



US007315282B2

(12) **United States Patent**
Shr

(10) **Patent No.:** **US 7,315,282 B2**
(45) **Date of Patent:** **Jan. 1, 2008**

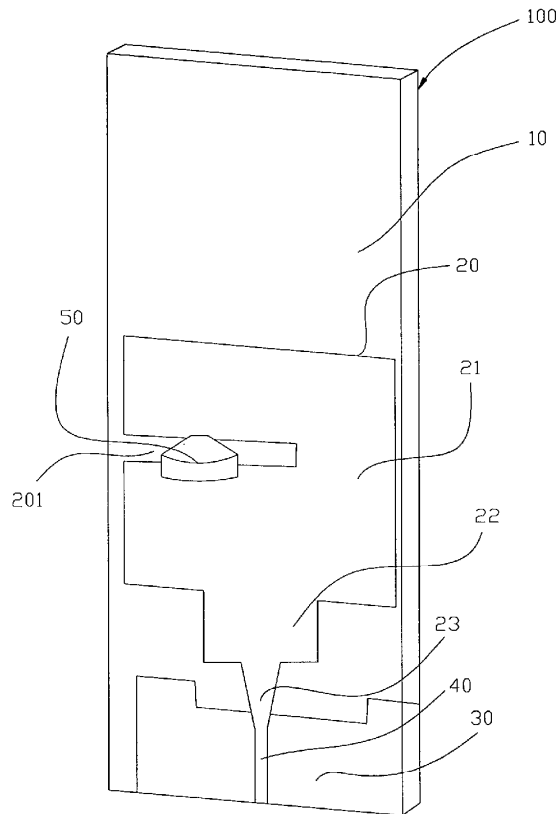
- (54) **MICRO-BELT ANTENNA**
 - (75) Inventor: **Shiuan-Guang Shr**, Taipei (TW)
 - (73) Assignee: **Lotes Co., Ltd.**, Keelung (TW)
 - (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
 - (21) Appl. No.: **11/439,976**
 - (22) Filed: **May 25, 2006**
 - (65) **Prior Publication Data**
US 2007/0273587 A1 Nov. 29, 2007
 - (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,**
343/767, 829, 846
- See application file for complete search history.

- (56) **References Cited**
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Primary Examiner—Tho Phan
(74) *Attorney, Agent, or Firm*—Rosenberg, Klein & Lee

(57) **ABSTRACT**

An antenna includes a dielectric substrate, a radiator, and a grounding board. A chink is formed at the radiator and the grounding board. The chink is loaded with a resistor. The antenna of the present invention has the following merits. The chink on the radiator increases the current path of the radiator so as to increase the frequency bandwidth of the antenna. The resistor loaded in the chink can improve balance the gain balance in the bandwidth.

12 Claims, 3 Drawing Sheets





US007315283B2

(12) **United States Patent**
Chang

(10) **Patent No.:** **US 7,315,283 B2**
(45) **Date of Patent:** **Jan. 1, 2008**

(54) **DUAL-BAND CIRCULARLY POLARIZED ANTENNA**

(75) Inventor: **The-Nan Chang**, Taipei (TW)

(73) Assignee: **Tatung Company**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 4 days.

(21) Appl. No.: **11/487,377**

(22) Filed: **Jul. 17, 2006**

(65) **Prior Publication Data**

US 2007/0236390 A1 Oct. 11, 2007

(30) **Foreign Application Priority Data**

Apr. 6, 2006 (TW) 95112155 A

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

(52) **U.S. Cl.** **343/700 MS; 343/770; 343/840; 343/846; 343/853; 343/892; 343/912**

(58) **Field of Classification Search** **343/700 MS, 343/767, 770, 840, 846, 848, 853, 893, 912**
See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Douglas W. Owens

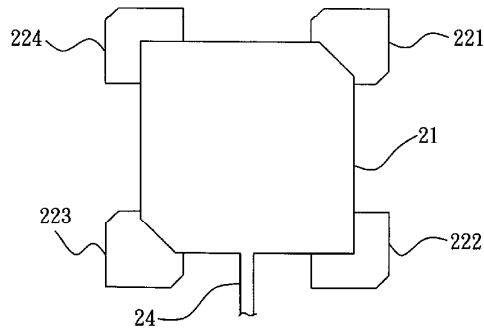
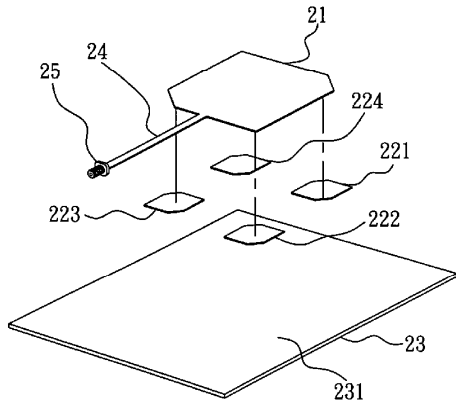
Assistant Examiner—Chuc Tran

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

(57) **ABSTRACT**

A dual-band circularly polarized antenna is disclosed, more particularly a dual-band circularly polarized antenna being able to transmit and receive circularly polarized signals at two different frequency bands, simultaneously. The dual-band circularly polarized antenna of the present invention comprises a first polarized radiating element with at least one corner being chamfered, a plurality of second polarized radiating elements with each of the second polarized radiating elements having at least one corner being chamfered, a signal distributor for distributing an electrical signal, a signal coupling unit electrically connecting with the first polarized radiating unit and the signal distributor, and a ground plate. The dual-band circularly polarized antenna of the present invention not only can be manufactured with a low cost, but also has a simpler structure. As a result, the dual-band circularly polarized antenna of the present invention can be easily integrated into the antenna module of an RFID system.

16 Claims, 7 Drawing Sheets





US007315284B2

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

(10) **Patent No.:** **US 7,315,284 B2**
(45) **Date of Patent:** **Jan. 1, 2008**

(54) **PORTABLE DEVICE AND ANTENNA THEREOF**

(75) Inventors: **Chieh-Sheng Hsu**, Taipei Hsien (TW);
Chang-Hsiu Huang, Taipei Hsien (TW)

(73) Assignee: **Wistron NeWeb Corporation**,
Hsi-Chih City, 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 0 days.

(21) Appl. No.: **11/534,209**

(22) Filed: **Sep. 21, 2006**

(65) **Prior Publication Data**
US 2007/0241967 A1 Oct. 18, 2007

(30) **Foreign Application Priority Data**
Apr. 17, 2006 (TW) 95113671 A

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

(52) **U.S. Cl.** **343/700 MS; 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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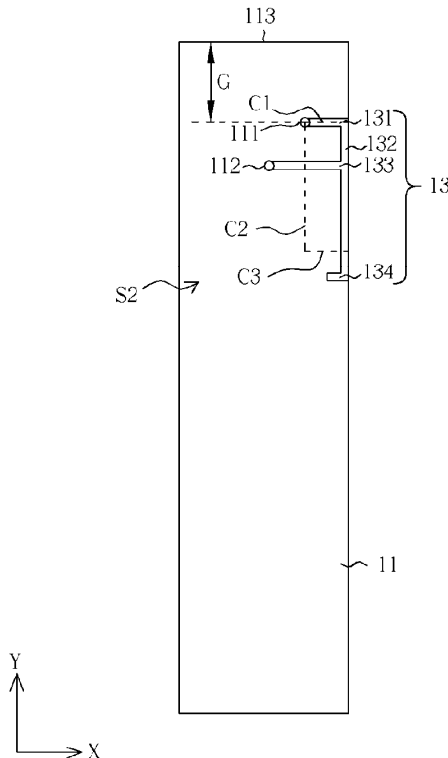
Primary Examiner—Hoang V. Nguyen

(74) *Attorney, Agent, or Firm*—Winston Hsu

(57) **ABSTRACT**

An antenna comprises a substrate, a grounding element and a radiating element. The grounding element has an opening and is disposed on a first surface of the substrate. The radiating element is disposed on a second surface and electrically connects to the grounding element. A projection on the first surface of the radiating element partially covers the opening.

29 Claims, 18 Drawing Sheets





US007315286B2

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

(10) **Patent No.:** **US 7,315,286 B2**
(45) **Date of Patent:** **Jan. 1, 2008**

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

(75) Inventors: **Jae-Ho Lee**, Gumi-si (KR);
Yeong-Moo Ryu, Gumi-si (KR);
Hark-Sang Kim, Daegu (KR); **Ji-Hwa Kim**, Gyeongsangbuk-do (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 18 days.

(21) Appl. No.: **11/342,628**

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

(65) **Prior Publication Data**

US 2007/0030202 A1 Feb. 8, 2007

(30) **Foreign Application Priority Data**

Aug. 4, 2005 (KR) 10-2005-0071312

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

(52) **U.S. Cl.** **343/702; 343/806; 343/895**

(58) **Field of Classification Search** **343/700 MS, 343/702, 795, 895, 806**
See application file for complete search history.

(56) **References Cited**

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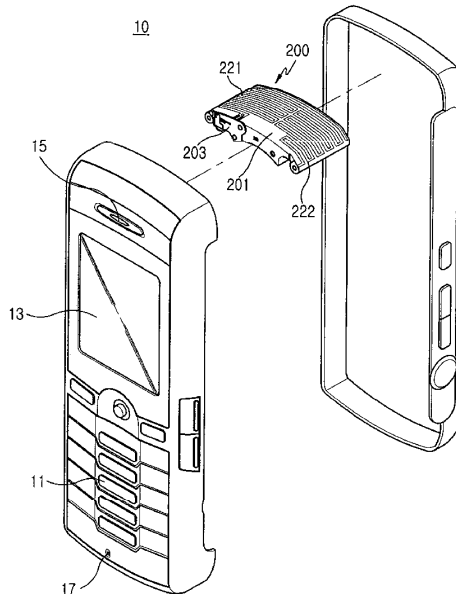
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—Roylance, Abrams, Berdo & Goodman, L.L.P.

(57) **ABSTRACT**

Provided is an antenna apparatus for a portable terminal including a first antenna pattern, and a second antenna pattern formed to correspond to the first antenna pattern, so that the second antenna provides a capacitive coupling along with the first pattern, thereby configuring a divergent type antenna with the second antenna pattern. The antenna apparatus configured in this manner comprises a pair of meander line antennas, whereby the antenna apparatus can efficiently suppress the generation of noise while being easily housed within the terminal. Furthermore, the antenna apparatus has an advantage of easily enhancing a specific absorption ratio (SAR) induced in a human body, which is an important factor for defining the function and quality of an antenna apparatus.

9 Claims, 5 Drawing Sheets





US007315289B2

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

(10) **Patent No.:** **US 7,315,289 B2**
(45) **Date of Patent:** **Jan. 1, 2008**

(54) **COUPLED MULTIBAND ANTENNAS**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Carles Puente Baliarda**, Sant Cugat del Valles Barcelona (ES); **Jaume Anguera Pros**, Vinaros (ES); **Jordi Soler Castany**, Mataro (ES); **Antonio Condes Martínez**, Esplugues de Llobregat (ES)

EP 0 942 488 9/1999

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

Hisamatsu Nakano et al., "Realization of Dual-Frequency and Wide-Band VSWR Performances Using Normal-Mode Helical and Inverted-F Antennas", IEEE Transactions on Antennas and Propagation, vol. 46, No. 6, Jun. 1998, pp. 788-793.

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 29 days.

(Continued)

Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—Winstead PC

(21) Appl. No.: **11/075,980**

(57) **ABSTRACT**

(22) Filed: **Mar. 9, 2005**

(65) **Prior Publication Data**

US 2005/0195124 A1 Sep. 8, 2005

Related U.S. Application Data

(63) Continuation of application No. PCT/EP02/11355, filed on Sep. 10, 2002.

(51) **Int. Cl.**
H01Q 21/00 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/36 (2006.01)
H01Q 1/32 (2006.01)

(52) **U.S. Cl.** **343/817; 343/846; 343/895**

(58) **Field of Classification Search** **343/700 MS, 343/702, 711, 795, 814-817, 846, 895**
See application file for complete search history.

(56) **References Cited**

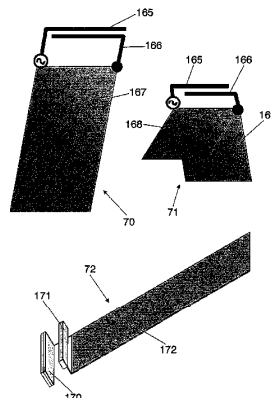
U.S. PATENT DOCUMENTS

4,628,322 A 12/1986 Marko et al.

The present invention consists of an antenna comprising at least two radiating structures, said radiating structures taking the form of two arms, said arms being made of or limited by a conductor, superconductor or semiconductor material, said two arms being coupled to each other through a region on first and second superconducting arms such that the combined structure of the coupled two-arms forms a small antenna with a broadband behavior, a multiband behavior or a combination of both effects. According to the present invention, the coupling between the two radiating arms is obtained by means of the shape and spatial arrangement of said two arms, in which at least one portion on each arm is placed in close proximity to each other (for instance, at a distance smaller than a tenth of the longest free-space operating wavelength) to allow electromagnetic fields in one arm being transferred to the other through said specific close proximity regions. Said proximity regions are located at a distance from the feeding port of the antenna (for instance a distance larger than $\frac{1}{40}$ of the free-space longest operating wavelength) and specifically exclude said feeding port of the antenna.

(Continued)

52 Claims, 17 Drawing Sheets





US007317420B2

(12) **United States Patent**
Aisenbrey

(10) **Patent No.:** **US 7,317,420 B2**
(45) **Date of Patent:** ***Jan. 8, 2008**

(54) **LOW COST OMNI-DIRECTIONAL ANTENNA MANUFACTURED FROM CONDUCTIVE LOADED RESIN-BASED MATERIALS**

(58) **Field of Classification Search** 29/600;
343/700 MS, 702, 793, 873
See application file for complete search history.

(75) Inventor: **Thomas Aisenbrey**, Littleton, CO (US)

(56) **References Cited**

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(73) Assignee: **Integral Technologies, Inc.**,
Bellingham, WA (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 64 days.

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This patent is subject to a terminal disclaimer.

Co-pending U.S. Appl. No. 10/309,429, filed Dec. 4, 2002, "Low Cost Antennas Using Conductive Plastics or Conductive Composites", assigned to the same assignee.

Primary Examiner—Trinh Vo Dinh

(74) *Attorney, Agent, or Firm*—Douglas R. Schnabel

(21) Appl. No.: **10/900,964**

(22) Filed: **Jul. 28, 2004**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2005/0007290 A1 Jan. 13, 2005

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/309,429, filed on Dec. 4, 2002, now Pat. No. 6,870,516, which is a continuation-in-part of application No. 10/075,778, filed on Feb. 14, 2002, now Pat. No. 6,741,221.

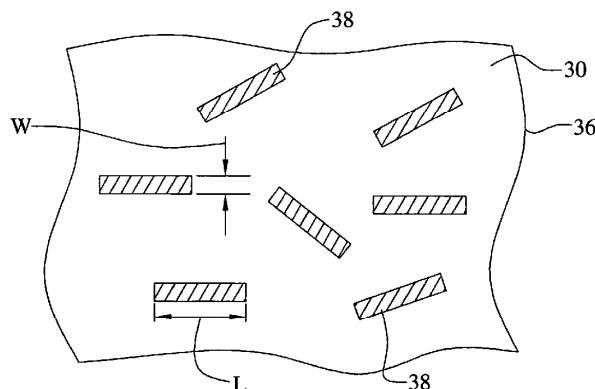
Omni-directional antenna devices are formed of a conductive loaded resin-based material. The conductive loaded resin-based material comprises micron conductive powder(s), conductive fiber(s), or a combination of conductive powder and conductive fibers in a base resin host. The percentage by weight of the conductive powder(s), conductive fiber(s), or a combination thereof is between about 20% and 50% of the weight of the conductive loaded resin-based material. The micron conductive powders are formed from non-metals, such as carbon, graphite, that may also be metallic plated, or the like, or from metals such as stainless steel, nickel, copper, silver, that may also be metallic plated, or the like, or from a combination of non-metal, plated, or in combination with, metal powders. The micron conductor fibers preferably are of nickel plated carbon fiber, stainless steel fiber, copper fiber, silver fiber, or the like.

(60) Provisional application No. 60/496,765, filed on Aug. 21, 2003, provisional application No. 60/317,808, filed on Sep. 7, 2001, provisional application No. 60/269,414, filed on Feb. 16, 2001, provisional application No. 60/268,822, filed on Feb. 15, 2001.

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

(52) **U.S. Cl.** **343/700 MS; 343/702; 343/713; 343/873**

24 Claims, 7 Drawing Sheets





US007317421B2

(12) **United States Patent**
Liu

(10) **Patent No.:** **US 7,317,421 B2**
(45) **Date of Patent:** **Jan. 8, 2008**

(54) **ANTENNA MODULE WITH AN ENHANCED ANGULAR COVERAGE**

(75) Inventor: **I-Ru Liu**, Taipei (TW)

(73) Assignee: **Accton 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 167 days.

(21) Appl. No.: **11/209,832**

(22) Filed: **Aug. 24, 2005**

(65) **Prior Publication Data**

US 2007/0052589 A1 Mar. 8, 2007

(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**

See application file for complete search history.

(56) **References Cited**

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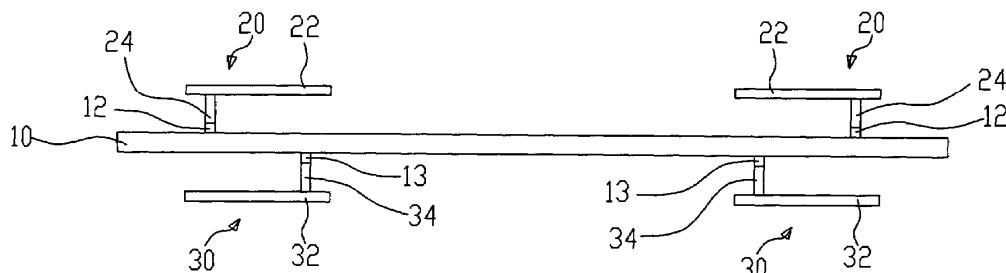
Primary Examiner—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Rosenberg, Klein & Lee

(57) **ABSTRACT**

An antenna module includes a substrate with at least a first antenna on one side while at least a second antenna on the other side of the substrate so that both sides of the antenna module are able to radiate signals. Therefore, the effective angular coverage of the antenna module is enlarged and the performance of the embedded wireless network device is improved.

18 Claims, 10 Drawing Sheets





US007317423B2

(12) **United States Patent**
Shimura

(10) **Patent No.:** **US 7,317,423 B2**
(45) **Date of Patent:** **Jan. 8, 2008**

(54) **ANTENNA DEVICE**
(75) Inventor: **Kazuhiro Shimura**, Hiratsuka (JP)
(73) Assignee: **The Yokohama Rubber 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 0 days.

(58) **Field of Classification Search** 343/711,
343/713, 717, 878
See application file for complete search history.

(56) **References Cited**
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6,997,048 B2* 2/2006 Komatsu et al. 73/146.2

(21) Appl. No.: **10/590,559**
(22) PCT Filed: **Mar. 16, 2005**
(86) PCT No.: **PCT/JP2005/004624**
§ 371 (c)(1),
(2), (4) Date: **Aug. 24, 2006**

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Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Greer, Burns & Crain, Ltd.

(87) PCT Pub. No.: **WO2005/087546**
PCT Pub. Date: **Sep. 22, 2005**

(57) **ABSTRACT**

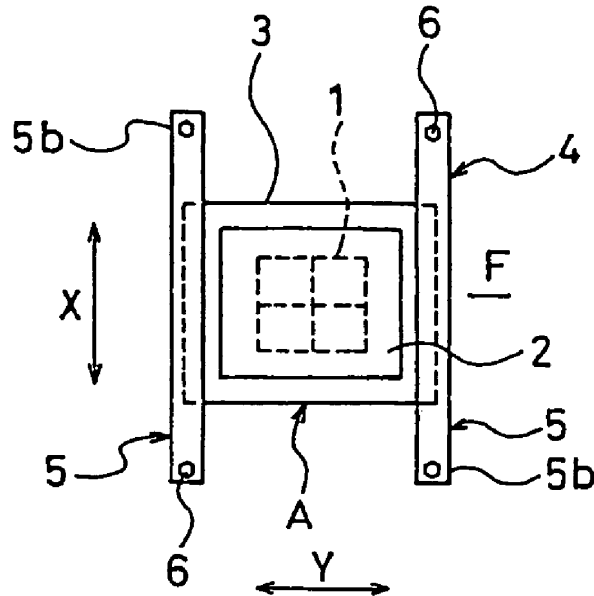
(65) **Prior Publication Data**
US 2007/0188314 A1 Aug. 16, 2007

An antenna device having an antenna to be mounted on the
body side of a vehicle for receiving a radio signal from a tire
condition detection device mounted on a tire side, or giving
and receiving a radio signal between the tire condition
detection device and a device mounted on the vehicle body
side. The antenna device includes attachment means with
which the antenna can be temporarily attached, moved and
securely attached to the vehicle body side.

(30) **Foreign Application Priority Data**
Mar. 17, 2004 (JP) 2004-075782

(51) **Int. Cl.**
H01Q 1/32 (2006.01)
(52) **U.S. Cl.** 343/711; 713/717

17 Claims, 4 Drawing Sheets





US007317901B2

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

(10) **Patent No.:** **US 7,317,901 B2**
(45) **Date of Patent:** **Jan. 8, 2008**

(54) **SLOTTED MULTIPLE BAND ANTENNA**

(75) Inventors: **Umesh D. Navsariwala**, Schaumburg, IL (US); **Nicholas E. Buris**, Deer Park, IL (US)

(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 332 days.

(21) Appl. No.: **10/774,835**

(22) Filed: **Feb. 9, 2004**

(65) **Prior Publication Data**
US 2005/0176390 A1 Aug. 11, 2005

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04B 1/16 (2006.01)

(52) **U.S. Cl.** **455/82**; 455/269; 455/273; 343/700 MS; 343/767

(58) **Field of Classification Search** 455/269, 455/272, 273, 282, 288; 343/700 MS, 767-778
See application file for complete search history.

(56) **References Cited**
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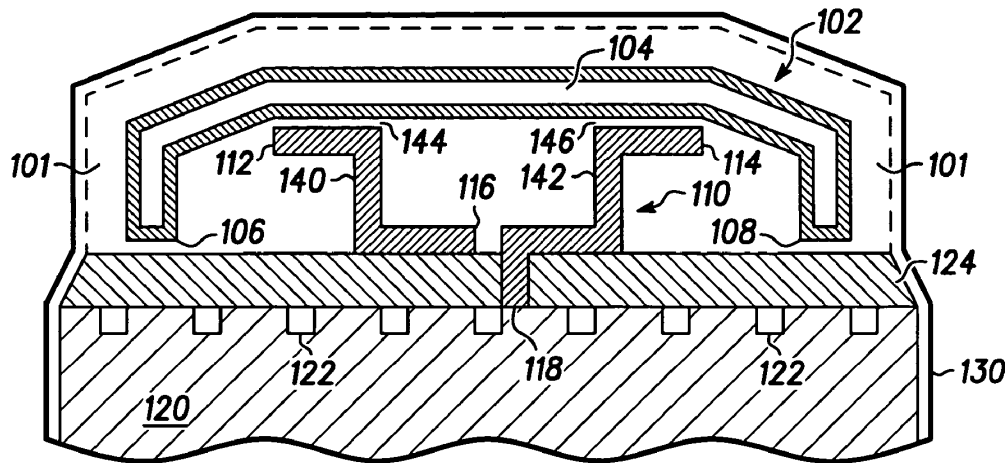
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Primary Examiner—Edward F. Urban
Assistant Examiner—Blane J. Jackson

(57) **ABSTRACT**

A multiple band antenna has an RF coupling structure (110) and a resonant RF structure (102). The RF coupling structure (110) has an RF connection (116, 118) and an RF coupling end (112, 114). The resonant RF structure (102) is reactively coupled to the RF coupling end (112, 114). The resonant RF structure (102) has a first end (106) and a second end (108) and has a conductive perimeter (104) enclosing at least one slot area (104) configured to induce an additional resonant RF band for the resonant RF structure (102). The first end (106) and the second end (108) are reactively coupled to a ground plane (124, 120) to facilitate longer wavelength operation. Cellular phones (800) and wireless communications sections incorporating such antennas are also provided.

16 Claims, 5 Drawing Sheets





US007319431B2

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

(10) **Patent No.:** **US 7,319,431 B2**
(45) **Date of Patent:** **Jan. 15, 2008**

(54) **SURFACE MOUNT ANTENNA APPARATUS HAVING TRIPLE LAND STRUCTURE**

(75) Inventors: **Chan Ik Jeon**, Suwon-si (KR); **Gun Sung Jang**, Seoul (KR)

(73) Assignee: **Partron Co., Ltd.**, Gyeonggi-do (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 19 days.

(21) Appl. No.: **11/445,953**

(22) Filed: **Jun. 2, 2006**

(65) **Prior Publication Data**
US 2007/0040749 A1 Feb. 22, 2007

(30) **Foreign Application Priority Data**
Jun. 3, 2005 (KR) 10-2005-0047908

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/700 MS; 343/702**
(58) **Field of Classification Search** **343/700 MS, 343/702, 767, 846, 848, 873, 829**
See application file for complete search history.

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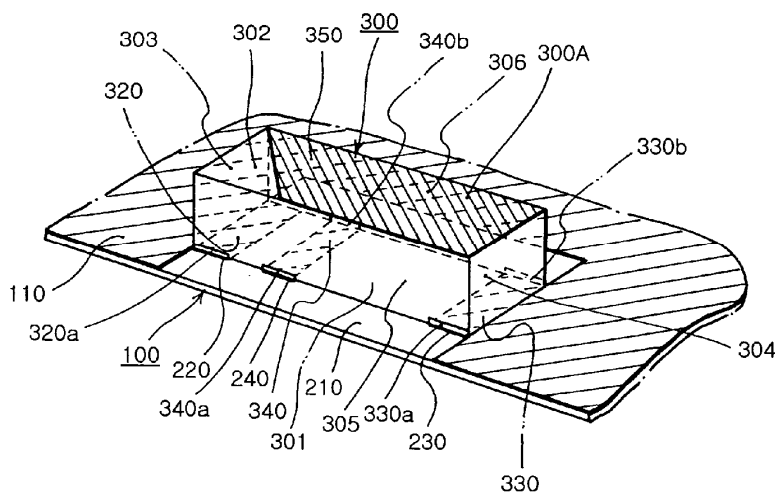
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Primary Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—The Webb Law Firm

(57) **ABSTRACT**

Disclosed herein is a surface mount antenna apparatus applied to a wireless terminal. The antenna apparatus includes a printed circuit board having a ground pattern, a land structure, and an antenna. The land structure includes a non-grounded area having no ground electrode, first and second land pads formed on opposite ends of the non-grounded area to be connected to ground electrodes, and an input pad formed between the first and second land pads and separated from them. The input pad is spaced apart from the first land pad by a preset interval. The antenna includes first and second ground electrodes formed on the lower surface of a dielectric block to be connected to the first and second land pads, a feeding electrode connected to the input pad, and a radiation electrode formed on some of the side surfaces and the upper surface of the dielectric block. The radiation electrode is connected to at least one of the first and second ground electrodes and the feeding electrode.

8 Claims, 10 Drawing Sheets





US007319432B2

(12) **United States Patent**
Andersson

(10) **Patent No.:** **US 7,319,432 B2**
(45) **Date of Patent:** **Jan. 15, 2008**

(54) **MULTIBAND PLANAR BUILT-IN RADIO ANTENNA WITH INVERTED-L MAIN AND PARASITIC RADIATORS**

(56) **References Cited**

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(75) Inventor: **Johan Andersson**, Malmö (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 0 days.

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JP 06-037531 2/1994

(21) Appl. No.: **10/507,574**

(22) PCT Filed: **Mar. 11, 2003**

(86) PCT No.: **PCT/EP03/02473**

§ 371 (c)(1),
(2), (4) Date: **Dec. 2, 2004**

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(87) PCT Pub. No.: **WO03/077360**

PCT Pub. Date: **Sep. 18, 2003**

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Primary Examiner—Shih-Chao Chen
Assistant Examiner—Minh Dieu A
(74) *Attorney, Agent, or Firm*—Renner, Otto, Boisselle & Sklar, LLP

(65) **Prior Publication Data**

US 2005/0110692 A1 May 26, 2005

Related U.S. Application Data

(60) Provisional application No. 60/366,514, filed on Mar. 19, 2002.

(57) **ABSTRACT**

A multi-band radio antenna device (1) for a radio communication terminal, comprising a flat ground substrate (20), a flat main radiating element (2, 9) having a radio signal feeding point (3), and a flat parasitic element (5, 6). The main radiating 5 element is located adjacent to and in the same plane as said ground substrate, and preferably dielectrically separated therefrom. The antenna device is suitable for being used as a built-in antenna in portable radio terminals, such as a mobile phone (30).

(30) **Foreign Application Priority Data**

Mar. 14, 2002 (EP) 02005816

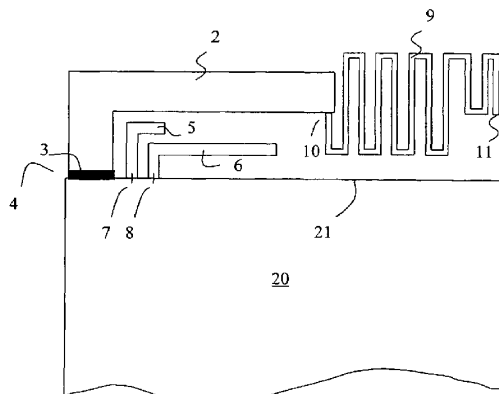
(51) **Int. Cl.**
H01Q 1/24 (2006.01)

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

(58) **Field of Classification Search** **343/702,**
343/846, 815, 817, 700 MS

See application file for complete search history.

33 Claims, 6 Drawing Sheets





US007319433B2

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

(10) **Patent No.:** **US 7,319,433 B2**
(45) **Date of Patent:** **Jan. 15, 2008**

- (54) **WIDEBAND ANTENNA DEVICE WITH EXTENDED GROUND PLANE IN A PORTABLE DEVICE**
- (75) Inventors: **Johan Anton Eduard Rosenberg**, Ed Dwingeloo (NL); **Johannes Lucas Schreuder**, Ae Borger (NL); **Tjapko Uildriks**, Tr Anderen (NL)
- (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 0 days.

- (52) **U.S. Cl.** 343/702; 343/866; 343/846; 343/741
- (58) **Field of Classification Search** 343/702, 343/700 MS, 741, 866, 829, 846-849
See application file for complete search history.
- (56) **References Cited**
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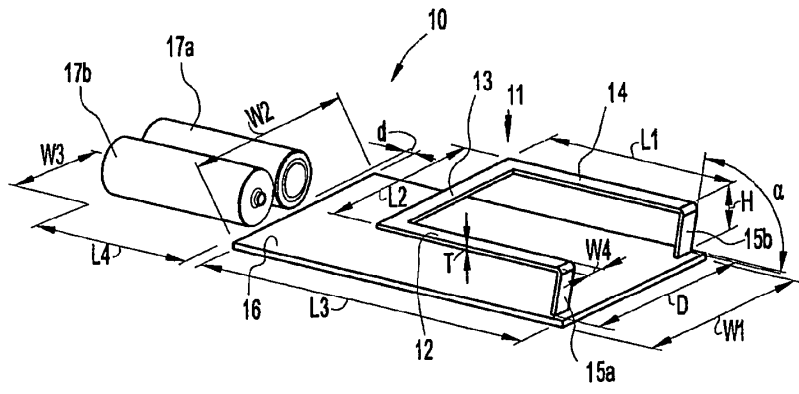
- (21) Appl. No.: **10/517,902**
- (22) PCT Filed: **Jun. 11, 2003**
- (86) PCT No.: **PCT/EP03/06109**
§ 371 (e)(1),
(2), (4) Date: **Dec. 15, 2005**
- (87) PCT Pub. No.: **WO03/107473**
PCT Pub. Date: **Dec. 24, 2003**
- (65) **Prior Publication Data**
US 2006/0109182 A1 May 25, 2006

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Primary Examiner—Douglas W. Owens
Assistant Examiner—Tung X Le
(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec, P.A.

- Related U.S. Application Data**
- (60) Provisional application No. 60/407,886, filed on Sep. 3, 2002.
- (30) **Foreign Application Priority Data**
Jun. 13, 2002 (EP) 02013085
Aug. 26, 2002 (EP) 02018940

- (57) **ABSTRACT**
An antenna device for a portable device has an antenna loop of conducting material to be connected to radio circuitry in the portable device. The antenna loop is positioned opposite a ground plane of a PCB. Also, the antenna device also comprises at least one battery, which is positioned in the extension of a first side of the PCB, and acts as an extension of the ground plane of the PCB.

(51) **Int. Cl.**
H01Q 1/24 (2006.01) **20 Claims, 4 Drawing Sheets**





US00D559838S

(12) **United States Design Patent** (10) **Patent No.:** **US D559,838 S**
Yuba et al. (45) **Date of Patent:** **** Jan. 15, 2008**

(54) **PLANAR ANTENNA**

D533,544 S * 12/2006 Lai D14/230

* cited by examiner

(75) Inventors: **Takashi Yuba**, Shinagawa (JP); **Hideki Iwata**, Shinagawa (JP); **Masahiro Yanagi**, Shinagawa (JP); **Takashi Arita**, Shinagawa (JP)

Primary Examiner—Stella M. Reid
Assistant Examiner—John Windmuller
(74) *Attorney, Agent, or Firm*—Staas & Halsey, LLP

(73) Assignee: **Fujitsu Component Limited**, Tokyo (JP)

(57) **CLAIM**

The ornamental design for a planar antenna, as shown and described.

(**) Term: **14 Years**

DESCRIPTION

(21) Appl. No.: **29/257,761**

FIG. 1 is a top front and right side perspective view of a planar antenna showing our new design;

(22) Filed: **Apr. 11, 2006**

FIG. 2 is a front view thereof;

(30) **Foreign Application Priority Data**

FIG. 3 is a rear view thereof;

Dec. 28, 2005 (JP) 2005-038824

FIG. 4 is a top view thereof;

(51) **LOC (8) Cl.** **08-08**

FIG. 5 is a bottom view thereof;

(52) **U.S. Cl.** **D14/230; D14/358**

FIG. 6 is a right side view thereof;

(58) **Field of Classification Search** D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 R-705, 343/871-908, 795, 840, 711-713, 819, 846; 455/90.2, 90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

FIG. 7 is a left side view thereof;

FIG. 8 is a rear bottom and left side perspective view thereof;

(56) **References Cited**

FIG. 9 is a top front and right side perspective view thereof where the antenna case thereof is disposed at a different angle from that shown in FIG. 1;

U.S. PATENT DOCUMENTS

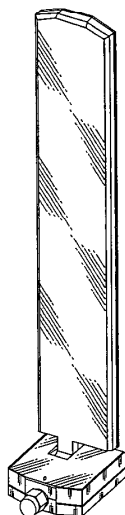
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- D525,239 S * 7/2006 Lai D14/230

FIG. 10 is a top front and right side perspective view thereof where the antenna case thereof is disposed at a different angle from that shown in FIG. 1; and,

FIG. 11 is a perspective view thereof showing an alternate position of use.

The broken line drawing of a laptop computer in FIG. 11 is for illustrative purposes only and forms no part of the claimed design.

1 Claim, 10 Drawing Sheets





US007321335B2

(12) **United States Patent**
Egorov

(10) **Patent No.:** **US 7,321,335 B2**
(45) **Date of Patent:** **Jan. 22, 2008**

(54) **ANTENNA CONFIGURATION CHANGE**

(75) Inventor: **Igor Egorov**, Lund (SE)
(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)

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2007/0069958	A1 *	3/2007	Ozkar	343/700 MS

(*) 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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Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—Harrity Snyder, LLP

(21) Appl. No.: **11/530,331**

(22) Filed: **Sep. 8, 2006**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2007/0247373 A1 Oct. 25, 2007

A Portable communication device includes in an interior of the portable communication device a ground plane and an antenna arrangement. The antenna arrangement includes an antenna element combination including a first radiating antenna element to be connected to a feeding potential and dimensioned for resonating in a first frequency band, and a second radiating antenna element dimensioned for resonating in a second frequency band. The antenna arrangement further includes at least one first element joining switch that in a closed position interconnects elements of the antenna element combination for dimensioning the antenna element combination for resonating in a third frequency band and in an open position separates these elements from each other, and a grounding switch which in a closed position joins the second radiating antenna element to a ground plane and in an open position separates the second radiating antenna element from the ground plane.

Related U.S. Application Data

(60) Provisional application No. 60/745,328, filed on Apr. 21, 2006.

(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, 846, 876**

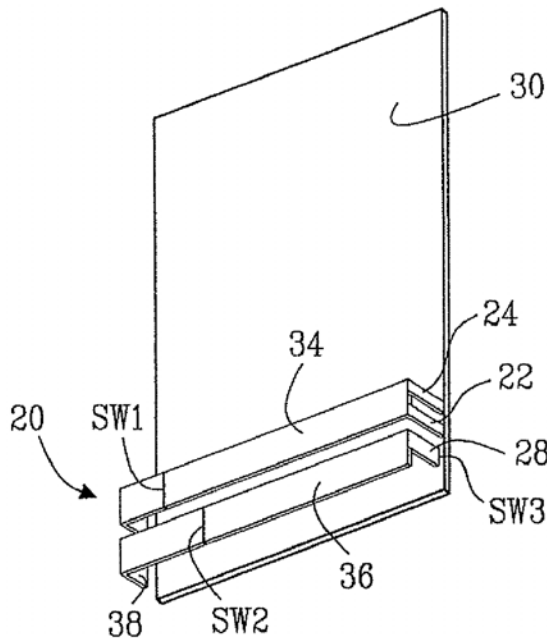
See application file for complete search history.

(56) **References Cited**

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16 Claims, 4 Drawing Sheets





US007321336B2

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

(10) **Patent No.:** **US 7,321,336 B2**
(45) **Date of Patent:** **Jan. 22, 2008**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE INCLUDING A WRAP-AROUND ANTENNA ASSEMBLY AND RELATED METHODS**

(75) Inventors: **Robert Phillips**, Waterloo (CA); **Yihong Qi**, St. Agatha (CA); **Ying Tong Man**, Waterloo (CA)

(73) Assignee: **Research in Motion Limited**, 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.

(21) Appl. No.: **11/554,874**

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

(65) **Prior Publication Data**
US 2007/0109204 A1 May 17, 2007

Related U.S. Application Data
(60) Provisional application No. 60/732,072, filed on Nov. 1, 2005.

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/906**
(58) **Field of Classification Search** **343/702, 343/906; 439/188, 916**
See application file for complete search history.

(56) **References Cited**
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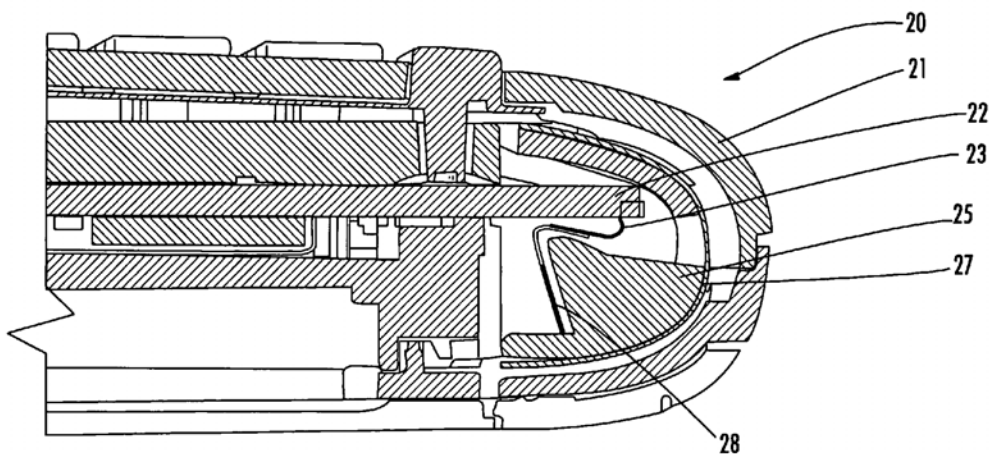
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Primary Examiner—Tho Phan
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A mobile wireless communications device may include a housing, a printed circuit board (PCB) carried by the housing, at least one wireless RF circuit carried by the PCB, and a first contact(s) carried by the PCB and electrically connected to the at least one wireless RF circuit. The device may further include a wrap-around antenna assembly comprising an antenna retainer frame removably coupled to an edge of the PCB and having first and second portions wrapping around adjacent first and second surfaces of the PCB at the edge thereof when the antenna retainer frame is coupled to the PCB. The wrap-around antenna assembly may also include an antenna carried by the antenna retainer frame and extending along the first and second portions thereof. The antenna may include a second contact(s) removably coupled to the first contact(s) when the antenna retainer frame is coupled to the PCB.

23 Claims, 6 Drawing Sheets





US007321337B2

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

(10) **Patent No.:** **US 7,321,337 B2**
(45) **Date of Patent:** **Jan. 22, 2008**

(54) **ELECTRONIC DEVICE HAVING METAL PACKAGE UNIT HAVING BUILT-IN ANTENNA UNIT**

(75) Inventors: **Ienobu Ikeda**, Tokyo (JP); **Takashi Ihara**, Tokyo (JP); **Minoru Kobayashi**, Tokyo (JP); **Yasuo Maekawa**, Tokyo (JP)

(73) Assignee: **Citizen Holdings 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 0 days.

(21) Appl. No.: **10/536,763**

(22) PCT Filed: **May 17, 2004**

(86) PCT No.: **PCT/JP2004/006999**

§ 371 (c)(1),
(2), (4) Date: **May 26, 2005**

(87) PCT Pub. No.: **WO2004/102738**

PCT Pub. Date: **Nov. 25, 2004**

(65) **Prior Publication Data**
US 2006/0109188 A1 May 25, 2006

(30) **Foreign Application Priority Data**
May 15, 2003 (JP) 2003-136757
May 19, 2003 (JP) 2003-140456

(51) **Int. Cl.**
H01Q 1/12 (2006.01)
H01Q 7/08 (2006.01)

(52) **U.S. Cl.** **343/718; 343/702; 343/788; 343/985; 343/866**

(58) **Field of Classification Search** **343/718, 343/702; 368/10, 278, 47, 281, 276**
See application file for complete search history.

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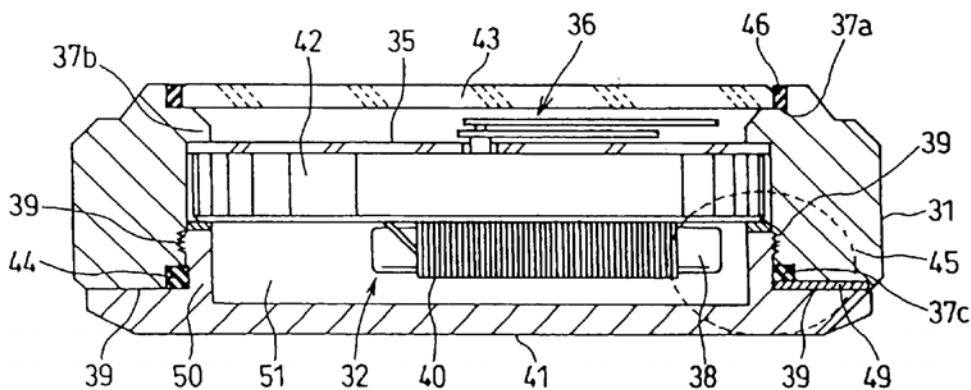
Primary Examiner—Douglas W. Owens
Assistant Examiner—Chuc Tran
(74) *Attorney, Agent, or Firm*—Greer, Burns & Crain, Ltd.

(57) **ABSTRACT**

An electronic device an antenna, an information processing apparatus for the purpose of processing information captured by the antenna, and a metal exterior parts capable of housing therewithin the antenna and the information processing apparatus, wherein the metal exterior parts is configured so that the antenna can receive magnetic flux from outside the metal exterior parts that has passed through the metal exterior parts and can resonate, and wherein at least a part of the metal exterior parts has an electrical resistance value that is different from another part of the metal exterior parts.

67 Claims, 34 Drawing Sheets

30





US007321338B2

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

(10) **Patent No.:** **US 7,321,338 B2**
(45) **Date of Patent:** **Jan. 22, 2008**

- (54) **ON-BOARD ANTENNA**
- (75) Inventors: **Satoru Komatsu**, Saitama (JP);
Hiroshi Kuribayashi, Saitama (JP);
Tomoyuki Fukumaru, Saitama (JP);
Hiroshi Iijima, Osaka (JP); **Hideaki Oshima**, Osaka (JP); **Tatsuo Matsushita**, Ibaraki (JP)
- (73) Assignee: **Honda Motor 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 0 days.

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- (21) Appl. No.: **10/743,408**
- (22) Filed: **Dec. 23, 2003**
- (65) **Prior Publication Data**
US 2004/0169605 A1 Sep. 2, 2004
- (30) **Foreign Application Priority Data**
Dec. 27, 2002 (JP) P2002-379994

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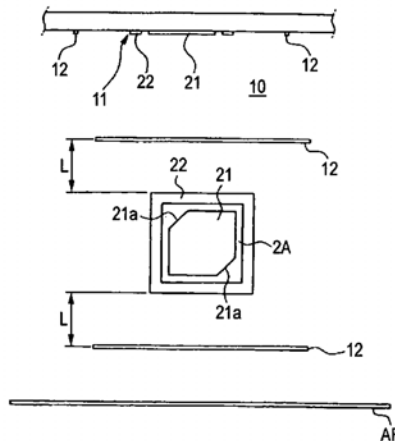
- (51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 1/38 (2006.01)
H01Q 1/32 (2006.01)
- (52) **U.S. Cl.** **343/846**; 343/700 MS;
343/711
- (58) **Field of Classification Search** 343/828,
343/700 MS, 769, 846, 850, 711, 713, 767,
343/712, 714-718
See application file for complete search history.

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Primary Examiner—Shih-Chao Chen
Assistant Examiner—Minh Dieu
(74) *Attorney, Agent, or Firm*—Arent Fox LLP

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(57) **ABSTRACT**
An on-board antenna includes a radiation element provided on a dielectric substrate, a grounding conductor surrounding a periphery of an outer edge portion of the radiation element at a position spaced away outwardly from the outer edge portion, and a conductive member provided on the surface at a position spaced away outwardly from an outer edge portion of the grounding conductor.

8 Claims, 3 Drawing Sheets





US007321341B2

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

(10) **Patent No.:** **US 7,321,341 B2**
(45) **Date of Patent:** **Jan. 22, 2008**

(54) **COMPACT BROADBAND ANTENNA WITH
CONSTANT RADIATION PATTERN**

(75) Inventors: **Yoonjae Lee**, Fairfax, VA (US); **Suman
Ganguly**, Falls Church, VA (US)

(73) Assignee: **Center for Remote Sensing, Inc.**,
Fairfax, VA (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.: **11/453,566**

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

(65) **Prior Publication Data**
US 2006/0290586 A1 Dec. 28, 2006

Related U.S. Application Data
(63) Continuation of application No. 11/165,613, filed on
Jun. 23, 2005, now abandoned.

(51) **Int. Cl.**
H01Q 21/00 (2006.01)
(52) **U.S. Cl.** **343/893; 343/810**
(58) **Field of Classification Search** **343/893,**
343/810, 900, 773, 774

See application file for complete search history.

(56) **References Cited**

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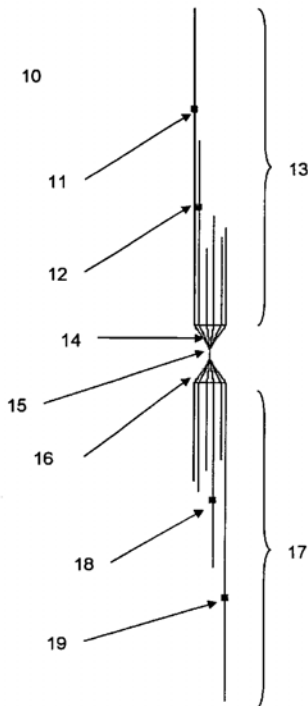
* cited by examiner

Primary Examiner—Hoanganh Le
(74) *Attorney, Agent, or Firm*—Hoffman, Wasson & Gitler,
PC

(57) **ABSTRACT**

An antenna having multiple antenna elements of unequal lengths, form in a conical shape. The longest antenna element has a trap in a specific location of the antenna element. Multiple traps can be used for extended coverage depending upon the frequency band. The antenna elements are connected together through a transversal-wire ring and a feed transmission line is attached to it. The antenna occupies minimal footprint in the horizontal direction and maintains a low VSWR and a uniform beam pattern over a wide frequency band, more than 1:20. The antenna has a constant radiation pattern over a 1:6 bandwidth and the pattern bandwidth may be increased using more antenna elements and traps. The elevation and azimuth patterns show a consistent characteristic from 100 MHz to 600 MHz.

14 Claims, 8 Drawing Sheets





US007324049B2

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

(10) **Patent No.:** **US 7,324,049 B2**
(45) **Date of Patent:** **Jan. 29, 2008**

(54) **MINIATURIZED ULTRA-WIDEBAND MICROSTRIP ANTENNA**

(75) Inventors: **Soung-ho Myoung**, Hanam-si (KR);
Do-Hoon Kwon, Seoul (KR);
Seong-soo Lee, 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 188 days.

(21) Appl. No.: **11/024,715**

(22) Filed: **Dec. 30, 2004**

(65) **Prior Publication Data**

US 2005/0156787 A1 Jul. 21, 2005

(30) **Foreign Application Priority Data**

Jan. 5, 2004 (KR) 10-2004-0000384

(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,
343/702, 833, 834, 846, 790, 792
See application file for complete search history.

(56) **References Cited**

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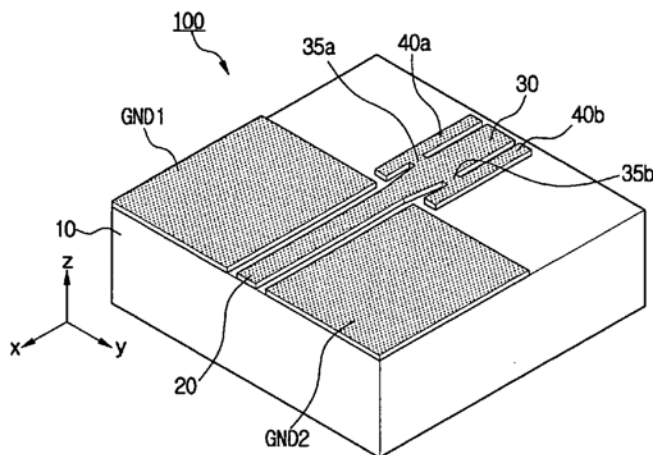
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Staas & Halsey LLP

(57) **ABSTRACT**

A miniaturized ultra-wideband microstrip antenna, includes: a dielectric substrate; a feed line disposed on the dielectric substrate, and supplying an electromagnetic energy supplied from an external power source; a main radiating element radiating the electromagnetic energy inputted by the feed line; and at least one sub-radiating element disposed in proximity to the main radiating element for multi-radiation. Also, the antenna further includes at least one connection plate electrically connecting the main radiating element to at least one of the sub-radiating elements. The miniaturized ultra-wideband microstrip antenna can also be made ultralight, and include additional sub-radiating elements besides the main radiating element, whereby multi-radiation in UWB's range can be attained.

45 Claims, 11 Drawing Sheets





US007324050B2

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

(10) **Patent No.:** **US 7,324,050 B2**
(45) **Date of Patent:** **Jan. 29, 2008**

(54) **ANTENNA**

(75) Inventors: **Tsung-Ying Chung**, Taipei (TW);
Hsi-Tseng Chou, Taipei (TW);
Chih-Ming Wang, Taipei (TW)

(73) Assignee: **Wistron NeWeb Corp.**, 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 156 days.

(21) Appl. No.: **11/251,459**

(22) Filed: **Oct. 13, 2005**

(65) **Prior Publication Data**
US 2007/0008224 A1 Jan. 11, 2007

(30) **Foreign Application Priority Data**
Jul. 11, 2005 (TW) 94123342 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, 767, 895

See application file for complete search history.

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Primary Examiner—Huedung Mancuso

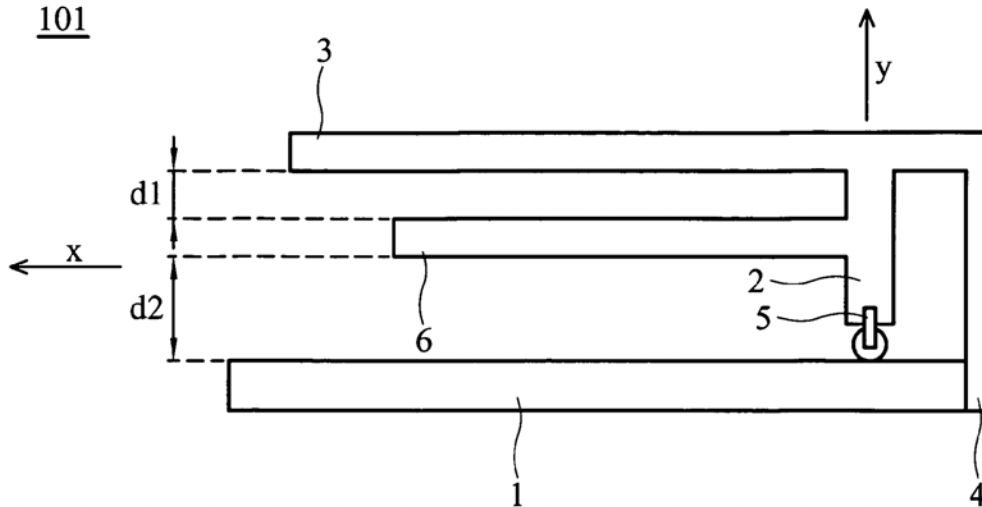
(74) *Attorney, Agent, or Firm*—Quintero Law Office

(57) **ABSTRACT**

An antenna comprises a signal line, a conductive element, a receiving element, a ground element, a short element and a bandwidth modifying element. The conductive element is coupled to the signal line. The receiving element is connected to the conductive element. The short element is coupled to the ground element and the conductive element. The bandwidth modifying element is connected to the conductive element and located between the receiving element and the ground element. The antenna receives a plurality of wireless signals comprising a center signal with a center frequency, and the center signal comprises a center wavelength λ .

27 Claims, 6 Drawing Sheets

101





US007324051B2

(12) **United States Patent**
Hayes

(10) **Patent No.:** **US 7,324,051 B2**
(45) **Date of Patent:** **Jan. 29, 2008**

- (54) **SUPPLEMENTAL PARASITIC ANTENNA APPARATUS**
- (75) Inventor: **Gerard James Hayes**, Wake Forest, NC (US)
- (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 107 days.
- (21) Appl. No.: **10/963,250**
- (22) Filed: **Oct. 12, 2004**
- (65) **Prior Publication Data**
US 2006/0077103 A1 Apr. 13, 2006
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
- (52) **U.S. Cl.** **343/702**
- (58) **Field of Classification Search** 343/702,
343/700 MS, 756, 814–818, 872
See application file for complete search history.

- (56) **References Cited**
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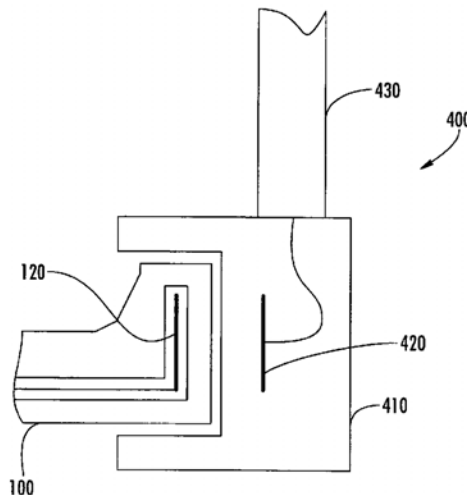
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Primary Examiner—Shih-Chao Chen
Assistant Examiner—Minh Dieu A
 (74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec

(57) **ABSTRACT**

A supplemental antenna assembly is provided for use with an electronic device having an integral radio antenna, such as a wireless-enabled laptop computer, notebook computer, gaming device, personal digital assistant (PDA), or circuit card (e.g., a PCMCIA card) or other circuit assembly designed be used with such a device. The supplemental antenna assembly includes a parasitic element supported by a frame. The frame is configured to be attached to the housing of the portable device such that an inductive coupling is provided between the parasitic element and the integral radio antenna. The parasitic element may include, for example, an antenna and/or a coupling element, e.g., a coupling element configured to be connected to an external antenna.

26 Claims, 10 Drawing Sheets





US00D560214S

(12) **United States Design Patent** (10) **Patent No.:** **US D560,214 S**
Yuba et al. (45) **Date of Patent:** **** Jan. 22, 2008**

(54) **PLANAR ANTENNA**

(75) Inventors: **Takashi Yuba**, Shinagawa (JP); **Hideki Iwata**, Shinagawa (JP); **Masahiro Yanagi**, Shinagawa (JP); **Takashi Arita**, Shinagawa (JP)

(73) Assignee: **Fujitsu Component Limited**, Tokyo (JP)

(**) Term: **14 Years**

(21) Appl. No.: **29/257,759**

(22) Filed: **Apr. 11, 2006**

(30) **Foreign Application Priority Data**

Dec. 28, 2005 (JP) 2005-038825

(51) **LOC (8) Cl.** **14-03**

(52) **U.S. Cl.** **D14/230; D14/358**

(58) **Field of Classification Search** D14/138, D14/230-238, 299, 358; D12/42, 43; 343/700 R-705, 343/871-908, 795, 840, 711-713, 819, 846; 455/90.2, 90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

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Primary Examiner—Stella M. Reid
Assistant Examiner—John Windmuller
(74) *Attorney, Agent, or Firm*—Staas & Halsey, LLP

(57) **CLAIM**

The ornamental design for a planar antenna, as shown and described.

DESCRIPTION

FIG. 1 is a top front and right side perspective view of a planar antenna showing our new design;

FIG. 2 is a front view thereof;

FIG. 3 is a rear view thereof;

FIG. 4 is a top view thereof;

FIG. 5 is a bottom view thereof;

FIG. 6 is a right side view thereof;

FIG. 7 is a left side view thereof;

FIG. 8 is a rear bottom and left side perspective view thereof;

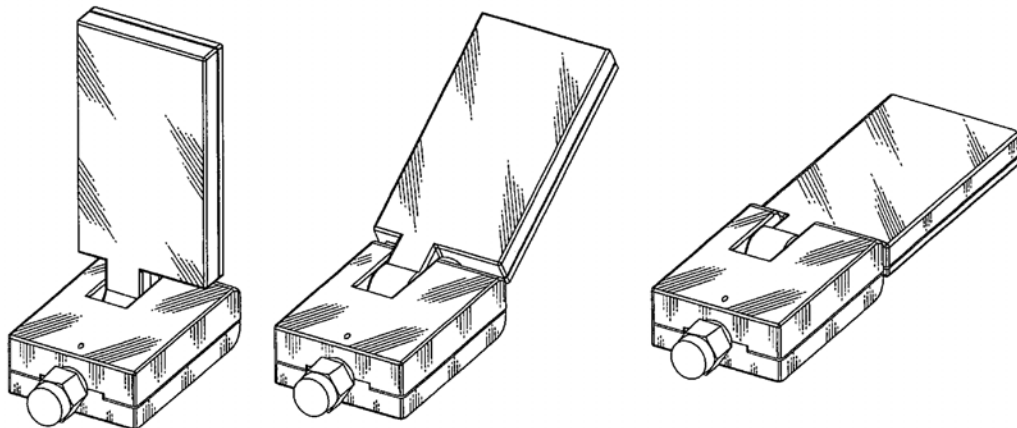
FIG. 9 is a top front and right side perspective view thereof where the antenna case thereof is disposed at a different angle from that shown in FIG. 1;

FIG. 10 is a top front and right side perspective view thereof where the antenna case thereof is disposed at a different angle from that shown in FIG. 1; and,

FIG. 11 is a perspective view thereof showing an alternate position of use.

The broken line showing of a laptop computer in FIG. 11 is included for the purpose of illustrating environment and forms no part of the claimed design.

1 Claim, 11 Drawing Sheets





US007324052B2

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

(10) **Patent No.:** **US 7,324,052 B2**
(45) **Date of Patent:** **Jan. 29, 2008**

- (54) **ANTENNA FOR A MOBILE TRANSMITTER AND/OR RECEIVER DEVICE**
- (75) Inventors: **Dirk Hamm**, Willich (DE); **Marc Lenkeit**, Willich (DE)
- (73) Assignee: **Success Chip Ltd.**, Tortola (VG)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 18 days.

(21) Appl. No.: **11/037,520**
(22) Filed: **Jan. 18, 2005**

(65) **Prior Publication Data**
US 2006/0152418 A1 Jul. 13, 2006

(30) **Foreign Application Priority Data**
Jan. 7, 2005 (EP) 05000255

- (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, 725, 727
See application file for complete search history.

(56) **References Cited**

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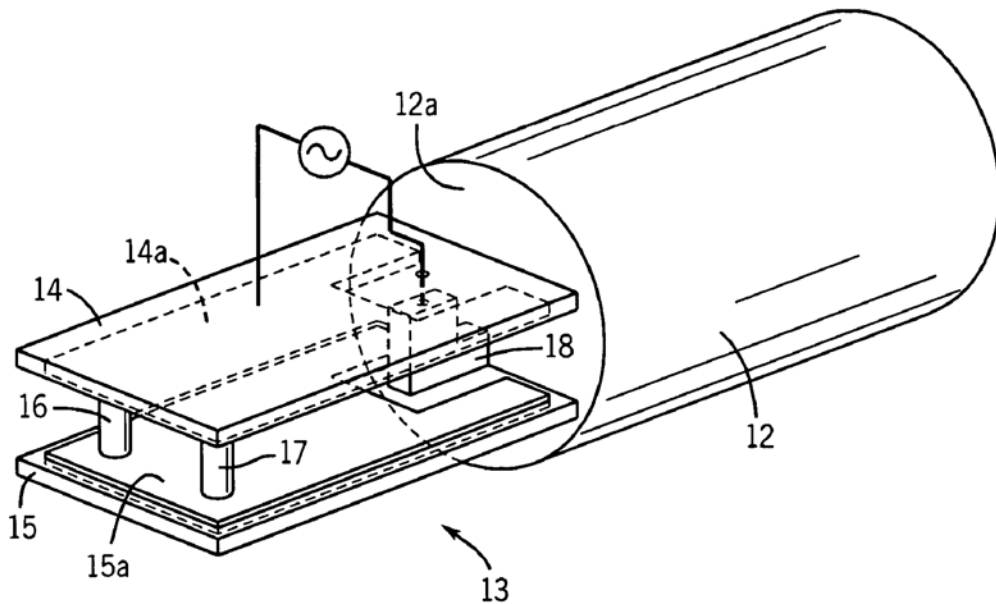
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Primary Examiner—Tan Ho
(74) *Attorney, Agent, or Firm*—Stoel Rives LLP

(57) **ABSTRACT**

An antenna for a mobile transmitter and/or receiver device suitable for a hand-held transmitter/receiver for a wireless microphone includes a monopole or dipole antenna element for the excitation of a monopole or diopole and an additional antenna element for the excitation of a parallel line mode.

14 Claims, 5 Drawing Sheets





US007324058B2

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

(10) **Patent No.:** **US 7,324,058 B2**

(45) **Date of Patent:** **Jan. 29, 2008**

(54) **TAG ANTENNA, TAG AND RFID SYSTEM USING THE SAME**

(75) Inventors: **Manabu Kai**, Kawasaki (JP); **Toru Maniwa**, Kawasaki (JP); **Takashi Yamagajo**, 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 47 days.

(21) Appl. No.: **11/349,179**

(22) Filed: **Feb. 8, 2006**

(65) **Prior Publication Data**

US 2007/0085751 A1 Apr. 19, 2007

(30) **Foreign Application Priority Data**

Oct. 19, 2005 (JP) 2005-303886

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

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

(58) **Field of Classification Search** **343/700 MS, 343/793, 795, 895; 340/572.7**

See application file for complete search history.

(56) **References Cited**

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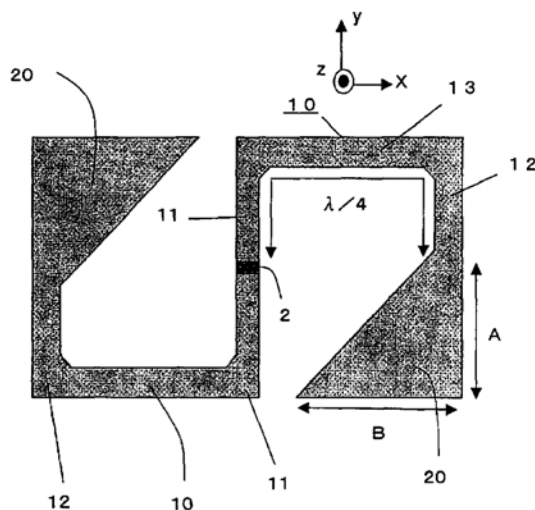
Primary Examiner—Tho Phan

(74) Attorney, Agent, or Firm—Bingham McCutchen LLP

(57) **ABSTRACT**

A communication distance difference due to an attached object can be canceled, and an RFID system can be provided which has approximately the same communication distance regardless of an attached position (surface) of a tag. A tag antenna used for such the RFID system is for transmitting/receiving a radio signal to/from an RFID reader/writer in an RFID system has a pair of antenna elements centered on a feeding point and when a carrier wavelength of the radio signal is λ , each of the pair of the antenna elements includes a dipole portion which has a length from the feeding point of approximate $\lambda/4$ and a plurality of bending portions as well as a circular polarized wave generation portion linked to an end of the dipole portion.

9 Claims, 21 Drawing Sheets





US007324059B2

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

(10) **Patent No.:** **US 7,324,059 B2**
(45) **Date of Patent:** **Jan. 29, 2008**

(54) **STUB PRINTED DIPOLE ANTENNA (SPDA) HAVING WIDE-BAND AND MULTI-BAND CHARACTERISTICS AND METHOD OF DESIGNING THE SAME**

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2007/0052610 A1* 3/2007 Lee 343/795

(75) Inventors: **Sung-Jun Lee**, Gyeonggi-do (KR);
Kwang-Chun Lee, Daejeon (KR)

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(73) Assignee: **Electronics and Telecommunications Research Institute**, Daejeon (KR)

Tefiku, F., et al. "Design of Broad-Band and Dual-Band Antennas Comprised of Series-Fed Printed-Strip Dipole Pairs". *IEEE Transactions on Antennas and Propagation*. 2000. 48:895-900.

(*) 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.: **11/504,512**

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

Primary Examiner—Trinh Vo Dinh
(74) *Attorney, Agent, or Firm*—Ladas & Parry LLP

(65) **Prior Publication Data**

US 2007/0040759 A1 Feb. 22, 2007

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Aug. 19, 2005 (KR) 10-2005-0076503
Nov. 11, 2005 (KR) 10-2005-0108100

A stub printed antenna (SPDA) and a method of designing the same are provided. The SPDA include: a substrate; dipole arms disposed at both surfaces of the substrate for transmitting/receiving a signal; a parallel metal strip line disposed at both surfaces of the substrate, and each having one end connected to each of the dipole arms; a stub disposed at both surfaces of the substrate, and connected to the other end of the parallel metal strip line; a coaxial probe connected to the junction of the parallel metal strip line and the stub for feeding signals; a hole for inserting an inner conductor of the coaxial probe; and a contact for connecting to an outer conductor of the coaxial probe.

(51) **Int. Cl.**
H01Q 9/18 (2006.01)

(52) **U.S. Cl.** **343/795**; 343/793; 343/700 MS

(58) **Field of Classification Search** 343/700 MS, 343/793, 795, 812

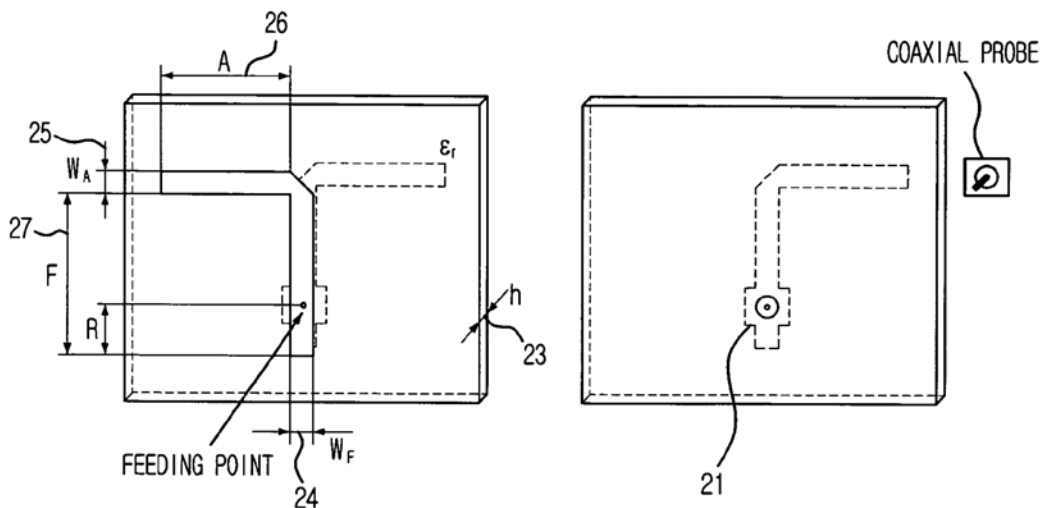
See application file for complete search history.

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11 Claims, 13 Drawing Sheets





US007324061B1

(12) **United States Patent**
Hadley

(10) **Patent No.:** **US 7,324,061 B1**
(45) **Date of Patent:** **Jan. 29, 2008**

(54) **DOUBLE INDUCTOR LOOP TAG ANTENNA**

(75) Inventor: **Mark A. Hadley**, Newark, CA (US)

(73) Assignee: **Alien Technology Corporation**,
Morgan Hill, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 214 days.

(21) Appl. No.: **10/848,643**

(22) Filed: **May 18, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/472,258, filed on May 20, 2003.

(51) **Int. Cl.**
H01Q 1/40 (2006.01)

(52) **U.S. Cl.** **343/873; 343/870; 340/572.7**

(58) **Field of Classification Search** 340/10.2,
340/505, 825.3, 572.7, 673; 342/51; 343/870,
343/872, 873; 361/767, 783

See application file for complete search history.

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Primary Examiner—Douglas W. Owens

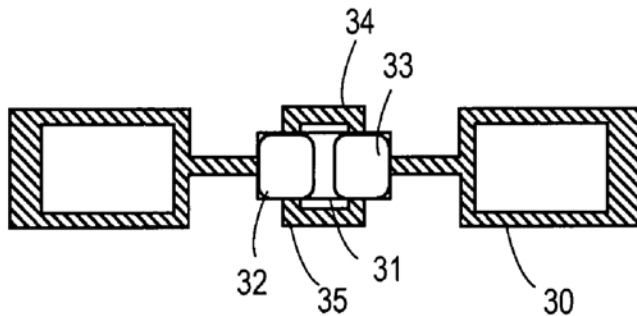
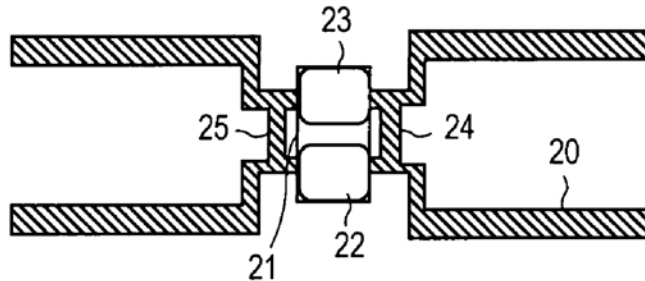
Assistant Examiner—Jimmy Vu

(74) *Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor & Zafman LLP

(57) **ABSTRACT**

An RFID tag in one embodiment. The RFID tag includes at least one integrated circuit and an antenna pattern coupled to the integrated circuit, wherein the antenna pattern has an inductor pattern which limits the effect of misplacement of the integrated circuit relative to the inductor pattern. Other embodiments and methods of making these apparatuses are described.

6 Claims, 8 Drawing Sheets





US007324062B2

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

(10) **Patent No.:** **US 7,324,062 B2**
(45) **Date of Patent:** **Jan. 29, 2008**

- (54) **ANTENNA UNIT**
- (75) Inventors: **Junichi Noro**, Akita (JP); **Takao Kato**, Akita (JP)
- (73) Assignee: **Mitsumi 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 27 days.

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 Related U.S. Appl. No. 11/318,411, filed Dec. 22, 2005; Inventor: J. Noro et al.
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Primary Examiner—Shih-Chao Chen
 (74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, P.C.

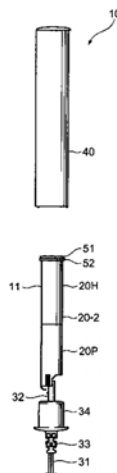
- (21) Appl. No.: **11/318,408**
- (22) Filed: **Dec. 22, 2005**
- (65) **Prior Publication Data**
US 2006/0202902 A1 Sep. 14, 2006
- (30) **Foreign Application Priority Data**
Mar. 10, 2005 (JP) 2005-067191
- (51) **Int. Cl.**
H01Q 1/36 (2006.01)
H01Q 1/42 (2006.01)
- (52) **U.S. Cl.** **343/895**; 343/872
- (58) **Field of Classification Search** 343/700 MS,
343/702, 872, 895
See application file for complete search history.

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(57) **ABSTRACT**

An antenna unit comprises a hollow cylindrical member obtained by forming a flexible insulating film member into a hollow cylinder and an antenna pattern composed of four conductors formed on an inner peripheral surface of the hollow cylindrical member. A phase shifter pattern is formed on the inner peripheral surface of the hollow cylindrical member so as to be electrically connected to the antenna pattern. The antenna unit further comprises a hollow cylindrical cover case covering the hollow cylindrical member and a shield member provided so as to cover the phase shifter pattern.

5 Claims, 12 Drawing Sheets





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(54) **RECTANGULAR HELICAL ANTENNA**

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(57) **ABSTRACT**

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In a helical antenna to be installed inside a mobile communication terminal, for processing low-bandwidth signals, a substrate is made of magnetic dielectric material, a plurality of lower electrodes are disposed on the underside of the substrate, and a plurality of upper electrodes are disposed on the top of the substrate. The upper electrodes are inclined with respect to the lower electrodes, respectively, at a predetermined angle. A plurality of side electrodes electrically connect the lower electrodes with the upper electrodes, respectively. At least a part of a magnetic moment vector, which is formed around each of the lower electrodes by a current flowing in the each lower electrode, is directed in parallel with a current flowing in each of the upper electrodes corresponding to the each lower electrode.

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(52) **U.S. Cl.** **343/895; 343/787**

(58) **Field of Classification Search** **343/787, 343/895**

See application file for complete search history.

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