



US007253770B2

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

(10) **Patent No.:** **US 7,253,770 B2**
(45) **Date of Patent:** **Aug. 7, 2007**

(54) **INTEGRATED GPS AND SDARS ANTENNA**

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2004/0174304 A1 9/2004 Komatsu et al. 343/700

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Monterey, CA., Jun. 20-25, 2004, vol. 1, pp. 479-482.
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and Propagation, Piscataway, NJ, vol. 47, No. 10, pp. 1633-1639,
Oct. 1999.

(73) Assignee: **Delphi Technologies, Inc.**, Troy, MI
(US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 44 days.

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(21) Appl. No.: **10/985,552**

(22) Filed: **Nov. 10, 2004**

Primary Examiner—Hoanganh Le
(74) *Attorney, Agent, or Firm*—Jimmy L. Funke

(65) **Prior Publication Data**

US 2006/0097924 A1 May 11, 2006

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/846, 848, 713, 711

See application file for complete search history.

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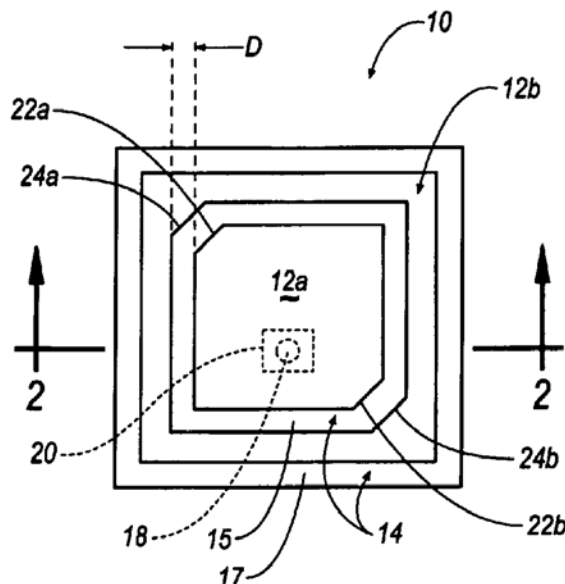
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(57) **ABSTRACT**

An integrated patch antenna is disclosed. The integrated
patch antenna receives at least a first and second band of
signals. The integrated patch antenna includes a bottom
metallization and first and second upper metallizations dis-
posed about a dielectric material to receive the first and
second signal bands. The first and second signal bands may
be, for example, a satellite digital audio radio systems
(SDARS) band and a global positioning system (GPS) band.

13 Claims, 3 Drawing Sheets





US007253771B2

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

(10) **Patent No.:** **US 7,253,771 B2**
(45) **Date of Patent:** **Aug. 7, 2007**

- (54) **ANTENNA DEVICE** 4,208,660 A * 6/1980 McOwen, Jr. 343/769
- (75) **Inventors:** **Toru Maniwa**, Kawasaki (JP); **Andrey S. Andrenko**, Kawasaki (JP); **Shigekazu Kimura**, Kawasaki (JP) 5,526,007 A * 6/1996 Murakami et al. 343/741
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7,119,745 B2 * 10/2006 Gaucher et al. 343/700 MS
- (73) **Assignee:** **Fujitsu Limited**, Kanagawa (JP) 2003/0076260 A1 * 4/2003 Ryken et al. 343/700 MS
2005/0237260 A1 * 10/2005 Bancroft 343/859
- (*) **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.:** **11/130,245**
- (22) **Filed:** **May 17, 2005** JP 07-131221 5/1995

Prior Publication Data

US 2006/0187135 A1 Aug. 24, 2006

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Foreign Application Priority Data

Feb. 24, 2005 (JP) 2005-048230

Primary Examiner—Trinh Vo Dinh
(74) *Attorney, Agent, or Firm*—Bingham McCutchen LLP

- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 9/16 (2006.01)
- (52) **U.S. Cl.** 343/700 MS; 343/793
- (58) **Field of Classification Search** 343/700 MS, 343/793, 795, 702
See application file for complete search history.

(57) **ABSTRACT**

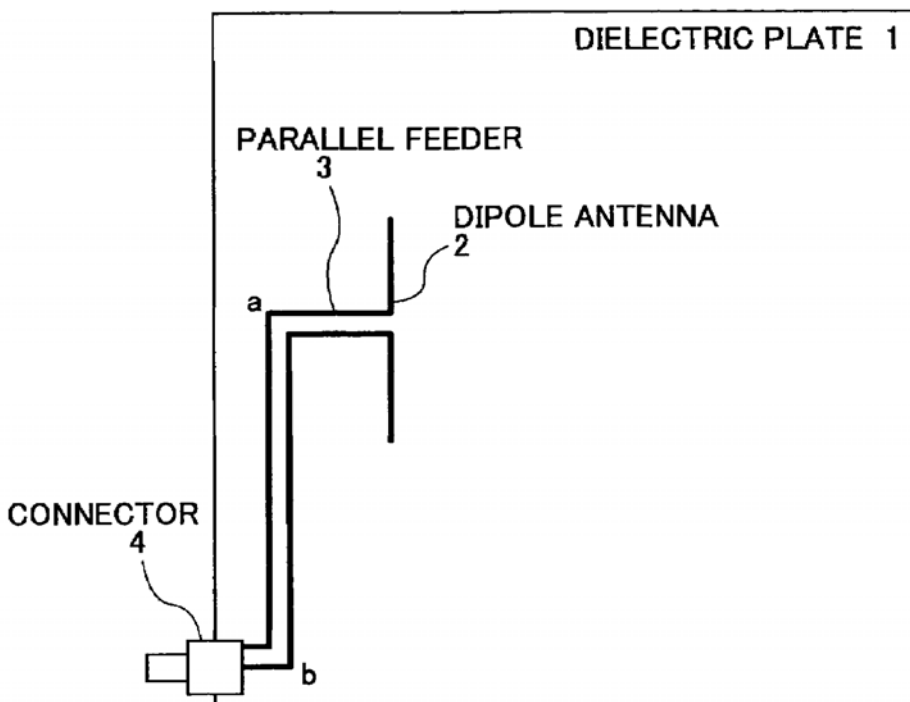
An antenna device is disclosed. An antenna such as a dipole antenna and a parallel feeder each formed of a conductor pattern are disposed on a dielectric plate. The connector is connected to the antenna through the parallel feeder. The parallel feeder has a length of an integral multiple of a half wavelength and has an even number of bending points between the connector and the antenna.

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3 Claims, 8 Drawing Sheets





US007253772B2

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

(10) **Patent No.:** **US 7,253,772 B2**
(45) **Date of Patent:** **Aug. 7, 2007**

(54) **WIDE FREQUENCY BAND PLANAR ANTENNA**

(75) Inventors: **Sheng-Yuan Chi**, Taipei County (TW);
Shyh-Jong Chung, Hsinchu (TW);
Yu-Cheng Chen, Tainan (TW)

(73) Assignee: **Delta Networks, 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 104 days.

(21) Appl. No.: **11/164,482**

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

(65) **Prior Publication Data**
US 2007/0115178 A1 May 24, 2007

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

(56) **References Cited**
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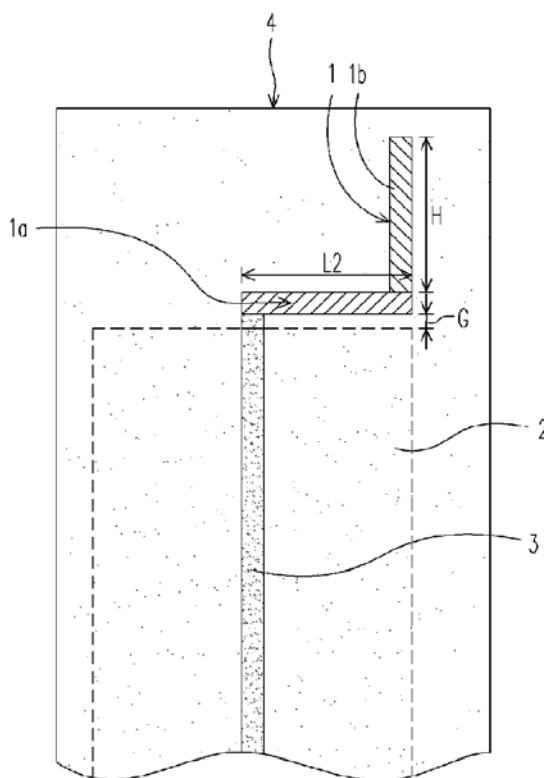
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Primary Examiner—Tho Phan
(74) *Attorney, Agent, or Firm*—Jianq Chyun IP Office

(57) **ABSTRACT**

A wide frequency band planar antenna comprises an elongated portion, substantially parallel to a circumferential edge of a ground pattern and comprising one end connected to a feeding transmission line, wherein there is a gap between the elongated portion and the circumferential edge of the ground pattern; a body stub and an impedance-matching-adjusting pattern for adjusting an impedance matching between the wide frequency band planar antenna and the feeding transmission line; wherein the gap value is less than 2 mm so as to enable the wide frequency band antenna to operate at a wide range of frequencies ranging from 2.3 GHz to near 6 GHz, thereby allowing the wide frequency band antenna to be applied in both WiFi LAN and WiMAX MAN.

19 Claims, 11 Drawing Sheets





US007253775B2

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

(10) **Patent No.:** **US 7,253,775 B2**
(45) **Date of Patent:** ***Aug. 7, 2007**

(54) **ANTENNA WITH NEAR-FIELD RADIATION CONTROL**

(75) Inventors: **Yihong Qi**, Waterloo (CA); **Perry Jarmuszewski**, Waterloo (CA); **Adam D. Stevenson**, Waterloo (CA)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 306 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/940,869**

(22) Filed: **Sep. 14, 2004**

(65) **Prior Publication Data**

US 2005/0040996 A1 Feb. 24, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/317,659, filed on Dec. 12, 2002, now Pat. No. 6,791,500.

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

(52) **U.S. Cl.** **343/702**; 343/795; 343/803; 343/818

(58) **Field of Classification Search** 343/702, 343/795, 793, 803, 806, 818, 833, 834
See application file for complete search history.

(56) **References Cited**

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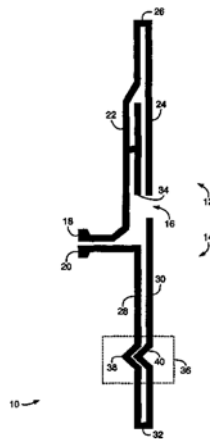
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Jones Day; Krishna K. Pathiyal; Robert C. Liang

(57) **ABSTRACT**

An antenna and a wireless mobile communication device incorporating the antenna are provided. The antenna includes a first conductor section electrically coupled to a first feeding point, a second conductor section electrically coupled to a second feeding point, and a near-field radiation control structure adapted to control characteristics of near-field radiation generated by the antenna. Near-field radiation control structures include a parasitic element positioned adjacent the first conductor section and configured to control characteristics of near-field radiation generated by the first conductor section, and a diffuser in the second conductor section configured to diffuse near-field radiation generated by the second conductor section into a plurality of directions.

29 Claims, 4 Drawing Sheets





US007253787B2

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

(10) **Patent No.:** **US 7,253,787 B2**
(45) **Date of Patent:** **Aug. 7, 2007**

(54) **HELIX ANTENNA AND METHOD FOR MANUFACTURING THE SAME**

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2002/0140622 A1 10/2002 Park et al.

(75) Inventors: **Kuo-Cheng Liu**, Xindian (TW);
Chin-Hon Fan, Xindian (TW);
Kun-Ting Lin, Xindian (TW);
Ren-Peng Chen, Xindian (TW)

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(73) Assignee: **High Tech Computer, Corp.**, Taoyuan (TW)

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WO WO 98/44590 A 10/1998

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 177 days.

(21) Appl. No.: **11/099,616**

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(22) Filed: **Apr. 6, 2005**

Primary Examiner—Shih-Chao Chen

(65) **Prior Publication Data**

(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

US 2006/0109196 A1 May 25, 2006

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Nov. 25, 2004 (TW) 93136269 A

A method for manufacturing a helix antenna. A ceramic cylinder including a central through hole, a first annular surface, and a second annular surface is provided. The first annular surface is opposite the second annular surface. The central through hole is between the first and second annular surfaces. A flexible printed circuit board with a metal feeding strip extending outside the flexible printed circuit board is provided. The flexible printed circuit board is swirled and attached to the circumferential surface of the ceramic cylinder.

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

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

(58) **Field of Classification Search** 343/700 MS,
343/725, 829, 846, 853, 895
See application file for complete search history.

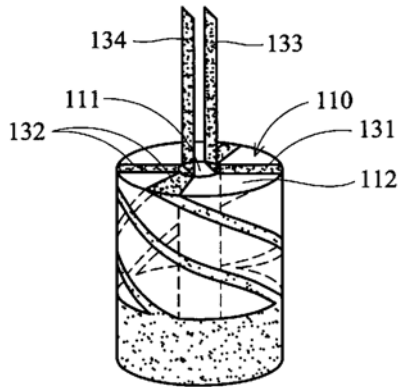
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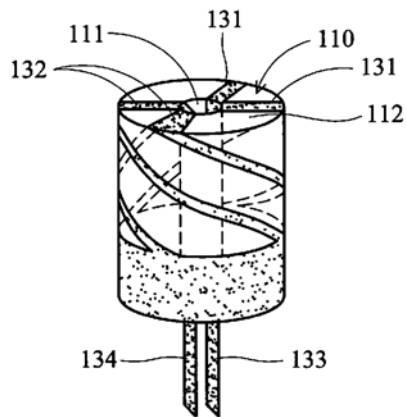
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20 Claims, 4 Drawing Sheets

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100





US007256739B2

(12) **United States Patent**
Usami

(10) **Patent No.:** **US 7,256,739 B2**
(45) **Date of Patent:** **Aug. 14, 2007**

(54) **ANTENNA FOR RADIO FREQUENCY IDENTIFICATION**

(75) Inventor: **Mitsuo Usami**, Tokyo (JP)

(73) Assignee: **Hitachi, 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.: **11/002,083**

(22) Filed: **Dec. 3, 2004**

(65) **Prior Publication Data**

US 2005/0134460 A1 Jun. 23, 2005

(30) **Foreign Application Priority Data**

Dec. 4, 2003 (JP) 2003-406031

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

(52) **U.S. Cl.** **343/700 MS**; 343/720; 340/572.7

(58) **Field of Classification Search** 343/700 MS, 343/702, 767, 720, 873; 340/572.7
See application file for complete search history.

(56) **References Cited**

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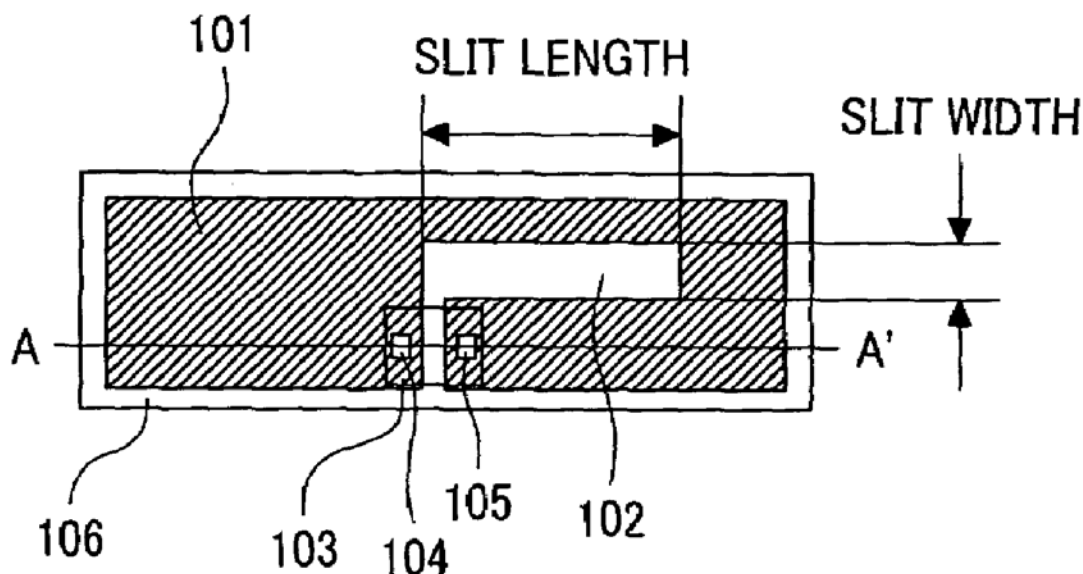
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Primary Examiner—Michael C. Wimer
(74) *Attorney, Agent, or Firm*—Mattingly, Stanger, Malur & Brundidge, PC

(57) **ABSTRACT**

To provide an antenna shape devised to be integrated and compact. The antenna connected to an IC chip that performs wireless identification includes a slit that separates two connection points with respect to the IC chip, in which a length of the slit is approximately 3 millimeters, and a width of the slit is in a range of from 0.8 millimeter to 1.4 millimeters.

18 Claims, 13 Drawing Sheets





US007256741B2

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

(10) **Patent No.:** **US 7,256,741 B2**
(45) **Date of Patent:** ***Aug. 14, 2007**

(54) **ANTENNA WITH MULTIPLE-BAND PATCH AND SLOT STRUCTURES**

(75) Inventors: **Geyi Wen**, Waterloo (CA); **Krystyna Bandurska**, Waterloo (CA); **Perry Jarmuszewski**, Waterloo (CA)

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

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/344,753**

(22) Filed: **Feb. 1, 2006**

(65) **Prior Publication Data**

US 2006/0125698 A1 Jun. 15, 2006

Related U.S. Application Data

(63) Continuation of application No. 10/844,685, filed on May 13, 2004, now Pat. No. 7,023,387.

(30) **Foreign Application Priority Data**

May 14, 2003 (EP) 03252987

(51) **Int. Cl.**

H01Q 1/38 (2006.01)
H01Q 13/10 (2006.01)
H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/770; 343/702**

(58) **Field of Classification Search** **343/700 MS, 343/725, 702, 770**

See application file for complete search history.

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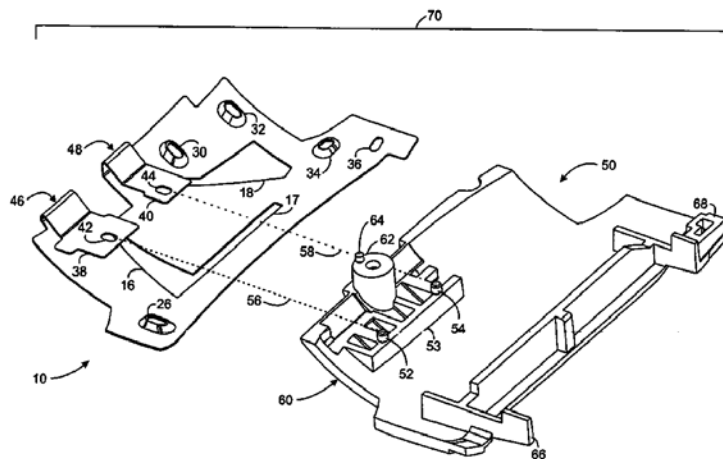
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Jones Day; Krishna K. Pathiyal; Robert C. Liang

(57) **ABSTRACT**

A multiple-band antenna having a plurality of operating frequency bands is provided. The antenna includes a plurality of structures configured for operation in respective ones of the plurality of operating frequency bands, and a plurality of structures configured for operation in more than one of the plurality of operating frequency bands. In one embodiment, a multiple-band antenna has first, second, and third operating frequency bands, and comprises a first patch structure associated with the first operating frequency band, a second patch structure connected to the first patch structure and associated with the second operating frequency band and the third operating frequency band, a first slot structure disposed between a first portion of the first patch structure and the second patch structure and associated with the first operating frequency band and the second operating frequency band, a second slot structure disposed between a second portion of the first patch structure and the second patch structure and associated with the second operating frequency band, and a third slot structure disposed between a third portion of the first patch structure and the second patch structure and associated with the first operating frequency band and the third operating frequency band.

34 Claims, 7 Drawing Sheets





US007256743B2

(12) **United States Patent**
Korva

(10) **Patent No.:** **US 7,256,743 B2**
(45) **Date of Patent:** **Aug. 14, 2007**

(54) **INTERNAL MULTIBAND ANTENNA**

OTHER PUBLICATIONS

- (75) Inventor: **Heikki Korva**, Tupos (FI)
- (73) Assignee: **Pulse Finland Oy**, Kempele (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.

Ciais, Pascal et al., "Design of an Internal Quad-Band Antenna for Mobile Phones," IEEE Microwave and Wireless Components Letters, vol. 14, No. 4, pp. 148-150, Apr. 2004.

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(21) Appl. No.: **11/279,664**

Primary Examiner—Tho Phan
(74) *Attorney, Agent, or Firm*—Darby & Darby

(22) Filed: **Apr. 13, 2006**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2006/0170600 A1 Aug. 3, 2006

Related U.S. Application Data

(63) Continuation of application No. PCT/FI04/00543, filed on Sep. 17, 2004.

(30) **Foreign Application Priority Data**

Oct. 20, 2003 (FI) 20031529

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

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

(58) **Field of Classification Search** **343/700 MS, 343/702, 815, 829, 846**

See application file for complete search history.

(56) **References Cited**

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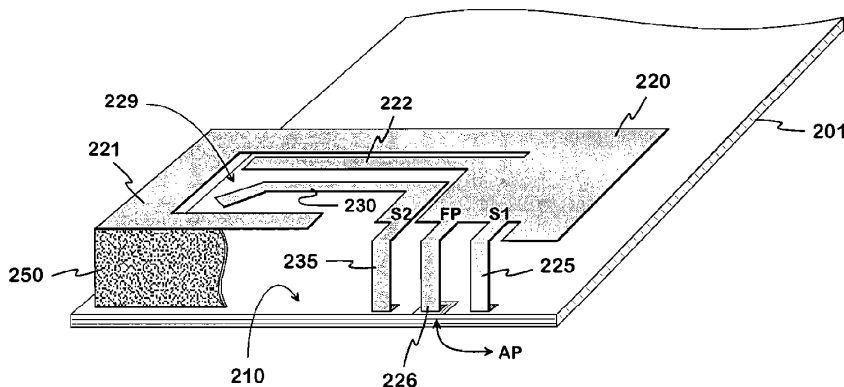
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The invention relates to an internal multiband antenna intended for small-sized radio devices, and a radio device with such an antenna. The basic structure of the antenna is a two-band PIFA. A parasitic element (230) is added to it inside the outline of the radiating plane (220) of the PIFA, e.g. in the space (229) between the conductor branches (221, 222) of the radiating plane. The parasitic element extends close to the feeding point (FP) of the antenna, from which place it is connected to the ground plane of the antenna with its own short-circuit conductor (235). The structure is dimensioned so that the resonance frequency based on the parasitic element comes close to the one resonance frequency of the PIFA, thus widening the corresponding operating band, or a separate third operating band is formed for the antenna with the parasitic element. Because the parasitic element is located in the central area of the radiating plane and not in its peripheral area, the radio device user's hand does not significantly impair the matching of the antenna on an operating band which has been formed by the parasitic element. In addition, when the resonance frequency based on the parasitic element is on the upper operating band, the matching of the antenna also improves on the lower operating band.

9 Claims, 3 Drawing Sheets





US007256744B2

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

(10) **Patent No.:** **US 7,256,744 B2**
(45) **Date of Patent:** ***Aug. 14, 2007**

(54) **MOBILE WIRELESS COMMUNICATIONS DEVICE COMPRISING NON-PLANAR INTERNAL ANTENNA WITHOUT GROUND PLANE OVERLAP**

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/422,170**

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

(65) **Prior Publication Data**
US 2006/0208952 A1 Sep. 21, 2006

Related U.S. Application Data

(63) Continuation of application No. 11/042,890, filed on Jan. 25, 2005, now Pat. No. 7,091,911.

(60) Provisional application No. 60/576,637, filed on Jun. 3, 2004, provisional application No. 60/576,159, filed on Jun. 2, 2004.

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

(52) **U.S. Cl.** **343/702; 343/700 MS; 343/725**

(58) **Field of Classification Search** **343/700 MS, 343/702, 866, 725, 846**

See application file for complete search history.

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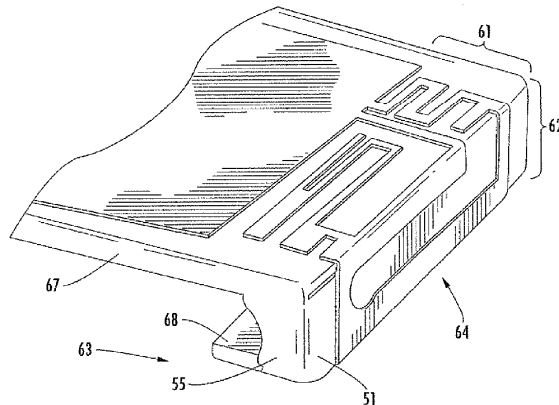
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Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A mobile wireless communications device may include a housing, a main dielectric substrate carried by the housing, circuitry carried by the main dielectric substrate, and a ground plane conductor on the main dielectric substrate. The mobile wireless communications device may further include an L-shaped dielectric extension comprising a vertical portion extending outwardly from the main dielectric substrate and an overhang portion extending outwardly from the vertical portion and above an adjacent portion of the main dielectric layer. A main loop antenna conductor comprising at least one conductive trace may be relatively positioned on the overhang portion of the L-shaped dielectric extension so as not to overlap the ground plane conductor.

17 Claims, 11 Drawing Sheets





US007256750B1

(12) **United States Patent**
Honda

(10) **Patent No.:** **US 7,256,750 B1**
(45) **Date of Patent:** ***Aug. 14, 2007**

(54) **E-PLANE OMNI-DIRECTIONAL ANTENNA**

(75) Inventor: **Royden M. Honda**, Post Falls, ID (US)

(73) Assignee: **Vivato, Inc.**, Portland, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 100 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/104,684**

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

Related U.S. Application Data

(62) Division of application No. 10/335,382, filed on Dec. 31, 2002, now Pat. No. 6,967,625.

(51) **Int. Cl.**
H01Q 9/04 (2006.01)

(52) **U.S. Cl.** **343/791; 343/790**

(58) **Field of Classification Search** 343/790-793
See application file for complete search history.

(56) **References Cited**

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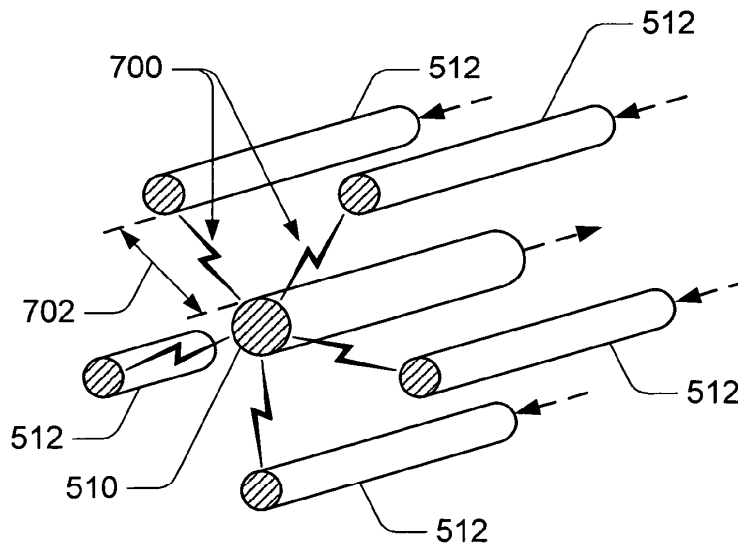
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Brooks, Cameron & Huebsch, PLLC

(57) **ABSTRACT**

E-plane omni-directional antenna is described. In an embodiment, a transmission signal connection system includes a center conductive rod to communicate a radio frequency transmission signal, and includes one or more outer conductive rods that each provide a grounded return for the radio frequency transmission signal and shield the center conductive rod. The center conductive rod and the one or more outer conductive rods also couple a first antenna element to at least a second antenna element, and the center conductive rod couples the first antenna element and the at least second antenna element to the radio frequency transmission signal. Each antenna element includes coplanar waveguide dipoles that generate an e-field transmission which are combined to form an E-plane omni-directional transmission pattern.

19 Claims, 7 Drawing Sheets





US007256751B2

(12) **United States Patent**
Cohen

(10) **Patent No.:** **US 7,256,751 B2**
(45) **Date of Patent:** ***Aug. 14, 2007**

(54) **FRactal ANTENNAS AND FRACTAL RESONATORS**

(76) Inventor: **Nathan Cohen**, 2 Ledgewood Pl., Belmont, MA (US) 02178

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 393 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/243,444**

(22) Filed: **Sep. 13, 2002**

(65) **Prior Publication Data**
US 2003/0160723 A1 Aug. 28, 2003

Related U.S. Application Data

(63) Continuation of application No. 08/512,954, filed on Aug. 9, 1995, now Pat. No. 6,452,553.

(51) **Int. Cl.**
H01Q 11/10 (2006.01)

(52) **U.S. Cl.** **343/792.5**

(58) **Field of Classification Search** **343/846, 343/741, 795, 792.5**

See application file for complete search history.

(56) **References Cited**

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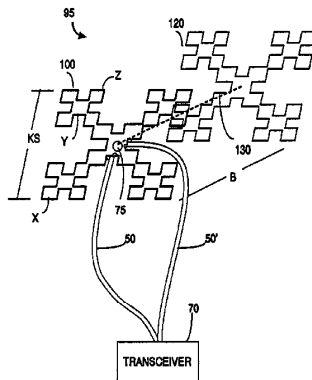
(Continued)

Primary Examiner—Michael C. Wimer
(74) *Attorney, Agent, or Firm*—McDermott Will & Emery LLP

(57) **ABSTRACT**

An antenna includes at least one element whose physical shape is at least partially defined as a second or higher iteration deterministic fractal. The resultant fractal antenna does not rely upon an opening angle for performance, and may be fabricated as a dipole, a vertical, or a quad, among other configurations. The number of resonant frequencies for the fractal antenna increases with iteration number N and more such frequencies are present than in a prior art Euclidean antenna. Further, the resonant frequencies can include non-harmonically related frequencies. At the high frequencies associated with wireless and cellular telephone communications, a second or third iteration, preferably Minkowski fractal antenna is implemented on a printed circuit board that is small enough to fit within the telephone housing. A fractal antenna according to the present invention is substantially smaller than its Euclidean counterpart, yet exhibits at least similar gain, efficiency, SWR, and provides a 50Ω termination impedance without requiring impedance matching.

8 Claims, 12 Drawing Sheets





US007256752B2

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

(10) **Patent No.:** **US 7,256,752 B2**
(45) **Date of Patent:** **Aug. 14, 2007**

- (54) **ANTENNA FEED STRUCTURE**
- (75) Inventors: **David Michael Wither**, Northampton (GB); **Oliver Paul Leisten**, Northampton (GB)
- (73) Assignee: **Sarantel Limited**, Wellingborough (GB)
- (*) 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—Michael C. Wimer

(74) *Attorney, Agent, or Firm*—John Bruckner, PC

- (21) Appl. No.: **10/987,311**
- (22) Filed: **Nov. 12, 2004**
- (65) **Prior Publication Data**
US 2006/0071874 A1 Apr. 6, 2006
- (30) **Foreign Application Priority Data**
Oct. 6, 2004 (GB) 0422179.2
- (51) **Int. Cl.**
H01Q 1/36 (2006.01)
- (52) **U.S. Cl.** **343/905; 343/895**
- (58) **Field of Classification Search** **343/895, 343/905**
See application file for complete search history.

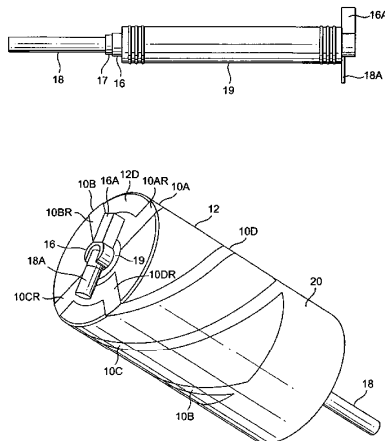
(57) **ABSTRACT**

A unitary feed structure for sliding installation in a passage in the insulative core of a dielectrically-loaded antenna comprises the unitary combination of a tubular outer shield conductor and elongate inner conductor which extends through the shield conductor and is insulated from the latter. The shield conductor and inner conductor have oppositely directed radially extending connection members at an end of the feed structure, these connection members being integrally formed as part of the respective conductors so that the feed structure can be inserted as a unit into the passage in the antenna core so that the connection members engage respective connection portions formed on an end face of the core adjacent on end of the passage. Soldering of the connection members to the connection portions can be performed as a single operation so as to connect the feed structure to conductive antenna elements plated on the outer surface of the core.

- (56) **References Cited**
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30 Claims, 5 Drawing Sheets





US007259719B2

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

(10) **Patent No.:** **US 7,259,719 B2**
(45) **Date of Patent:** **Aug. 21, 2007**

(54) **SURFACE-MOUNTED ANTENNA AND PORTABLE WIRELESS DEVICE INCORPORATING THE SAME**

5,969,680 A * 10/1999 Tsuru et al. 343/700 MS
6,100,849 A * 8/2000 Tsubaki et al. 343/702
2002/0047804 A1 4/2002 Ghosh et al. 343/700 MS

(75) Inventors: **Ryo Horie**, Tokyo (JP); **Senzo Toyoda**, Gunma (JP)

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(73) Assignee: **Yokowo Co., Ltd.**, Tokyo (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 55 days.

(21) Appl. No.: **10/620,438**

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(22) Filed: **Jul. 17, 2003**

Primary Examiner—Michael C. Wimer

(65) **Prior Publication Data**

(74) Attorney, Agent, or Firm—Morgan, Lewis & Bockius, LLP

US 2005/0259007 A1 Nov. 24, 2005

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Jul. 19, 2002 (JP) P. 2002-211428

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

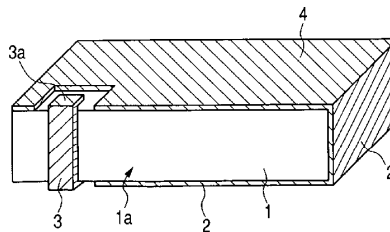
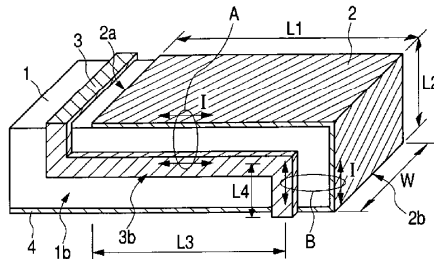
A ground electrode is provided on a first surface of a dielectric body. A radiation electrode has a first end which is left open and a second end which is connected to the ground electrode. A feeding terminal is provided on the first surface. A feeding electrode has a first end which is connected to the feeding terminal and a second end which is connected to the ground electrode. At least a part of the feeding electrode is extended in parallel with an elongated direction of the radiation electrode, so as to excite the radiation electrode with an induction coupling in a non-contact manner.

(56) **References Cited**

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6 Claims, 3 Drawing Sheets

5,886,668 A 3/1999 Pedersen et al. 343/700 MS





US007259720B2

(12) **United States Patent**
Ryu

(10) **Patent No.:** **US 7,259,720 B2**
(45) **Date of Patent:** ***Aug. 21, 2007**

- (54) **INTERNAL ANTENNA FOR A MOBILE HANDSET**
- (75) Inventor: **Ji Woong Ryu**, Seoul (KR)
- (73) Assignee: **Pantech Co., Ltd**, Seoul (KR)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **11/251,170**

(22) Filed: **Oct. 14, 2005**

(65) **Prior Publication Data**
US 2006/0033668 A1 Feb. 16, 2006

Related U.S. Application Data

(63) Continuation of application No. 10/810,367, filed on Mar. 26, 2004, now Pat. No. 6,995,717.

Foreign Application Priority Data

Nov. 20, 2003 (KR) 10-2003-0082706

- (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, 741, 866, 895, 846**
See application file for complete search history.

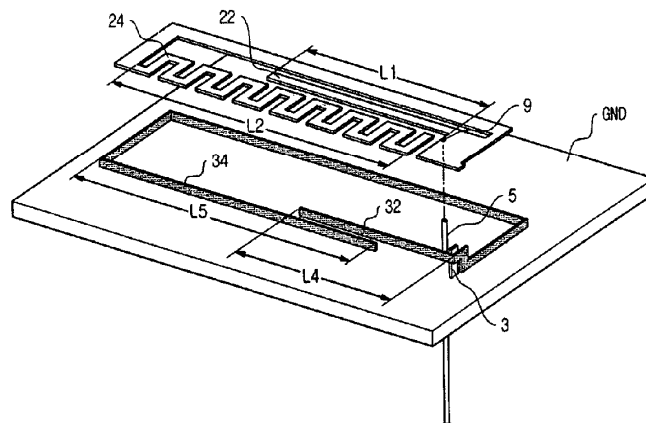
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Primary Examiner—Michael C. Wilmer
(74) *Attorney, Agent, or Firm*—Ohlandt, Greeley, Ruggiero & Perle L.L.P.

(57) **ABSTRACT**

The present invention relates to an internal antenna for a mobile handset comprising: a feeding pin for power supply; an upper radiating patch connected to the feeding pin, having a first upper patch portion and a second upper patch portion, which receive power supply from the feeding pin and resonate at different frequency bands respectively; a side radiating patch receiving power supply from the feeding pin, extended along the side of the upper radiating patch and vertically apart from the upper radiating patch by certain distance; and a short pin, one end of which is in contact with the upper radiating patch and the side radiating patch and the other end of which is grounded. According to the present invention, a bandwidth to be used can be broadened without increasing space for a general small size dual band Planar Inverted F Antenna PIFA.

16 Claims, 3 Drawing Sheets





US007259722B2

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

(10) **Patent No.:** **US 7,259,722 B2**
(45) **Date of Patent:** **Aug. 21, 2007**

(54) **ANTENNA COUPLER AND MOUNT FOR MOBILE RADIO TERMINALS**

(75) Inventors: **Karsten Strauss**, Crailsheim (DE);
Thomas Schlegel, Nuremberg (DE)

(73) Assignee: **Audioton Keibelwerk GmbH**
Zweigniederlassung Scheinfeld (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 70 days.

(21) Appl. No.: **10/550,138**

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

(86) PCT No.: **PCT/DE03/03766**

§ 371 (e)(1),
(2), (4) Date: **Sep. 21, 2005**

(87) PCT Pub. No.: **WO2004/086558**

PCT Pub. Date: **Oct. 7, 2004**

(65) **Prior Publication Data**

US 2007/0008233 A1 Jan. 11, 2007

(30) **Foreign Application Priority Data**

Mar. 25, 2003 (DE) 103 13 498

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/32 (2006.01)
H01Q 1/50 (2006.01)

(52) **U.S. Cl.** 343/702; 343/713; 343/906

(58) **Field of Classification Search** 343/711,
343/713, 702, 906

See application file for complete search history.

(56) **References Cited**

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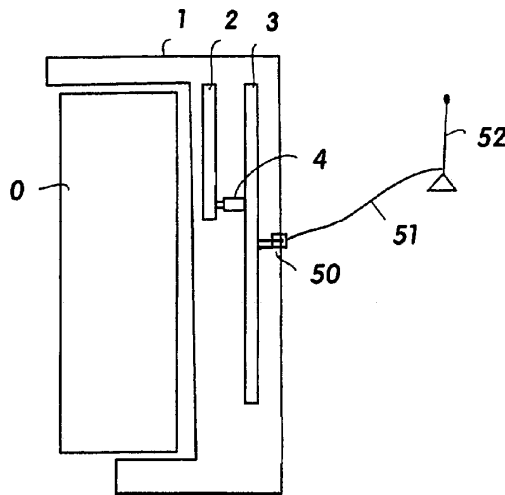
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Fulbright & Jaworski; Jan K. Simpson

(57) **ABSTRACT**

The invention relates to a holder for a mobile radio terminal and an antenna coupler for a mobile radio terminal. The holder is provided with an interface for connection of an external antenna, in particular of a motor vehicle antenna, and with a coupling structure for electromagnetic coupling of RF signals between the holder and the antenna of a mobile radio terminal which is located in the holder. The coupling structure is arranged in the holder in such a way that, when the mobile radio terminal is inserted, the coupling structure is positioned in the vicinity of the mobile radio terminal. The coupling structure is in the form of a two-layer or multilayer coupling structure with two or more coupling structure elements arranged one above the other.

13 Claims, 6 Drawing Sheets





US007259726B2

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

(10) **Patent No.:** **US 7,259,726 B2**
(45) **Date of Patent:** **Aug. 21, 2007**

(54) **COMPACT LOOP ANTENNA FOR
INDUCTIVE READ/WRITE APPARATUS**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Toshiaki Ibi**, Tokyo (JP); **Shigeru Hashimoto**, Tokyo (JP); **Yoshiyasu Sugimura**, Tokyo (JP)

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JP	11-027030	1/1999
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JP	11-272826	10/1999
JP	2001-325574	11/2001

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

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

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(21) Appl. No.: **11/496,283**

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

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(65) **Prior Publication Data**

US 2007/0030207 A1 Feb. 8, 2007

Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Schwegman, Lundberg, Woessner and Kluth P.A.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2005/000413, filed on Jan. 14, 2005.

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Feb. 2, 2004 (JP) 2004-025358

In order to provide a compact loop antenna, for use in an inductive read/write apparatus, capable of extending a communication range even if the antenna area or power supply thereto is constrained, a compact loop antenna, for use in an inductive read/write apparatus, comprises two layers of loop antennas, each thereof comprising a printed circuit board 2 for featuring a loop pattern 1, a loop pattern 1 formed by an etching process on the printed circuit board 2, and a start terminal 3 and an end terminal 4 for supplying power for signal transmission and outputting a received signal and each thereof maintaining a predetermined distance from each other.

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

(52) **U.S. Cl.** 343/867; 343/870; 343/742

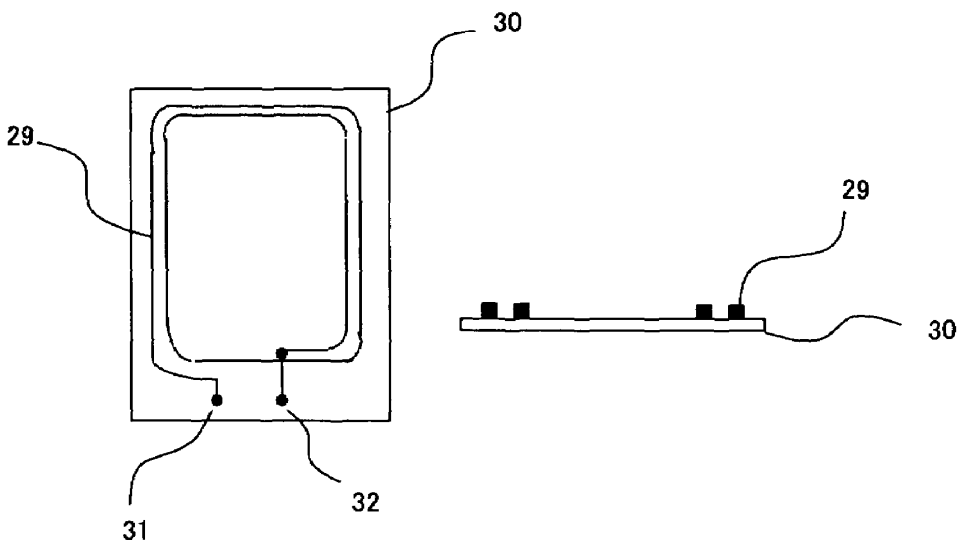
(58) **Field of Classification Search** 343/895, 343/867, 742, 700 MS, 870, 866
See application file for complete search history.

(56) **References Cited**

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16 Claims, 5 Drawing Sheets





US007259728B1

(12) **United States Patent**
Östervall

(10) **Patent No.:** **US 7,259,728 B1**
(45) **Date of Patent:** **Aug. 21, 2007**

(54) **TELESCOPIC RETRACTABLE ANTENNA**

6,317,086 B1* 11/2001 Woo 343/702
6,608,606 B1* 8/2003 Chang 343/702
6,992,642 B2 1/2006 Goldman et al.

(75) Inventor: **Torsten Östervall**, Stockholm (SE)

(73) Assignee: **Laird Technologies, Inc.**, Lincoln, NE (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.

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Primary Examiner—Thuy V. Tran
Assistant Examiner—Dieu Hien T Duong
(74) *Attorney, Agent, or Firm*—Holland & Hart LLP

(21) Appl. No.: **11/458,022**

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

(57) **ABSTRACT**

Related U.S. Application Data

(60) Provisional application No. 60/804,193, filed on Jun. 8, 2006.

(51) **Int. Cl.**
H01Q 1/10 (2006.01)

(52) **U.S. Cl.** **343/901; 343/702**

(58) **Field of Classification Search** **343/900, 343/901, 903, 906, 702, 752**

See application file for complete search history.

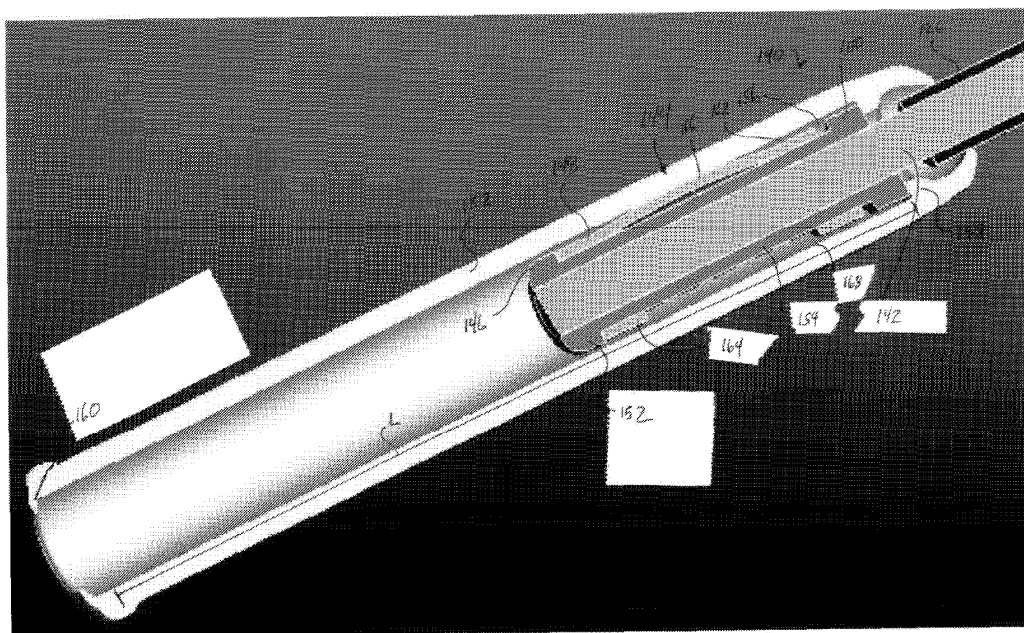
A retractable antenna having an elongated radiating element with an upper portion and a lower portion is provided. A slide tube is coupled to the lower portion such that the elongated radiating element is movable with respect to the slide tube. A compressible contact is provided on a bottom portion of the lower portion. The compressible contact is compressed by an inner sidewall of the slide tube at least when the elongated radiating element is in the extended position to facilitate maintaining the elongated radiating element in the extended position and provide an electrical connection between the elongated radiating member and the slide tube.

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6,239,754 B1* 5/2001 Kim 343/702

20 Claims, 2 Drawing Sheets





US007260424B2

(12) **United States Patent**
Schmidt

(10) **Patent No.:** **US 7,260,424 B2**
(45) **Date of Patent:** **Aug. 21, 2007**

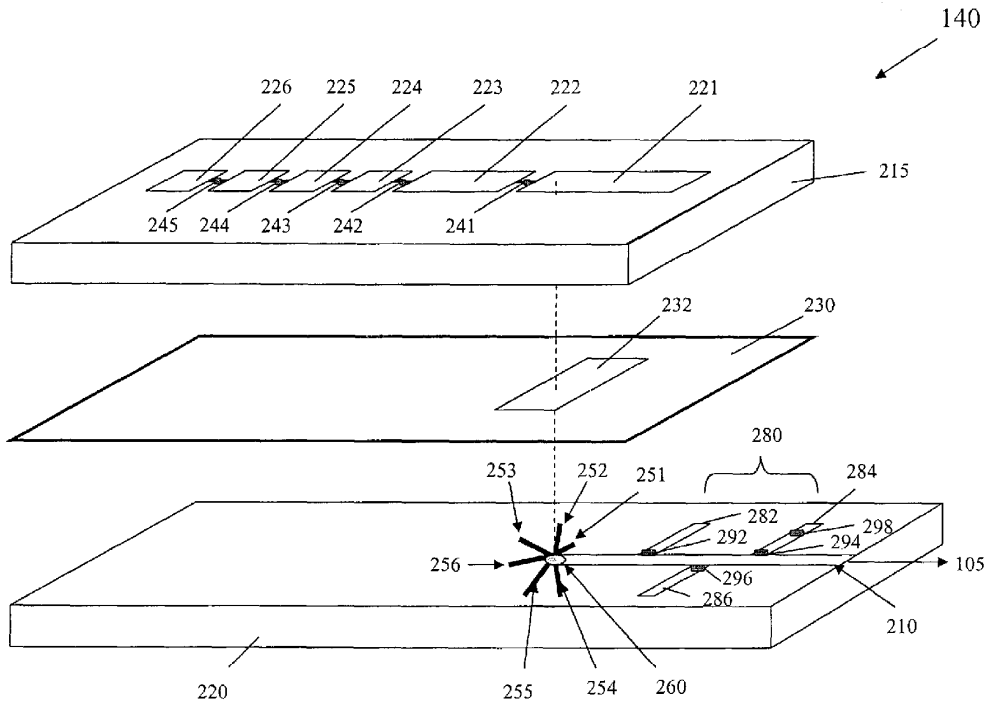
- (54) **DYNAMICALLY CONFIGURED ANTENNA FOR MULTIPLE FREQUENCIES AND BANDWIDTHS**
 - (76) Inventor: **Dominik J. Schmidt**, 580 Arastradero Rd., Palo Alto, CA (US) 94306
 - (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1078 days.
 - (21) Appl. No.: **10/155,485**
 - (22) Filed: **May 24, 2002**
 - (65) **Prior Publication Data**
US 2003/0219035 A1 Nov. 27, 2003
 - (51) **Int. Cl.**
H04Q 7/32 (2006.01)
 - (52) **U.S. Cl.** **455/575.7**; 455/575.1; 455/550.1; 455/552.1; 455/73; 455/90.3; 343/700; 343/702; 343/751; 379/433.01; 379/428.01; 379/429
 - (58) **Field of Classification Search** 455/575.7, 455/552.1, 550.1, 553.1, 575.1, 422.1, 403, 455/73, 78, 83, 500, 517, 90.1, 90.2, 90.3, 455/88; 343/702, 703, 751, 700, 895; 379/433.01, 379/428.01, 429
- See application file for complete search history.

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Primary Examiner—Keith Ferguson

(57) **ABSTRACT**
A wireless communication device includes a reconfigurable antenna and one or more wireless transceivers coupled to the antenna. The reconfigurable antenna can be dynamically configured to transmit and receive wireless signals at a plurality of frequencies and bandwidths. A processor core is coupled to the reconfigurable antenna and the wireless transceivers. The processor core dynamically controls the configurations of the reconfigurable antenna and processes the wireless signals transmitted and received at the plurality of frequencies.

16 Claims, 8 Drawing Sheets





US00D549696S

(12) **United States Design Patent** (10) **Patent No.:** **US D549,696 S**
Oshima et al. (45) **Date of Patent:** **** Aug. 28, 2007**

(54) **PLANAR ANTENNA ELEMENT FOR VEHICLE WINDOWPANE**

(75) Inventors: **Hideaki Oshima**, Minato-ku (JP);
Satoru Komatsu, Minato-ku (JP);
Hiroshi Kuribayashi, Minato-ku (JP);
Tomoyuki Fukumaru, Minato-ku (JP)

(73) Assignees: **Nippon Sheet Glass Company, Limited**, Tokyo (JP); **Honda Motor Company, Limited**, Tokyo (JP)

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

(21) Appl. No.: **29/209,348**

(22) Filed: **Jul. 15, 2004**

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

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

(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,
343/767, 748, 700 MS, 741, 866; 455/90.2,
455/90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

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Primary Examiner—Louis S. Zarfaz

Assistant Examiner—John Windmuller

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

(57) **CLAIM**

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

DESCRIPTION

FIG. 1 is a front elevational view of a planar antenna element for vehicle windowpane showing our new design;

FIG. 2 is a rear elevational view thereof;

FIG. 3 is a right side elevational view thereof;

FIG. 4 is a left side elevational view thereof;

FIG. 5 is a top plan view thereof;

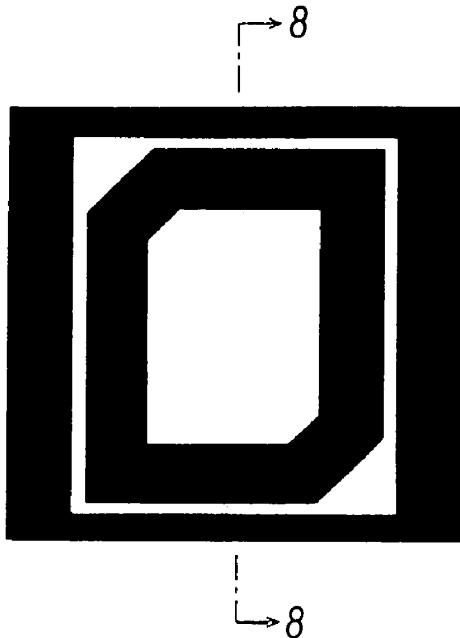
FIG. 6 is a bottom plan view thereof;

FIG. 7 is an enlarged front elevational view thereof; and,

FIG. 8 is a cross sectional view thereof taken along line 8—8 in FIG. 7.

The broken line showing of a vehicle windowpane is included for the purpose of illustrating environment and forms no part of the claimed design.

1 Claim, 4 Drawing Sheets





US007262701B1

(12) **United States Patent**
Nguyen

(10) **Patent No.:** **US 7,262,701 B1**
(45) **Date of Patent:** **Aug. 28, 2007**

- (54) **ANTENNA STRUCTURES FOR RFID DEVICES**
- (75) Inventor: **Thanh Huu Nguyen**, San Jose, CA (US)
- (73) Assignee: **National Semiconductor Corporation**, Santa Clara, CA (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 148 days.

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Primary Examiner—Benjamin C. Lee

Assistant Examiner—Son Tang

(74) *Attorney, Agent, or Firm*—Stallman & Pollock LLP

(21) Appl. No.: **11/135,055**

(22) Filed: **May 23, 2005**

(51) **Int. Cl.**
G08B 13/04 (2006.01)
H01Q 9/16 (2006.01)

(52) **U.S. Cl.** **340/572.7**; 340/572.4;
340/572.5; 343/822; 343/795; 343/860; 343/700

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

(56) **References Cited**

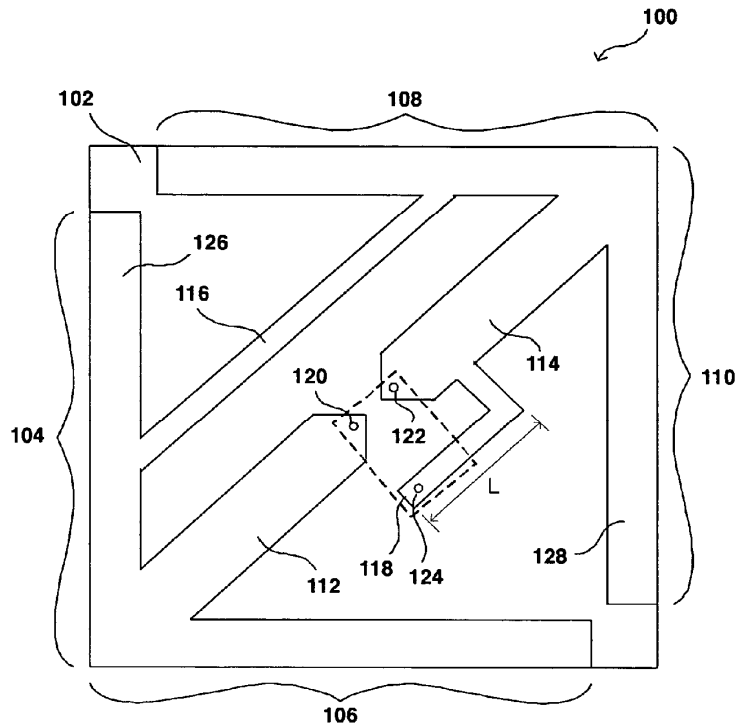
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(57) **ABSTRACT**

An improved antenna structure for RFID tags uses a pair of bent dipole antennas having arms that extend substantially about an outer edge of an RFID substrate. The antennas can be adjusted to resonance at about a half-wavelength of an applied electromagnetic field in the conductive material of the antennas. The antennas can be shorted together using a shorting path, the position of which can be adjusted to adjust an input impedance of the antenna structure. A shorting stub can be used to couple the antenna structure to a supply voltage connection of an RFID device used for the tag. The overall length of the shorting stub can be adjusted to match the impedance of the antenna structure to the impedance of the RFID device. These antenna structures can be used with RFID devices such as CDIP devices and bumped die packages.

20 Claims, 4 Drawing Sheets





US007262735B2

(12) **United States Patent**
Noe

(10) **Patent No.:** **US 7,262,735 B2**
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **SNAP-IN ANTENNA ASSEMBLY FOR WIRELESS RADIO CIRCUIT CARD**

(75) Inventor: **Gary L. Noe**, Lexington, KY (US)

(73) Assignee: **Lexmark International, Inc.**, Lexington, KY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 153 days.

(21) Appl. No.: **10/999,110**

(22) Filed: **Nov. 29, 2004**

(65) **Prior Publication Data**

US 2006/0114160 A1 Jun. 1, 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, 893; 455/269**

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Thuy V. Tran

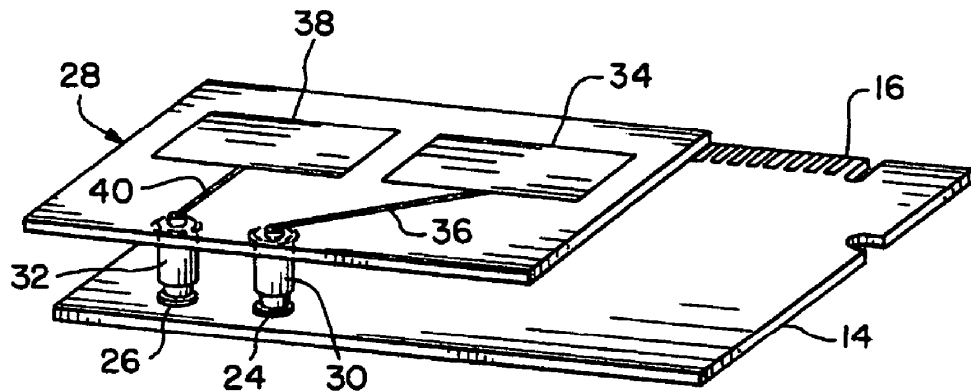
Assistant Examiner—Dieu Hien T Duong

(74) *Attorney, Agent, or Firm*—Todd T. Taylor, Esq.

(57) **ABSTRACT**

An electronic wireless communication system includes an electronic device with a plug-in circuit card. The plug-in circuit card includes a wireless radio circuit and at least one on-board coaxial connector coupled with the wireless radio circuit. An antenna card includes at least one antenna and at least one on-board coaxial connector. At least one of the on-board coaxial connectors on the antenna card is coupled with a corresponding antenna. Each on-board coaxial connector on the antenna card is also coupled with a mating on-board coaxial connector on the plug-in circuit card.

29 Claims, 2 Drawing Sheets





US007262737B2

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

(10) **Patent No.:** **US 7,262,737 B2**
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **EXTENDABLE ANTENNA ARCHITECTURE**
(75) Inventors: **Arthur Zarnowitz**, San Jose, CA (US);
Weiping Dou, Milpitas, CA (US);
Chrome Cebe, San Jose, CA (US)

5,918,163	A *	6/1999	Rossi	455/558
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6,618,013	B1	9/2003	Aldous	
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2004/0185808	A1 *	9/2004	Chow	455/127.2

(73) Assignee: **Palm, Inc.**, Sunnyvale, CA (US)

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

EP	1265369	A1	6/2001
EP	1309156	A1	5/2003
EP	1422787	A1	11/2003
JP	04-253927		9/2004
WO	2007022098	A1	8/2006

(21) Appl. No.: **11/204,280**

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(22) Filed: **Aug. 15, 2005**

Primary Examiner—Tho Phan

(65) **Prior Publication Data**

(74) Attorney, Agent, or Firm—Kacvinsky LLC

US 2007/0035454 A1 Feb. 15, 2007

(57) **ABSTRACT**

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702**; 343/901; 455/575.7
(58) **Field of Classification Search** 343/702,
343/700 MS, 900, 901; 455/558, 575.7
See application file for complete search history.

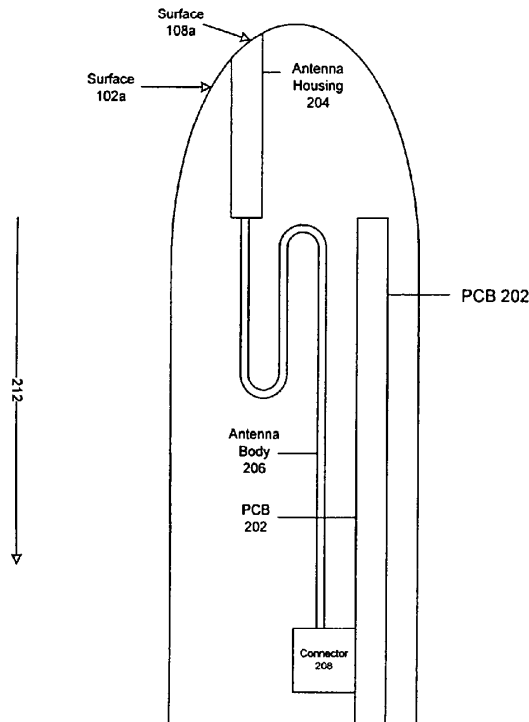
A system and apparatus for an extendable antenna architecture are described. The apparatus may include an antenna body having one or more antenna traces, and an antenna housing to couple to the antenna body. The antenna housing may have an extended position and a retracted position. The antenna housing may have a first external surface forming a substantially continuous plane with a second external surface for a device housing when in the retracted position. Other embodiments are described and claimed.

(56) **References Cited**

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29 Claims, 8 Drawing Sheets





US007262738B2

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

(10) **Patent No.:** **US 7,262,738 B2**
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **MULTI-MODE ANTENNA AND MULTI-BAND ANTENNA COMBINATION**

(56) **References Cited**

(75) Inventors: **David Ho**, Taipei (TW); **Dian Gu**, Shanghai (CN); **Chih-Chung Hung**, Shanghai (CN)

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(73) Assignee: **Inventec Appliances Corp.**, Taipei (TW)

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

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Primary Examiner—Hoanganh Le
Assistant Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Bacon & Thomas, PLLC

(21) Appl. No.: **11/167,476**

(22) Filed: **Jun. 28, 2005**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2006/0050009 A1 Mar. 9, 2006

The present invention is to provide a combination antenna having multi-mode and multi-band arrangements, which comprises a conductive seat; a non-uniform helical antenna extending from one end of the conductive seat; and a pole antenna extending from one end of the conductive seat through the helical antenna, enabling to be tuned to three or more resonant frequencies through tuning the helical antenna to a plurality of resonant frequencies and tuning the pole antenna to a plurality of resonant frequencies different from that to which the helical antenna is tuned.

(30) **Foreign Application Priority Data**

Sep. 8, 2004 (TW) 93127158 A

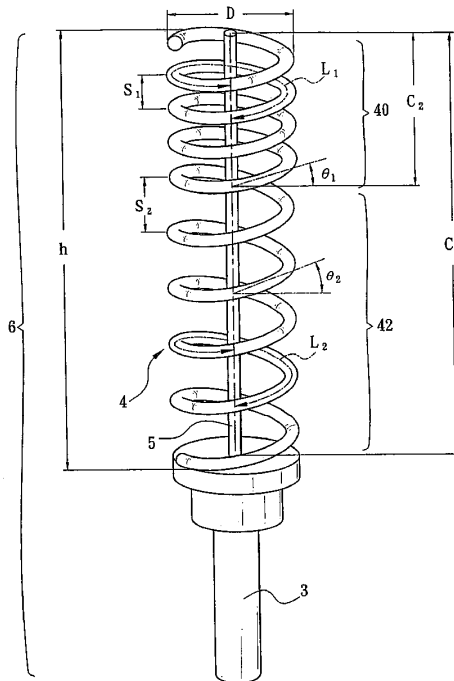
(51) **Int. Cl.**
H01Q 21/00 (2006.01)

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

(58) **Field of Classification Search** **343/725, 343/702, 895, 790, 792; 455/550, 899**

See application file for complete search history.

6 Claims, 5 Drawing Sheets





US007262739B2

(12) **United States Patent**
Chen

(10) **Patent No.:** **US 7,262,739 B2**
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **MONOPOLE ANTENNAS** 6,809,687 B2 * 10/2004 Yuanzhu 343/700 MS

(75) Inventor: **Chih-Lung Chen**, Taipei (TW)

FOREIGN PATENT DOCUMENTS

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

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 55 days.

Maria A. Stuchly et al., "Modeling Antenna Close to the Human Body," *IEEE*, vol. 5, 2000, pp. 83-89, USA.

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(21) Appl. No.: **11/313,867**

Primary Examiner—Hoang V. Nguyen

(22) Filed: **Dec. 20, 2005**

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

(65) **Prior Publication Data**

(57) **ABSTRACT**

US 2007/0030199 A1 Feb. 8, 2007

(30) **Foreign Application Priority Data**

Aug. 3, 2005 (TW) 94126332 A

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

(52) **U.S. Cl.** **343/725; 343/700 MS; 343/702**

(58) **Field of Classification Search** **343/700 MS, 343/702, 846, 725**

See application file for complete search history.

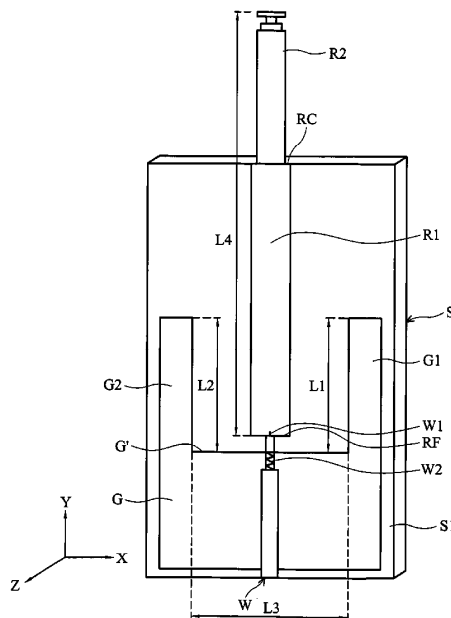
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Monopole antennas are provided. A monopole antenna transmitting radio signals within a specific frequency range includes a substrate, a ground, a first sleeve portion, a second sleeve portion, a first conductive element, a second conductive element and a cable. The first conductive element and the ground are formed on the substrate. The first and second sleeves electrically connect the ground and project from a side of the ground in a first direction. The first conductive element comprises a feed end and a connection portion adjacent to an edge of the substrate. The second conductive element connects the connection portion and projects from the edge of the substrate substantially in the first direction. The cable connects the ground and the feed end to transmit the radio signal.

25 Claims, 12 Drawing Sheets





US007262740B2

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

(10) **Patent No.:** **US 7,262,740 B2**
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **SMALL PLANAR ANTENNA WITH ENHANCED BANDWIDTH AND SMALL RECTENNA FOR RFID AND WIRELESS SENSOR TRANSPONDER**

WO WO 03/094293 A1 11/2003
WO WO 2004/047222 A1 6/2004

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(75) Inventors: **Yuri Tikhov**, Suwon-si (KR);
Young-hoon Min, Anyang-si (KR);
Yong-jin Kim, Seoul (KR)

Azadegan R et al., "Design of miniaturized slot antennas", IEEE Antennas and Propagation Society International Symposium. 2001 Digest. APS. Boston, MA, Jul. 8-13, 2001, New York, NY: IEEE, US, vol. 1 of 4, Jul. 8, 2001, pp. 565-568, XP010564702.

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

McLean J S: "A Re-Examination of the Fundamental Limits on the Radiation Q of Electrically Small Antennas", IEEE Transactions on Antennas and Propagation, IEEE Inc. New York, US, vol. 44, No. 5, May 1, 1996, pp. 672-675, XP000584236.

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 75 days.

L. J. Chu, "Physical Limitations of Omni-Directional Antennas", Massachusetts Institute of Technology, Research Library of Electronics, Boston, Massachusetts, received May 27, 1948, vol. 19, Dec. 1948, pp. 1163-1165.

(21) Appl. No.: **11/207,724**

Harold A. Wheeler et al., "Fundamental Limitations of Small Antennas", Proceedings of the I.R.E., decimal classification: R120, original manuscript received by the Institute, Nov. 11, 1946, presented at the I.R.E. national Convention, Mar. 6, 1947, pp. 1479-1484.

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

(65) **Prior Publication Data**

US 2006/0038724 A1 Feb. 23, 2006

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(30) **Foreign Application Priority Data**

Aug. 21, 2004 (KR) 10-2004-0066159
Mar. 30, 2005 (KR) 10-2005-0026496

Primary Examiner—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

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

(57) **ABSTRACT**

(52) **U.S. Cl.** **343/770; 343/768**

(58) **Field of Classification Search** **343/767, 343/770, 768**

See application file for complete search history.

A small planar antenna with an enhanced bandwidth and a small rectenna for RFID (Radio Frequency Identification) and wireless sensor transponder are provided. The small planar antenna includes a dielectric substrate, a metal layer formed on an upper part of the dielectric substrate, a main slot formed in pattern on the metal layer, and a plurality of sub-slots connected to the main slot and winding in a specified direction, and the plurality of sub-slots form a pair of symmetric sub-slot groups around the main slot. According to the small planar antenna, the antenna region that substantially takes part in the radiation is substantially increased, and thus an enhanced bandwidth can be obtained without affecting the radiation pattern, radiation efficiency, polarization purity, etc., of the antenna.

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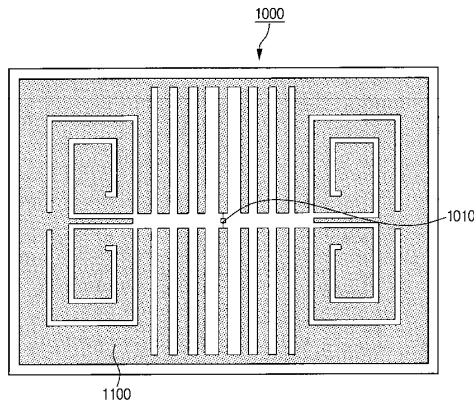
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2005/0285809 A1 * 12/2005 Louzir et al. 343/770

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WO WO 03/044892 A1 3/2003

9 Claims, 14 Drawing Sheets





US007262741B2

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

(10) **Patent No.:** **US 7,262,741 B2**
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **ULTRA WIDEBAND ANTENNA**

(75) Inventors: **Dragan Krupezevic**, Stuttgart (DE);
Mohamed Ratni, Esslingen (DE)
(73) Assignee: **Sony Deutschland GmbH**, Koeln (DE)
(*) 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.: **11/291,406**

(22) Filed: **Dec. 1, 2005**

(65) **Prior Publication Data**
US 2006/0119529 A1 Jun. 8, 2006

(30) **Foreign Application Priority Data**
Dec. 3, 2004 (EP) 04028746

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 21/26 (2006.01)
H01Q 9/38 (2006.01)
(52) **U.S. Cl.** 343/770; 343/797; 343/830
(58) **Field of Classification Search** 343/732,
343/769, 770, 793, 797, 830
See application file for complete search history.

(56) **References Cited**

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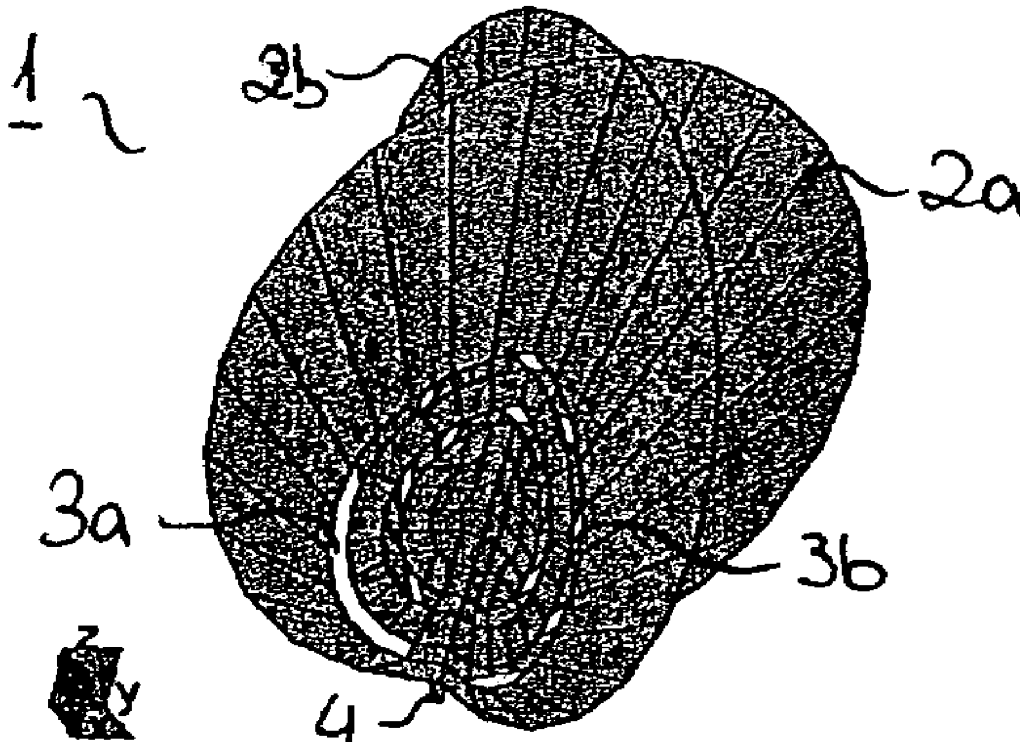
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Primary Examiner—Shih-Chao Chen
(74) *Attorney, Agent, or Firm*—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

(57) **ABSTRACT**

An ultra wideband antenna includes at least one radiator for transmitting and/or receiving an electromagnetic wave, the radiator having a planar elliptical shape for the whole UWB frequency band and one having at least one elliptical gap for omitting the transmission and reception of an electromagnetic wave at a predefined wavelength λ , whereby the length of the gap depends on the predefined wavelength λ .

17 Claims, 5 Drawing Sheets





US007262745B2

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

(10) **Patent No.:** US 7,262,745 B2
(45) **Date of Patent:** Aug. 28, 2007

(54) **ANTENNA UNIT** 6,784,850 B2 * 8/2004 Morooka et al. 343/895

(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 11 days.

(21) Appl. No.: **11/318,407**

(22) Filed: **Dec. 22, 2005**

(65) **Prior Publication Data**
US 2006/0202901 A1 Sep. 14, 2006

(30) **Foreign Application Priority Data**
Mar. 10, 2005 (JP) 2005-066652

(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** 343/702, 343/700 MS, 872, 895
See application file for complete search history.

(56) **References Cited**
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Related U.S. Appl. No. 11/318,408, filed Dec. 22 2005; Inventor: J. Noro et al.

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.

(57) **ABSTRACT**

An antenna unit comprises a hollow cylindrical member obtained by forming a flexible insulating film member into a hollow cylinder, an antenna pattern composed of at least one conductor formed at the hollow cylindrical member, and a board mounted with a low-noise amplifier. A hollow cylindrical cover case covers the hollow cylindrical member and the board. A cable having one end is connected to the low-noise amplifier and extends downward from a lower end of the cover case. The antenna unit further comprises an undercap attached to the lower end of the cover case and a packing press-fitted into the undercap. The board is inserted in the packing.

9 Claims, 12 Drawing Sheets

