antenna can have a radiating element formed from a conductive structure such as a patch or helix. The antenna can be shaped to accommodate buttons and other components in the handheld device. The antenna may be connected to a printed circuit board in the handheld device using springs, pogo pins, and other suitable connecting structures. Radio-frequency switches and passive components such as duplexers and diplexers may be used to couple radio-frequency transceiver circuitry to the different feeds of the antenna. Antenna efficiency can be enhanced by avoiding the use of capacitive loading for antenna tuning.

11 Claims, 14 Drawing Sheets



US007671807B2

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

(10) **Patent No.: US 7,671,807 B2**
(45) **Date of Patent: Mar. 2, 2010**

(54) **HIGH-DIRECTIONAL WIDE-BANDWIDTH ANTENNA**

(75) Inventors: **I Ju Fu**, Taoyuan (TW); **Yung Chih Lo**, Changhua (TW); **Yao Jen Chen**, Kaohsiung (TW)

(73) Assignee: **Amos Technologies Inc.**, Hsinchu 300 (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 149 days.

(21) Appl. No.: **12/078,828**

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

(65) **Prior Publication Data**

US 2009/0051599 A1 Feb. 26, 2009

(30) **Foreign Application Priority Data**

Aug. 22, 2007 (TW) ..... 96131092 A

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

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

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

See application file for complete search history.

(56) **References Cited**

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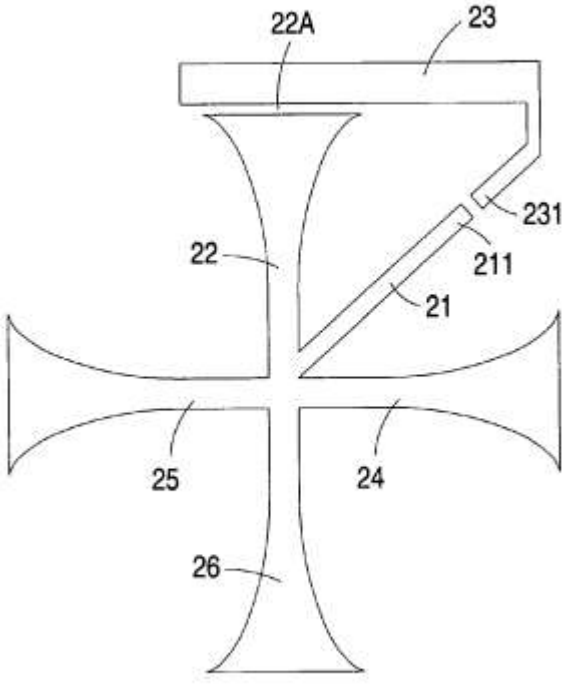
Primary Examiner—Hoang V Nguyen
(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(57) **ABSTRACT**

A high-directional wide-bandwidth antenna is disclosed. The high-directional wide-bandwidth antenna includes a first element, a first radiating body, a second radiating body, a third radiating body, and a fourth radiating body. The first element has a first feeding point, wherein its equivalent reactance is inductive. One end of the first radiating body is connected to the first element and the other end of the first radiating body is a coupling surface. The second radiating body has a second feeding point and is extended through the second feeding point to the coupling surface so that the energy is transferred between the first radiating body and the second radiating body through the coupling surface. The first resonant frequency is attained by the first radiating body and the second radiating body, and the second resonant frequency is attained by the third radiating body and the fourth radiating body.

16 Claims, 5 Drawing Sheets



US007671808B2

(12) **United States Patent**
Boyle

(10) **Patent No.: US 7,671,808 B2**
(45) **Date of Patent: Mar. 2, 2010**

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

(75) Inventor: **Kevin R. Boyle**, Horsham (GB)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 197 days.

(21) Appl. No.: **10/563,649**

(22) PCT Filed: **Jul. 2, 2004**

(86) PCT No.: **PCT/IB2004/002235**

§ 371 (c)(1),
(2), (4) Date: **Jan. 6, 2006**

(87) PCT Pub. No.: **WO2005/006493**

PCT Pub. Date: **Jan. 20, 2005**

(65) **Prior Publication Data**

US 2006/0234657 A1 Oct. 19, 2006

(30) **Foreign Application Priority Data**

Jul. 10, 2003 (GB) 0316169.2

(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

See application file for complete search history.

(56) **References Cited**

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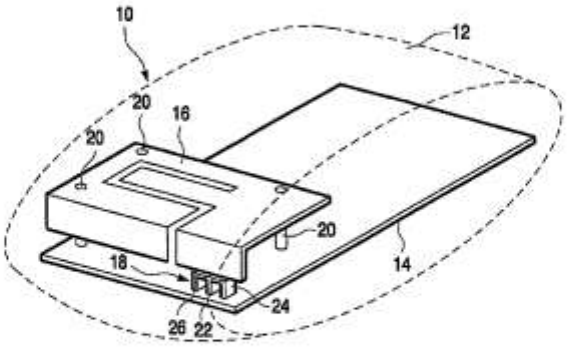
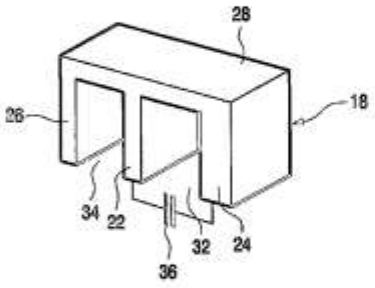
Primary Examiner—Douglas W Owens
Assistant Examiner—Dieu Hien T Duong

(57) **ABSTRACT**

A communications device, such as a cellular telephone, comprises a RF circuit and a PIFA antenna having feed and shorting terminations. An electrically conductive, self supporting member is provided to effect a connection between contact points of the RF circuit and the antenna. The member has at least one feed pillar and a shorting pillar which are substantially permanently connected to respective contact points of the RF circuit, and an antenna interface which forms a pressure connection with the terminations of the antenna.

19 Claims, 2 Drawing Sheets





US007671810B2

(12) **United States Patent**
Yu

(10) **Patent No.: US 7,671,810 B2**
(45) **Date of Patent: Mar. 2, 2010**

(54) **ANTENNA STRUCTURE FOR A NOTEBOOK**

(75) Inventor: **Yao-Wen Yu**, Pa-Te (TW)

(73) Assignee: **Auden Techno Corp.**, Pa-Te, Tao-Yuan Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 456 days.

(21) Appl. No.: **11/746,678**

(22) Filed: **May 10, 2007**

(65) **Prior Publication Data**

US 2008/0278401 A1 Nov. 13, 2008

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

(52) **U.S. Cl.** **343/702**; 343/878

(58) **Field of Classification Search** 343/702, 343/878, 893

See application file for complete search history.

(56) **References Cited**

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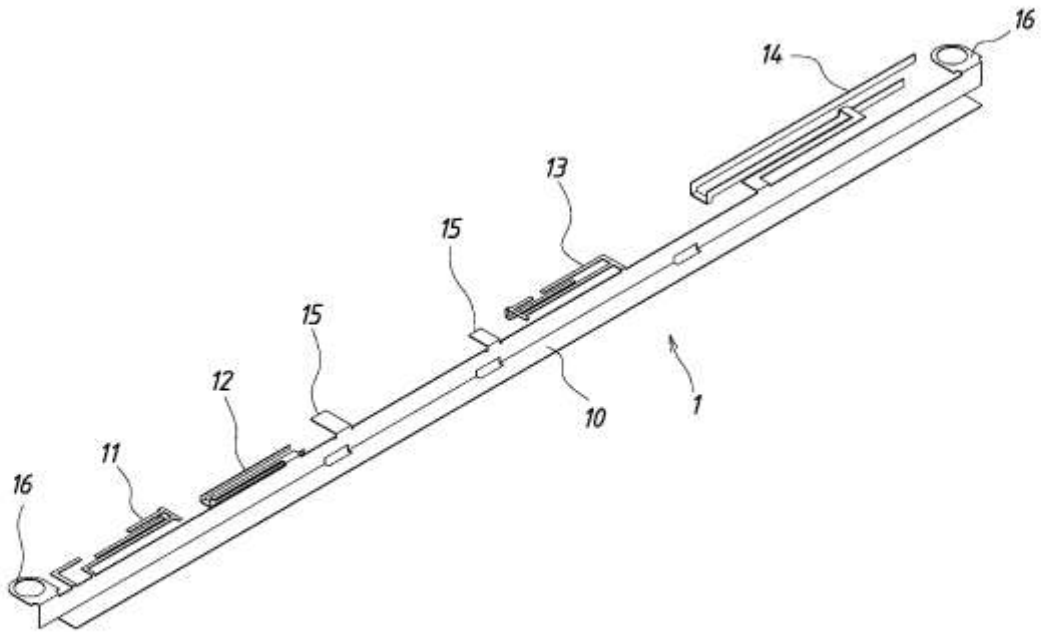
Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—Guice Patents PLLC

(57) **ABSTRACT**

An antenna structure for a notebook with four radiation members, the antenna structure has an elongate supporting rack having thereon a first radiation member, a second radiation member, a third radiation member and a fourth radiation member; each radiation member is planar, and is integrally connected with the supporting rack. Thereby, when the notebook uses a plurality of antennas, the costs of mold developing and time for processing can be reduced, and in designing, the space of the antenna will not waste by having the structure, and a better effect in function can be obtained.

6 Claims, 4 Drawing Sheets



US007671811B2

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

(10) **Patent No.: US 7,671,811 B2**
(45) **Date of Patent: Mar. 2, 2010**

(54) **ANTENNA DEVICE WITH GROUND PLANE COUPLED TO CONDUCTIVE PORTION OF AN ELECTRONIC DEVICE**

(75) Inventors: **Yu-Chiang Cheng**, Taipei (TW); **Ping-Cheng Chang**, Chaozhou Town (TW); **Cheng-Zing Chou**, Xinying (TW)

(73) Assignee: **Getac 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 166 days.

(21) Appl. No.: **11/878,674**

(22) Filed: **Jul. 26, 2007**

(65) **Prior Publication Data**

US 2008/0169986 A1 Jul. 17, 2008

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/651,981, filed on Jan. 11, 2007, now abandoned.

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

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

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

(56) **References Cited**

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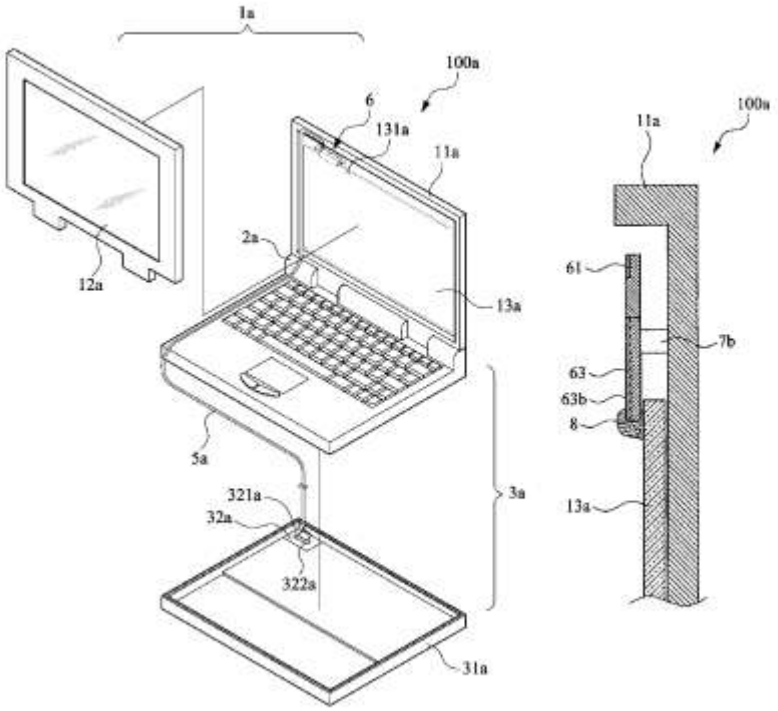
Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—Quintero Law Office

(57) **ABSTRACT**

Disclosed is an antenna device arranged inside a display module of an electronic device with a conductive portion. The antenna device includes an antenna element with a ground plane and a signal feeding end for transceiving a wireless signal, an antenna signal feeding line coupled to the signal feeding end of the antenna element for feeding the wireless signal transceived by the antenna element. At least one mounting element for fixing the antenna element onto the casing and forcing the ground plane of the antenna electrically contacting with the conductive portion of the casing, so that the conductive porting serves as an extended ground for the ground plane of the antenna element.

15 Claims, 9 Drawing Sheets



US007671817B2

(12) **United States Patent**
Moser

(10) **Patent No.: US 7,671,817 B2**
(45) **Date of Patent: Mar. 2, 2010**

(54) **WIDEBAND ANTENNA**

(75) Inventor: **Michael Moser**, Hägersten (SE)

(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 186 days.

(21) Appl. No.: **11/679,442**

(22) Filed: **Feb. 27, 2007**

(65) **Prior Publication Data**

US 2008/0204354 A1 Aug. 28, 2008

(51) **Int. Cl.**

H01Q 1/00	(2006.01)
H01Q 21/00	(2006.01)
H01Q 1/36	(2006.01)
H01Q 13/00	(2006.01)

(52) **U.S. Cl.** **343/828**; 343/829; 343/825; 343/908; 343/773

(58) **Field of Classification Search** 343/702, 343/896, 897, 898, 899, 825, 828, 829, 908, 343/846, 848, 773, 786

See application file for complete search history.

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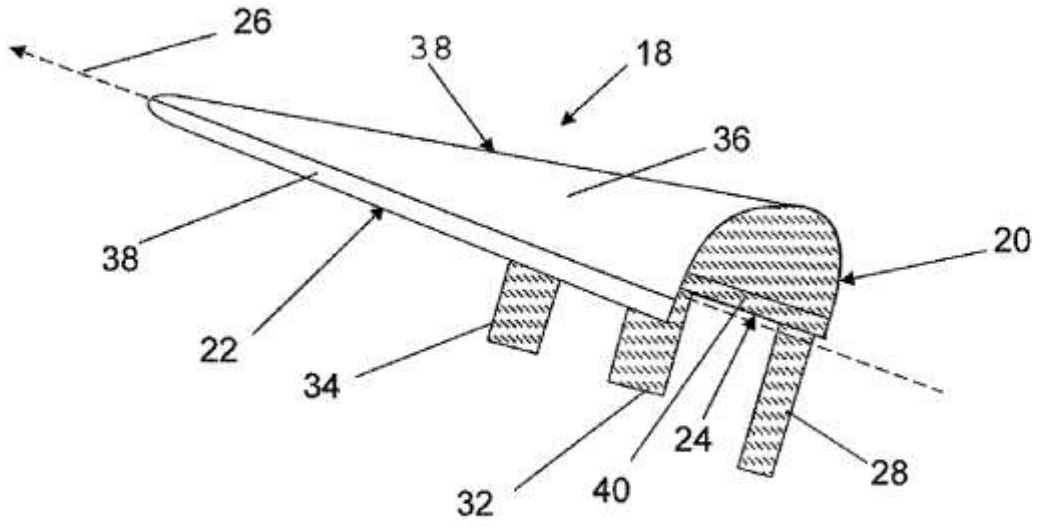
Primary Examiner—Douglas W Owens
Assistant Examiner—Jennifer F Hu
(74) *Attorney, Agent, or Firm*—Harrity & Harrity, LLP

(57) **ABSTRACT**

An antenna arrangement for a communication device is provided that may include a monopole antenna element having a bottom side joined to a first lateral side and joined to a second lateral side. The bottom side may be joined to each lateral side at an angle less than 90 degrees for forming an antenna element area defined at least by the bottom side and the first and second lateral sides. The antenna element area may include an central part arcuate around a longitudinal axis in a conical fashion, so that at least a part of the bottom side is provided half a turn around the longitudinal axis.

20 Claims, 3 Drawing Sheets



US007675463B2

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

(10) **Patent No.: US 7,675,463 B2**
(45) **Date of Patent: Mar. 9, 2010**

(54) **MINIATURIZED INTEGRATED MONOPOLE ANTENNA**

(75) Inventors: **Richard Wallace**, Jaerfaella (SE); **Are Bjorneklett**, Vaesteras (SE)

(73) Assignee: **Infineon Technologies AG**, Munich (DE)

(*) 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.: **11/522,097**

(22) Filed: **Sep. 15, 2006**

(65) **Prior Publication Data**

US 2007/0103373 A1 May 10, 2007

(30) **Foreign Application Priority Data**

Sep. 15, 2005 (EP) 05020115

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/36 (2006.01)

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

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

(56) **References Cited**

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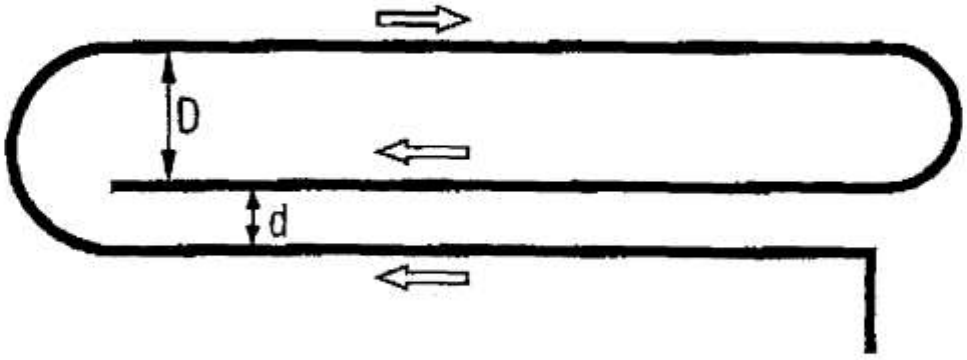
Primary Examiner—Trinh V Dinh
(74) *Attorney, Agent, or Firm*—Maginot, Moore & Beck

(57) **ABSTRACT**

The invention is related to a monopole antenna provided for short-range applications, having a conductive pattern arranged on a dielectric substrate. The conductive pattern has a first straight radiating element connected to an antenna feeding point, a second straight radiating element arranged essentially parallel to the first radiating element and interconnected to it, and further a third straight radiating element arranged between the first and second radiating elements and essentially parallel to both of the first and second radiating elements and interconnected to the second radiating element. The electric and magnetic fields of the first and the third radiating elements are thereby interacting constructively. The invention is also related to an integrated circuit having such monopole antenna, and a method for manufacturing such monopole antenna.

17 Claims, 3 Drawing Sheets



US007675470B2

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

(10) **Patent No.: US 7,675,470 B2**
(45) **Date of Patent: *Mar. 9, 2010**

(54) **MULTI-BAND MONOPOLE ANTENNA FOR A MOBILE COMMUNICATIONS DEVICE**

(75) Inventors: **Alfonso Sanz**, Barcelona (ES); **Carles Puente 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.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/055,748**

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

(65) **Prior Publication Data**

US 2008/0211722 A1 Sep. 4, 2008

Related U.S. Application Data

(63) Continuation of application No. 11/713,324, filed on Mar. 2, 2007, now Pat. No. 7,403,164, which is a continuation of application No. 11/124,768, filed on May 9, 2005, now Pat. No. 7,411,556, which is a continuation of application No. PCT/EP02/14706, filed on Dec. 22, 2002.

(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

See application file for complete search history.

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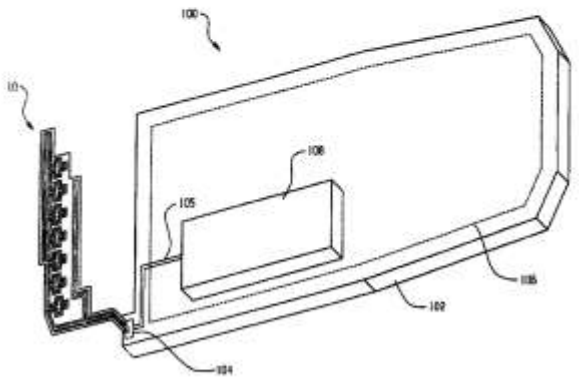
(Continued)

Primary Examiner—Tan Ho
(74) *Attorney, Agent, or Firm*—Winstead PC

(57) **ABSTRACT**

A multi-band monopole antenna for a mobile communications device includes a common conductor coupled to both a first radiating arm and a second radiating arm. The common conductor includes a feeding port for coupling the antenna to communications circuitry in a mobile communications device. In one embodiment, the first radiating arm includes a space-filling curve. In another embodiment, the first radiating arm includes a meandering section extending from the common conductor in a first direction and a contiguous extended section extending from the meandering section in a second direction.

20 Claims, 7 Drawing Sheets



US007678853B2

(12) **United States Patent**
Oohira

(10) **Patent No.: US 7,678,853 B2**
(45) **Date of Patent: Mar. 16, 2010**

(54) **HIGHLY DIELECTRIC ELASTOMER COMPOSITION AND DIELECTRIC ANTENNA**

(75) Inventor: **Kouya Oohira**, Iwata (JP)

(73) Assignee: **NTN 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 423 days.

(21) Appl. No.: **11/629,646**

(22) PCT Filed: **Jun. 15, 2005**

(86) PCT No.: **PCT/JP2005/010949**

§ 371 (c)(1),
(2), (4) Date: **Dec. 15, 2006**

(87) PCT Pub. No.: **WO2005/123841**

PCT Pub. Date: **Dec. 29, 2005**

(65) **Prior Publication Data**

US 2007/0182640 A1 Aug. 9, 2007

(30) **Foreign Application Priority Data**

Jun. 16, 2004 (JP) P2004-177969
Jul. 30, 2004 (JP) P2004-222910
Dec. 10, 2004 (JP) P2004-358623

(51) **Int. Cl.**
C08K 3/10 (2006.01)

(52) **U.S. Cl.** **524/403**; 343/785; 343/907; 501/138; 501/139

(58) **Field of Classification Search** 524/403; 501/138, 139; 343/785, 907

See application file for complete search history.

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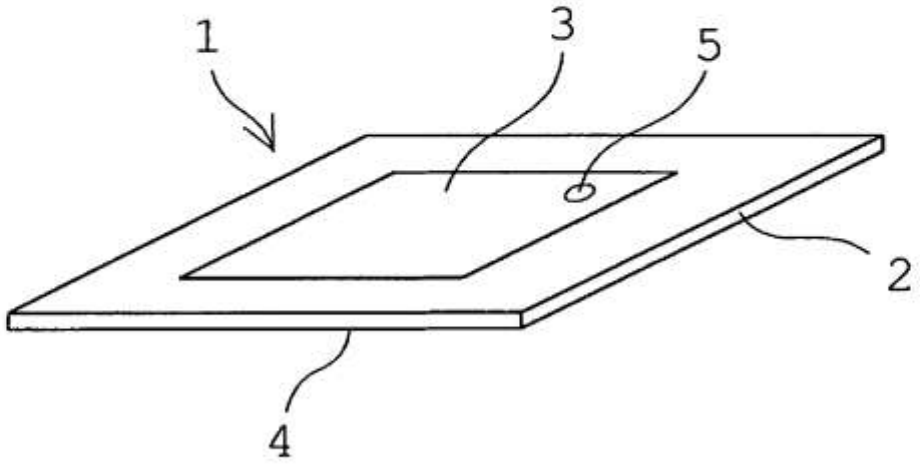
Electronic Monthly, Jul. 1998, pp. 16-19.

Primary Examiner—Peter D Mulcahy
(74) *Attorney, Agent, or Firm*—Headman & costigan; James V. Costigan

(57) **ABSTRACT**

The present invention provides a highly dielectric elastomer composition which shows a high dielectric constant in a wide temperature range from low to high temperature and has a low dielectric loss tangent, and a dielectric antenna composed of the highly dielectric elastomer composition. A dielectric antenna including a molding of a highly dielectric elastomer composition composed of an elastomer and a highly dielectric ceramic powder mixed with the elastomer and an electrode formed on the molding. The highly dielectric ceramic powder of barium titanate.neodymium ceramic has a temperature coefficient α(unit: 1/° C.) of a dielectric constant of the ceramic powder on 25° C. standard ranging from -200×10^{-6} to 100×10^{-6} over a temperature range from −40° C. to 100° C. The dielectric constant of the highly dielectric elastomer composition is ≧7 and a dielectric loss tangent thereof is ≦0.01.

5 Claims, 3 Drawing Sheets



US007679565B2

(12) **United States Patent**
Sorvala

(10) **Patent No.: US 7,679,565 B2**
(45) **Date of Patent: Mar. 16, 2010**

(54) **CHIP ANTENNA APPARATUS AND METHODS**

(75) Inventor: **Juha Sorvala**, Oulu (FI)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 224 days.

(21) Appl. No.: **11/648,431**

(22) Filed: **Dec. 28, 2006**

(65) **Prior Publication Data**

US 2007/0152885 A1 Jul. 5, 2007

Related U.S. Application Data

(63) Continuation of application No. PCT/FI2005/050089, filed on Mar. 16, 2005.

(30) **Foreign Application Priority Data**

Jun. 28, 2004 (FI) 20040892

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

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/846

See application file for complete search history.

(56) **References Cited**

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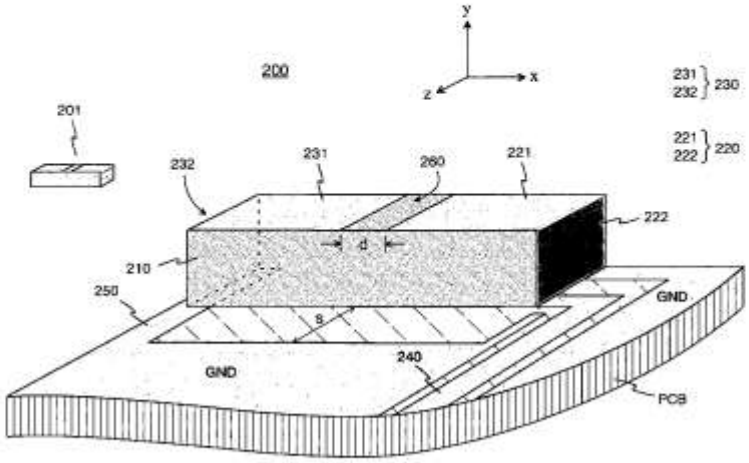
Primary Examiner—Tho G Phan
(74) *Attorney, Agent, or Firm*—Gazdzinski & Associates, PC

(57) **ABSTRACT**

A chip component with dielectric substrate and plurality of radiating antenna elements on the surface thereof. In one embodiment, two (2) substantially symmetric elements are used, each covering an opposite head and upper surface portion of the device. The surface between the elements comprises a slot. The chip is mounted on a circuit board (e.g., PCB) whose conductor pattern is part of the antenna. No ground plane is used under the chip or its sides to a certain distance. One of the antenna elements is coupled to the feed conductor on the PCB and to the ground plane, while the parasitic element is coupled only to the ground plane. The parasitic element is fed through coupling over the slot, and both elements resonate at the operating frequency. The antenna can be tuned and matched without discrete components, is substantially omni-directional, and has low substrate losses due to simple field image.

44 Claims, 5 Drawing Sheets



US007679566B2

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

(10) **Patent No.: US 7,679,566 B2**
(45) **Date of Patent: Mar. 16, 2010**

(54) **ANTENNA STRUCTURE HAVING STABLE PROPERTIES AND HEADSET**

(75) Inventors: **Masahiko Higasa**, Fukushima-ken (JP); **Akihiro Kato**, Fukushima-ken (JP); **Masao Miyaura**, Fukushima-ken (JP); **Atsushi Murata**, Fukushima-ken (JP)

(73) Assignee: **Alps Electric Co., Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 209 days.

(21) Appl. No.: **11/895,254**

(22) Filed: **Aug. 22, 2007**

(65) **Prior Publication Data**

US 2008/0079645 A1 Apr. 3, 2008

(30) **Foreign Application Priority Data**

Sep. 29, 2006 (JP) 2006-268875

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

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

(58) **Field of Classification Search** ..... 343/770, 343/700 MS, 702

See application file for complete search history.

(56) **References Cited**

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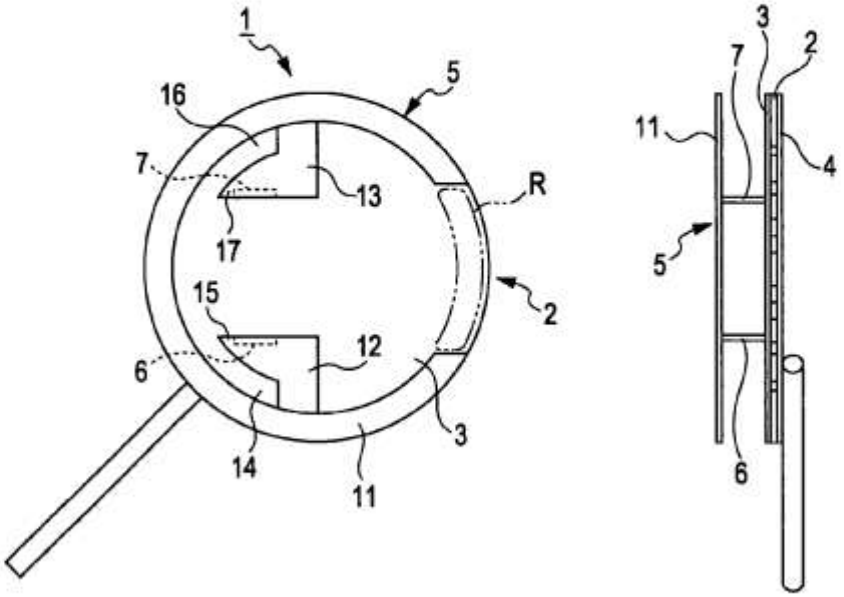
Primary Examiner—Michael C Wimer
Assistant Examiner—Kyana R Robinson
(74) *Attorney, Agent, or Firm*—Beyer Law Group LLP

(57) **ABSTRACT**

An antenna structure includes a radiation conductor made of a metal plate that is supported by legs provided upright on a surface of a dielectric substrate and is spaced apart from the surface. The radiation conductor is circularly shaped such that the contour of the radiation conductor conforms to the outer periphery of the dielectric substrate and such that the radiation conductor includes an open portion. One of the legs functions as a feeding terminal and the other functions as a grounding terminal, whereby the radiation conductor operates as a dipole antenna. The radiation conductor has slots for adjusting impedance. Impedance can be adjusted by changing the length of the slots.

9 Claims, 5 Drawing Sheets



US007679569B2

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

(10) **Patent No.: US 7,679,569 B2**
(45) **Date of Patent: Mar. 16, 2010**

(54) **ANTENNA DEVICE AND MULTI-BAND TYPE WIRELESS COMMUNICATION APPARATUS USING SAME**

(75) Inventors: **Yasunori Takaki**, Saitama (JP); **Hiroyuki Aoyama**, Saitama (JP); **Hiroto Ideno**, Tottori (JP)

(73) Assignee: **Hitachi Metals, Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 369 days.

(21) Appl. No.: **11/723,878**

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

(65) **Prior Publication Data**

US 2007/0290944 A1 Dec. 20, 2007

(30) **Foreign Application Priority Data**

Apr. 10, 2006 (JP) 2006-107177
Aug. 12, 2006 (JP) 2006-220792

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

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

(58) **Field of Classification Search** ..... 373/702, 373/700 MS, 725–726, 729
See application file for complete search history.

(56) **References Cited**

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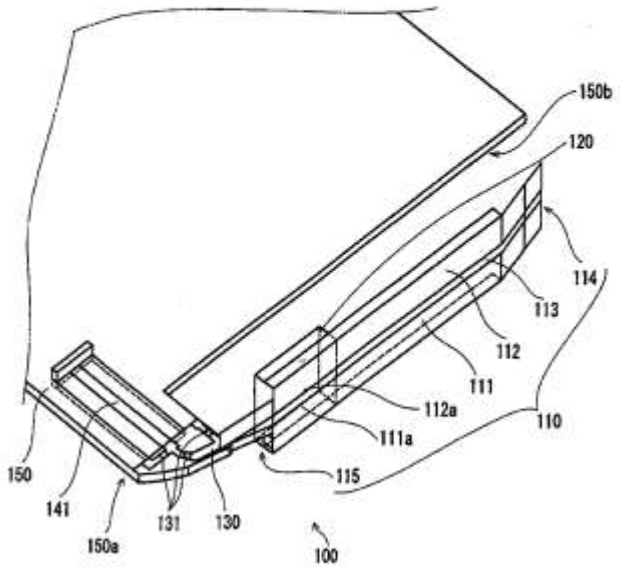
Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—McGinn IP Law Group PLLC

(57) **ABSTRACT**

An antenna device is provided which is capable of saving space, of operating in wide bands (in a multi-band) and of achieving an excellent gain and maintaining non-directivity of vertically polarized waves in each band. The antenna device has a conductor antenna. An end portion **111***a* on one end side of the conductor antenna is mounted as a power feeding section and an end portion **112***a* on the other end side of the conductor antenna **110** is mounted as an open end terminal. The antenna device also has a base body made of an insulating material which is coupled to one end and other end of the conductor antenna. The base band is coupled in a place where an electric field strength of the conductor antenna having a folded-back portion is increased, thus achieving the wideband and high-gain antenna device.

29 Claims, 42 Drawing Sheets



US007683839B2

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

(10) **Patent No.: US 7,683,839 B2**
(45) **Date of Patent: Mar. 23, 2010**

(54) **MULTIBAND ANTENNA ARRANGEMENT**

(75) Inventors: **Jani Ollikainen**, Helsinki (FI); **Antero Lehtola**, Turku (FI); **Joonas Krogerus**, Espoo (FI); **Jussi Rahola**, Espoo (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.: **11/479,651**

(22) Filed: **Jun. 30, 2006**

(65) **Prior Publication Data**

US 2008/0122698 A1 May 29, 2008

(51) **Int. Cl.**

H01Q 1/24	(2006.01)
H01Q 1/38	(2006.01)
H01Q 5/00	(2006.01)
H01Q 9/04	(2006.01)
H01Q 1/48	(2006.01)

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

(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 846, 848

See application file for complete search history.

(56) **References Cited**

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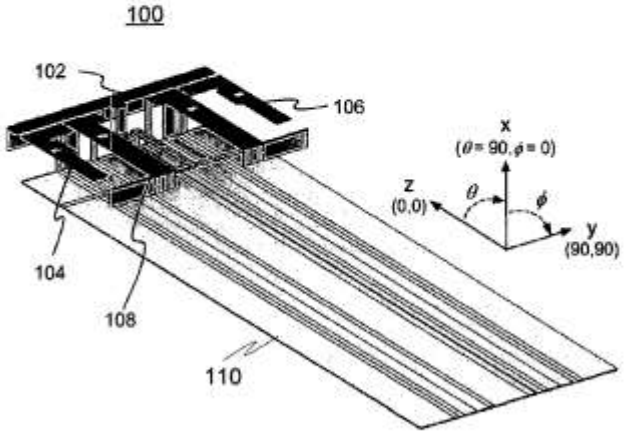
Primary Examiner—Douglas W Owens
Assistant Examiner—Jennifer F Hu
(74) *Attorney, Agent, or Firm*—Harrington & Smith

(57) **ABSTRACT**

The invention relates to a radio antenna and, more specifically, to an internal multiband antenna for use e.g. in a portable telecommunication device, such as a mobile phone. In particularly the invention relates to an antenna module for a mobile terminal including a non-resonant antenna element, two resonant antenna elements each covering at least any one of a first, second, third or fourth frequency band, said two resonant elements are substantially in the same plane and define a planar surface wherein the two resonant elements are each positioned at a corner of the planar surface and the non-resonant element is positioned along an edge of the planar surface.

22 Claims, 8 Drawing Sheets



US007683840B2

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

(10) **Patent No.: US 7,683,840 B2**
(45) **Date of Patent: Mar. 23, 2010**

(54) **INTEGRATED BROADBAND ANTENNA DEVICE WITH WIDE BAND FUNCTION**

(75) Inventors: **Yu-Ching Lin**, Taipei (TW); **Tsung-Wen Chiu**, Taipei (TW); **Fu-Ren Hsiao**, Taipei (TW); **Chun-Ching Lan**, Taipei (TW); **Yun-Fan Bai**, Taipei (TW)

(73) Assignee: **Advanced Connectek, Inc.**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

(21) Appl. No.: **11/652,137**

(22) Filed: **Jan. 11, 2007**

(65) **Prior Publication Data**

US 2008/0012777 A1 Jan. 17, 2008

(30) **Foreign Application Priority Data**

Jul. 14, 2006 (TW) ..... 95125855 A

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

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

(58) **Field of Classification Search** 343/702, 343/749, 752

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Hoang V Nguyen
Assistant Examiner—Robert Karacsony
(74) *Attorney, Agent, or Firm*—Schmeiser, Olsen & Watts LLP

(57) **ABSTRACT**

An integrated broadband antenna device with wide band function is disclosed. The antenna device comprises a ground plate, a feeding wire, a first metal radiator, a second metal radiator, a ground metal radiator and a parasitic metal radiator. The first metal radiator is connected with the positive ends of signals of the feeding wire for transmitting electric signals and producing a high frequency mode. The first metal radiator is coupled to and energizes the second metal radiator and the parasitic metal radiator, and then the two metal radiator producing a low frequency mode and a second high frequency mode along with the ground metal radiator obtains a wider bandwidth. The broadband antenna device integrating various kinds of antennas is able to have a enough bandwidth to meet the requirements of AMPS (824~894 MHz), GSM (880~960 MHz), GPS (1575 MHz), DCS (1710~1880 MHz), PCS (1850~1990 MHz), UMTS (1920~2170 MHz) and Wi-Fi (2400~2500 MHz).

2 Claims, 7 Drawing Sheets