



US007227500B2

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

(10) **Patent No.:** **US 7,227,500 B2**
(45) **Date of Patent:** **Jun. 5, 2007**

(54) **PLANAR ANTENNA AND METHOD FOR DESIGNING THE SAME**

(75) Inventors: **Hideaki Oshima**, Minato-ku (JP);
Tatsuo Matsushita, Minato-ku (JP)

(73) Assignee: **Nippon Sheet Glass Company, 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 143 days.

(21) Appl. No.: **10/516,632**

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

(86) PCT No.: **PCT/JP03/07417**

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

(87) PCT Pub. No.: **WO03/105278**

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

(65) **Prior Publication Data**

US 2005/0179593 A1 Aug. 18, 2005

(30) **Foreign Application Priority Data**

Jun. 11, 2002 (JP) 2002-169471

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

(52) **U.S. Cl.** **343/700 MS; 343/700 MS; 343/711; 343/712; 343/713**

(58) **Field of Classification Search** **343/700 MS, 343/712, 713, 767, 770, 711**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,873,529 A * 10/1989 Gibson 343/700 MS

6,140,968 A * 10/2000 Kawahata et al. ... 343/700 MS
6,198,437 B1 * 3/2001 Watson et al. 343/700 MS
6,480,170 B1 * 11/2002 Langley et al. 343/826
6,639,556 B2 * 10/2003 Baba 343/700 MS
2003/0189520 A1 * 10/2003 Goto et al. 343/702
2004/0169605 A1 * 9/2004 Komatsu et al. 343/700 MS

FOREIGN PATENT DOCUMENTS

JP 63-31849 2/1988
JP 8-148921 A 6/1996
JP 2000-151259 A 5/2000

OTHER PUBLICATIONS

Misao Haishi et al., Saishin Heimen Antenna Gijutsu, 1st edition, Kabushiki Kaisha Sogo Gijutsu Center, Mar. 25, 1993, pp. 216-223.

* cited by examiner

Primary Examiner—Hoang V. Nguyen

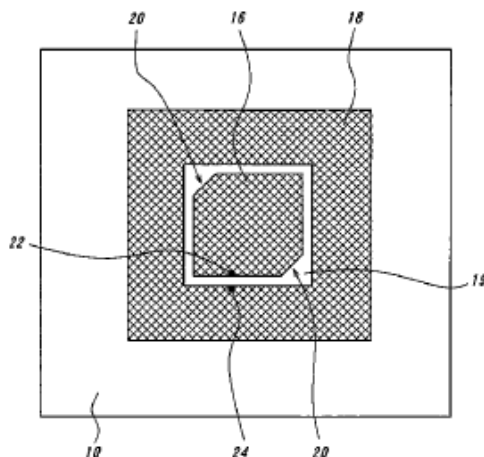
Assistant Examiner—Dieu Hien Duong

(74) *Attorney, Agent, or Firm*—RatnerPrestia

(57) **ABSTRACT**

A coplanar type circularly polarize wave planar antenna is provided, which can be formed on one side of a dielectric substrate. The planar antenna comprises a dielectric substrate; an almost square radiating element formed on one main surface of the dielectric substrate, the radiating element having notched portions at two corners opposing in one diagonal direction; and a ground conductor formed on the one main surface, the ground conductor having a square opening portion at a center portion thereof and a square outer peripheral shape. The radiating element is placed inside the opening portion of the ground conductor with a gap of a predetermined width being provided with respect to the ground conductor.

6 Claims, 5 Drawing Sheets





US007227502B2

(12) **United States Patent**
Yamamoto

(10) **Patent No.:** **US 7,227,502 B2**
(45) **Date of Patent:** **Jun. 5, 2007**

(54) **PATCH ANTENNA WHOSE DIRECTIVITY IS SHIFTED TO A PARTICULAR DIRECTION, AND A MODULE INTEGRATED WITH THE PATCH ANTENNA**

2002/0140609 A1* 10/2002 Aoki et al. 343/700 MS
2002/0175669 A1* 11/2002 Ziegner et al. 324/95
2003/0147197 A1* 8/2003 Uriu et al. 361/311
2006/0256018 A1* 11/2006 Soler Castany et al. 343/700 MS

(75) Inventor: **Shinji Yamamoto**, Osaka (JP)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka (JP)

JP 5-183328 A 7/1993
JP 5-347509 A 12/1993
JP 09-172321 6/1997
JP 2000-278028 A 10/2000
JP 2000-341026 12/2000
JP 2001-094336 4/2001
JP 2001-196840 A 7/2001

(*) 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.: **11/014,240**

* cited by examiner

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

Primary Examiner—Alford Kindred
Assistant Examiner—Angela M Lie

(65) **Prior Publication Data**

US 2005/0179595 A1 Aug. 18, 2005

(74) *Attorney, Agent, or Firm*—McDermott Will & Emery LLP

(30) **Foreign Application Priority Data**

Dec. 18, 2003 (JP) 2003-420651

(57) **ABSTRACT**

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

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

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

See application file for complete search history.

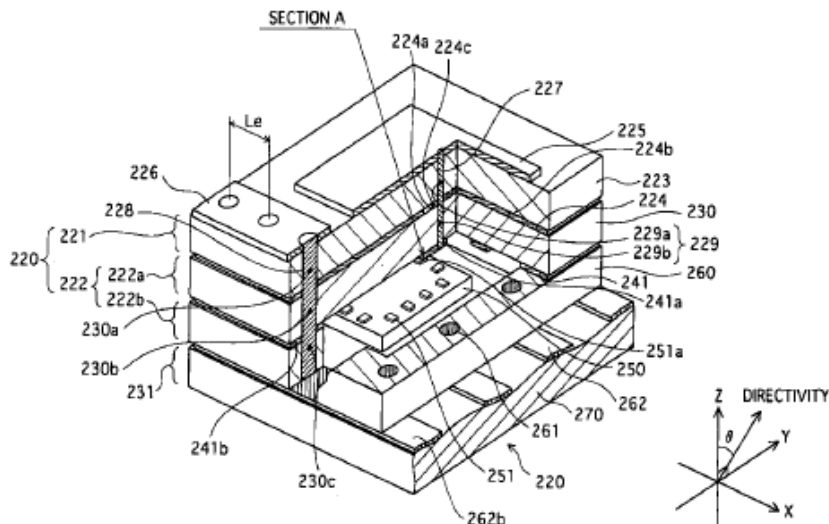
A patch antenna with a directivity includes: a dielectric substrate to which at least one through hole is provided; a first ground electrode at least partially covering a back surface of the dielectric substrate; an antenna electrode partially covering an area of a front surface of the dielectric substrate, the area positionally corresponding to the first ground electrode; a second ground electrode provided within the area in a vicinity of the antenna electrode, the second ground electrode having the through hole underneath; and a conductive material provided in the through hole so as to electrically connect the first ground electrode and the second ground electrode.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,571,592 A * 2/1986 Justice 343/767
5,376,942 A * 12/1994 Shiga 343/700 MS
6,850,192 B2 * 2/2005 Yeh 343/700 MS

4 Claims, 8 Drawing Sheets





US007227504B2

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

(10) **Patent No.:** **US 7,227,504 B2**
(45) **Date of Patent:** **Jun. 5, 2007**

(54) **GATE ANTENNA DEVICE**

(75) Inventors: **Futoshi Deguchi**, Fukuoka (JP);
Hiroshi Yoshinaga, Kasuya-gun (JP);
Masahiko Tanaka, Fukuoka (JP);
Hiroaki Haruyama, Fukuoka (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 212 days.

(21) Appl. No.: **10/929,449**

(22) Filed: **Aug. 31, 2004**

(65) **Prior Publication Data**

US 2005/0057422 A1 Mar. 17, 2005

(30) **Foreign Application Priority Data**

Sep. 1, 2003 (JP) 2003-308560
Nov. 21, 2003 (JP) 2003-392238

(51) **Int. Cl.**

H01Q 11/12 (2006.01)
H01Q 21/00 (2006.01)

(52) **U.S. Cl.** **343/742; 343/855; 343/867**

(58) **Field of Classification Search** **343/702, 343/855, 866, 867, 742**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,701,764 A 10/1987 Malcombe 343/742
4,906,973 A 3/1990 Karbowski et al. 340/551
5,153,378 A 10/1992 Garvy, Jr. 174/393
5,258,766 A 11/1993 Murdoch 343/742
5,360,941 A 11/1994 Roes 361/816

5,367,291 A 11/1994 Fockens 340/572
5,602,556 A 2/1997 Bowers 343/742
5,761,054 A 6/1998 Kuhn 361/818
6,043,792 A 3/2000 Finlayson 343/867
6,054,647 A 4/2000 Ridener 174/35 MS
6,127,928 A 10/2000 Issacman et al. 340/572.1
6,166,637 A 12/2000 Cyr et al. 340/572.7
6,344,824 B1 2/2002 Takasugi et al. 343/700 MS
6,356,243 B1 3/2002 Schneider et al. 343/866
6,703,935 B1* 3/2004 Chung et al. 340/572.7

(Continued)

FOREIGN PATENT DOCUMENTS

JP 01126785 5/1989

(Continued)

OTHER PUBLICATIONS

International Search Report and Written Opinion dated Jan. 24, 2005.

(Continued)

Primary Examiner—Shih-Chao Chen

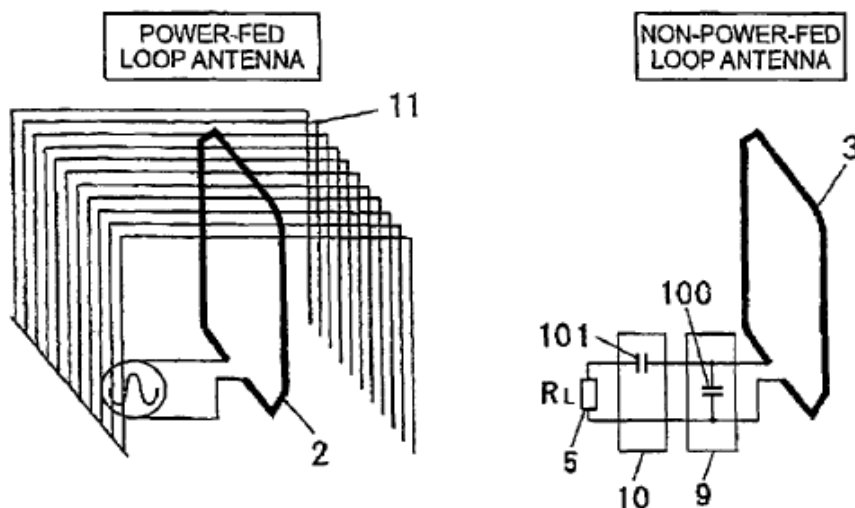
(74) *Attorney, Agent, or Firm*—Stevens, Davis, Miller & Mosher, LLP

(57) **ABSTRACT**

A gate antenna device has a plurality of loop antennas which supplies power and transmission data to an IC-integrated medium through electromagnetic induction and acquires reception data in the form of a fluctuation of a load from the IC-integrated medium. The plurality of loop antennas include a power-fed loop antenna to which a signal current is supplied and a non-power-fed loop antenna to which no signal current is supplied. The gate antenna device expands the distance and range of communication with an IC-integrated medium and improves the accuracy of communication while suppressing power consumption and leakage electric fields.

19 Claims, 13 Drawing Sheets

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US007227507B2

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

(10) **Patent No.:** **US 7,227,507 B2**
(45) **Date of Patent:** **Jun. 5, 2007**

(54) **CIRCULAR POLARIZATION ANTENNA**
(75) Inventors: **Philippe Minard**, Saint Medard sur Ille (FR); **Ali Louzir**, Rennes (FR); **Franck Thudor**, Rennes (FR); **Françoise Le Bolzer**, Rennes (FR)
(73) Assignee: **Thomson Licensing**, Boulogne-Billancourt (FR)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(56) **References Cited**
U.S. PATENT DOCUMENTS
4,208,660 A * 6/1980 McOwen, Jr. 343/769
5,539,420 A 7/1996 Dusseux et al.
5,714,961 A * 2/1998 Kot et al. 343/769
5,905,471 A * 5/1999 Biebl et al. 343/769
6,219,002 B1 * 4/2001 Lim 343/769
6,798,386 B1 * 9/2004 Louzir 343/840
6,914,574 B2 * 7/2005 Fourdeux et al. 343/769
6,917,342 B2 * 7/2005 Thudor et al. 343/770

(21) Appl. No.: **10/499,638**
(22) PCT Filed: **Dec. 17, 2002**
(86) PCT No.: **PCT/FR02/04376**
§ 371 (c)(1),
(2), (4) Date: **Apr. 18, 2005**
(87) PCT Pub. No.: **WO03/052872**
PCT Pub. Date: **Jun. 26, 2003**

FOREIGN PATENT DOCUMENTS
EP 426972 5/1991
OTHER PUBLICATIONS
X.M. Wing et al. "Circularly polarised circular ring slot antenna fed by stripline hybrid coupler" Electronics Letter, IEE Stevenage, GB, vol. 35, No. 25, Dec. 9, 1999, pp. 2154-2155.

(65) **Prior Publication Data**
US 2005/0200542 A1 Sep. 15, 2005

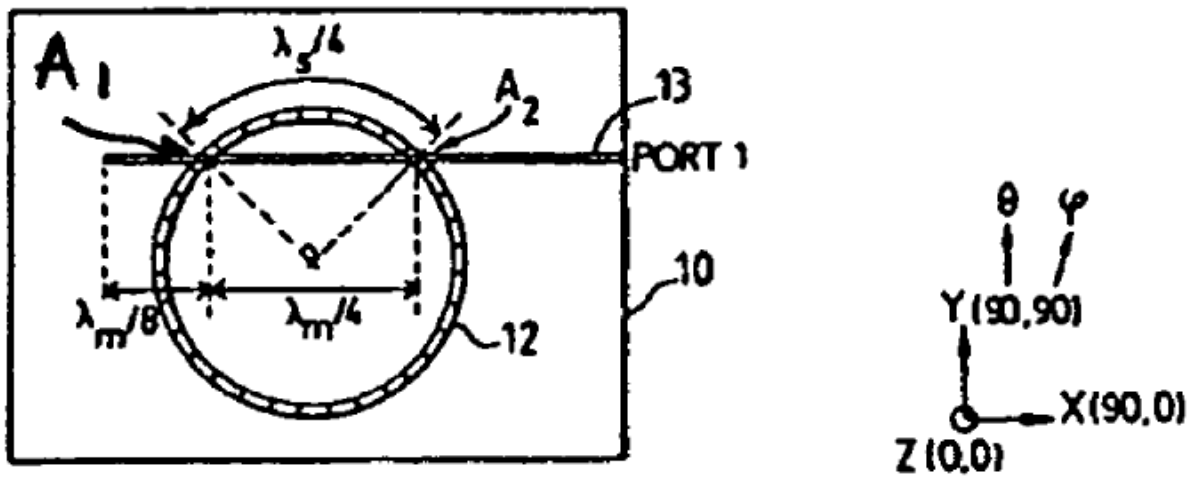
(Continued)
Primary Examiner—Tan Ho
(74) *Attorney, Agent, or Firm*—Joseph J. Laks; Robert D. Shedd; Brian J. Cromarty

(30) **Foreign Application Priority Data**
Dec. 19, 2001 (FR) 01 16469

(57) **ABSTRACT**
The present invention relates to a device for the reception and/or the transmission of electromagnetic signals comprising at least one means of reception and/or of transmission of electromagnetic signals, consisting of an antenna of the slot type and a feed line coupled electromagnetically with the slot of the antenna so as to connect the means of reception and/or of transmission of electromagnetic signals to means of utilization of the signals, the feed line being coupled electromagnetically with the slot at two points chosen such that the electromagnetic waves exhibit a circular polarization.

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 13/12 (2006.01)
(52) **U.S. Cl.** 343/767; 343/769
(58) **Field of Classification Search** 343/769, 343/770, 767
See application file for complete search history.

4 Claims, 2 Drawing Sheets





US007227509B2

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

(10) **Patent No.:** **US 7,227,509 B2**
(45) **Date of Patent:** **Jun. 5, 2007**

(54) **ANTENNA DEVICE**

(75) Inventors: **Yutaka Saito**, Nomi-gun (JP);
Hiroyuki Uno, Ishikawa-gun (JP);
Genichiro Ota, Miura (JP); **Hiroshi Haruki**, Yokohama (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 22 days.

(21) Appl. No.: **10/542,783**

(22) PCT Filed: **Jan. 16, 2004**

(86) PCT No.: **PCT/JP2004/000274**

§ 371 (c)(1),
(2), (4) Date: **Jul. 20, 2005**

(87) PCT Pub. No.: **WO2004/068635**

PCT Pub. Date: **Aug. 12, 2004**

(65) **Prior Publication Data**

US 2006/0071870 A1 Apr. 6, 2006

(30) **Foreign Application Priority Data**

Jan. 30, 2003 (JP) 2003-022369

(51) **Int. Cl.**
H01Q 19/10 (2006.01)

(52) **U.S. Cl.** **343/834**

(58) **Field of Classification Search** **343/834,**
343/805, 806, 767, 770, 700 M, 795, 733

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,044,360 A * 8/1977 Wolfson et al. 343/754

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0604304 6/1994

(Continued)

OTHER PUBLICATIONS

European Search Report dated Nov. 17, 2005.

(Continued)

Primary Examiner—Hoanganh Le

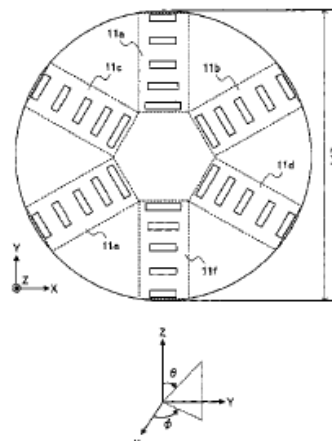
Assistant Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—Stevens, Davis, Miller & Mosher, LLP

(57) **ABSTRACT**

Linear elements **101a** to **101d** are conductors, which have the element length equivalent to half a wavelength, have been placed so that they may draw a diamond shape. Delay elements **102a** and **102b** are bent conductors, which have a total length equivalent to one fourth wavelength and a length **L2** equivalent to one eighth. The linear elements **101a** and **101c** are connected one another via the delay element **102a**, while the linear elements **101b** and **101d** are connected one another via the delay element **102b**. A feeding section **103** is connected to each of the ends of the linear elements **101a** and **101b** for feeding power to them. Between the tips of the linear elements **101c** and **101d**, a gap with a length **L3** is left. A reflector **104** has been placed at a distance **h** from a diamond-shape antenna with delay elements along the $-Z$ axis, the distance **h** being equivalent to 0.42 wavelength. This achieves the antenna device, which may be suitably mounted on any of small wireless apparatuses and form a primary beam, of which horizontally-polarized wave or vertically-polarized wave tilts toward the horizontal direction.

10 Claims, 14 Drawing Sheets





US007230571B2

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

(10) **Patent No.:** **US 7,230,571 B2**
(45) **Date of Patent:** **Jun. 12, 2007**

(54) **QUADBAND ANTENNA FOR PORTABLE DEVICES**

2004/0056805 A1* 3/2004 Chen 343/700 MS
2004/0246179 A1* 12/2004 Chen et al. 343/700 MS
2005/0062651 A1* 3/2005 Dai et al. 343/700 MS

(75) Inventors: **Brian P. Gaucher**, Brookfield, CT
(US); **Duixian Liu**, Yorktown Heights, NY (US)

* cited by examiner

(73) Assignee: **Lenova (Singapore) Pte. Ltd.**,
Singapore (SG)

Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—William N. Hogg; Driggs,
Hogg & Fry Co., LPA

(*) 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**

(21) Appl. No.: **10/967,407**

A compact sized integrated quadband antenna for portable devices used in wireless applications is provided to provide wireless wide area network quadband coverage for world wide applications. The antenna design includes a combination of F-shaped and variations of L-shaped metal pieces. The F-shaped and variations of L-shaped metal pieces are provided on a double-sided printed circuit board. The F-shaped metal piece covers 800 MHz and 900 MHz bands. Two variations of L-shaped metal pieces are provided, whereby the two variations produce two resonants in the 1800 MHz and 1900 MHz bands. The two variations of L-shaped metal pieces are provided inside the F-shaped metal piece. The laptop display frame or the metal display supporters are used as part of the antenna, the display frame or the metal display supporters providing the ground plane to the antenna design.

(22) Filed: **Oct. 18, 2004**

(65) **Prior Publication Data**

US 2006/0082503 A1 Apr. 20, 2006

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

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

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

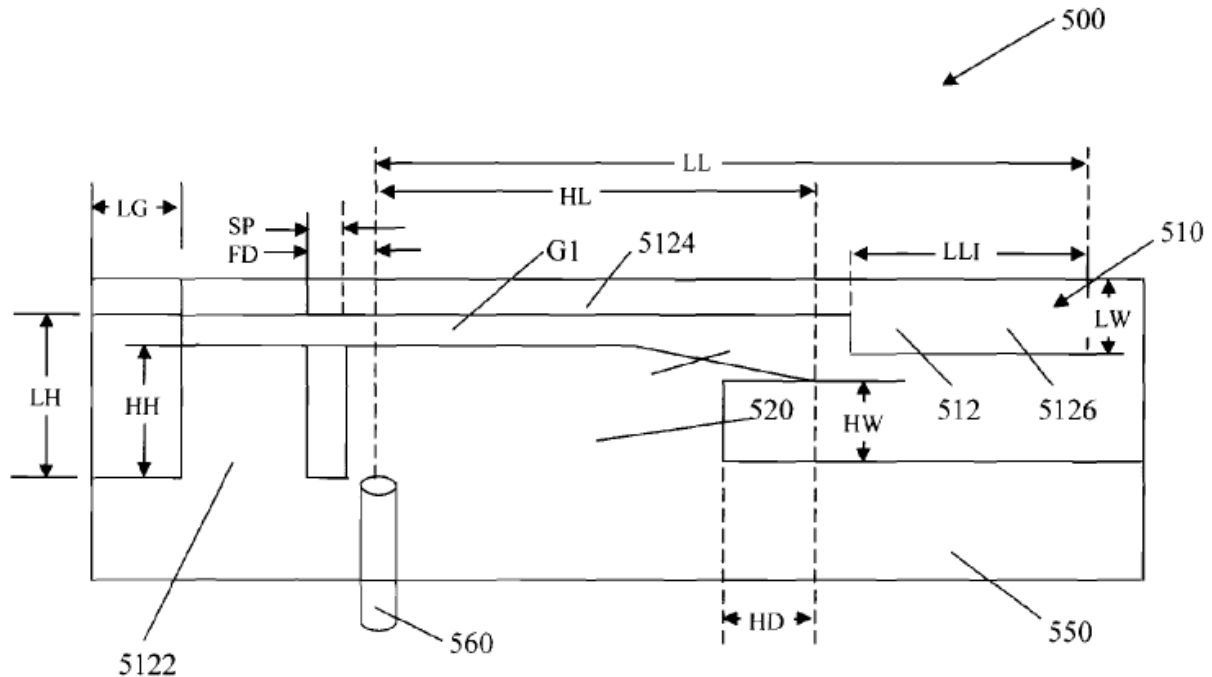
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0175861 A1* 11/2002 Lin 343/700 MS

18 Claims, 8 Drawing Sheets





US007230572B2

(12) **United States Patent**
Aisenbrey

(10) **Patent No.:** **US 7,230,572 B2**

(45) **Date of Patent:** **Jun. 12, 2007**

(54) **LOW COST ANTENNA DEVICES
COMPRISING CONDUCTIVE LOADED
RESIN-BASED MATERIALS WITH
CONDUCTIVE WRAPPING**

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

(73) Assignee: **Integral Technologies, Inc.**,
Bellingham, WA (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.: **10/967,487**

(22) Filed: **Oct. 18, 2004**

(65) **Prior Publication Data**

US 2005/0078050 A1 Apr. 14, 2005

Related U.S. Application Data

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

(60) Provisional application No. 60/519,673, filed on Nov.
13, 2003, provisional application No. 60/512,352,
filed on Oct. 17, 2003, provisional application No.
60/317,808, filed on Sep. 7, 2001, provisional appli-
cation No. 60/269,414, filed on Feb. 16, 2001, pro-
visional application No. 60/268,822, filed on Feb. 15,
2001.

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

(52) **U.S. Cl.** **343/700 MS; 343/788;**
343/873

(58) **Field of Classification Search** **343/700 MS,**
343/795, 787, 788, 873

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,916,078 A * 10/1975 Priaroggia 174/10
5,990,841 A 11/1999 Sakamoto et al. 343/749

(Continued)

FOREIGN PATENT DOCUMENTS

GB 377449 A 7/2001

(Continued)

OTHER PUBLICATIONS

Co-pending filed Dec. 4, 2002, U.S. Appl. No. 10/309,429, "Low
Cost Antennas Using Conductive Plastics or Conductive Compos-
ites".

Primary Examiner—Hoang V. Nguyen

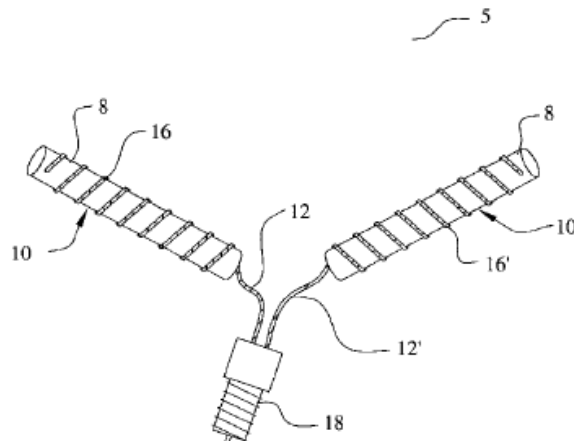
(74) *Attorney, Agent, or Firm*—Douglas Schnabel

(57) **ABSTRACT**

Antennas are formed of a conductive loaded resin-based
material with conductive wrapping, embedding, and/or center-
fusing. The conductive loaded resin-based material com-
prises micron conductive powder(s), conductive fiber(s), or
a combination of conductive powder and conductive fibers
in a base resin host. The percentage by weight of the
conductive powder(s), conductive fiber(s), or a combination
thereof is between about 20% and 50% of the weight of the
conductive loaded resin-based material. The micron conduc-
tive powders are formed from non-metals, such as carbon,
graphite, that may also be metallic plated, or the like, or from
metals such as stainless steel, nickel, copper, silver, alumi-
num that may also be metallic plated, or the like, or from a
combination of non-metal, plated, or in combination with,
metal powders. The micron conductor fibers preferably are
of nickel plated carbon fiber, stainless steel fiber, copper
fiber, silver fiber, aluminum fiber, or the like.

See application file for complete search history.

79 Claims, 8 Drawing Sheets





US007230573B2

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

(10) **Patent No.:** **US 7,230,573 B2**
(45) **Date of Patent:** **Jun. 12, 2007**

(54) **DUAL-BAND ANTENNA WITH AN IMPEDANCE TRANSFORMER**

(75) Inventors: **Hsien-Chu Lin**, Tu-Chen (TW); **Lung Sheng Tai**, Tu-Chen (TW); **Chen-Ta Hung**, Tu-Chen (TW)

(73) Assignee: **Hon Hai Precision Ind. Co., Ltd.**, 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 59 days.

(21) Appl. No.: **11/025,169**

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

(65) **Prior Publication Data**
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(30) **Foreign Application Priority Data**
Mar. 9, 2004 (TW) 093203508 U

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

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

(58) **Field of Classification Search** **343/702, 343/700, 767, 770, 846**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,360,813	A *	11/1982	Fitzsimmons	.....	342/350
6,563,468	B2 *	5/2003	Hill et al.	.....	343/741
6,600,448	B2 *	7/2003	Ikegaya et al.	.....	343/700 MS
6,985,108	B2 *	1/2006	Mikkola et al.	.....	343/700 MS
2005/0078037	A1 *	4/2005	Leclerc et al.	.....	343/702

* cited by examiner

Primary Examiner—Tho Phan

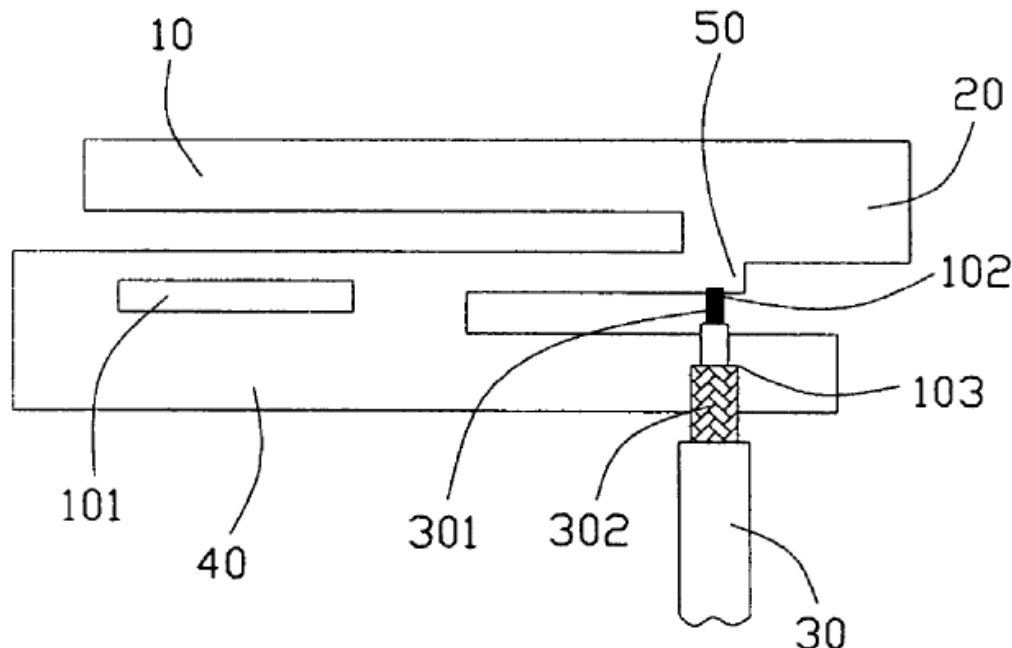
(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A dual-band antenna (1) for communication device includes a first radiating element portion (10) operating at a first frequency band, a second radiating element portion (20) operating at a second frequency band, an L-shaped ground portion (40), a conductive connection (50) interconnecting the first and second radiating element portions (10, 20) with the ground portion (40) and a slot (101) served as an impedance transformer and positioned on the ground portion (40). The slot (101) is implemented as a capacitive load that eliminates the inductive part of the input impedance of the antenna, thereby the slot (101) can match the input impedance of the antenna with a feed line.

18 Claims, 13 Drawing Sheets

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US007230578B2

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

(10) **Patent No.:** **US 7,230,578 B2**
(45) **Date of Patent:** **Jun. 12, 2007**

(54) **DUAL-BAND DIPOLE ANTENNA**

(75) Inventors: **Yun Long Ke**, Tu-Chen (TW); **Hsin Kuo Dai**, Tu-chen (TW); **Lüing-Sheng Tai**, Tu-chen (TW); **Chin Pao Kuo**, Tu-chen (TW)

(73) Assignee: **Hon Hai Precision Ind. Co., Ltd.**, 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 117 days.

(21) Appl. No.: **11/026,637**

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

(65) **Prior Publication Data**
US 2005/0243007 A1 Nov. 3, 2005

(30) **Foreign Application Priority Data**
Apr. 29, 2004 (CN) 2004 2 0268943 U

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

(52) **U.S. Cl.** **343/792; 343/790; 343/793**

(58) **Field of Classification Search** 343/702, 343/790-793, 795, 797, 700 MS
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,638,813 A *	1/1987	Turner	607/154
6,333,715 B1 *	12/2001	Kato et al.	343/701
6,421,024 B1	7/2002	Stolle	
6,741,220 B2 *	5/2004	Inoue	343/797
6,937,204 B2 *	8/2005	Hall	343/795

* cited by examiner

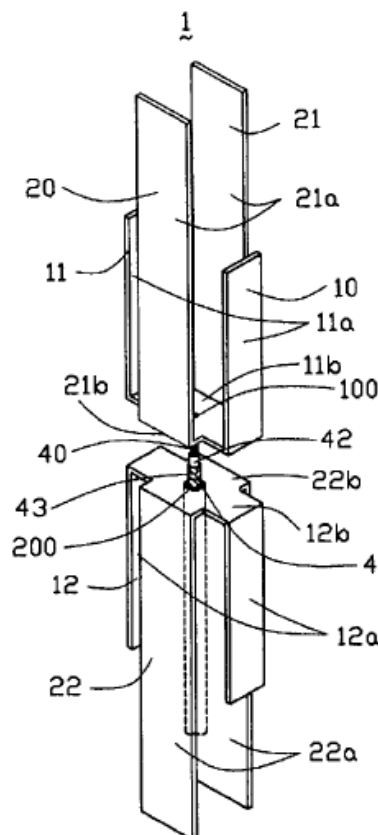
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Wei Te Chung

(57) **ABSTRACT**

A dual-band antenna (1) includes a first antenna (2) and a second antenna (3). The first antenna includes a u-shaped first dipole half (11) and an n-shaped second dipole half (12). The first dipole half is disposed above the second dipole half with a space therebetween and the two dipole halves are mirror imaged. The second antenna includes a u-shaped third dipole half (21) and an n-shaped fourth dipole half (22). The first and the third dipole halves are crossly connected with each other at bottom. The second and the fourth dipole halves are crossly connected with each other at top.

11 Claims, 6 Drawing Sheets





US007233289B2

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

(10) **Patent No.:** **US 7,233,289 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **MULTIPLE-FREQUENCY ANTENNA STRUCTURE**

(75) Inventors: **Shyh-Jong Chung**, HsinChu (TW);
Ya-Ying Wang, Taipei (TW);
Min-Chuan Wu, Tai-Chung (TW);
Kuang-Yu Yen, Tai-Chung (TW)

(73) Assignee: **Realtek Semiconductor Corp.**,
HsinChu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 10 days.

(21) Appl. No.: **11/160,984**

(22) Filed: **Jul. 19, 2005**

(65) **Prior Publication Data**

US 2005/0275592 A1 Dec. 15, 2005

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/605,952, filed on Nov. 10, 2003, now abandoned.

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

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

(58) **Field of Classification Search** **343/700 MS, 343/702, 818, 833, 834**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,002,369 A 12/1999 Richard

6,008,773 A	12/1999	Matsuoka et al.	
6,028,567 A *	2/2000	Lahti	343/895
6,100,848 A *	8/2000	Hayes	343/702
6,529,170 B1	3/2003	Nishizawa et al.	
6,774,853 B2	8/2004	Wong et al.	
6,982,672 B2 *	1/2006	Lin et al.	343/700 MS
7,050,010 B2 *	5/2006	Wang et al.	343/702
7,061,430 B2 *	6/2006	Zheng et al.	343/700 MS
2001/0050643 A1 *	12/2001	Egorov et al.	343/702
2003/0122718 A1	7/2003	Fang et al.	
2003/0222823 A1 *	12/2003	Flint et al.	343/702
2005/0093750 A1 *	5/2005	Vance	343/702
2006/0119517 A1 *	6/2006	Futamata	343/700 MS

* cited by examiner

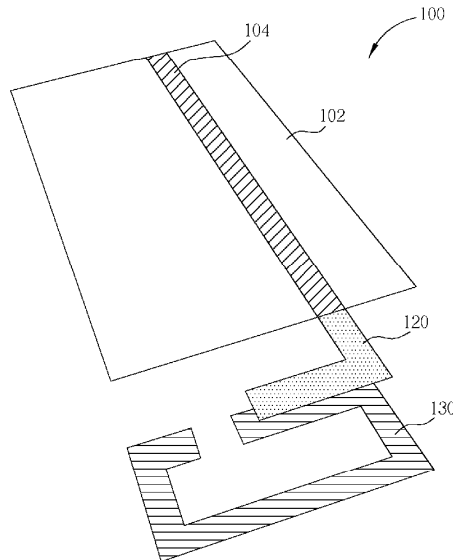
Primary Examiner—Hoang V. Nguyen

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

(57) **ABSTRACT**

A multiple-frequency antenna includes a circuit board of dielectric material having a first surface and a second surface which is spaced apart from and is substantially parallel to the first surface, a ground plane layer of electrically conductive material covering a portion of the first surface of the circuit board, and a feed-line of electrically conductive material disposed on the second surface of the circuit board so as to extend over the ground plane layer. A first radiating element of electrically conductive material is disposed on the circuit board and electrically connected to the feed-line. A second radiating element of electrically conductive material is disposed on the circuit board in close proximity to the first radiating element for coupling with the first radiating element, the coupling providing an electromagnetic feed to the second radiating element.

28 Claims, 8 Drawing Sheets





US007233290B2

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

(10) **Patent No.:** **US 7,233,290 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **ANTENNA AND NOTEBOOK UTILIZING THE SAME**
(75) Inventors: **Chih-Kai Liu**, Taipei (TW); **Wei-Li Cheng**, Taipei Hsien (TW)
(73) Assignee: **Wistron NeWeb Corp.**, Taipei Hsien (TW)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 48 days.

6,459,413	B1 *	10/2002	Tseng et al.	343/702
6,476,769	B1 *	11/2002	Lehtola	343/702
6,864,854	B2 *	3/2005	Dai et al.	343/846
6,995,717	B2 *	2/2006	Ryu	343/702
7,113,135	B2 *	9/2006	Jo et al.	343/702
2002/0175866	A1 *	11/2002	Gram	343/702
2004/0130493	A1 *	7/2004	Horita et al.	343/702
2005/0259031	A1 *	11/2005	Sanz et al.	343/895
2006/0049994	A1 *	3/2006	Ide	343/702

(21) Appl. No.: **11/233,781**

(22) Filed: **Sep. 23, 2005**

(65) **Prior Publication Data**
US 2007/0013587 A1 Jan. 18, 2007

* cited by examiner

Primary Examiner—Tan Ho

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

(30) **Foreign Application Priority Data**
Jul. 14, 2005 (TW) 94123889 A

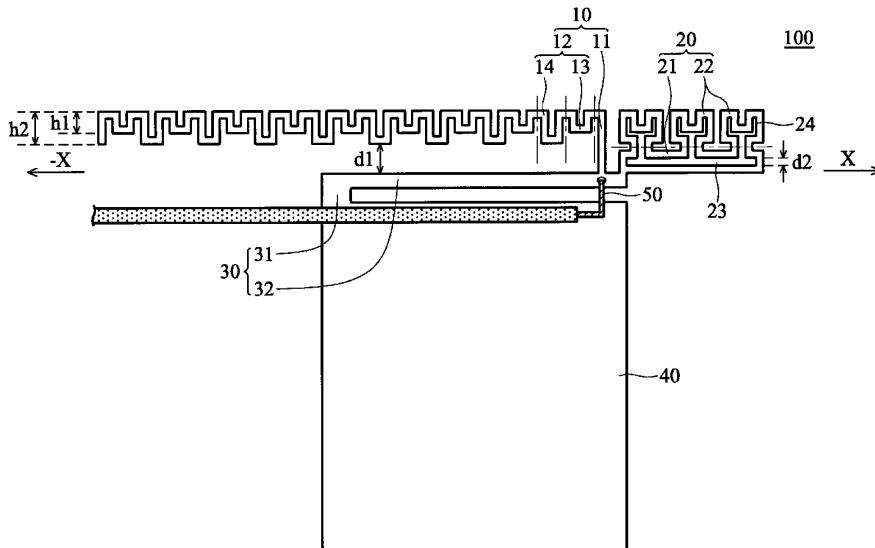
(57) **ABSTRACT**

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
(52) **U.S. Cl.** **343/700 MS**; 343/895;
343/702
(58) **Field of Classification Search** 343/700 MS,
343/702, 895, 846, 795
See application file for complete search history.

An antenna comprises a ground element, a conductive element, a signal line, a first transmitting element, a second transmitting element. The conductive element is L-shaped and connected to the ground element. The signal line is coupled to the conductive element. The first transmitting element is connected to the conductive element for transmitting a first signal. The second transmitting element is connected to the conductive element for transmitting a second signal. The first signal is a GSM900 signal and the second signal is a DCS1800 signal.

(56) **References Cited**
U.S. PATENT DOCUMENTS
5,926,139 A * 7/1999 Korisch 343/702

18 Claims, 8 Drawing Sheets





US007233291B2

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

(10) **Patent No.:** **US 7,233,291 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **ANTENNA STRUCTURES AND THEIR USE
IN WIRELESS COMMUNICATION DEVICES**

(75) Inventors: **Motti Elkobi**, Netanya (IL); **Maksim Berezin**, Netanya (IL); **Yona Newman**, Ra-Anana (IL)

(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 0 days.

(21) Appl. No.: **11/068,373**

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

(65) **Prior Publication Data**
US 2005/0200535 A1 Sep. 15, 2005

(30) **Foreign Application Priority Data**
Aug. 28, 2003 (WO) PCT/EP03/50389

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

(56) **References Cited**
U.S. PATENT DOCUMENTS
5,001,492 A * 3/1991 Shapiro et al. 343/700 MS

5,608,413 A *	3/1997	Macdonald	.....	343/700 MS
6,061,024 A *	5/2000	McGirr et al.	.....	343/700 MS
6,448,931 B1 *	9/2002	Deguchi et al.	.....	343/700 MS
6,483,462 B2 *	11/2002	Weinberger	.....	343/700 MS
6,483,463 B2 *	11/2002	Kadambi et al.	.....	343/700 MS
6,630,906 B2 *	10/2003	Tomomatsu et al.	.....	343/700 MS
6,642,892 B2 *	11/2003	Masaki et al.	.....	343/702
6,768,460 B2 *	7/2004	Hoashi et al.	.....	343/700 MS
6,801,164 B2 *	10/2004	Bit-Babik et al.	.....	343/700 MS
6,889,066 B2 *	5/2005	Gupta et al.	.....	455/570
2004/0252058 A1 *	12/2004	Rawnick et al.	.....	343/700 MS

* cited by examiner

Primary Examiner—Don Wong

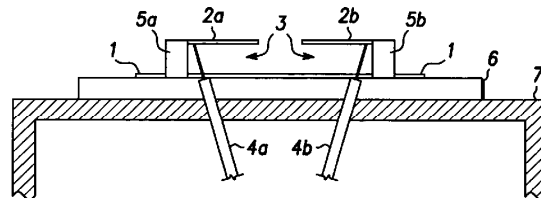
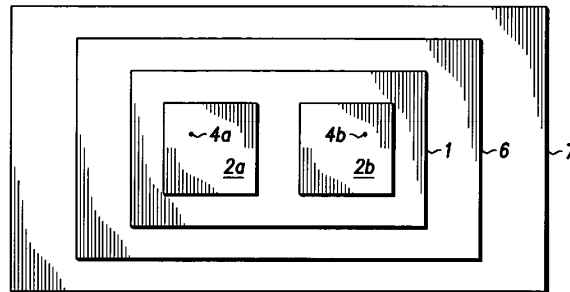
Assistant Examiner—Binh Van Ho

(74) *Attorney, Agent, or Firm*—Barbara R. Doutré

(57) **ABSTRACT**

An antenna structure for use in a wireless communication device, the structure comprising (i) a plurality of antenna portions each having a substantially planar radiating surface and (ii) a conducting ground portion; wherein the radiating surfaces of the antenna portions are substantially parallel to one another in a side-by-side relationship and are substantially parallel to part of the conducting ground portion located behind the antenna portions with respect to a direction of transmission of radiation from the antenna portions, the conducting ground portion comprising a first part galvanically connected to each of the antenna portions and, electrically coupled to the first part, a second conducting part forming at least part of a cover for a wireless communication device.

10 Claims, 5 Drawing Sheets





US007233293B2

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

(10) **Patent No.:** **US 7,233,293 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **ANTENNA DEVICE FOR PORTABLE WIRELESS TERMINAL**

(75) Inventors: **Wan-Sang Ryu**, Suwon-si (KR);
Jang-Hyun Nam, Suwon-si (KR);
In-Taek Lee, Yongin-si (KR);
Dong-Beom Seol, Suwon-si (KR)

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

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

(21) Appl. No.: **11/182,340**

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

(65) **Prior Publication Data**
US 2005/0248492 A1 Nov. 10, 2005

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/969,732, filed on Oct. 20, 2004, now Pat. No. 7,106,260.

(30) **Foreign Application Priority Data**
Feb. 17, 2004 (KR) 2004-10382
Dec. 22, 2004 (KR) 10-2004-0110406

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

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

(58) **Field of Classification Search** 343/702,
343/700 MS, 876, 872; 455/90, 575
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,905,467 A 5/1999 Narayanaswamy et al.
5,978,655 A 11/1999 Ohura et al.
6,225,951 B1 5/2001 Holshouser et al.

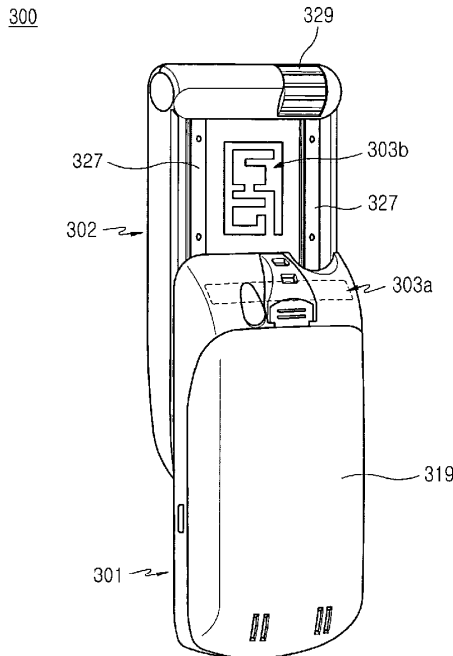
Primary Examiner—Hoang V. Nguyen

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

(57) **ABSTRACT**

Disclosed herein is an antenna device for use with a portable wireless terminal having a main body, and a sub-body slidably coupled thereto, with a first antenna mounted in the main body and a second antenna mounted on the sub-body. The second antenna is selectively exposed to the outside as the sub-body moves slidably on the main body. Conventional sliding-type terminals incorporate an antenna device in its main body that is interfered with by user body parts, thereby causing deteriorated performance. The antenna device of the present invention improves performance by using an additional second antenna mounted on the sub-body of the terminal to improve transmitting/receiving signal quality of the terminal. Furthermore, as such an antenna device is incorporated inside a sliding-type terminal or a pop-up type terminal, it is possible to eliminate risk of damage and to diversify the design of the terminal.

6 Claims, 8 Drawing Sheets





US007233294B2

(12) **United States Patent**
Fang

(10) **Patent No.:** **US 7,233,294 B2**
(45) **Date of Patent:** ***Jun. 19, 2007**

(54) **COMPUTER WITH AN EMBEDDED ANTENNA**

(75) Inventor: **Chien-Hsing Fang, Da-Li (TW)**

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

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/259,415**

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

(65) **Prior Publication Data**
US 2006/0077108 A1 Apr. 13, 2006

Related U.S. Application Data
(63) Continuation of application No. 10/812,112, filed on Mar. 29, 2004, now Pat. No. 6,995,718, which is a continuation of application No. 10/087,839, filed on Mar. 5, 2002, now Pat. No. 6,724,348.

(30) **Foreign Application Priority Data**
May 17, 2001 (TW) 90111862 A

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

(52) **U.S. Cl.** **343/702; 343/846**
(58) **Field of Classification Search** 343/702, 343/846, 872
See application file for complete search history.

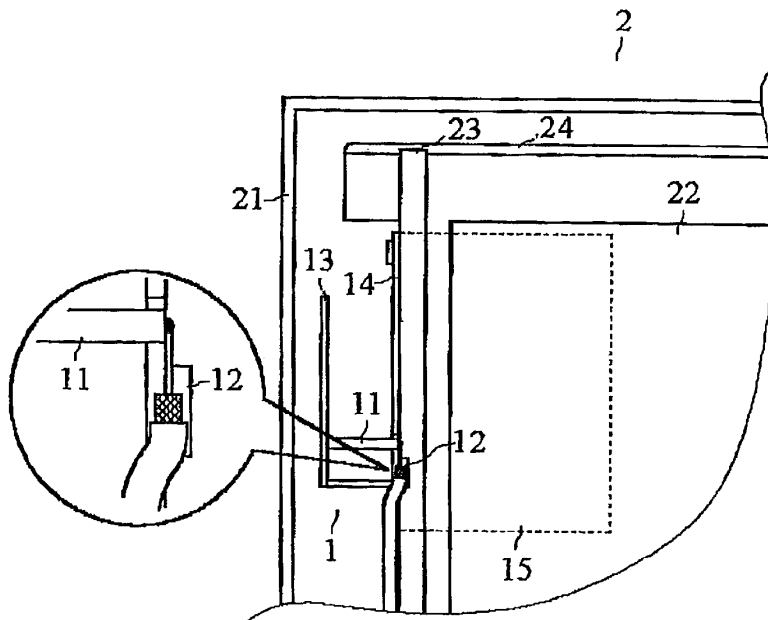
(56) **References Cited**
U.S. PATENT DOCUMENTS
5,677,698 A * 10/1997 Snowdon 343/770
5,684,672 A * 11/1997 Karidis et al. 361/683

* cited by examiner
Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Quintero Law Office

(57) **ABSTRACT**

A laptop computer with an embedded antenna is disclosed. The laptop computer contains an LCD panel and an antenna embedded inside the LCD panel. The antenna is embedded in the gap between the covering of the LCD panel and the frame supporting the LCD on the LCD panel. The ground surface of the antenna is effectively extended through incorporating the conducting surface on the back of the LCD. When the LCD panel is opened the antenna is at a distance above the operating surface of the laptop computer and produces omni-directional radiation pattern in the horizontal plane.

14 Claims, 5 Drawing Sheets





US007233295B2

(12) **United States Patent**
Regala

(10) **Patent No.:** **US 7,233,295 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

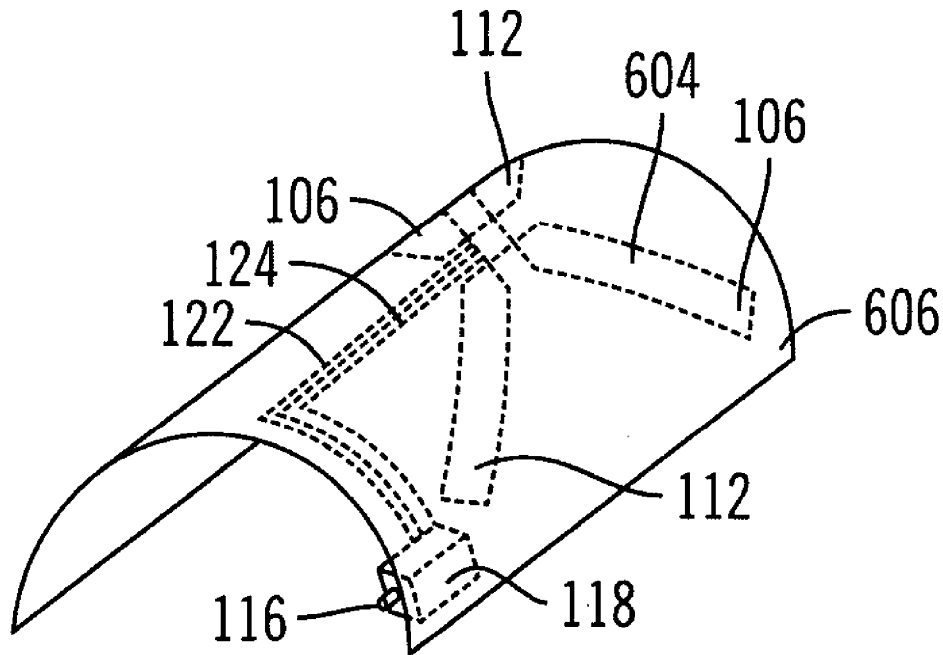
- (54) **CONFORMAL DRIVESHAFT COVER
SATCOM ANTENNA**
- (76) Inventor: **Florenio Pinili Regala**, 3097 Klondike Ave., Costa Mesa, CA (US) 92626
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 202 days.
- (21) Appl. No.: **11/120,337**
- (22) Filed: **May 3, 2005**
- (65) **Prior Publication Data**
US 2006/0250317 A1 Nov. 9, 2006
- (51) **Int. Cl.**
H01Q 1/28 (2006.01)
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/705**; 343/700 MS;
343/793
- (58) **Field of Classification Search** 343/700 MS,
343/803, 792-797, 705

- (56) **References Cited**
U.S. PATENT DOCUMENTS
3,789,416 A * 1/1974 Kuecken et al. 343/792
5,554,997 A * 9/1996 Cobb 343/793
2006/0250317 A1 * 11/2006 Regala 343/795
- OTHER PUBLICATIONS
Dayton-Granger Inc., Ft. Lauderdale, FL., Sikorsky "Blackhawk" Program; p. 215; www.daytongranger.com, no date.
* cited by examiner
Primary Examiner—Trinh Vo Dinh
(74) *Attorney, Agent, or Firm*—Mayback & Hoffman, P.A.; Scott D. Smiley

(57) **ABSTRACT**
An antenna assembly (700) includes a set of conformal shells (704, 706) housing a set of orthogonal dipoles (102, 104, 108, 110) that produce a circularly polarized radiation pattern. The dipoles (102, 104, 108, 110) are fed by a quadrature hybrid (118) and impedance matching circuit (114). The assembly (700) also includes a set of baluns (126, 128) to reduce VSWR.

See application file for complete search history.

20 Claims, 9 Drawing Sheets





US007233296B2

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

(10) **Patent No.:** **US 7,233,296 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **TRANSPARENT THIN FILM ANTENNA**

6,606,062 B2 * 8/2003 Ngounou Kouam
et al. 343/700 MS

(75) Inventors: **Hyok J. Song**, Los Angeles, CA (US);
Tsung Yuan Hsu, Westlake Village, CA
(US); **Daniel F. Stevenpiper**, Santa
Monica, CA (US); **Timothy J. Talty**,
Beverly Hills, MI (US); **Hui-Pin Hsu**,
Northridge, CA (US)

OTHER PUBLICATIONS

R.N. Simons and R. Q. Lee, "Feasibility Study of Optically Trans-
parent Microstrip Patch Antenna", IEEE Antennas and Propagation
Society International Symposium 1997 Digest, Montreal, Quebec,
Jul. 14-18, 1997, vol. 4, pp. 2100-2103.

(73) Assignee: **GM Global Technology Operations,
Inc.**, Detroit, MI (US)

K. Oshima et al., "Use of a Transparent Conductive Thin-film on a
Glass Substrate in Active Integrated Antenna Arrays with Double
Strong Coupling", IEEE MTT-S Digest, 2002, pp. 1569-1572.

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

Simons et al., "Finite Width Coplanar Waveguide Patch Antenna
with Vertical Fed Through Connect", NASA Technical Memorandum
107136, prepared for 1996 IEEE AP-S International Symposi-
um and URSI Radio Science Meeting Cosponsored by IEEE,
AP-S, and U.R.S.I., Baltimore, Maryland, Jul. 16-21, 1996, pp. 1-6.

(21) Appl. No.: **11/207,512**

* cited by examiner

(22) Filed: **Aug. 19, 2005**

Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Kathryn A. Marra

(65) **Prior Publication Data**

(57) **ABSTRACT**

US 2007/0040756 A1 Feb. 22, 2007

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

(52) **U.S. Cl.** **343/713; 343/711; 343/767**

(58) **Field of Classification Search** **343/711,**
343/713, 767, 769, 770, 704

See application file for complete search history.

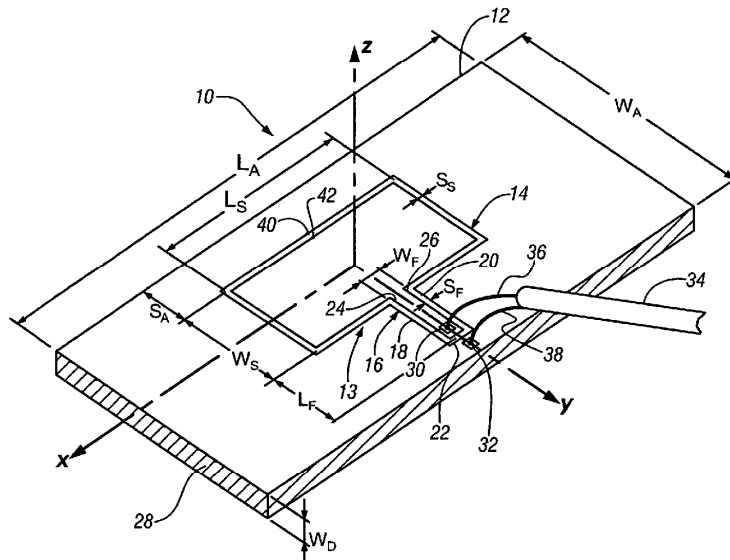
A method for improving the efficiency of antennas having
transparent thin-film conductive surfaces, and antennas
improved by the method are disclosed. For a selected
frequency of antenna operation, values for surface current
density in areas distributed over the surface of the thin-film
are determined. Regions of the surface containing areas
having concentrated current flow are identified based upon
the determined values of current density. Antenna efficiency
is improved by increasing conductivity in areas of the
thin-film surface found to have concentrated current flow.
The method enables the improvement of the efficiency of
antennas having transparent thin-film conducting surfaces,
without unnecessarily obstructing the optical view through
the thin-film surfaces of the antennas.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,063,246 A * 12/1977 Greiser 347/700 MS
5,926,141 A 7/1999 Lindenmeier et al. 343/713
6,097,345 A * 8/2000 Walton 343/769
6,329,950 B1 * 12/2001 Harrell et al. 343/700 MS
6,417,811 B1 * 7/2002 Adrian 343/713

13 Claims, 5 Drawing Sheets





US007233297B1

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

(10) **Patent No.:** **US 7,233,297 B1**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **STEERABLE RADIAL LINE SLOT ANTENNA**

6,737,938 B2* 5/2004 Kitamori et al. 333/161
6,853,344 B2* 2/2005 Huor 343/767

(75) Inventors: **Robin J. Harvey**, Newbury Park, CA (US); **Franklin A. Dolezal**, Reseda, CA (US)

OTHER PUBLICATIONS

Ando, M., et al., "A Radial Line Slot Antenna for 12 Ghz Satellite TV Reception," *IEEE Transactions on Antennas and Propagation*, vol. AP-33, No. 12, pp. 1347-1352 (Dec. 1985).
Hirokawa, J., et al., "Waveguide Array," *IEE Proceedings*, vol. 137, Pt. H., No. 6, pp. 367-371 (Dec. 1990).
Takahashi, M., et al., "Characteristics of Small-Aperture, Single-Layered, Radial-Line Slot Antennas," *IEE Proceedings-H*, vol. 139, No. 1, pp. 79-83 (Feb. 1992).
Yamamoto, T., et al., "Application of Radial Line Slot Antenna to Millimeter-Wave Systems at 60Ghz Band," *IEEE*, pp. 62-65 (1996).

(73) Assignee: **HRL Laboratories, LLC**, Malibu, CA (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.

* cited by examiner

(21) Appl. No.: **10/890,574**

Primary Examiner—Shih-Chao Chen

(22) Filed: **Jul. 13, 2004**

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

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

(57) **ABSTRACT**

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

A steerable antenna comprising an array of T-shaped slots. The location of the slots is moved to define an array of ring- or spiral-patterned phase constant regions. Distortions or contractions of the pattern occur by repositioning some or all of the slots forming the array. The antenna also comprises an intermediate insulating layer and a lower plate. The insulating layer is formed by a deformable dielectric medium. Deformation of the dielectric medium allows the beam angle to be altered.

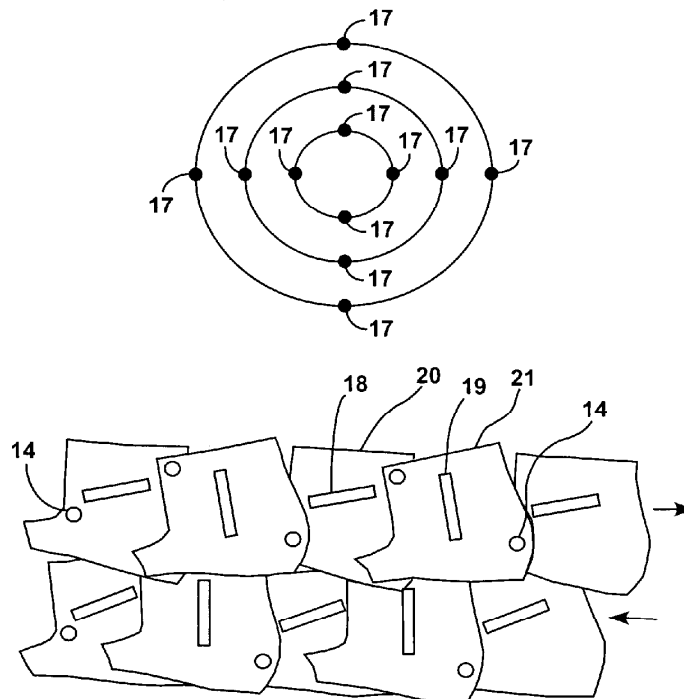
(58) **Field of Classification Search** 343/767-771
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,711,440 A *	6/1955	Rines	.....	342/179
4,697,272 A	9/1987	Harvey	.....	372/99
4,716,415 A *	12/1987	Kelly	.....	343/771
5,175,561 A	12/1992	Goto	.....	343/769
6,124,833 A *	9/2000	Bialkowski et al.	.....	343/770
6,542,130 B2 *	4/2003	Falk et al.	.....	343/771

38 Claims, 6 Drawing Sheets





US007233298B2

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

(10) **Patent No.:** **US 7,233,298 B2**
(45) **Date of Patent:** **Jun. 19, 2007**

(54) **HIGH PERFORMANCE ANTENNA**

(75) Inventors: **Jon L. Nagel**, San Jose, CA (US);
Jeffrey Nagel, San Jose, CA (US)

(73) Assignee: **Wavetest Systems, Inc.**

(*) 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.: **10/697,338**

(22) Filed: **Oct. 30, 2003**

(65) **Prior Publication Data**

US 2005/0093765 A1 May 5, 2005

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

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

(58) **Field of Classification Search** 343/718,
343/722, 793, 795, 802, 803, 806, 878, 895,
343/713, 702, 700

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,788,550 A * 11/1988 Chadima, Jr. 343/712
5,134,422 A * 7/1992 Auriol 343/895
5,754,143 A * 5/1998 Warnagiris et al. 343/767
5,767,808 A * 6/1998 Robbins et al. 343/700 MS

5,986,616 A * 11/1999 Edvardsson 343/853
6,061,025 A * 5/2000 Jackson et al. 343/700 MS
6,069,592 A * 5/2000 Wass 343/895
6,107,967 A * 8/2000 Hill 343/702
6,181,290 B1* 1/2001 Zaitsev et al. 343/786
6,246,371 B1* 6/2001 Kurz et al. 343/702
6,317,094 B1* 11/2001 Wu et al. 343/767
6,404,394 B1* 6/2002 Hill 343/702
6,417,816 B2* 7/2002 Sadler et al. 343/795
6,642,893 B1* 11/2003 Hebron et al. 343/702
6,650,302 B2* 11/2003 Sanad 343/841
6,677,905 B2* 1/2004 Deguchi et al. 343/702
6,753,816 B1* 6/2004 Apostolos 343/700 MS
6,806,831 B2* 10/2004 Johansson et al. ... 343/700 MS
2002/0075188 A1* 6/2002 Wu 343/702
2003/0071757 A1* 4/2003 Yamaki 343/741
2003/0210188 A1* 11/2003 Hebron et al. 343/700 MS
2004/0051672 A1* 3/2004 Nevermann et al. 343/702
2005/0057418 A1* 3/2005 Knadle et al. 343/815

FOREIGN PATENT DOCUMENTS

RU 2 205 478 * 5/2003

* cited by examiner

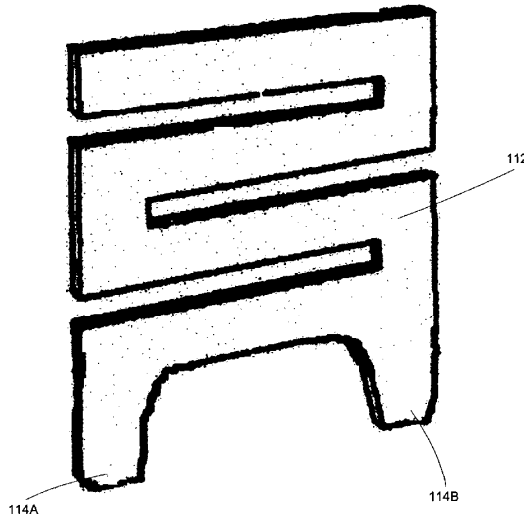
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Ethan D. Civan

(57) **ABSTRACT**

An antenna including a planar conductor, in which the planar conductor is self-supporting and the radiating pattern of the antenna is substantially isotropic.

25 Claims, 12 Drawing Sheets





US007236065B2

(12) **United States Patent**
Hyvönen

(10) **Patent No.:** **US 7,236,065 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **INTEGRATED RF-FRONT END HAVING AN ADJUSTABLE ANTENNA**

6,815,739 B2* 11/2004 Huff et al. 257/275
6,828,556 B2* 12/2004 Pobanz et al. 250/336.1

(75) Inventor: **Lassi Hyvönen**, Helsinki (FI)

OTHER PUBLICATIONS

(73) Assignee: **Nokia Corporation**, Espoo (FI)

R.T. Kuroda et al., Large scale W-band focal plane array developments for passive millimeter wave imaging, Apr. 1998, SPIE conference, pp. 57-62.*

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 59 days.

United States Frequency Allocations, Oct. 2003, US Department of Commerce NTIA, 1 page.*

Wikipedia, Radio frequency, Aug. 2006, 4 pages.*

* cited by examiner

(21) Appl. No.: **10/833,891**

Primary Examiner—Dean Takaoka

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

(74) *Attorney, Agent, or Firm*—Ware, Fressola, Van Der Sluys & Adolphson LLP

(65) **Prior Publication Data**

US 2005/0253664 A1 Nov. 17, 2005

(57) **ABSTRACT**

(51) **Int. Cl.**
H01P 1/10 (2006.01)
H04B 1/38 (2006.01)

(52) **U.S. Cl.** **333/101**; 333/103; 333/105; 455/74

(58) **Field of Classification Search** 333/101, 333/246, 103; 343/700 MS, 702; 257/275; 455/74

See application file for complete search history.

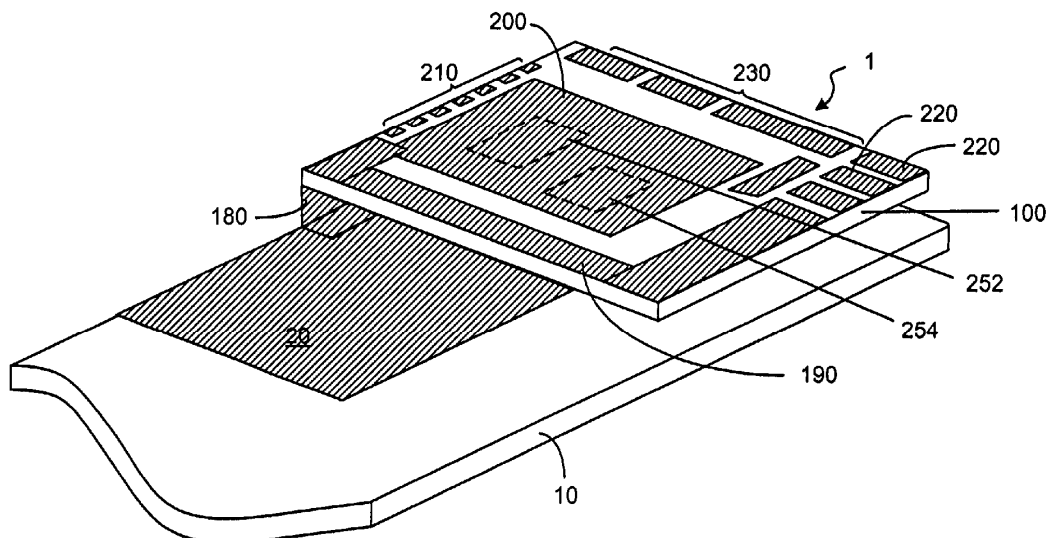
An integrated RF front-end module for use in a communications device, such as a mobile phone. The RF front-end module is made from a laminated structure consisting of a plurality of layers. At least one of the layers is used to embed RF electronics. Microvias are disposed in various layers of the laminated structure so as to provide electrical connections to the embedded RF electronics. Two electrically conductive layers are provided on both sides of the laminated structure for shielding the RF components against electromagnetic interference. An antenna has one or two radiating elements disposed on one or both sides of the laminated structures for conveying RF signals to and from the RF electronics. The antenna can be fine-tuned and the operational frequency range of the antenna can also be changed.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,043,738 A * 8/1991 Shapiro et al. 343/700 MS
5,764,189 A * 6/1998 Lohninger 343/700 MS
6,342,869 B1 * 1/2002 Edvardsson et al. 343/841
6,542,050 B1 * 4/2003 Arai et al. 333/134

16 Claims, 9 Drawing Sheets





US007236129B2

(12) **United States Patent**
Nilsson

(10) **Patent No.:** **US 7,236,129 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **APPARATUS AND METHOD FOR A MULTI-POLARIZED ANTENNA**

(75) Inventor: **Jack Nilsson**, Medina, OH (US)

(73) Assignee: **WIFI-Plus, Inc.**, Brunswick Hills, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 7 days.

(21) Appl. No.: **10/787,031**

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

(65) **Prior Publication Data**
US 2004/0164918 A1 Aug. 26, 2004

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/294,420, filed on Nov. 14, 2002, now Pat. No. 6,806,841.

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
(52) **U.S. Cl.** **343/700 MS**
(58) **Field of Classification Search** 343/700 MS,
343/713, 845, 846, 711, 712
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,218,707 A	10/1940	Franz	
5,805,113 A	9/1998	Ogino et al.	
6,100,855 A *	8/2000	Vinson et al.	343/846
6,714,170 B2 *	3/2004	Kleinschmidt	343/883

OTHER PUBLICATIONS

<http://www.magneticsciences.com/UWBandVpolAnts-ns4.html>, "Ultra-Wideband (UWB) and Multiband antenna for RF, micro-waves and UWB".

<http://www.magneticsciences.com/MultibeamSATCOMantenna-ns4.html>, "Multiple Beam Antenna for Satellite Communications and LOS Communications".
<http://www.northcountryradio.com/Articles/discfig2.htm>, "Discone Figures".
http://kyleti.aswww.net/index.php?page=projects&old_project+80211b_Discone, "Tim and David's 2.4 GHz 802.11b Discone".
<http://www.wave-report.com/tutorials/OFDM.htm>, "OFDM Tutorial".
Broadband Wireless Internet Forum White Paper, "VOFDM Broadband Wireless Transmission and Its Advantages over Single Carrier Modulation; Document No. WP-1_TG-1," Broadband Wireless Internet Forum, 1.2 ed., Broadband Wireless Internet Forum, p. 1-35, (Dec. 15, 2000).

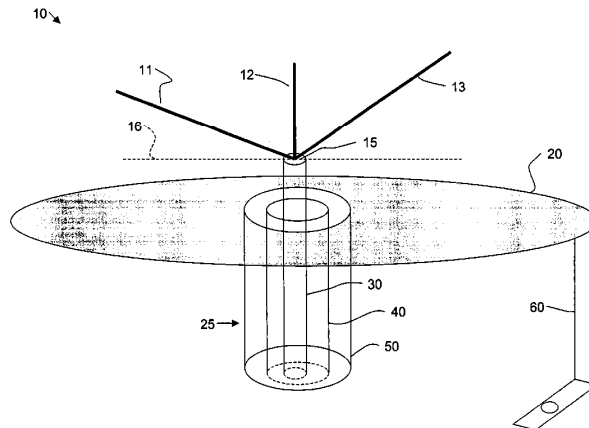
* cited by examiner

Primary Examiner—Hoanganh Le
Assistant Examiner—Huedung Mancuso
(74) *Attorney, Agent, or Firm*—Sheldon Mak Rose & Anderson PC

(57) **ABSTRACT**

A multi-polarized antenna for transmitting and/or receiving radio frequency (RF) signals, and a method for constructing same, is disclosed. The antenna comprises at least two radiative antenna elements each having a first end and a second end. The second ends of the antenna elements are electrically connected at an apex point and are disposed outwardly away from the apex point at an acute angle relative to and to a first side of an imaginary plane intersecting the apex point. The antenna also includes an electrically conductive ground plane located at and/or to a second side of the imaginary plane.

29 Claims, 9 Drawing Sheets





US007236130B2

(12) **United States Patent**
Voigtlaender

(10) **Patent No.:** **US 7,236,130 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **SYMMETRICAL ANTENNA IN LAYER CONSTRUCTION METHOD**
(75) Inventor: **Klaus Voigtlaender**, Wangen (DE)
(73) Assignee: **Robert Bosch GmbH**, Stuttgart (DE)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

4,682,180	A *	7/1987	Gans	.....	343/769
5,418,544	A *	5/1995	Elliot	.....	343/797
5,497,164	A *	3/1996	Croq	.....	343/700 MS
5,917,458	A *	6/1999	Ho et al.	.....	343/909
6,281,843	B1 *	8/2001	Evtiushkine et al.	.....	343/700 MS
6,320,547	B1 *	11/2001	Fathy et al.	.....	343/700 MS
6,384,785	B1 *	5/2002	Kamogawa et al.	.....	343/700 MS
7,012,569	B2 *	3/2006	Gottwald et al.	.....	343/700 MS
2004/0113840	A1 *	6/2004	Gottwald et al.	.....	343/700 MS

(21) Appl. No.: **10/992,192**

FOREIGN PATENT DOCUMENTS

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

DE 100 63 437 11/2002

(65) **Prior Publication Data**
US 2005/0104795 A1 May 19, 2005

* cited by examiner

(30) **Foreign Application Priority Data**
Nov. 17, 2003 (DE) 103 53 686

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

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 9/16 (2006.01)

(57) **ABSTRACT**

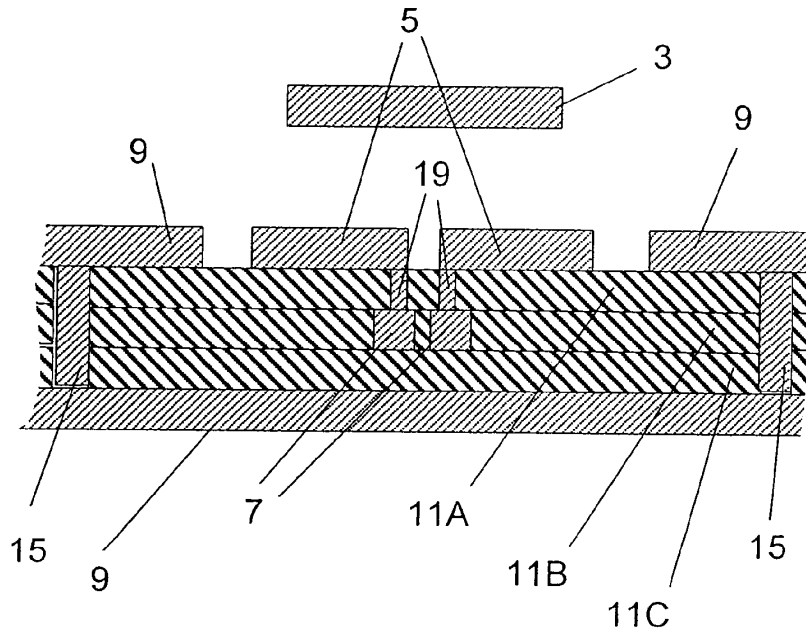
(52) **U.S. Cl.** **343/700 MS; 343/713; 343/793; 343/815**

An antenna array, especially for spacing ascertainment or speed ascertainment in the surroundings of motor vehicles, includes devices for transmitting and/or receiving signal waves, which includes a shielding layer construction, made up of at least two layers, which includes the transmitting or receiving devices at least in part. To achieve above all a good immunity to interference, the antenna array includes a differential input buried in a dielectric layer and it includes a transmitting and/or receiving dipole, which is composed of two separate dipole halves.

(58) **Field of Classification Search** 343/792, 343/841, 700 MS
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
4,162,499 A * 7/1979 Jones et al. 343/700 MS

12 Claims, 13 Drawing Sheets





US007236132B1

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

(10) **Patent No.:** **US 7,236,132 B1**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **COUPLED MULTI-BAND ANTENNA**

6,992,627 B1* 1/2006 Honda et al. 343/700 MS
2005/0001766 A1* 1/2005 Tasi 343/700 MS

(75) Inventors: **Sheng-Chih Lin**, Taipei Hsien (TW);
Tsung-Wen Chiu, Taipei Hsien (TW);
Fu-Ren Hsiao, Taipei Hsien (TW)

* cited by examiner

(73) Assignee: **Advance Connectek Inc**, Hsin-Tien
(TW)

Primary Examiner—Tuyet Thi Vo
(74) *Attorney, Agent, or Firm*—Alan Kamrath; Kamrath &
Associates PA

(*) 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**

(21) Appl. No.: **11/598,461**

A coupled multi-band antenna with the broadband function includes a coupled radiator, a feed wire, a first radiating extension, and a second radiating extension. The coupled radiator has a microwave substrate, a coupled metal element, a first radiating element, a second radiating element, and a connecting portion. The coupled metal element is connected to the positive terminal of the feed wire, and the second radiating element is connected to the negative terminal of the feed wire for the purposes of transmitting electrical signals and generating the multi-band operating modes of the antenna. By connecting the first and second radiating extensions to the coupled radiator, the surface current distribution and impedance variation of the antenna can be effectively adjusted to provide multi-band functions. The antenna utilizes the simple structure of coupled radiator to achieve multi-band operations and uses the radiating extensions to provide sufficient bandwidths.

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

(30) **Foreign Application Priority Data**

Oct. 5, 2006 (TW) 95137114 A

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

(52) **U.S. Cl.** **343/700 MS; 343/702;**
343/906; 343/846

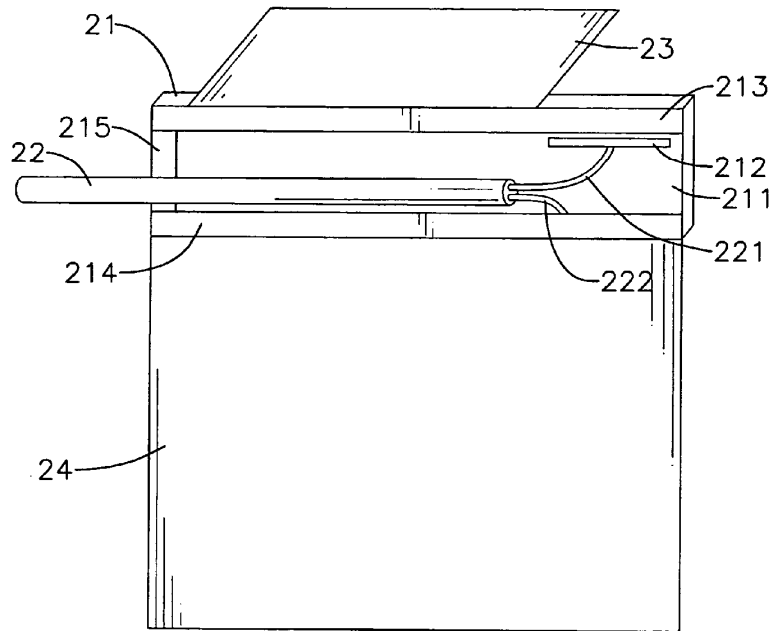
(58) **Field of Classification Search** 343/700 MS;
343/702, 906, 846; 333/24 C
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,864,842 B2* 3/2005 Hung et al. 343/700 MS

6 Claims, 5 Drawing Sheets





US007236133B2

(12) **United States Patent**
Ohara

(10) **Patent No.:** **US 7,236,133 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **ANTENNA SYSTEM**
(75) Inventor: **Katsuhiko Ohara**, Obu (JP)
(73) Assignee: **DENSO Corporation**, Kariya (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.

6,570,538 B2 * 5/2003 Vaisanen et al. 343/702
6,768,460 B2 * 7/2004 Hoashi et al. 343/700 MS
6,807,401 B2 10/2004 Boyle

* cited by examiner

Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Harness, Dickey & Pierce, PLC

(21) Appl. No.: **11/147,475**
(22) Filed: **Jun. 8, 2005**

(57) **ABSTRACT**

(65) **Prior Publication Data**
US 2005/0275598 A1 Dec. 15, 2005

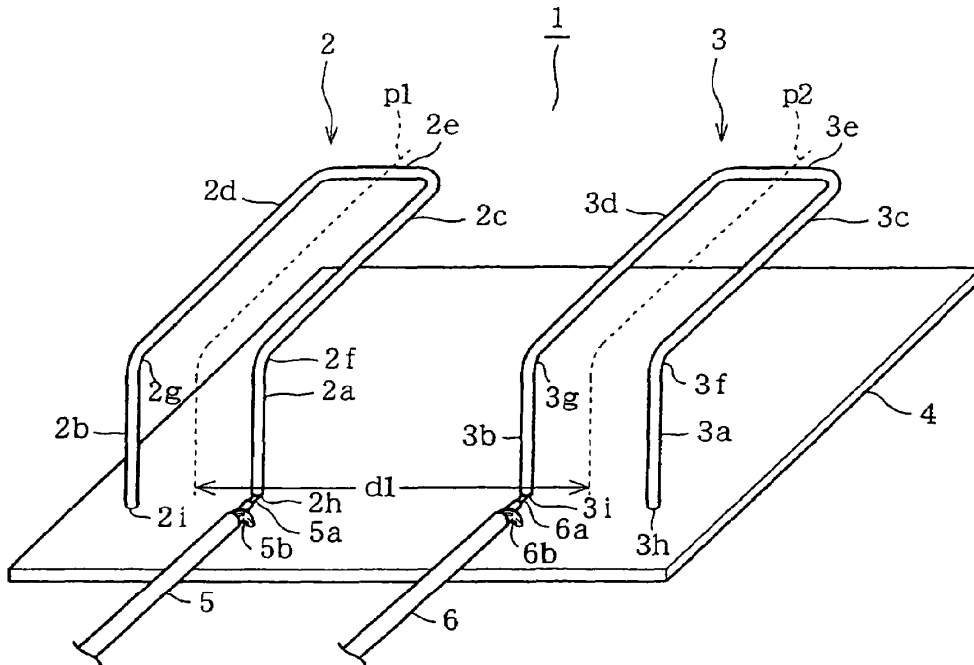
(30) **Foreign Application Priority Data**
Jun. 9, 2004 (JP) 2004-171123

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 21/00 (2006.01)
(52) **U.S. Cl.** **343/702; 343/844**
(58) **Field of Classification Search** 343/702,
343/700 MS, 846, 844
See application file for complete search history.

A compact and low-lying antenna system for receiving a radio wave includes a ground plate, a first crooked monopole antenna having a horizontal portion extending in parallel with the ground plate and a vertical portion extending vertically to the ground plate in such that the length of the horizontal portion and the vertical portion is approximately a quarter of the radio wave length, a second crooked monopole antenna having a horizontal portion extending in parallel with the ground plate and a vertical portion extending vertically to the ground plate in such that the length of the horizontal portion and the vertical portion is approximately a quarter of the radio wave length. The first and second antennas are disposed side by side at a distance that is approximately a quarter of the radio wave length.

(56) **References Cited**
U.S. PATENT DOCUMENTS
5,966,097 A * 10/1999 Fukasawa et al. ... 343/700 MS

3 Claims, 4 Drawing Sheets





US007236134B2

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

(10) **Patent No.:** **US 7,236,134 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **PROXIMITY-COUPLED FOLDED-J ANTENNA**

6,759,990 B2 *	7/2004	Rossmann	.....	343/700 MS
6,943,730 B2 *	9/2005	Poilasne et al.	.....	343/700 MS
6,956,530 B2 *	10/2005	Kadambi et al.	.....	343/702
7,072,690 B2 *	7/2006	Shin et al.	.....	455/557
7,084,813 B2 *	8/2006	Pathak et al.	.....	343/700 MS

(75) Inventors: **Stanislav Licul**, Plantation, FL (US);
Pha C. Nguyen, Lake Worth, FL (US);
Lorenzo A. Ponce De Leon, Lake Worth, FL (US)

FOREIGN PATENT DOCUMENTS

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

WO WO 2004/025778 3/2004

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 59 days.

* cited by examiner

Primary Examiner—Tho Phan

(21) Appl. No.: **11/273,973**

(57) **ABSTRACT**

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

A Proximity Coupled-Folded-J Antenna PC-FJA (104) includes a ground plane (240), first resonant element (352) with a "J" shape that resonates at a first radio frequency, a second resonant element (350) positioned within the "J" shape and that resonates at a second radio frequency, and a third resonant element (118) with a portion that is substantially parallel to and removed from the plane of the "J" shape and that resonates at a third radio frequency. The PC-FJA (104) has a fourth resonant element (130) with a loop (132) in a plane perpendicular to and removed from the plane of the "J" shape. The fourth resonant element (130) resonates at a fourth radio frequency. These elements are ohmically coupled to a connection arm (108). The ground plane (240) is removed from PC-FJA (104) and is perpendicular to the plane of the "J" shape.

(65) **Prior Publication Data**

US 2007/0109201 A1 May 17, 2007

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

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

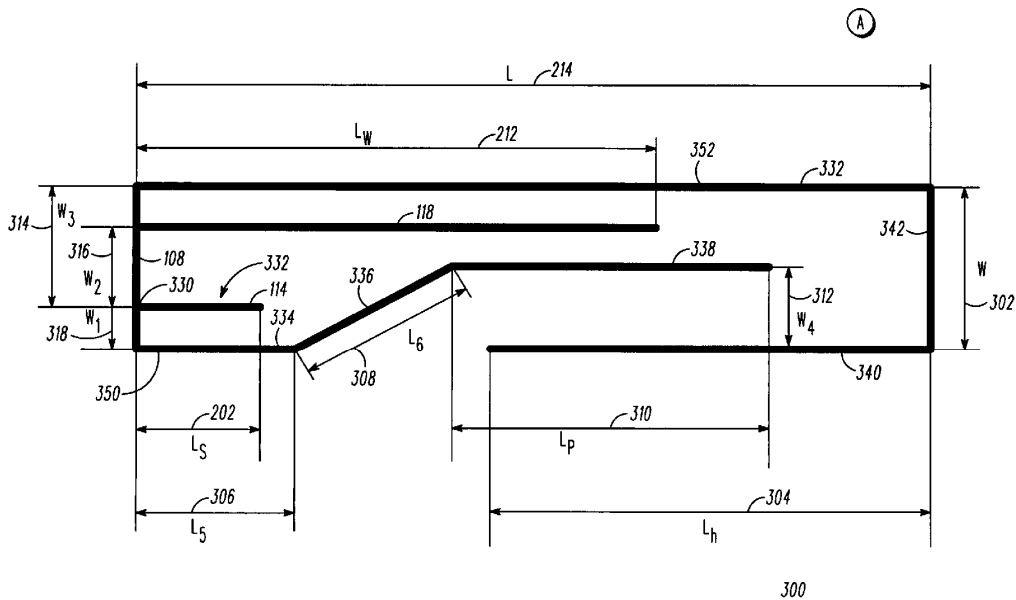
(58) **Field of Classification Search** 343/700 MS,
343/702, 829, 846
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,628,322 A * 12/1986 Marko et al. 343/702

20 Claims, 6 Drawing Sheets





US007236135B2

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

(10) **Patent No.:** **US 7,236,135 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **REINFORCEMENT PIECE FOR A MOTOR VEHICLE, AND THE USE OF SUCH A PIECE AS AN ANTENNA**

(58) **Field of Classification Search** 343/711,
343/712, 713

See application file for complete search history.

(75) **Inventors:** **Jerome Grando**, Vertrieu (FR);
Bertrand Jaud, Lyons (FR)

(56) **References Cited**

U.S. PATENT DOCUMENTS

(73) **Assignee:** **Compagnie Plastic Omnium**, Lyons (FR)

5,739,794 A * 4/1998 Nagy et al. 343/713
5,999,134 A * 12/1999 Dishart et al. 343/713
6,266,023 B1 * 7/2001 Nagy et al. 343/713
6,900,769 B2 * 5/2005 Schlieber et al. 343/713
7,145,514 B2 * 12/2006 Lachenmaler et al. 343/711

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

* cited by examiner

(21) **Appl. No.:** **11/405,437**

Primary Examiner—Tan Ho

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

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

(65) **Prior Publication Data**

US 2006/0284776 A1 Dec. 21, 2006

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

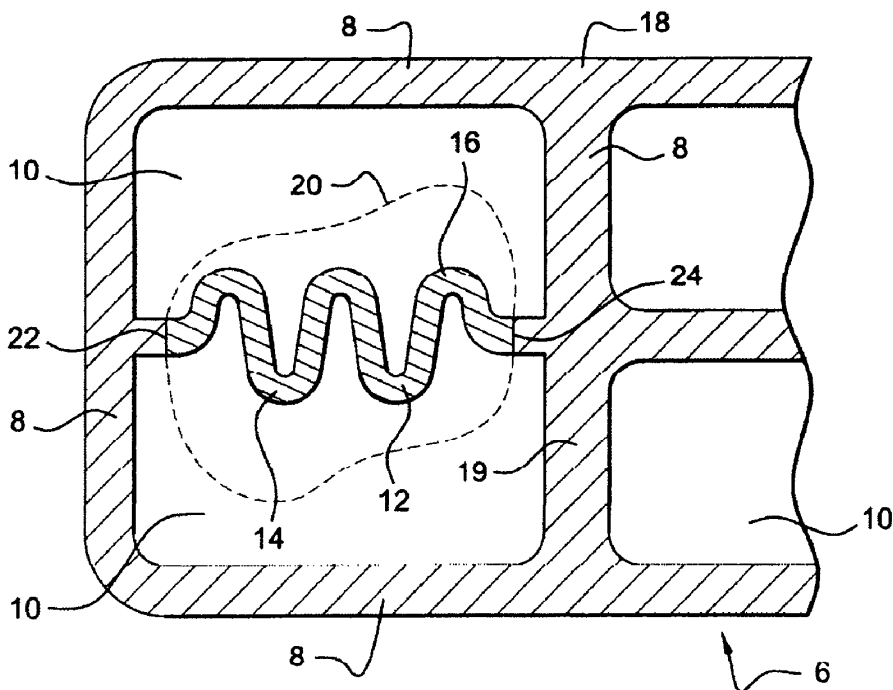
Apr. 18, 2005 (FR) 05 03871

The invention relates to a reinforcement piece (6) for reinforcing a piece of motor vehicle bodywork, the reinforcement piece comprising at least one strip (8, 12) of thermoplastic material defining at least one opening (10) in the piece (6), the piece being covered at least in part in an electrically-conductive covering (14).

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

(52) **U.S. Cl.** 343/712; 343/713

6 Claims, 2 Drawing Sheets





US007236141B2

(12) **United States Patent**
Huang

(10) **Patent No.:** **US 7,236,141 B2**
(45) **Date of Patent:** **Jun. 26, 2007**

(54) **ANTENNA SYSTEM AND A METHOD FOR FABRICATING THE SAME**

(75) Inventor: **Tzung-Fang Huang**, Chiayi Hsien (TW)

(73) Assignee: **Benq Corporation**, Taoyuan (TW)

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

(21) Appl. No.: **11/262,426**

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

(65) **Prior Publication Data**

US 2006/0092092 A1 May 4, 2006

(30) **Foreign Application Priority Data**

Oct. 29, 2004 (TW) 93133141 A

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

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

(58) **Field of Classification Search** **343/895, 343/700 MS**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,169,267 A * 9/1979 Wong et al. 343/895
6,140,973 A * 10/2000 Annamaa et al. 343/790
6,710,752 B2 * 3/2004 Saito et al. 343/895

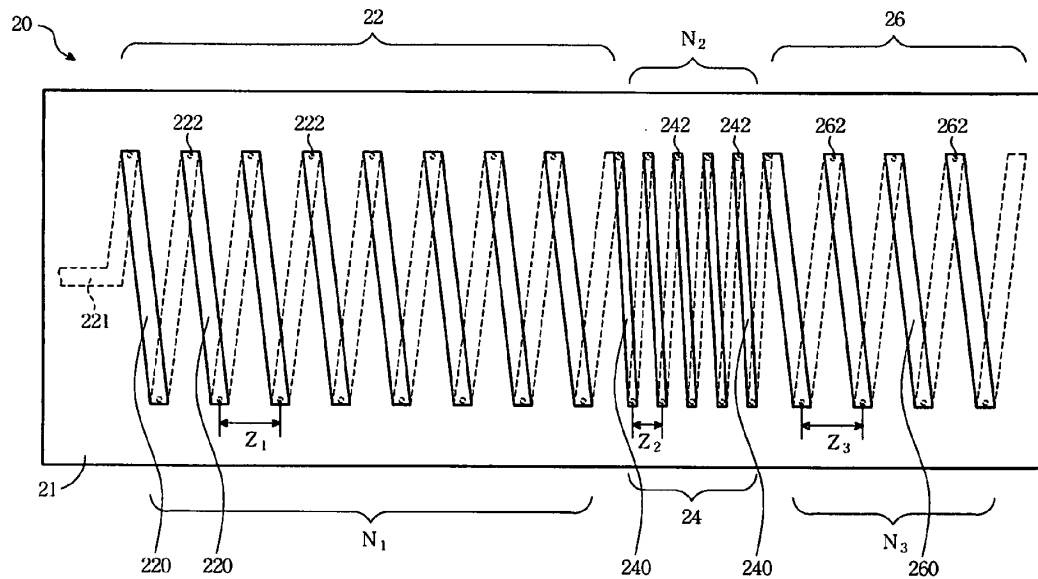
* cited by examiner

Primary Examiner—Hoang V. Nguyen
(74) *Attorney, Agent, or Firm*—Ladas and Parry LLP

(57) **ABSTRACT**

An antenna system includes interconnected first, second and third saw-like antenna units, each of which is formed by a plurality of metal strips of specific width. An adjacent two of the first metal strips define a first acute angle therebetween. An adjacent two of the second metal strips define a second acute angle smaller than the first acute angle. An adjacent two of the third metal strips define the third acute angle the same as the first acute angle. The second metal strips of the second antenna unit are located densely in such a manner to provide an electromagnetic induction to achieve a second frequency band different from that provided by the first and third antenna units.

14 Claims, 5 Drawing Sheets





US00D544471S

(12) **United States Design Patent** (10) **Patent No.:** **US D544,471 S**
Wang (45) **Date of Patent:** **** Jun. 12, 2007**

(54) **INDOOR ANTENNA** D481,031 S * 10/2003 Wang D14/235
D501,000 S * 1/2005 Wang D14/235
D517,535 S * 3/2006 Wu D14/230
(75) Inventor: **Cheng-Si Wang**, Changhua Hsien (TW)
(73) Assignee: **Trans Electric Co., Ltd.**, Changhua Hsien (TW) * cited by examiner
(**) Term: **14 Years** *Primary Examiner*—Louis S. Zarfes
Assistant Examiner—John Windmuller
(21) Appl. No.: **29/264,618** (74) *Attorney, Agent, or Firm*—Posz Law Group, PLC; R. Eugene Vardell, Jr.
(22) Filed: **Aug. 15, 2006**

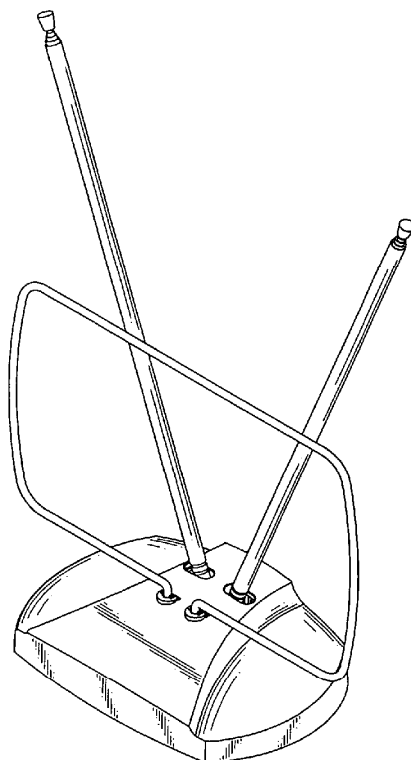
(51) **LOC (8) Cl.** **14-03**
(52) **U.S. Cl.** **D14/230**
(58) **Field of Classification Search** D14/138,
D14/230–238, 299, 358; D12/42, 43; 343/700 R–705,
343/871–908, 795, 840, 711–713, 819, 846;
455/90.2, 90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
D211,025 S * 5/1968 Callaghan D14/234
D224,973 S * 10/1972 Franzone D14/235
D236,503 S * 8/1975 Middlemark D14/235
D239,774 S * 5/1976 Kuldin D14/235
D480,713 S * 10/2003 Wang D14/235

(57) **CLAIM**
The ornamental design for an indoor antenna, as shown.

DESCRIPTION
FIG. 1 is a perspective view of an indoor antenna showing my new design;
FIG. 2 is a front elevational view thereof;
FIG. 3 is a rear elevational view thereof;
FIG. 4 is a left side elevational view thereof;
FIG. 5 is a right side elevational view thereof;
FIG. 6 is a top plan view thereof; and,
FIG. 7 is a bottom plan view thereof.

1 Claim, 6 Drawing Sheets





US00D543974S

(12) **United States Design Patent** (10) **Patent No.:** **US D543,974 S**
Oshima et al. (45) **Date of Patent:** **** Jun. 5, 2007**

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

2006/0055602 A1* 3/2006 Huber et al. 343/700 MS
2007/0001906 A1* 1/2007 Pelzer et al. 343/700 MS

(75) Inventors: **Hideaki Oshima**, Tokyo (JP); **Satoru Komatsu**, Tokyo (JP); **Hiroshi Kuribayashi**, Tokyo (JP); **Tomoyuki Fukumaru**, Tokyo (JP); **Tatsuo Matsushita**, Tokyo (JP)

* cited by examiner

Primary Examiner—Louis S. Zarfaz
Assistant Examiner—John Windmuller
(74) *Attorney, Agent, or Firm*—Oliff & Berridge, PLC

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

(57) **CLAIM**

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

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

DESCRIPTION

(21) Appl. No.: **29/209,350**

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

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

FIG. 2 is a rear elevational view thereof;

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

FIG. 3 is a right side elevational view thereof;

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

FIG. 4 is a left side elevational view thereof;

(58) **Field of Classification Search** D14/138,
D14/230–238, 299, 358; D12/42, 43; 343/700 R–705,
343/871–908, 795, 840, 711–713, 819, 846,
343/767, 748, 700 MS, 741, 866; 455/90.2,
455/90.3, 91, 128, 269, 344, 347, 562.1

FIG. 5 is a top plan view thereof;

See application file for complete search history.

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.

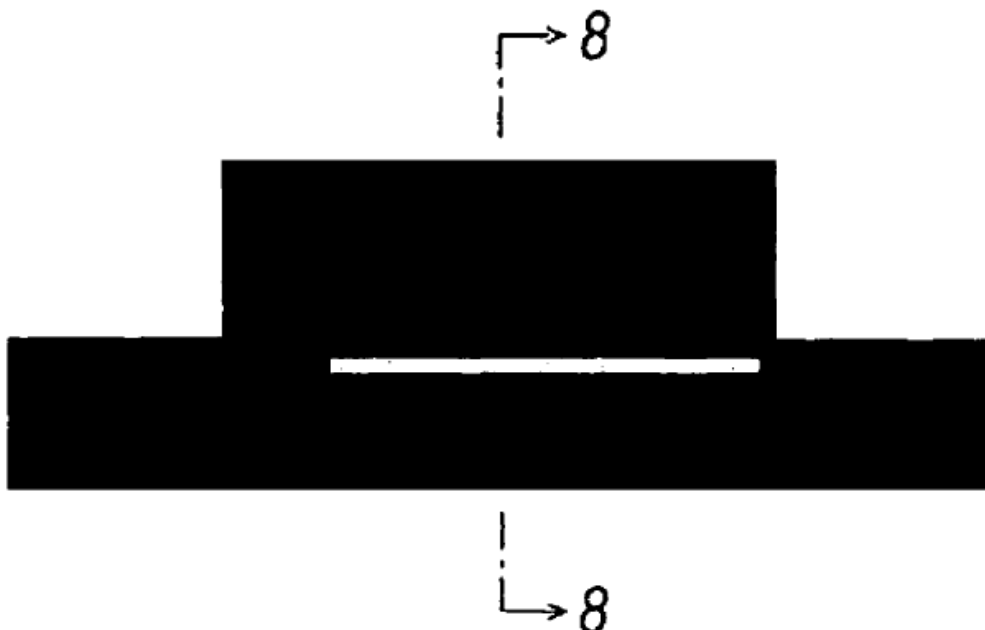
(56) **References Cited**

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

U.S. PATENT DOCUMENTS

2005/0248488 A1* 11/2005 Modro 343/700 MS
2006/0050002 A1* 3/2006 Wang et al. 343/767

1 Claim, 4 Drawing Sheets





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(12) **United States Design Patent** (10) **Patent No.:** **US D543,976 S**
Oliver (45) **Date of Patent:** **** Jun. 5, 2007**

(54) **RFID ANTENNA**
(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)
(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)
(**) Term: **14 Years**
(21) Appl. No.: **29/266,518**
(22) Filed: **Sep. 21, 2006**
(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 MS,
343/700 R-705, 711-713, 741, 748, 767,
343/795, 819, 840, 846, 866, 871-908; 455/90.2,
455/90.3, 91, 128, 269, 344, 347, 562.1
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
2002/0067315 A1* 6/2002 Kunysz 343/769
2002/0075184 A1* 6/2002 Tuttle 343/700 MS
2004/0125023 A1* 7/2004 Fujii et al. 343/700 MS

2005/0104789 A1* 5/2005 Hashidate et al. ... 343/700 MS
2005/0134460 A1* 6/2005 Usami 340/572.7
2005/0259030 A1* 11/2005 Mizuno et al. 343/866
2006/0038730 A1* 2/2006 Parsche 343/741
* cited by examiner

Primary Examiner—Louis S. Zarfes
Assistant Examiner—John Windmuller
(74) *Attorney, Agent, or Firm*—Thelen Reid Brown
Raysman & Steiner LLP; David B. Ritchie

(57) **CLAIM**

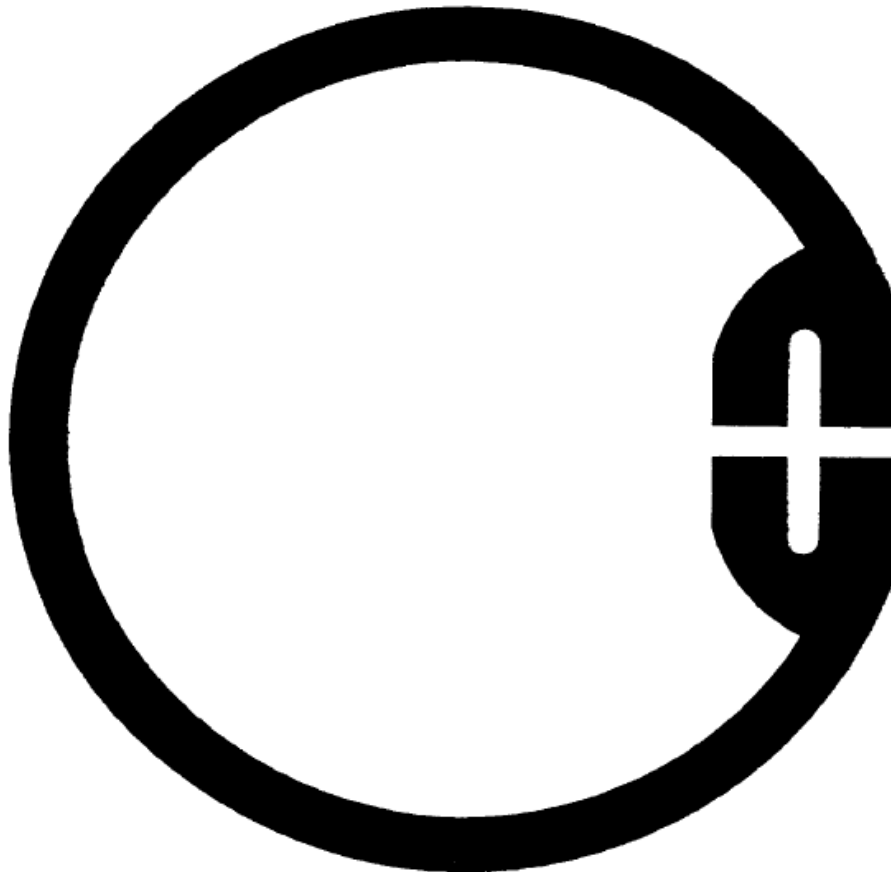
The ornamental design for an RFID antenna, as shown and described.

DESCRIPTION

FIG. 1 is a top plan view of an RFID antenna showing my new design, the bottom plan view being a mirror image thereof; and,

FIG. 2 is a top plan view thereof in use with an RFID chip. The broken line showing of a square RFID chip in FIG. 2 is included for the purpose of illustrating environment and forms no part of the claimed design.

1 Claim, 2 Drawing Sheets





US00D544469S

(12) **United States Design Patent** (10) **Patent No.:** **US D544,469 S**
Oshima (45) **Date of Patent:** **** Jun. 12, 2007**

(54) **PLANAR ANTENNA ELEMENT FOR VEHICLE WINDOW PANE**

2006/0055602 A1* 3/2006 Huber et al. 343/700 MS

* cited by examiner

(75) Inventor: **Hideaki Oshima**, Minato-ku (JP)

Primary Examiner—Louis S. Zarfes

(73) Assignee: **Nippon Sheet Glass Company, Limited**, Tokyo (JP)

Assistant Examiner—John Windmuller

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

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

(57) **CLAIM**

(21) Appl. No.: **29/209,351**

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

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

DESCRIPTION

(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.

FIG. 1 is a front elevational view of a planar antenna element for vehicle windowpane showing my 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.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,019,699	B2*	3/2006	Komatsu et al.	343/713
7,102,520	B2*	9/2006	Liu et al.	340/572.1
2004/0135731	A1*	7/2004	Komatsu et al.	343/713
2004/0155825	A1*	8/2004	Komatsu et al.	343/713
2005/0134460	A1*	6/2005	Usami	340/572.7
2005/0200531	A1*	9/2005	Huang et al.	343/700 MS
2006/0044197	A1*	3/2006	Ikeda et al.	343/713

1 Claim, 4 Drawing Sheets

