



US007304611B2

(12) **United States Patent**
Yuanzhu

(10) **Patent No.:** **US 7,304,611 B2**
(45) **Date of Patent:** **Dec. 4, 2007**

(54) **ANTENNA SYSTEM WITH HIGH GAIN FOR RADIO WAVES POLARIZED IN PARTICULAR DIRECTION**

4,672,386	A *	6/1987	Wood	343/770
6,735,849	B2 *	5/2004	Cheng et al.	29/600
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2003/0016179	A1 *	1/2003	Boyle	343/702

(75) Inventor: **Dou Yuanzhu**, Fukushima-ken (JP)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 77 days.

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JP	A-08-213832	8/1996
JP	A-10-093332	4/1998

(21) Appl. No.: **10/870,641**

(22) Filed: **Jun. 17, 2004**

(65) **Prior Publication Data**

US 2004/0263400 A1 Dec. 30, 2004

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Primary Examiner—Hoang V. Nguyen

(74) *Attorney, Agent, or Firm*—Brink Hofer Gilson & Lione

(30) **Foreign Application Priority Data**

Jun. 26, 2003	(JP)	2003-182957
Sep. 1, 2003	(JP)	2003-308961

(57) **ABSTRACT**

In an antenna system, a short-circuiting conductive plate and a power-supply conductive plate are bent at the center region of a metal plate so as to be perpendicular to the planar surface of the metal plate. The remaining metal plate excluding the short-circuiting conductive plate and the power-supply conductive plate constitutes the emission conductive plate. The antenna system is mounted on a ground plane and the emission conductive plate is disposed parallel to the ground plane. The bottom end of the short-circuiting conductive plate is soldered to the ground plane and the bottom end of the power-supply conductive plate is connected to a power-supply circuit.

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/48 (2006.01)

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

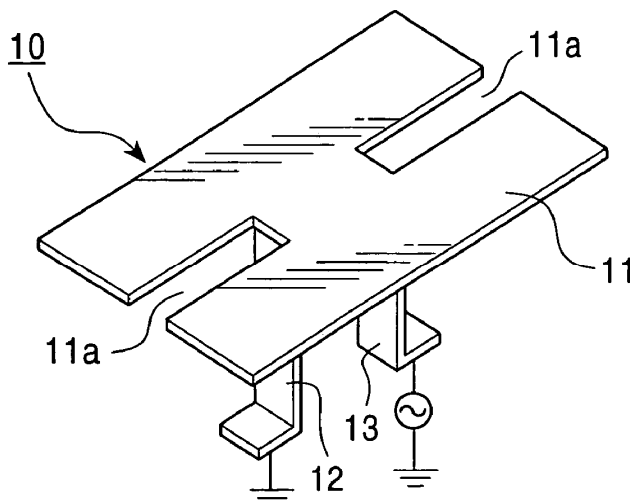
(58) **Field of Classification Search** 343/767-769, 343/846, 845, 702, 700 MS, 713
See application file for complete search history.

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30 Claims, 6 Drawing Sheets





US007304612B2

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

(10) **Patent No.:** **US 7,304,612 B2**
(45) **Date of Patent:** **Dec. 4, 2007**

(54) **MICROSTRIP ANTENNA WITH INTEGRAL FEED AND ANTENNA STRUCTURES**

(75) Inventors: **John Grabner**, Plano, TX (US);
Richard Smith, Dallas, TX (US); **Ed Condon**, Murphy, TX (US)

(73) Assignee: **Navini Networks, Inc.**, Richardson, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 78 days.

(21) Appl. No.: **11/214,505**

(22) Filed: **Aug. 30, 2005**

(65) **Prior Publication Data**
US 2007/0035449 A1 Feb. 15, 2007

Related U.S. Application Data

(60) Provisional application No. 60/707,469, filed on Aug. 10, 2005.

(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, 846

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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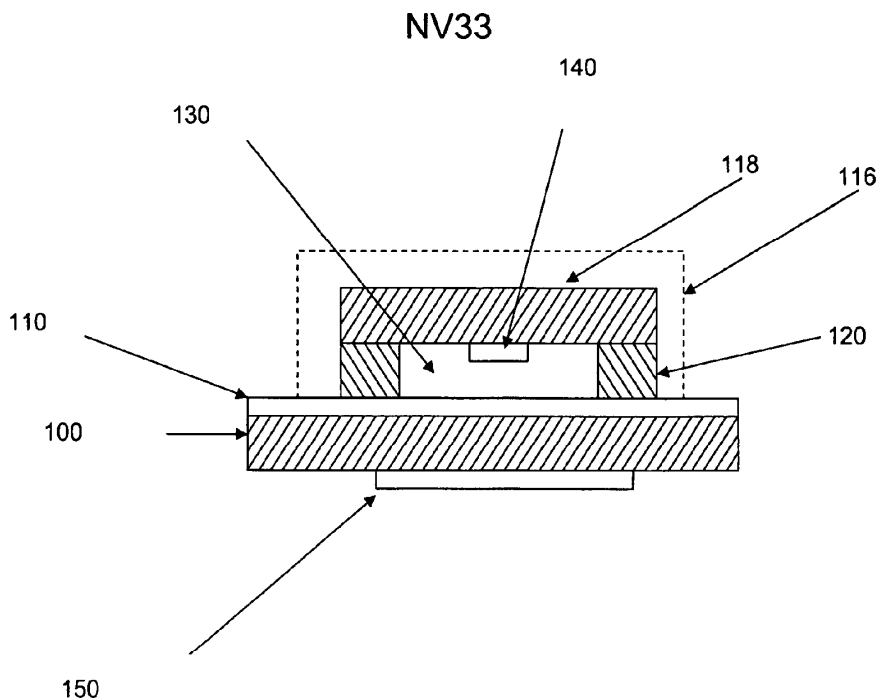
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—K & L Gates

(57) **ABSTRACT**

A method and system is disclosed for a microstrip antenna module having an antenna structure with one or more radiating elements and an integral feed structure enclosing at least one transmission line, wherein the antenna structure and the feed structure share a ground plane.

13 Claims, 1 Drawing Sheet





US007304613B2

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

(10) **Patent No.:** **US 7,304,613 B2**
(45) **Date of Patent:** **Dec. 4, 2007**

(54) **BOWTIE MONOPOLE ANTENNA AND COMMUNICATION DEVICE USING SAME**

(75) Inventors: **Adam R. Aron**, Ft. Lauderdale, FL (US); **Paul M. Greco**, Parkland, FL (US); **Jan-Ove U. Mattsson**, Plantation, FL (US); **Lorenzo Ponce De Leon**, Lake Worth, FL (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 51 days.

(21) Appl. No.: **10/872,860**

(22) Filed: **Jun. 21, 2004**

(65) **Prior Publication Data**
US 2005/0280584 A1 Dec. 22, 2005

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

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

(58) **Field of Classification Search** **343/702, 343/895; 455/575.7**

See application file for complete search history.

(56) **References Cited**

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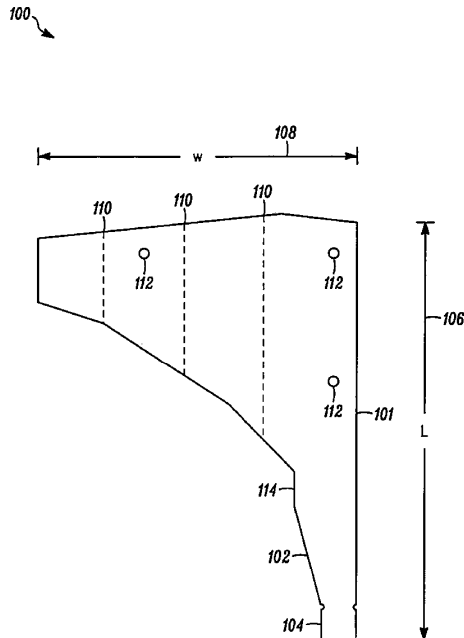
Primary Examiner—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Scott M. Garrett

(57) **ABSTRACT**

A bowtie monopole antenna is fabricated of a sheet metal radiating body **102** that is triangular shaped, and having a longitudinal dimension and axis (**106**) and a width (**108**). One corner of the radiating body is tapered to form a feed point (**104**). The length dimension determines the antenna's lowest resonance frequency while the taper created by the width determines the highest point of resonance. For using the bowtie monopole antenna in a communication device, the radiating body (**102**) is folded or wrapped around towards itself To facilitate the folding or wrapping a mounting substrate (**202**) is used. The substrate may be provided with retaining features (**206**) to capture the antenna assembly within the communication device.

12 Claims, 5 Drawing Sheets





US007304615B2

(12) **United States Patent**
Nakamura

(10) **Patent No.:** **US 7,304,615 B2**
(45) **Date of Patent:** **Dec. 4, 2007**

(54) **WIDEBAND RECEIVING ANTENNA DEVICE**

4,805,232 A * 2/1989 Ma 455/291
6,529,169 B2 * 3/2003 Justice 343/788
7,123,206 B2 * 10/2006 Hess et al. 343/788

(75) Inventor: **Yusuke Nakamura**, Fukushima-ken (JP)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **ALPS Electric Co., Ltd.**, Ota-Ku, Tokyo (JP)

JP 51-83755 7/1976
JP 2005-210564 8/2005

(*) 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—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Beyer Weaver LLP

(21) Appl. No.: **11/523,264**

(57) **ABSTRACT**

(22) Filed: **Sep. 18, 2006**

An antenna device includes a substrate formed of a dielectric body or a magnetic body, first to third radiation conductors wound in spirals around outer circumferential surfaces of the substrate, a plurality of capacitance elements spread over the first radiation conductor and the second radiation conductor, and a high-frequency switch interposed between feed ends. The feed ends are selectively connected to a high-frequency circuit via the high-frequency switch connected to a tuner. Since the total length of the second and third radiation conductors connected in series with each other is longer than that of the first radiation conductor, the first radiation conductor is capable of resonating in a high band and the second and third radiation conductors are capable of resonating in a low band. By changing the capacitances of the variable capacitance elements from the tuner side, a resonant frequency can be changed within a selected frequency band.

(65) **Prior Publication Data**

US 2007/0115197 A1 May 24, 2007

(30) **Foreign Application Priority Data**

Nov. 22, 2005 (JP) 2005-337483

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

(52) **U.S. Cl.** **343/788; 343/895**

(58) **Field of Classification Search** **343/787, 343/788, 895, 742, 743, 867**

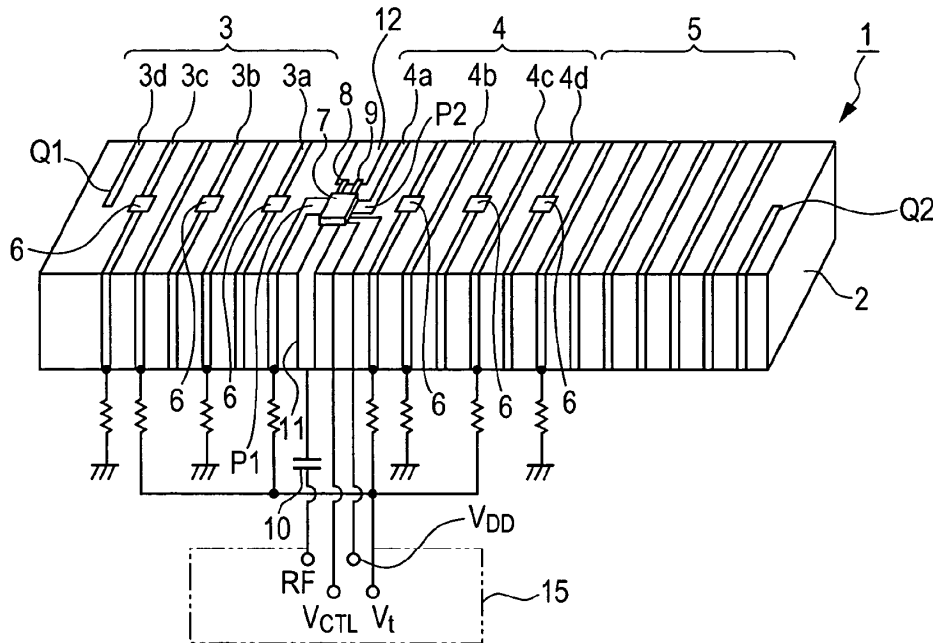
See application file for complete search history.

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4 Claims, 3 Drawing Sheets





US007304616B1

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

(10) **Patent No.:** **US 7,304,616 B1**
(45) **Date of Patent:** **Dec. 4, 2007**

(54) **ANTENNA STRUCTURE OF MOBILE PHONE**

2005/0088351 A1* 4/2005 Tai et al. 343/702
2007/0109196 A1* 5/2007 Tang et al. 343/700 MS

(75) Inventors: **Hung Jen Chen**, Tu-Cheng (TW); **Jia Hung Su**, Tu-Cheng (TW); **Jhao Huei Yu**, Tu-Cheng (TW); **Yu Yuan Wu**, Tu-Cheng (TW)

* cited by examiner

Primary Examiner—Shih-Chao Chen

(73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, Taipei Hsien (TW)

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

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

(57) **ABSTRACT**

An antenna structure includes an antenna portion having an antenna defining a feeding point and a grounding point, and a grounding portion electrically connecting with the grounding point of the antenna. The grounding portion defines a basic board. The basic board is bent upwardly from edges thereof to form a first extending portion. The first extending portion is bent inwardly from a top edge thereof to form a second extending portion approximately paralleling with the basic board. Through the first and second extending portions, the area of the grounding portion is extended. And the electric field is widely distributed all over the whole grounding portion including the basic board and the first and second extending portions to decrease the SAR of the antenna.

(21) Appl. No.: **11/510,810**

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

(51) **Int. Cl.**
H01Q 1/48 (2006.01)
H01Q 1/38 (2006.01)

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

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

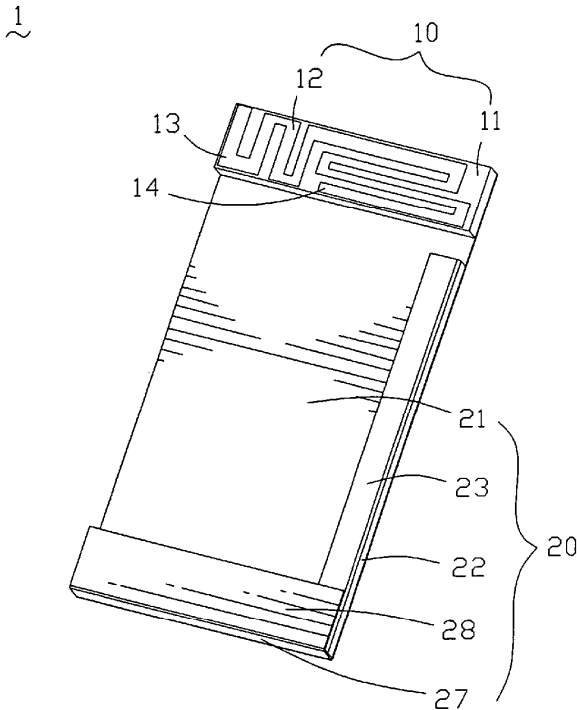
See application file for complete search history.

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5 Claims, 4 Drawing Sheets





US007305935B1

(12) **United States Patent**
Foster

(10) **Patent No.:** **US 7,305,935 B1**
(45) **Date of Patent:** **Dec. 11, 2007**

(54) **SLOTTED ANTENNA WAVEGUIDE PLASMA SOURCE**

(75) Inventor: **John Foster**, Strongsville, OH (US)

(73) Assignee: **The United States of America as represented by the Administration of NASA**, Washington, DC (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.: **10/925,499**

(22) Filed: **Aug. 25, 2004**

(51) **Int. Cl.**
C23C 16/00 (2006.01)
C23F 1/00 (2006.01)
H01L 21/306 (2006.01)

(52) **U.S. Cl.** **118/723 MA**; 118/723 MW;
156/345.41; 156/345.42

(58) **Field of Classification Search** 118/723 MW,
118/723 MA, 723 MR; 156/345.36, 345.41,
156/345.42, 345.46, 345.49

See application file for complete search history.

(56) **References Cited**

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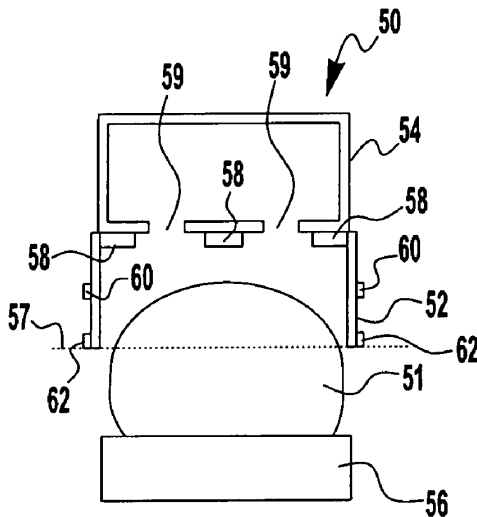
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Primary Examiner—Parviz Hassanzadeh
Assistant Examiner—Rakesh K. Dhingra
(74) *Attorney, Agent, or Firm*—Howard M Cohn

(57) **ABSTRACT**

A high density plasma generated by microwave injection using a windowless electrodeless rectangular slotted antenna waveguide plasma source has been demonstrated. Plasma probe measurements indicate that the source could be applicable for low power ion thruster applications, ion implantation, and related applications. This slotted antenna plasma source invention operates on the principle of electron cyclotron resonance (ECR). It employs no window and it is completely electrodeless and therefore its operation lifetime is long, being limited only by either the microwave generator itself or charged particle extraction grids if used. The high density plasma source can also be used to extract an electron beam that can be used as a plasma cathode neutralizer for ion source beam neutralization applications.

5 Claims, 5 Drawing Sheets





US007307494B2

(12) **United States Patent**
Erb

(10) **Patent No.:** **US 7,307,494 B2**
(45) **Date of Patent:** **Dec. 11, 2007**

(54) **MULTI-BRANCH ANTENNA SIGNAL SEPARATING DEVICE**

6,982,612 B2* 1/2006 Sakano 333/133

(75) Inventor: **Jean-Luc Erb**, Horbourg-Wihr (FR)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **TDK Corporation**, Tokyo (JP)

EP 0 871 288 10/1998
EP 0 872 953 10/1998

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 42 days.

* cited by examiner

(21) Appl. No.: **11/090,709**

Primary Examiner—Robert Pascal
Assistant Examiner—Kimberly E Glenn
(74) *Attorney, Agent, or Firm*—Darby & Darby

(22) Filed: **Mar. 25, 2005**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2005/0219010 A1 Oct. 6, 2005

(30) **Foreign Application Priority Data**

Mar. 30, 2004 (EP) 04007634

(51) **Int. Cl.**
H01P 5/12 (2006.01)
H03H 7/38 (2006.01)

One aspect of the invention provides a signal separating device comprising a first and a second circuit branch connected to an antenna port, the first circuit branch comprising a filter for passing signals in a first frequency band, and the second circuit branch comprising a filter for passing signals in a second frequency band. The first and second circuit branches being arranged so that a respective reactive impedance is presented to the antenna port in both said first and said second frequency bands. The device further comprises an impedance matching circuit at the antenna port arranged to substantially to cancel out the respective reactive impedances. In the preferred embodiment, each circuit branch presents a respective shunt capacitance to the antenna port when out-of-band and the matching circuit comprises a shunt inductor at the antenna port.

(52) **U.S. Cl.** 333/126; 333/129; 333/132

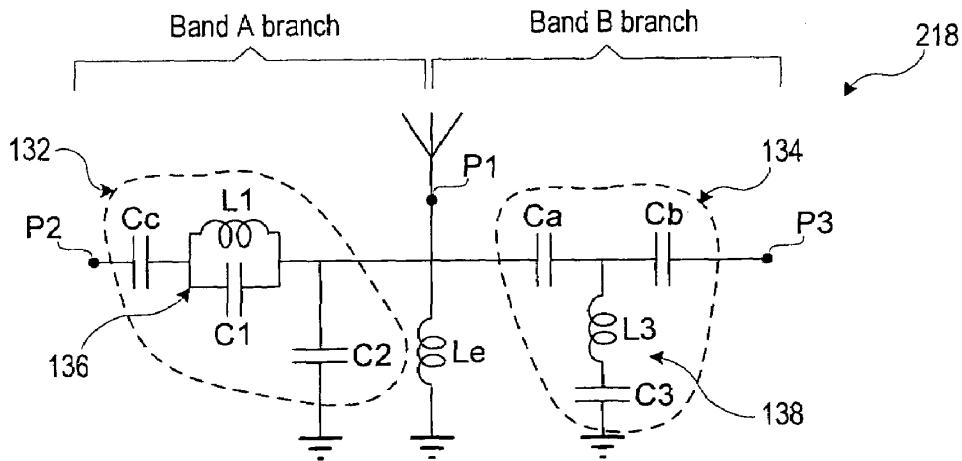
(58) **Field of Classification Search** 333/126, 333/129, 132, 32, 33
See application file for complete search history.

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9 Claims, 2 Drawing Sheets





US007307588B2

(12) **United States Patent**
Tseng

(10) **Patent No.:** **US 7,307,588 B2**
(45) **Date of Patent:** **Dec. 11, 2007**

(54) **ULTRA WIDE BANDWIDTH PLANAR ANTENNA**

(75) Inventor: **Kuo-Hua Tseng, Kaohsiung Hsien (TW)**

(73) Assignee: **Universal Scientific Industrial Co., Ltd., Nan-Tou Hsien (TW)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 36 days.

(21) Appl. No.: **11/281,639**

(22) Filed: **Nov. 16, 2005**

(65) **Prior Publication Data**
US 2007/0109195 A1 May 17, 2007

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

(52) **U.S. Cl.** **343/700 MS; 343/829; 343/830; 343/725; 343/729**

(58) **Field of Classification Search** **343/700 MS; 343/767, 770, 793, 795, 810, 865, 846, 859**
See application file for complete search history.

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Primary Examiner—Douglas W. Owens

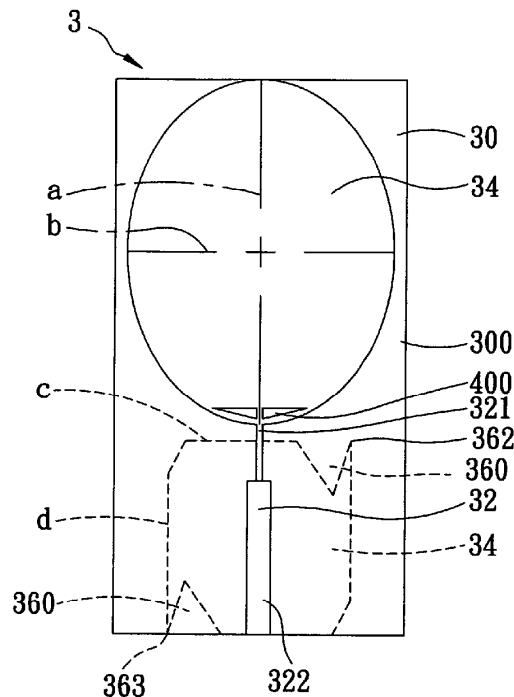
Assistant Examiner—Chuc Tran

(74) *Attorney, Agent, or Firm*—Ladas & Parry, LLP

(57) **ABSTRACT**

A planar antenna, which is operable within the ultra wide bandwidth, includes a dielectric substrate, an elliptical radiating element, a feeding element, and a grounding element. The dielectric substrate has opposite first and second surfaces. The elliptical radiating element is formed on the first surface of the dielectric substrate, and has major and minor axes. The ratio of the major axis to the minor axis is between 1.25 and 1.7. The feeding element is formed on the first surface of the dielectric substrate, and is coupled to the radiating element. The grounding element is formed on the second surface of the dielectric substrate, and is coupled to the feeding element.

21 Claims, 9 Drawing Sheets





US007307590B1

(12) **United States Patent**
Tonn

(10) **Patent No.:** **US 7,307,590 B1**
(45) **Date of Patent:** **Dec. 11, 2007**

- (54) **WIDEBAND TRAVELING WAVE MICROSTRIP ANTENNA**
- (75) Inventor: **David A. Tonn**, Charlestown, RI (US)
- (73) Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, DC (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 34 days.

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Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—James M. Kasischke; Jean-Paul A. Nasser; Michael P. Stanley

(21) Appl. No.: **11/444,810**

(22) Filed: **May 19, 2006**

(57) **ABSTRACT**

- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 13/12 (2006.01)
H01Q 1/48 (2006.01)
- (52) **U.S. Cl.** **343/700 MS**; 343/769; 343/846
- (58) **Field of Classification Search** 343/700 MS, 343/769, 770, 846, 848
See application file for complete search history.

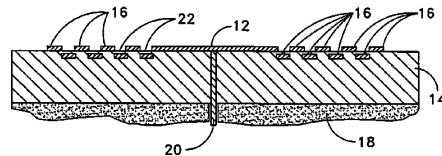
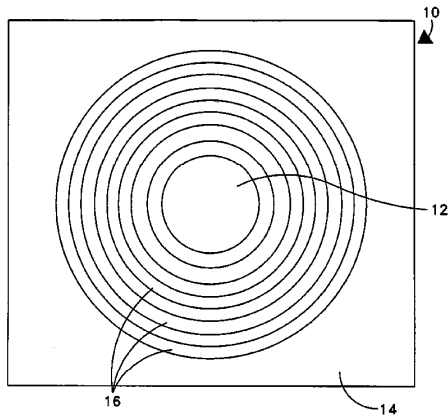
The present invention by propagates a traveling wave of electric current along a microstrip antenna structure rather than a standing wave. By loading an antenna with a series of capacitive gaps of the correct values, the shape of the electric current distribution can be tailored to suppress the resonant properties of the antenna, specifically the standing wave of electric current that normally forms along the antenna structure. A microstrip antenna having a “bull’s-eye target” structure comprised of a center disk and concentrically larger capacitively coupled annular sections will tailor the shape of the electric current distribution to achieve a suppression of the resonant properties of the antenna, thereby increasing the antenna bandwidth.

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1 Claim, 1 Drawing Sheet





US007307591B2

(12) **United States Patent**
Zheng

(10) **Patent No.:** **US 7,307,591 B2**
(45) **Date of Patent:** **Dec. 11, 2007**

- (54) **MULTI-BAND ANTENNA**
- (75) Inventor: **Ming Zheng**, Farnborough (GB)
- (73) Assignee: **Nokia Corporation**, Espoo (FI)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
- (21) Appl. No.: **10/896,212**
- (22) Filed: **Jul. 20, 2004**
- (65) **Prior Publication Data**
US 2006/0017635 A1 Jan. 26, 2006
- (51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 9/00 (2006.01)
H01Q 7/00 (2006.01)
- (52) **U.S. Cl.** **343/702; 343/745; 343/748**
- (58) **Field of Classification Search** **343/745, 343/749, 750, 700 MS, 748, 702**
See application file for complete search history.
- (56) **References Cited**

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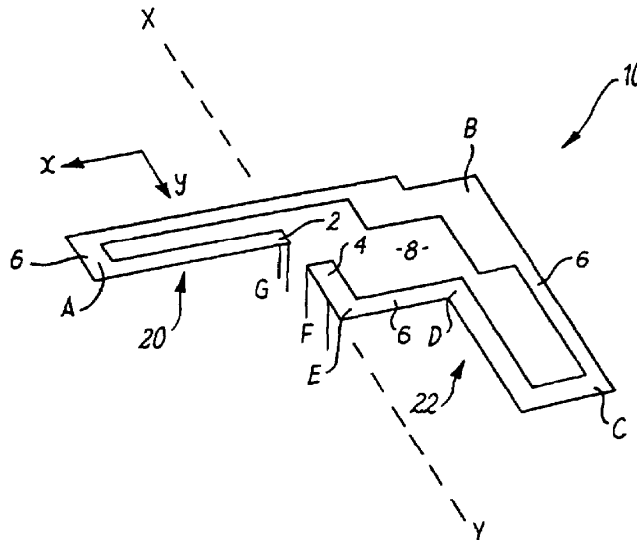
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Primary Examiner—Don Wong
Assistant Examiner—Angela M Lie
 (74) *Attorney, Agent, or Firm*—Harrington & Smith, PC

(57) **ABSTRACT**

An antenna having a plurality of resonant frequencies and comprising a feed point, a ground point and a conductive track that extends from the feed point and returns to the ground point and means for locally increasing the reactance of the antenna track at a first position coincident with a maximum electromagnetic field associated with at least one of the plurality of resonant frequencies.

31 Claims, 4 Drawing Sheets





US007307597B2

(12) **United States Patent**
Okayama

(10) **Patent No.:** **US 7,307,597 B2**
(45) **Date of Patent:** **Dec. 11, 2007**

- (54) **ANTENNA**
- (75) Inventor: **Motoyuki Okayama**, Takatsuki (JP)
- (73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka (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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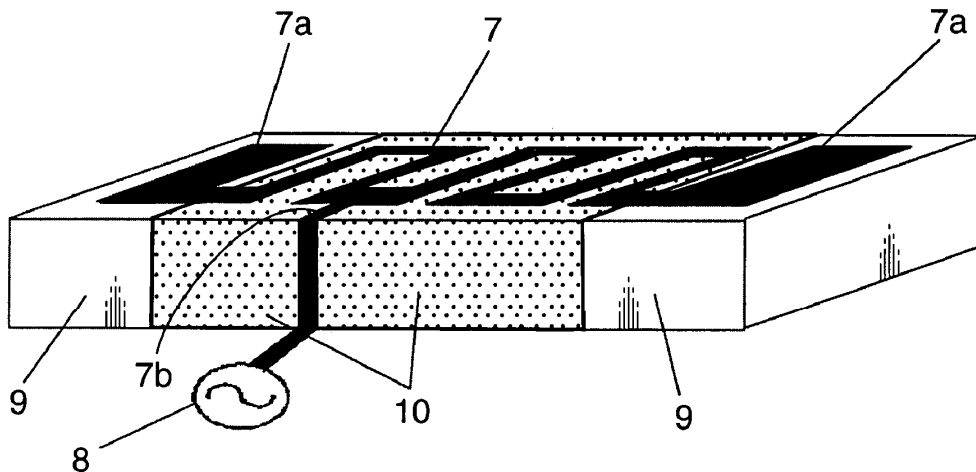
- (21) Appl. No.: **11/080,930**
- (22) Filed: **Mar. 16, 2005**
- (65) **Prior Publication Data**
US 2005/0206574 A1 Sep. 22, 2005
- (30) **Foreign Application Priority Data**
Mar. 17, 2004 (JP) 2004-076219
- (51) **Int. Cl.**
H01Q 7/08 (2006.01)
- (52) **U.S. Cl.** **343/788**
- (58) **Field of Classification Search** 343/895,
343/702, 700 MS, 785, 787, 788, 796, 802,
343/911 R
See application file for complete search history.

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Primary Examiner—Shih-Chao Chen
Assistant Examiner—Minh Dieu A
 (74) *Attorney, Agent, or Firm*—Wenderoth, Lind & Ponack L.L.P.

- (56) **References Cited**
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(57) **ABSTRACT**
 An antenna is provided which includes a radiation conductor; a basebody provided on the radiation conductor, and including a dielectric section made of a dielectric material and a magnetic section made of a magnetic material; and a power supplier connected to the radiation conductor, wherein the magnetic section is provided on a part where a current distribution of the radiation conductor is higher, and the dielectric section is provided on a part where a voltage distribution of the radiation conductor is higher.

6 Claims, 7 Drawing Sheets





US007308291B2

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

(10) **Patent No.:** **US 7,308,291 B2**
(45) **Date of Patent:** **Dec. 11, 2007**

(54) **ANTENNA FOR SENDING AND RECEIVING SIGNALS IN A PLURALITY OF FREQUENCY BANDS**

7,148,849 B2* 12/2006 Lin 343/700 MS
7,164,933 B1* 1/2007 Steigerwald et al. 455/562.1
2003/0189522 A1 10/2003 Zeilinger

(75) Inventors: **Robert Kenoun**, Palatine, IL (US);
McKay R. Johnson, Chicago, IL (US)

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

Primary Examiner—Thanh Cong Le

(74) *Attorney, Agent, or Firm*—Sylvia Chen

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 436 days.

(57) **ABSTRACT**

(21) Appl. No.: **11/013,008**

An antenna (400) for sending and receiving signals in a plurality of frequency bands generates a plurality of resonances in the plurality of frequency bands and includes a first radiating element (402) that generates a first resonance in a first frequency band, a second radiating element (404), coupled to and extending at an angle from the first radiating element (402), that generates a second resonance in the first frequency band, and a third radiating element (406), coupled to and extended at an angle from the first radiating element (402). A capacitive coupling between the second radiating element (404) and the third radiating element (406) generates a loop with a third resonance in the first frequency band, and the third radiating element (406) generates a fourth resonance in a second frequency band independent of the loop at the second frequency band.

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

(65) **Prior Publication Data**

US 2006/0128333 A1 Jun. 15, 2006

(51) **Int. Cl.**
H04B 1/38 (2006.01)

(52) **U.S. Cl.** **455/575.7; 343/702**

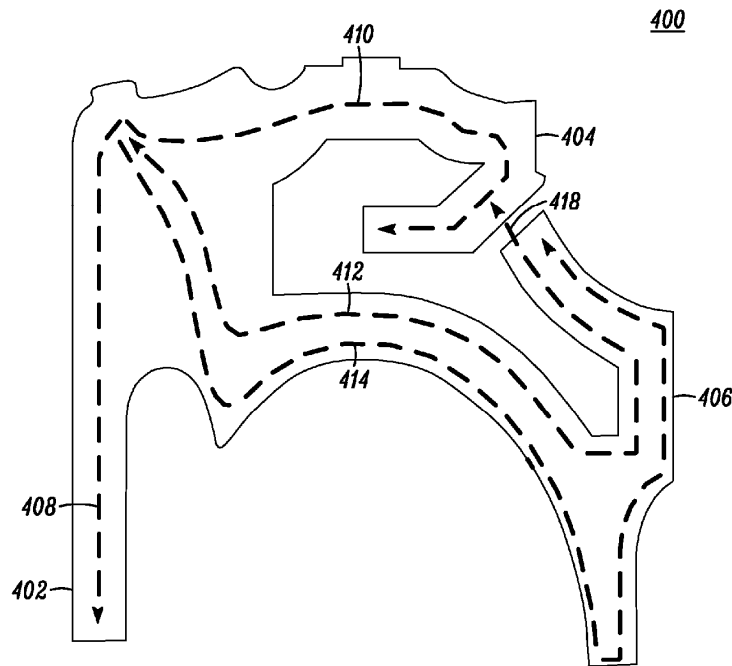
(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**

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7,030,833 B2* 4/2006 Ohara et al. 343/867

15 Claims, 10 Drawing Sheets





US007310066B1

(12) **United States Patent**
Li

(10) **Patent No.:** **US 7,310,066 B1**
(45) **Date of Patent:** **Dec. 18, 2007**

(54) **DUAL POLARIZED ANTENNA**

(75) Inventor: **Nan Lin Li**, 7F, No. 276, Sec. 1, Datong Rd., Sijhih City, Taipei County (TW)

(73) Assignees: **Wieson Technologies Co., Ltd.**, Sijhih (TW); **Nan Lin Li**, Sijhih (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.: **11/544,860**

(22) Filed: **Oct. 10, 2006**

(30) **Foreign Application Priority Data**
Sep. 1, 2006 (TW) 95132437 A

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

(52) **U.S. Cl.** **343/700 MS; 343/853**

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

(56) **References Cited**

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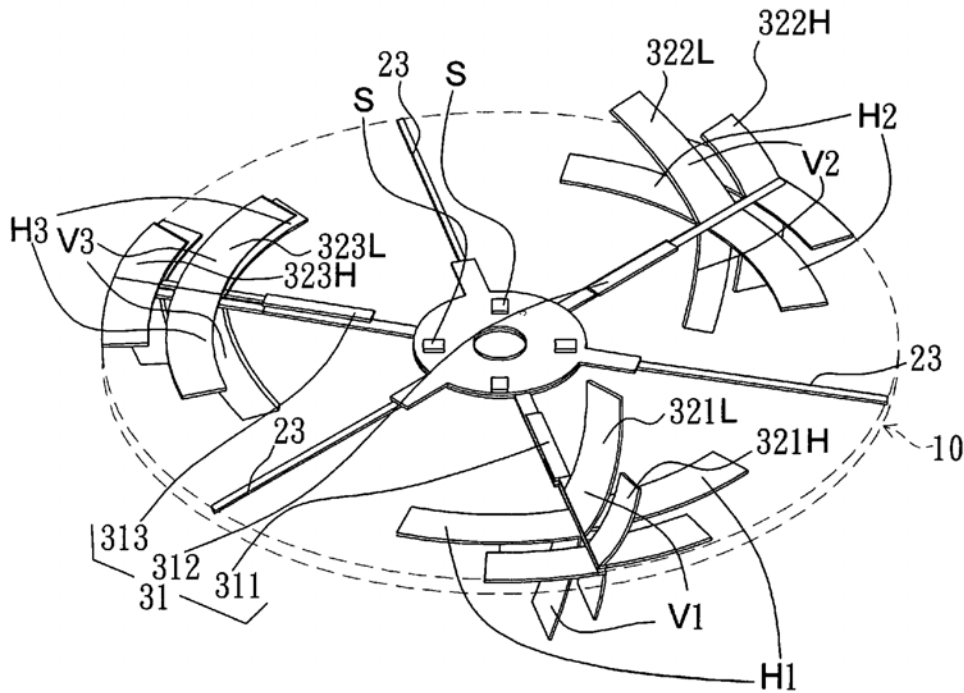
Primary Examiner—Hoang V. Nguyen

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

(57) **ABSTRACT**

The present invention relates to dual polarized antenna which is capable of simultaneously radiating electromagnetic waves in horizontal as well as vertical polarization directions for the broadest electromagnetic-wave coverage and forming an omnidirectional electromagnetic field.

4 Claims, 5 Drawing Sheets





US007310068B2

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

(10) **Patent No.:** **US 7,310,068 B2**
(45) **Date of Patent:** **Dec. 18, 2007**

(54) **CHIP ANTENNA MOUNTING APPARATUS**

(75) Inventors: **Chuan-Lin Hu**, Sijhih (TW); **Yu-Wei Chen**, Sijhih (TW); **Chang-Lun Liao**, Sijhih (TW); **Shun-Tian Lin**, Taipei (TW); **Chang-Fa Yang**, Taipei (TW); **Yen-Ming Chen**, Taipei (TW); **Chao-Wei Wang**, Taipei (TW)

(73) Assignee: **Chant Sincere Co., Ltd.**, Hsi Chih, 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.: **11/564,033**

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

(65) **Prior Publication Data**

US 2007/0194996 A1 Aug. 23, 2007

(30) **Foreign Application Priority Data**

Feb. 20, 2006 (TW) 95105666 A

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

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

(58) **Field of Classification Search** 343/700 MS, 343/878, 702, 873
See application file for complete search history.

(56) **References Cited**

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2007/0164420 A1 * 7/2007 Chen et al. 257/691

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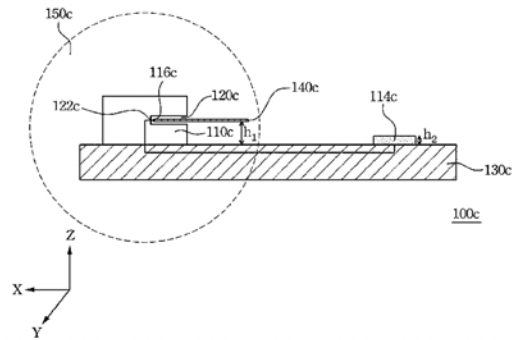
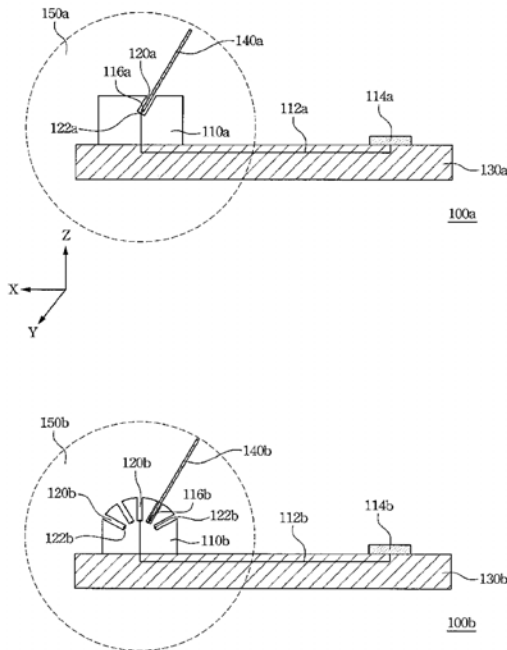
Primary Examiner—Tan Ho

(74) *Attorney, Agent, or Firm*—Thomas, Kayden, Horstemeier & Risley

(57) **ABSTRACT**

A connection apparatus for a chip antenna includes a connection base and at least one chip slot. The connection base is disposed on a circuit board and connects to the electronic components of the circuit board via a connection wire. The chip slot is disposed on the connection base for inserting the chip antenna. Thus, the chip antenna is connected to the electronic components of the circuit board via the connection wire.

24 Claims, 18 Drawing Sheets





US007310069B2

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

(10) **Patent No.:** **US 7,310,069 B2**
(45) **Date of Patent:** ***Dec. 18, 2007**

(54) **ANTENNA FOR TIRE PRESSURE MONITORING WHEEL ELECTRONIC DEVICE**

(75) Inventors: **John S. Nantz**, Brighton, MI (US);
Qingfeng Tang, Novi, MI (US);
Ronald O. King, Brownstown, MI (US);
Riad Ghabra, Dearborn Heights, MI (US)

(73) Assignee: **Lear Corporation**, Southfield, MI (US)

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/160,370**

(22) Filed: **Jun. 21, 2005**

(65) **Prior Publication Data**

US 2005/0231433 A1 Oct. 20, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/322,005, filed on Dec. 17, 2002, now Pat. No. 6,933,898.

(60) Provisional application No. 60/360,762, filed on Mar. 1, 2002.

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

(52) **U.S. Cl.** **343/711**

(58) **Field of Classification Search** 343/711,
343/712, 713, 702, 700 MS; 73/146.5, 146.4;
340/442, 445

See application file for complete search history.

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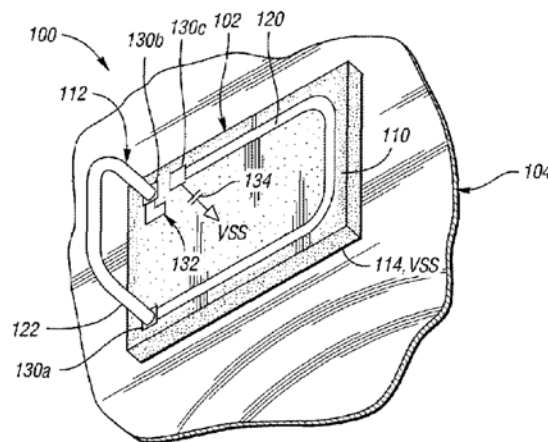
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Brooks Kushman P.C.

(57) **ABSTRACT**

An antenna system for a tire pressure monitoring radio frequency (RF) electronic device that includes a printed circuit board (PCB), a ground plane, and an active element. The PCB has a top surface and a bottom surface. The ground plane is on the bottom surface. The active element is mounted on the top surface. The active element includes a first segment positioned in a top surface plane and connected to a second segment oriented at an angle to the top surface.

20 Claims, 1 Drawing Sheet





US007310070B1

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

(10) **Patent No.:** **US 7,310,070 B1**
(45) **Date of Patent:** **Dec. 18, 2007**

(54) **RADIO FREQUENCY IDENTIFICATION SHELF ANTENNA WITH A DISTRIBUTED PATTERN FOR LOCALIZED TAG DETECTION**

5,955,951 A 9/1999 Wischerop et al.
5,959,568 A 9/1999 Woolley
5,963,134 A 10/1999 Bowers et al.

(75) Inventors: **Gordon E. Hardman**, Boulder, CO (US); **John W. Pyne**, Erie, CO (US); **Gary L. Overhultz**, River Forest, IL (US)

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(73) Assignee: **Goliath Solutions, LLC**, Deerfield, IL (US)

WO WO 2004/086337 A2 10/2004

(*) 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.: **11/508,466**

(Continued)

(22) Filed: **Aug. 23, 2006**

Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Jones Day

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

(52) **U.S. Cl.** **343/742**; 343/867; 340/10.1; 340/572.1

(58) **Field of Classification Search** 343/742, 343/867, 700 MS; 340/572.1, 10.1
See application file for complete search history.

(57) **ABSTRACT**

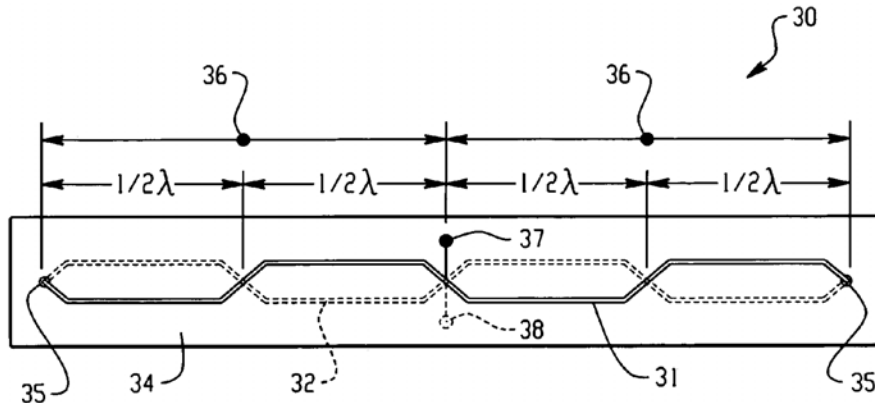
In accordance with the teachings described herein, an RFID antenna system is provided for detecting RFID tags on a display structure. The antenna system may include an antenna having an elongated conductor extending from a feeding point to a grounding point in a configuration that defines at least two loops and that has at least two conductor sections crossing each other at an intersection location between two adjacent loops, with a dielectric interposed between the conductor sections at the intersection location. The antenna may be attached to the display structure and may be located at a position on the display structure in relation to a reflective plane that allows the antenna to have a directional longitudinal radiation pattern that radiates into an area of the display structure that is configured to support a displayed item with an attached RFID tag.

(56) **References Cited**

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43 Claims, 7 Drawing Sheets





US007312754B2

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

(10) **Patent No.:** US 7,312,754 B2
(45) **Date of Patent:** Dec. 25, 2007

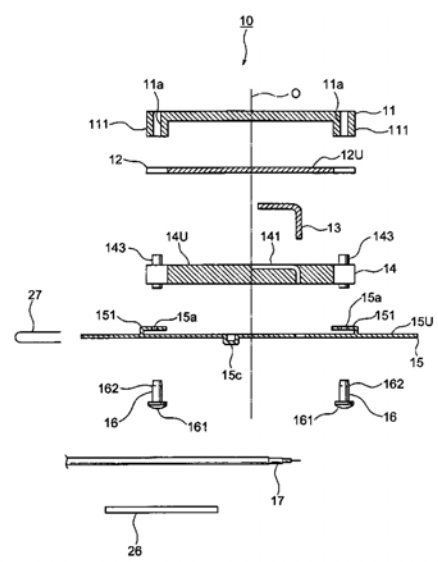
- (54) **PLANAR ANTENNA CAPABLE OF DECREASING THE NUMBER OF PARTS**
- (75) Inventors: **Junichi Noro**, Akita (JP); **Kanenari Kusanagi**, Akita (JP); **Yoshiaki Imano**, Akita (JP)
- (73) Assignee: **Mitsumi Electric Co., Ltd.**, Tokyo (JP)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 60 days.
- (21) Appl. No.: **11/291,645**
- (22) Filed: **Nov. 30, 2005**
- (65) **Prior Publication Data**
US 2006/0187122 A1 Aug. 24, 2006
- (30) **Foreign Application Priority Data**
Feb. 23, 2005 (JP) 2005-047086
- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 5/00 (2006.01)
H01Q 9/04 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/32 (2006.01)
- (52) U.S. Cl. **343/700 MS**; 343/702; 343/713
- (58) **Field of Classification Search** 343/700 MS, 343/702, 711, 712, 713, 872; 455/575, 90
See application file for complete search history.

- (56) **References Cited**
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Primary Examiner—Hoang V Nguyen
Assistant Examiner—Robert Karacsony
(74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, P.C.

(57) **ABSTRACT**
In a planar antenna including a board having an upper surface on which a planar antenna element pattern is formed, a probe for feeding to the planar antenna element pattern by electromagnetic coupling, a ground plate, and a base having a groove for disposing the probe therein, the planar antenna has a fastening member for fastening the board to the ground plate with the base sandwiched therebetween. The fastening member has a case, disposed on the upper surface of the board, having four bosses which extend downwards and which have four screw holes and four screws threaded to the four screw holes from the ground plate side.

5 Claims, 19 Drawing Sheets





US007312755B2

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

(10) **Patent No.:** **US 7,312,755 B2**
(45) **Date of Patent:** **Dec. 25, 2007**

(54) **INTERNAL ANTENNA OF WIRELESS COMMUNICATION TERMINAL**

(75) Inventors: **Young Joon Ko**, Seoul (KR); **Hong Teuk Kim**, Yungin-si (KR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 115 days.

(21) Appl. No.: **11/172,970**

(22) Filed: **Jul. 5, 2005**

(65) **Prior Publication Data**
US 2006/0017629 A1 Jan. 26, 2006

(30) **Foreign Application Priority Data**
Jul. 6, 2004 (KR) 10-2004-0052243

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

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

(58) **Field of Classification Search** 343/700 MS, 343/702, 846, 848, 824, 825
See application file for complete search history.

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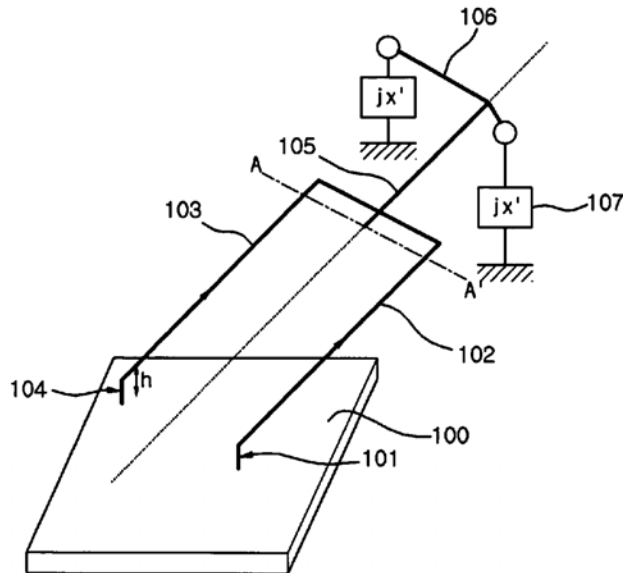
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Primary Examiner—Hoanganh Le
(74) *Attorney, Agent, or Firm*—Ked & Associates, LLP

(57) **ABSTRACT**

An internal antenna of a wireless communication terminal, in which internal style folded monopole antenna is installed, is provided. The internal antenna of a wireless communication terminal includes a folded monopole antenna. The folded monopole antenna includes two folded radiation planes having a quarter wavelength, and reactances loaded to predetermined positions of the two radiation planes. Therefore, a space for installing the antenna in the terminal is minimized, and due to the no directional characteristics, the internal antenna can be applied to a wireless communication system of dual bandwidths.

19 Claims, 10 Drawing Sheets





US007312756B2

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

(10) **Patent No.:** **US 7,312,756 B2**
(45) **Date of Patent:** **Dec. 25, 2007**

(54) **ANTENNA** 4,968,984 A * 11/1990 Katoh et al. 343/713
6,903,690 B2 6/2005 Leclerc et al.
(75) Inventors: **Feng-Chi Eddie Tsai**, Taipei (TW);
Kuan-Hsueh Tseng, Taipei (TW) 7,053,844 B2 * 5/2006 Gaucher et al. 343/702

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 97 days. *Primary Examiner*—Michael C. Wimer
(74) *Attorney, Agent, or Firm*—Quintero Law Office

(57) **ABSTRACT**

An antenna comprises a ground element, a first transmission element, a feed element, a second transmission element and a third transmission element. The first transmission element is electrically connected to the ground element, wherein the first transmission element comprises at least one coupling portion, a first side and a second side. The feed element corresponds to the coupling portion. The second transmission element corresponds to the first side and is electrically connected to the ground element. The third transmission element corresponds to the second side and is electrically connected to the ground element. When a first wireless signal is transmitted, the feed element couples to the first transmission element to transmit the first wireless signal. When a second wireless signal is transmitted, the feed element couples to the first transmission element, and the second and third transmission elements couple to the first transmission element to transmit the second wireless signal.

(21) Appl. No.: **11/328,888**

(22) Filed: **Jan. 9, 2006**

(65) **Prior Publication Data**

US 2007/0159398 A1 Jul. 12, 2007

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/826; 343/829;
455/575.7

(58) **Field of Classification Search** 343/700 MS,
343/702, 846, 826, 829; 455/575.1
See application file for complete search history.

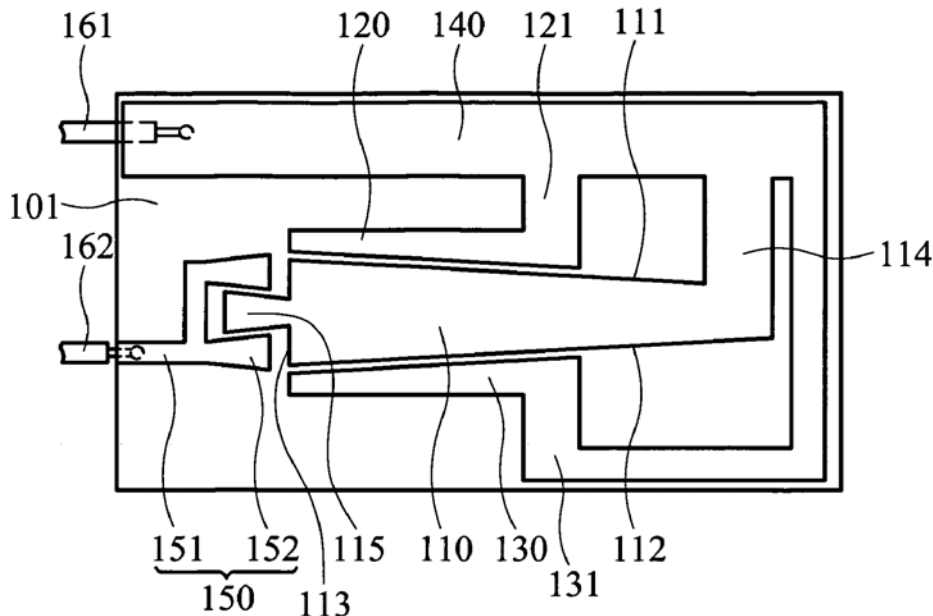
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30 Claims, 15 Drawing Sheets

100





US007312757B2

(12) **United States Patent**
Watanabe

(10) **Patent No.:** **US 7,312,757 B2**
(45) **Date of Patent:** ***Dec. 25, 2007**

(54) **ANTENNA DEVICE, METHOD AND PROGRAM FOR CONTROLLING DIRECTIVITY OF THE ANTENNA DEVICE, AND COMMUNICATIONS APPARATUS**

(58) **Field of Classification Search** 343/702, 343/700 MS, 846, 848
See application file for complete search history.

(75) Inventor: **Shin Watanabe**, Kawasaki (JP)

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

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

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This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **11/396,849**

Primary Examiner—Hoanganh Le
(74) *Attorney, Agent, or Firm*—Katten Muchin Rosenman LLP

(22) Filed: **Apr. 3, 2006**

(65) **Prior Publication Data**

US 2006/0181476 A1 Aug. 17, 2006

Related U.S. Application Data

(62) Division of application No. 10/894,984, filed on Jul. 20, 2004, now Pat. No. 7,084,816.

(57) **ABSTRACT**

The present invention relates to an antenna device and enables the directivity of an antenna element to be changed without affecting the resonance frequency of the antenna element. The antenna device comprises a first grounded conductor, an antenna element mounted on the first grounded conductor via an insulator, a second grounded conductor disposed separate from the first grounded conductor, and a changing unit for changing directivity of the antenna element by adding the second grounded conductor to the first grounded conductor or canceling the addition thereof.

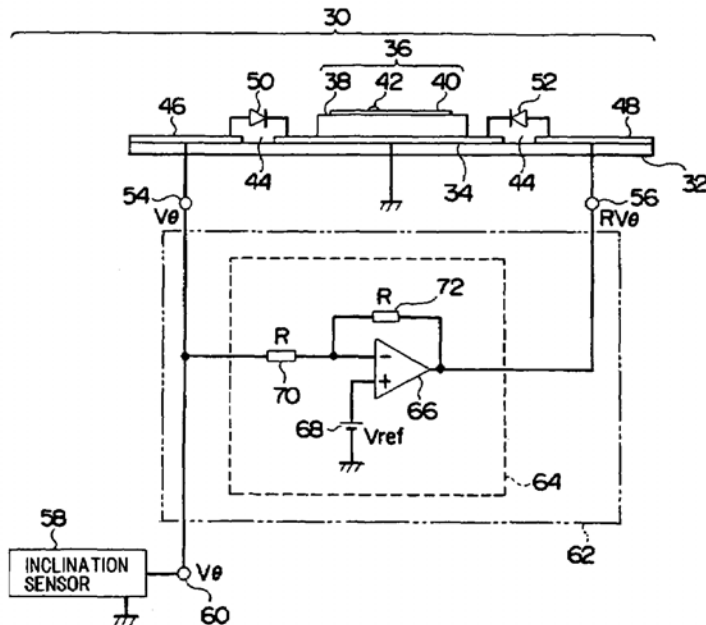
(30) **Foreign Application Priority Data**

Mar. 11, 2004 (JP) 2004-069516

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)

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

6 Claims, 25 Drawing Sheets





US007312758B2

(12) **United States Patent**
Seybold

(10) **Patent No.:** **US 7,312,758 B2**

(45) **Date of Patent:** **Dec. 25, 2007**

(54) **DUAL GAIN HANDHELD RADIO ANTENNA**

(75) Inventor: **John S. Seybold**, Malabar, FL (US)

(73) Assignee: **Harris Corporation**, Melbourne, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 60 days.

(21) Appl. No.: **11/397,280**

(22) Filed: **Apr. 4, 2006**

(65) **Prior Publication Data**

US 2007/0229389 A1 Oct. 4, 2007

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

(52) **U.S. Cl.** **343/702; 343/895; 343/900**

(58) **Field of Classification Search** **343/702, 343/895, 900, 901, 850, 860**

See application file for complete search history.

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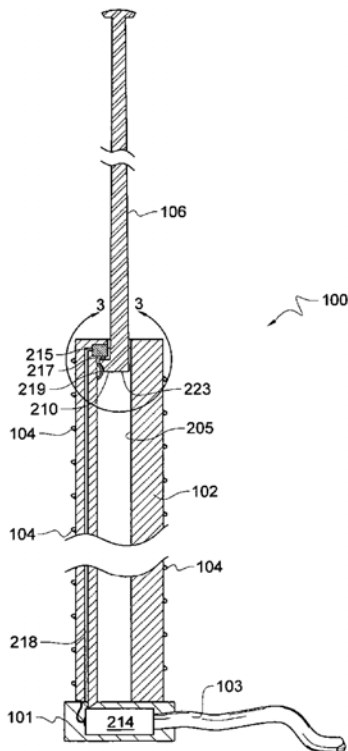
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Darby & Darby PC; Robert J. Sacco

(57) **ABSTRACT**

The present invention concerns a dual gain antenna system **100** with an integrated system to control a matching network **214**. The dual gain antenna system **100** comprises an antenna that includes a first helically shaped antenna element **104**, a second vertical antenna element **106**, and a base portion **101**. The first antenna element **104** is disposed around a longitudinal axis of a dielectric rod **102** that contains a bore **205**. The second antenna element **106** is disposed within the longitudinal axis of the dielectric rod bore **205**. A sensor **215** detects when the second antenna element **106** is in the extended position and transmits a control signal to a matching system **214** that selectively controls the impedance matching network **214** between the antenna and the RF feed line **103**.

13 Claims, 5 Drawing Sheets





US007312760B1

(12) **United States Patent**
Cheng

(10) **Patent No.:** US 7,312,760 B1
(45) **Date of Patent:** Dec. 25, 2007

(54) **SOLID ANTENNA AND MANUFACTURING METHOD THEREOF**

6,980,155 B2* 12/2005 Lee et al. 343/700 MS

(75) Inventor: **Shih-Chieh Cheng**, Tainan County (TW)

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Primary Examiner—Hoang V. Nguyen

(73) Assignee: **Arcadyan Technology Corporation**, Hsinchu (TW)

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

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

(57) **ABSTRACT**

A solid antenna includes a first grounding portion, a second grounding portion, a first radiating portion, a second radiating portion, a first feeding portion and a second feeding portion. The second grounding portion is extended from one side of the first grounding portion. The first radiating portion is extended from the other side of the first grounding portion opposite to the one side of the first grounding portion. The second radiating portion is extended from the other side of the first grounding portion and has one side opposite to the other side of the first grounding portion. The first feeding portion is extended from the one side of the second radiating portion. The second feeding portion is extended from the first feeding portion and approximately parallel to the first radiating portion and the second radiating portion. In addition, the invention also discloses a method of manufacturing the solid antenna.

(21) Appl. No.: **11/588,266**

(22) Filed: **Oct. 27, 2006**

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

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

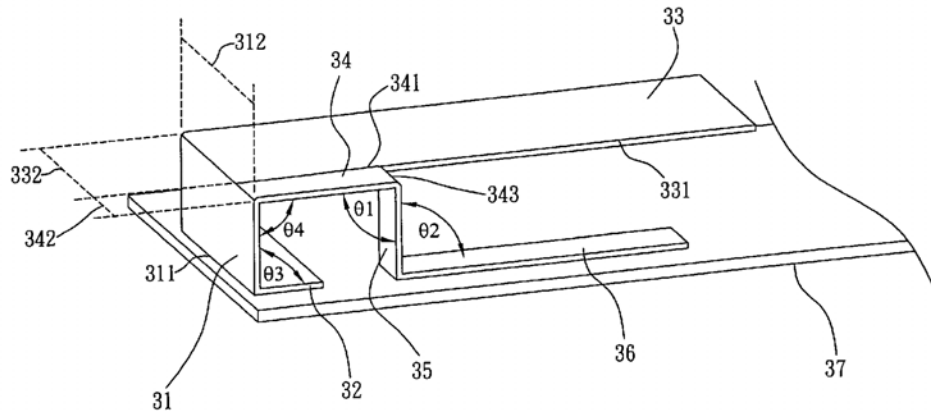
(58) **Field of Classification Search** 343/702, 343/700 MS, 846
See application file for complete search history.

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18 Claims, 15 Drawing Sheets





US007312762B2

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

(10) **Patent No.:** **US 7,312,762 B2**
(45) **Date of Patent:** **Dec. 25, 2007**

- (54) **LOADED ANTENNA**
- (75) Inventors: **Carles Puente Ballarda**, Barcelona (ES); **Jordi Soler Castany**, Barcelona (ES)
- (73) Assignee: **Fractus, S.A.**, Barcelona (ES)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 479 days.

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- (21) Appl. No.: **10/822,933**
- (22) Filed: **Apr. 13, 2004**

- (65) **Prior Publication Data**
US 2006/0077101 A1 Apr. 13, 2006

Related U.S. Application Data

- (63) Continuation of application No. PCT/EP01/11914, filed on Oct. 16, 2001.

Foreign Application Priority Data

- (30) Oct. 16, 2001 (EP) PCT/EP2001/11914

- (51) **Int. Cl.**
H01Q 9/42 (2006.01)
- (52) **U.S. Cl.** **343/752; 343/792.5**
- (58) **Field of Classification Search** 343/700 MS, 343/745, 795, 861, 752, 792.5
See application file for complete search history.

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Primary Examiner—Michael C. Wimer
(74) *Attorney, Agent, or Firm*—Winstead PC

(57) **ABSTRACT**

A novel loaded antenna is defined in the present invention. The radiating element of the loaded antenna consists of two different parts: a conducting surface and a loading structure. By means of this configuration, the antenna provides a small and multiband performance, and hence it features a similar behaviour through different frequency bands.

21 Claims, 16 Drawing Sheets

