



US008031122B2

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

(10) **Patent No.:** **US 8,031,122 B2**  
(45) **Date of Patent:** **Oct. 4, 2011**

(54) **PROTECTIVE CIRCUIT MODULE AND SECONDARY BATTERY PACK INCLUDING THE SAME**

2005/0142439 A1 \* 6/2005 Lee et al. .... 429/163  
2006/0263647 A1 \* 11/2006 Moon et al. .... 429/7  
2007/0011870 A1 1/2007 Lerch et al.

(75) Inventors: **Youngcheol Jang**, Yongin-si (KR);  
**Nohyun Kwag**, Yongin-si (KR)

FOREIGN PATENT DOCUMENTS

JP 2000-174651 6/2000  
JP 2001-228042 8/2001  
KR 10-1997-0072551 A 11/1997  
KR 10-0343898 6/2002  
KR 10-2004-0075202 A 8/2004  
KR 10-2006-0110579 10/2006  
KR 10-2006-0132345 A 12/2006  
KR 10-0944989 2/2010

(73) Assignee: **Samsung SDI Co., Ltd.**, Yongin-si (KR)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 424 days.

OTHER PUBLICATIONS

English abstract of Korean Publication 10-1997-0072551, published Nov. 7, 1997, previously filed in an IDS dated Jul. 29, 2010. Machine translation of JP 2000-174651. SIPO Office action dated Apr. 6, 2011, for corresponding Chinese Patent application 200810171166.4, with English translation, noting listed reference in this IDS. English-language abstract of KR 10-2000-0023068. English-language abstract of KR 10-2006-0068119.

(21) Appl. No.: **12/246,763**

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

(65) **Prior Publication Data**

US 2009/0109099 A1 Apr. 30, 2009

(30) **Foreign Application Priority Data**

Oct. 30, 2007 (KR) ..... 10-2007-0109726

\* cited by examiner

Primary Examiner — Hoang V Nguyen

(74) Attorney, Agent, or Firm — Christie, Parker & Hale, LLP

(51) **Int. Cl.**  
**H01Q 1/38** (2006.01)  
**H01Q 11/12** (2006.01)

(52) **U.S. Cl.** ..... **343/700 MS; 343/741; 343/866**

(58) **Field of Classification Search** ..... 343/702, 343/700 MS, 741, 866, 895  
See application file for complete search history.

(57) **ABSTRACT**

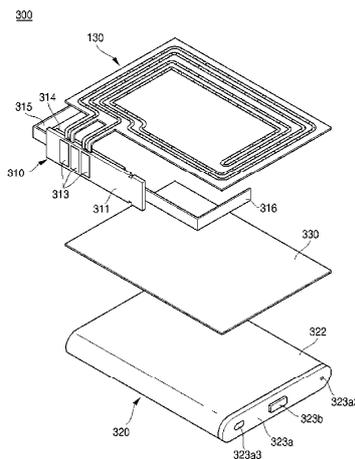
A protective circuit module including a layered insulating substrate, a printed circuit pattern disposed within the insulating substrate, and a loop antenna electrically connected to the printed circuit pattern. Ends of the loop antenna can be inserted into the insulating substrate and connected to the printed circuit pattern. Portions of the printed circuit pattern may extend out of the insulating substrate, and may be connected to the loop antenna. The protective circuit module can be included in a secondary battery pack comprising a secondary battery. The loop antenna can be adhered to the secondary battery.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,492,058 B1 \* 12/2002 Watanabe et al. .... 429/121  
6,628,931 B1 9/2003 Tomida  
7,439,933 B2 \* 10/2008 Uesaka ..... 343/895  
7,562,445 B2 \* 7/2009 Lerch et al. .... 29/832  
7,679,315 B2 \* 3/2010 Kim et al. .... 320/106  
7,736,800 B2 \* 6/2010 Lee ..... 429/181  
7,859,480 B2 \* 12/2010 Shimizu ..... 343/895

**20 Claims, 7 Drawing Sheets**





US008031126B2

(12) **United States Patent  
Cunningham**

(10) **Patent No.:** US 8,031,126 B2  
(45) **Date of Patent:** Oct. 4, 2011

- (54) **DUAL POLARIZED ANTENNA**
- (75) Inventor: **Patrick W. Cunningham**, McKinney, TX (US)
- (73) Assignee: **Raytheon Company**, Waltham, MA (US)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 953 days.
- (21) Appl. No.: **11/939,300**
- (22) Filed: **Nov. 13, 2007**
- (65) **Prior Publication Data**  
US 2009/0121967 A1 May 14, 2009
- (51) **Int. Cl.**  
**H01Q 13/10** (2006.01)
- (52) **U.S. Cl.** ..... **343/770; 343/767**
- (58) **Field of Classification Search** ..... **343/767, 343/770, 771, 772, 893, 908**  
See application file for complete search history.

|              |      |         |                    |         |
|--------------|------|---------|--------------------|---------|
| 5,461,392    | A    | 10/1995 | Mott et al.        |         |
| 6,344,830    | B1   | 2/2002  | Taylor             |         |
| 7,348,933    | B2 * | 3/2008  | Nilsson .....      | 343/895 |
| 2002/0118138 | A1   | 8/2002  | Lindenmeier et al. |         |
| 2003/0210197 | A1   | 11/2003 | Cencich et al.     |         |
| 2004/0004580 | A1   | 1/2004  | Toland et al.      |         |

**FOREIGN PATENT DOCUMENTS**

EP 0 227 121 7/1987

**OTHER PUBLICATIONS**

PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration, regarding PCT Application No. US2008/080587 (14 pages).

\* cited by examiner

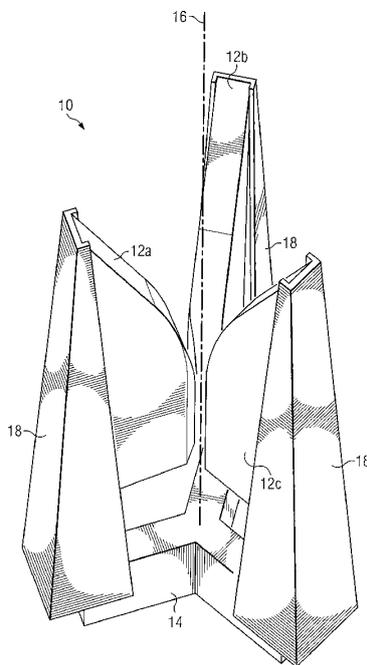
*Primary Examiner* — Jacob Y Choi  
*Assistant Examiner* — Robert Karacsony  
(74) *Attorney, Agent, or Firm* — Baker Botts L.L.P.

(57) **ABSTRACT**

In one embodiment according to the teachings of the present disclosure, an antenna generally includes a first, second, and third elements. The first and second elements form a first electro-magnetic radiator that is operable to transmit or receive a first signal having a first sense of polarization. The first and third elements form a second electro-magnetic radiator that is operable to transmit or receive a second signal having a second sense of polarization that is different than the first sense of polarization.

**25 Claims, 3 Drawing Sheets**

- (56) **References Cited**
- U.S. PATENT DOCUMENTS
- 2,480,182 A 8/1949 Clapp
- 4,978,965 A \* 12/1990 Mohuchy ..... 343/727
- 5,068,671 A 11/1991 Wicks
- 5,070,339 A 12/1991 Chu et al.





US008035563B2

(12) **United States Patent**  
**Ishimiya**

(10) **Patent No.:** **US 8,035,563 B2**

(45) **Date of Patent:** **Oct. 11, 2011**

(54) **MULTIBAND ANTENNA DEVICE AND COMMUNICATION TERMINAL DEVICE**

(75) Inventor: **Katsunori Ishimiya**, Tokyo (JP)

(73) Assignee: **Sony Ericsson Mobile Communications Japan, Inc.**, Tokyo (JP)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 387 days.

(21) Appl. No.: **12/089,922**

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

(86) PCT No.: **PCT/JP2006/318859**

§ 371 (c)(1),

(2), (4) Date: **Apr. 11, 2008**

(87) PCT Pub. No.: **WO2007/049414**

PCT Pub. Date: **May 3, 2007**

(65) **Prior Publication Data**

US 2009/0231213 A1 Sep. 17, 2009

(30) **Foreign Application Priority Data**

Oct. 25, 2005 (JP) ..... 2005-309345

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|              |      |         |                 |         |
|--------------|------|---------|-----------------|---------|
| 5,872,546    | A *  | 2/1999  | Ihara et al.    | 343/795 |
| 6,320,545    | B1   | 11/2001 | Nagumo et al.   |         |
| 2004/0056804 | A1   | 3/2004  | Kadambi et al.  |         |
| 2004/0207557 | A1   | 10/2004 | Chen et al.     |         |
| 2005/0280588 | A1 * | 12/2005 | Fujikawa et al. | 343/702 |

FOREIGN PATENT DOCUMENTS

|    |            |    |         |
|----|------------|----|---------|
| CN | 1279521    | A  | 1/2001  |
| DE | 103 41 310 | A1 | 3/2004  |
| EP | 1 267 441  | A2 | 12/2002 |
| EP | 1 478 047  | A1 | 11/2004 |
| JP | 36 12823   |    | 5/1961  |
| JP | 62 161410  |    | 10/1987 |

(Continued)

OTHER PUBLICATIONS

T. Sittironnarit, et al. "A Dual-Band Vehicular Planar Inverted-F Antenna for Ultra High Frequency (UHF) Applications", IEEE, 55<sup>th</sup> Vehicular Technology Conference, Proceedings, vol. 1, XP 001210405, May 6, 2002, pp. 345-349.

(Continued)

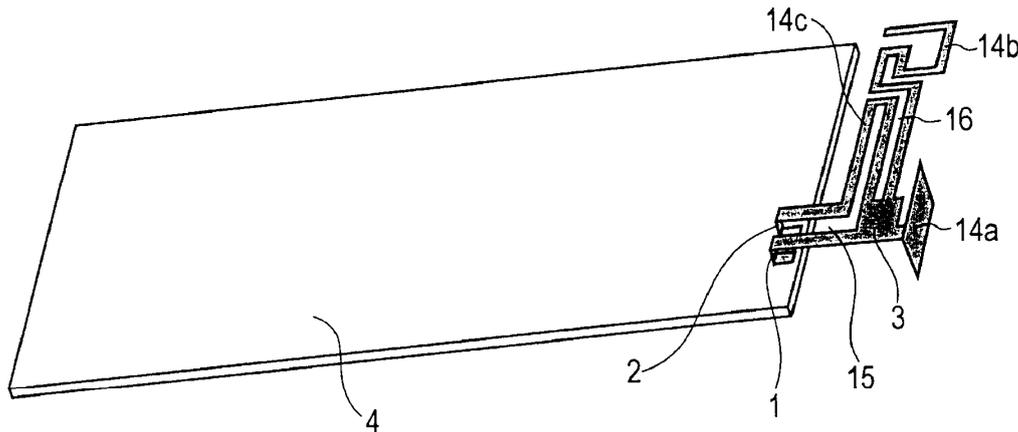
*Primary Examiner* — David G Phan

(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

A slit (15) is formed between a feed point and GND point of an inverted-F antenna to make the points electrically distant from each other, and at least three antenna elements (14a, 14b, and 14c) are formed. The at least three antenna elements (14a, 14b, and 14c) generate at least three resonance points. An antenna radiating plate (3) projects outwardly so that at least a major part thereof does not face a ground plate (4). Therefore, a multi-band antenna device capable of achieving a wider bandwidth without using a parasitic element, and a communication terminal apparatus are provided.

**4 Claims, 10 Drawing Sheets**





US008035564B2

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

(10) **Patent No.:** **US 8,035,564 B2**

(45) **Date of Patent:** **Oct. 11, 2011**

(54) **SURFACE MOUNTED PLANAR ANTENNA APPARATUS**

(75) Inventors: **Tsai-Yi Yang**, Tainan Hsien (TW);  
**Ching-wen Wu**, Tainan Hsien (TW);  
**Wei-Hung Hsu**, Tainan Hsien (TW);  
**Te-Yi Chu**, Tainan Hsien (TW)

(73) Assignee: **Cirotech Technology Corp.**, Tainan (TW)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 352 days.

(21) Appl. No.: **12/325,481**

(22) Filed: **Dec. 1, 2008**

(65) **Prior Publication Data**

US 2010/0134357 A1 Jun. 3, 2010

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

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

(58) **Field of Classification Search** ..... **343/700 MS,**  
**343/713**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,075,490 B2 \* 7/2006 Noro ..... 343/713  
7,432,864 B1 \* 10/2008 Yang et al. .... 343/700 MS  
7,498,991 B2 \* 3/2009 Chu et al. .... 343/702  
2003/0052755 A1 \* 3/2003 Barnes et al. .... 333/260  
\* cited by examiner

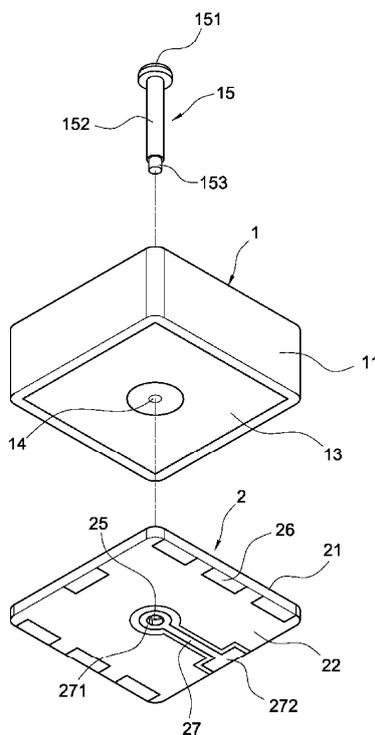
*Primary Examiner* — Tan Ho

(74) *Attorney, Agent, or Firm* — Chun-Ming Shih; HDLS IPR Services

(57) **ABSTRACT**

A surface mounted planar antenna apparatus includes an antenna and a circuit board. The antenna includes a base, a radiation metal plate arranged on a top face of the base, and a ground metal plate arranged on a bottom face of the base. A through hole is defined from the radiation metal plate and passed through the base to the ground metal plate. A signal feeder is arranged in the through hole and electrically connected to the radiation metal plate but electrically insulated with the ground metal plate. The circuit board is attached on the bottom face of the base and includes an upper face and a lower face, the upper face includes an area for binding with the ground metal plate on the bottom face of the base, and the lower face includes a first pad and a signal feeding trace electrically connected with the signal feeder.

**7 Claims, 7 Drawing Sheets**





US008035565B2

(12) **United States Patent**  
**Gamand**

(10) **Patent No.:** **US 8,035,565 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **ANTENNA DEVICE AND RF COMMUNICATION EQUIPMENT**

(75) Inventor: **Patrice Gamand**, Douvres la Delivrande (FR)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 513 days.

(21) Appl. No.: **12/293,415**

(22) PCT Filed: **Mar. 14, 2007**

(86) PCT No.: **PCT/IB2007/050864**

§ 371 (c)(1),  
(2), (4) Date: **Sep. 17, 2008**

(87) PCT Pub. No.: **WO2007/107923**

PCT Pub. Date: **Sep. 27, 2007**

(65) **Prior Publication Data**

US 2009/0102728 A1 Apr. 23, 2009

(30) **Foreign Application Priority Data**

Mar. 17, 2006 (EP) ..... 06300244

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

(52) **U.S. Cl.** ..... 343/702; 343/700 MS; 343/767

(58) **Field of Classification Search** ..... 343/700 MS,  
343/702, 767

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|           |      |         |                  |            |
|-----------|------|---------|------------------|------------|
| 5,041,839 | A *  | 8/1991  | Rees             | 343/700 MS |
| 5,767,808 | A *  | 6/1998  | Robbins et al.   | 343/700 MS |
| 5,903,239 | A    | 5/1999  | Takahashi et al. |            |
| 6,329,655 | B1 * | 12/2001 | Jack et al.      | 250/338.1  |
| 6,842,144 | B2 * | 1/2005  | Guo et al.       | 343/700 MS |
| 6,989,790 | B1 * | 1/2006  | Rees             | 343/700 MS |
| 7,838,328 | B2 * | 11/2010 | Isa              | 438/99     |

FOREIGN PATENT DOCUMENTS

|    |         |    |        |
|----|---------|----|--------|
| EP | 1494167 | A  | 1/2005 |
| EP | 1580837 | A1 | 9/2005 |

OTHER PUBLICATIONS

Zhang Y P; "Recent Advances in Integration of Antennas on Silicon Chip and on Ceramic Package". Conf-2005 IEEE International Workshop on Antenna Technology: Small Antennas and Novel Metamaterials, Mar. 7-9, 2005, Singapore, pp. 151-154. IEEE Piscataway, NJ, USA.

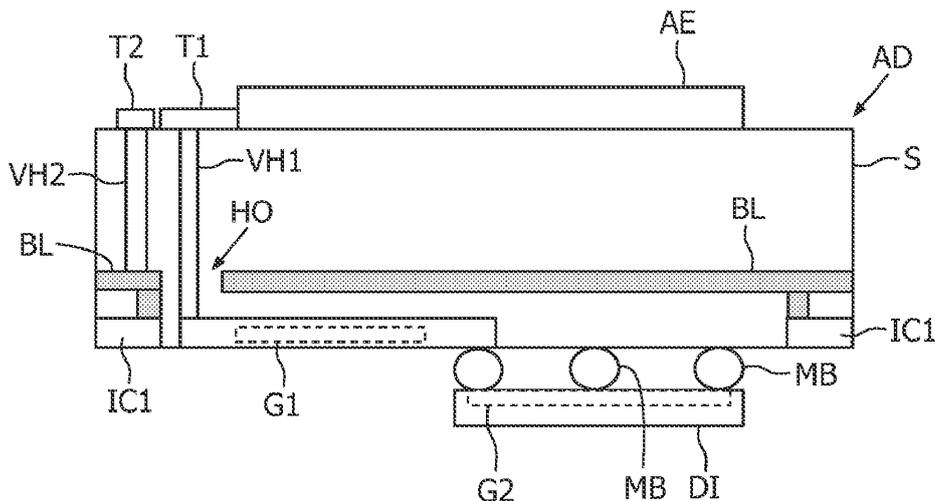
\* cited by examiner

*Primary Examiner* — David G Phan

(57) **ABSTRACT**

An antenna device (AD) for a RF communication equipment, comprises i) a substrate (S) comprising front (FS) and back (BS) sides, ii) a planar antenna element (AE) fixed to the substrate back side (BS), iii) a group of at least one component (G1) fixed to the substrate front side (FS), in an area located under the antenna element (AE), and connected to the antenna element (AE) through at least a first connecting means (VH 1) passing through the substrate (S), and a low resistivity layer (BL) buried into the substrate (S) for connecting to ground in order to isolate at least the group of component(s) from electromagnetic disturbances induced by the antenna element (AE).

**17 Claims, 2 Drawing Sheets**





US008035566B2

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

(10) **Patent No.:** **US 8,035,566 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **MULTI-BAND ANTENNA**

(56) **References Cited**

(75) Inventors: **Yung-Chih Tsai**, Tu-Cheng (TW);  
**Jia-Hung Su**, Tu-Cheng (TW); **Kai Shih**,  
Tu-Cheng (TW); **Yu-Yuan Wu**, Tu-Cheng (TW)

U.S. PATENT DOCUMENTS

|           |      |         |                |            |
|-----------|------|---------|----------------|------------|
| 6,246,371 | B1 * | 6/2001  | Kurz et al.    | 343/702    |
| 6,639,560 | B1 * | 10/2003 | Kadambi et al. | 343/700 MS |
| 6,861,986 | B2 * | 3/2005  | Fang et al.    | 343/700 MS |
| 7,292,194 | B2 * | 11/2007 | Tai et al.     | 343/702    |
| 7,362,277 | B2 * | 4/2008  | Su             | 343/702    |
| 7,429,955 | B2 * | 9/2008  | Tai et al.     | 343/702    |
| 7,466,272 | B1 * | 12/2008 | Su et al.      | 343/700 MS |

(73) Assignee: **Cheng Uei Precision Industry Co., Ltd.**, New Taipei (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 395 days.

Primary Examiner — Tho G Phan

(21) Appl. No.: **12/436,125**

(57) **ABSTRACT**

(22) Filed: **May 6, 2009**

A multi-band antenna has a grounding plate with a first end and a second end defined at a longer side thereof. The longer side has an upward first connecting portion adjacent to the first end and a vertical second connecting portion. A feeding portion extends downwards from a lower edge of the second connecting portion. A first antenna radiator extends towards a same direction with respect to the second connecting portion along the grounding plate from an upper side of the second connecting portion. A second antenna radiator includes a first radiating portion, a second radiating portion and a third radiating portion. A third antenna radiator extends parallel to the first radiating portion from a side of the feeding portion. A coupling component includes a first section, a second section and a third section extending opposite to the first section from an end of the second section.

(65) **Prior Publication Data**

US 2010/0283685 A1 Nov. 11, 2010

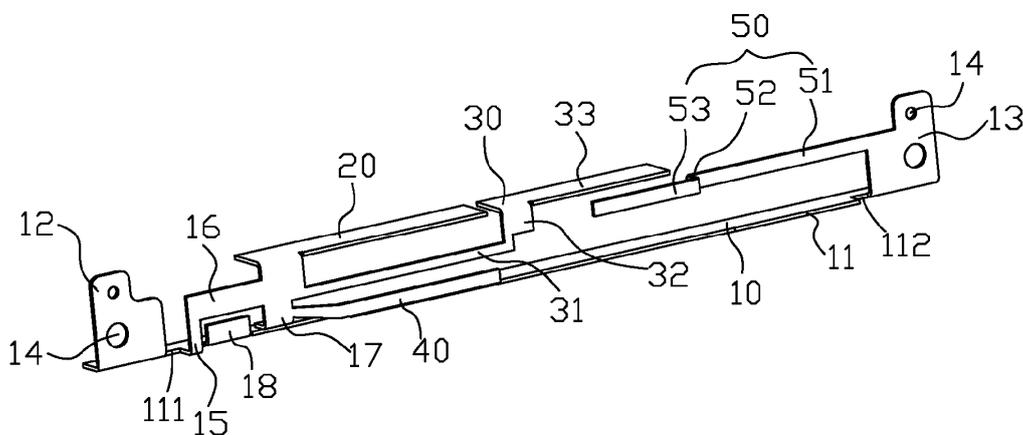
(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)

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

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

See application file for complete search history.

**6 Claims, 6 Drawing Sheets**





US008035567B2

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

(10) **Patent No.:** **US 8,035,567 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **MOBILE ANTENNA UNIT AND  
ACCOMPANYING COMMUNICATION  
APPARATUS**

(75) Inventors: **Takeshi Asano**, Atsugi (JP); **Shohhei Fujio**, Machida (JP)

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

(\*) 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.: **12/781,973**

(22) Filed: **May 18, 2010**

(65) **Prior Publication Data**

US 2010/0220055 A1 Sep. 2, 2010

**Related U.S. Application Data**

(62) Division of application No. 12/127,091, filed on May 27, 2008, now Pat. No. 7,719,473, which is a division of application No. 10/788,056, filed on Feb. 26, 2004, now Pat. No. 7,379,025.

(30) **Foreign Application Priority Data**

Feb. 27, 2003 (JP) ..... 2003-050328

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

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

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

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

6,326,921 B1 \* 12/2001 Egorov et al. .... 343/700 MS  
6,741,214 B1 \* 5/2004 Kadambi et al. .... 343/700 MS  
6,876,329 B2 \* 4/2005 Milosavljevic ..... 343/700 MS  
7,319,432 B2 \* 1/2008 Andersson ..... 343/702  
2002/0019247 A1 \* 2/2002 Egorov ..... 455/557  
2004/0113848 A1 \* 6/2004 Gaucher et al. .... 343/702

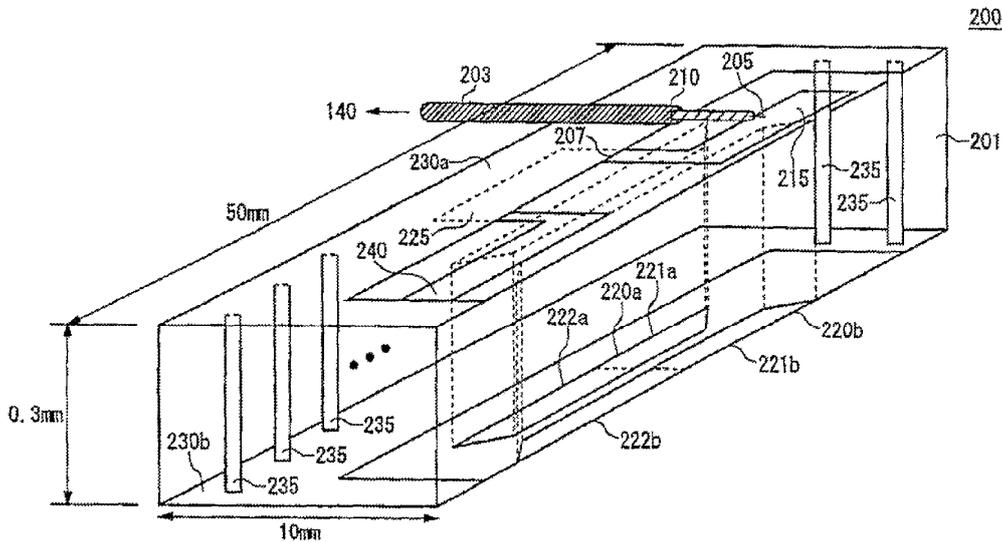
\* cited by examiner

*Primary Examiner* — David G Phan

(57) **ABSTRACT**

An antenna unit is provided with an inverted F-type antenna element provided with a feeding point and a ground connection point, and a non-feed antenna element configured so as to resonate with the inverted F-type antenna element through electrical coupling. In addition, the antenna unit may also be provided with a ground part which is grounded to the earth and connected to the ground connection point provided on one edge of the inverted F-type antenna element, and a resonance element, one edge of which is connected to the ground part, resonated by the non-feed antenna element through electrical coupling.

**7 Claims, 4 Drawing Sheets**





US008035570B2

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

(10) **Patent No.:** **US 8,035,570 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **HIGH-STRENGTH MICROWAVE ANTENNA ASSEMBLIES**

(75) Inventors: **Mani N. Prakash**, Boulder, CO (US); **Francesca Rossetto**, Longmont, CO (US); **Anthony C. Lee**, San Francisco, CA (US); **Steven Kim**, Los Altos, CA (US); **Ted Su**, Sunnyvale, CA (US); **Jonathan L. Glassman**, Cambridge, MA (US)

(73) Assignee: **Vivant Medical, Inc.**, Boulder, CO (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 366 days.

(21) Appl. No.: **12/419,395**

(22) Filed: **Apr. 7, 2009**

(65) **Prior Publication Data**  
US 2010/0082082 A1 Apr. 1, 2010

**Related U.S. Application Data**

(63) Continuation of application No. 11/493,392, filed on Jul. 26, 2006, now Pat. No. 7,527,623, which is a continuation of application No. 10/961,994, filed on Oct. 7, 2004, now Pat. No. 7,147,632, which is a continuation of application No. 10/052,848, filed on Nov. 2, 2001, now Pat. No. 6,878,147.

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

(52) **U.S. Cl.** ..... **343/790; 606/33; 606/41; 607/101**

(58) **Field of Classification Search** ..... **343/790, 343/791, 792; 606/33, 41; 607/101, 102**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|               |         |                |         |
|---------------|---------|----------------|---------|
| 3,750,181 A * | 7/1973  | Kuecken        | 343/790 |
| 4,140,130 A   | 2/1979  | Storm, III     |         |
| 4,292,960 A   | 10/1981 | Paglione       |         |
| 4,311,154 A   | 1/1982  | Sterzer et al. |         |
| 4,397,313 A   | 8/1983  | Vaguine        |         |
| 4,557,272 A   | 12/1985 | Carr           |         |
| 4,583,589 A   | 4/1986  | Kasevich       |         |

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 667 126 8/1995

(Continued)

OTHER PUBLICATIONS

Int'l Search Report from corresponding European Application No. EP 02 78 6604 mailed Feb. 10, 2010.

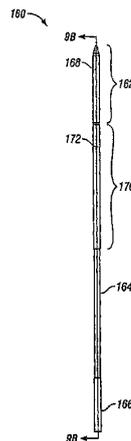
(Continued)

*Primary Examiner* — David G Phan

(57) **ABSTRACT**

Various high-strength microwave antenna assemblies are described herein. The microwave antenna has a radiating portion connected by a feedline to a power generating source, e.g., a generator. The antenna is a dipole antenna with the distal end of the radiating portion being tapered and terminating at a tip to allow for direct insertion into tissue. Antenna rigidity comes from placing distal and proximal radiating portions in a pre-stressed state, assembling them via threaded or overlapping joints, or fixedly attaching an inner conductor to the distal portion. The inner conductor is affixed to the distal portion by, e.g., welding, brazing, soldering, or by adhesives. A junction member made from a hard dielectric material, e.g., ceramic, can be placed between the two portions and can have uniform or non-uniform shapes to accommodate varying antenna designs. Electrical chokes may also be used to contain returning currents to the distal end of the antenna.

**8 Claims, 18 Drawing Sheets**





US008035571B2

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

(10) **Patent No.:** **US 8,035,571 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **ANTENNA DEVICE AND SIGNAL RECEIVING METHOD**

(75) Inventors: **Masaki Nishio**, Tokyo (JP); **Takayoshi Ito**, Yokohama (JP)

(73) Assignee: **Kabushiki Kaisha Toshiba**, Tokyo (JP)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 437 days.

(21) Appl. No.: **12/222,920**

(22) Filed: **Aug. 19, 2008**

(65) **Prior Publication Data**

US 2009/0058758 A1 Mar. 5, 2009

(30) **Foreign Application Priority Data**

Aug. 29, 2007 (JP) ..... 2007-223133

(51) **Int. Cl.**  
**H01Q 11/00** (2006.01)

(52) **U.S. Cl.** ..... **343/843**; 343/793; 343/810

(58) **Field of Classification Search** ..... 343/767, 343/792.5, 753, 793, 745, 705, 859, 810, 343/850, 843, 708, 756; 342/373; 257/728; 324/326; 333/126, 318, 24 R; 340/572.7  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|              |      |         |                  |           |
|--------------|------|---------|------------------|-----------|
| 7,400,863    | B2 * | 7/2008  | Kobayashi et al. | 455/78    |
| 2001/0035844 | A1 * | 11/2001 | Reece et al.     | 343/810   |
| 2002/0084942 | A1 * | 7/2002  | Tsai et al.      | 343/795   |
| 2002/0084943 | A1 * | 7/2002  | Tsai et al.      | 343/795   |
| 2004/0106381 | A1 * | 6/2004  | Tiller           | 455/73    |
| 2008/0278329 | A1 * | 11/2008 | Kim et al.       | 340/572.4 |
| 2009/0102706 | A1 * | 4/2009  | Goldblatt et al. | 342/352   |

FOREIGN PATENT DOCUMENTS

|    |             |        |
|----|-------------|--------|
| EP | 0 987 887   | 3/2000 |
| JP | 2001-028561 | 1/2001 |

\* cited by examiner

*Primary Examiner* — Douglas W Owens

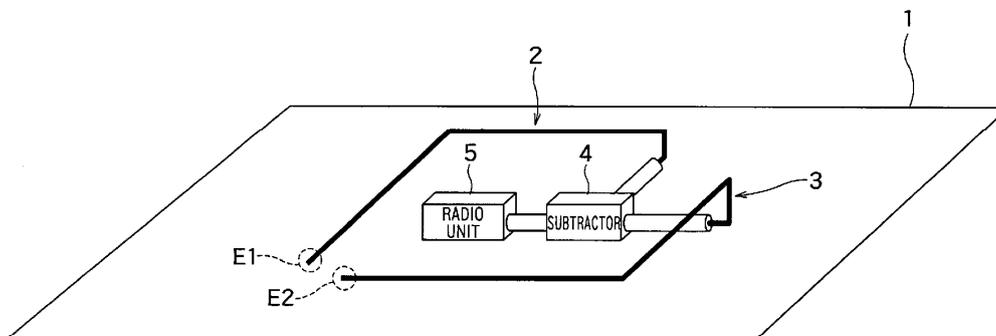
*Assistant Examiner* — Jae Kim

(74) *Attorney, Agent, or Firm* — Nixon & Vanderhye, P.C.

(57) **ABSTRACT**

An example antenna device includes a conductive ground plane and first and second antenna elements connected to the conductive ground plane through first and second feeding points, respectively. Directivities of the first and second antenna elements are arranged to be approximately perpendicular to each other. A phase adjusting circuit is configured to provide a phase difference of approximately 180 degrees between first and second received signals by the first and second antenna elements, respectively and a combining circuit is configured to combine the first and second received signals having a phase difference of approximately 180 degrees therebetween to obtain a combined signal. A radio unit is configured to process the combined signal.

**8 Claims, 19 Drawing Sheets**





US008035572B2

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

(10) **Patent No.:** **US 8,035,572 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **H-TYPE MONOPOLE ISOLATION ANTENNA**

(75) Inventors: **Je-hoon Yun**, Daejeon (KR);  
**Joung-myoun Kim**, Daejeon (KR);  
**Ung-hee Park**, Daejeon (KR); **Soon-ik Jeon**, Daejeon (KR)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1056 days.

(21) Appl. No.: **11/722,248**

(22) PCT Filed: **Dec. 21, 2005**

(86) PCT No.: **PCT/KR2005/004428**

§ 371 (c)(1),  
(2), (4) Date: **Jun. 20, 2007**

(87) PCT Pub. No.: **WO2006/068418**

PCT Pub. Date: **Jun. 29, 2006**

(65) **Prior Publication Data**

US 2010/0001922 A1 Jan. 7, 2010

(30) **Foreign Application Priority Data**

Dec. 21, 2004 (KR) ..... 10-2004-0109404

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

(52) **U.S. Cl.** ..... **343/879; 343/890**

(58) **Field of Classification Search** ..... 343/878,  
343/879, 890, 891

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|              |      |         |                    |         |
|--------------|------|---------|--------------------|---------|
| 5,262,793    | A *  | 11/1993 | Sperry             | 343/713 |
| 5,291,211    | A *  | 3/1994  | Tropper            | 343/890 |
| 6,313,800    | B1 * | 11/2001 | Kallina            | 343/715 |
| 6,531,984    | B1   | 3/2003  | Johannisson et al. |         |
| 2002/0135523 | A1   | 9/2002  | Romero et al.      |         |

FOREIGN PATENT DOCUMENTS

|    |         |        |
|----|---------|--------|
| EP | 1071160 | 1/2001 |
|----|---------|--------|

(Continued)

OTHER PUBLICATIONS

Karode, S.L., et al. (1999). "Dual Polarised Microstrip Patch Antenna Using Feedforward Isolation Enhancement for Simultaneous Transmit/Receive Applications." *National Conference on Antennas and Propagation*. Mar. 30-Apr. 1, 1999. Conference Publication No. 461, IEE 1999. pp. 49-52.

(Continued)

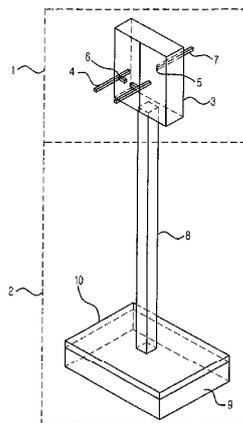
*Primary Examiner* — Tan Ho

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

(57) **ABSTRACT**

Provided is an H-type monopole isolation antenna. The antenna provides an H-type monopole isolation antenna which can gain a high bi-directional transmitting/receiving isolation between a transmitting antenna and a receiving antenna of co-channel/co-polarization by including an antenna symmetrically positioned in right/left sides based on a covering means. A transmitting/receiving isolation antenna for maintaining high isolation between a transmitting signal and a receiving signal includes a cover which includes a conductor; and first and second antennas which are bisymmetrically positioned in right and left parts of the covering means and separately operated as a transmitting antenna or a receiving antenna. The antenna is used in a co-channel bi-direction repeater system.

**16 Claims, 5 Drawing Sheets**





US008036288B2

(12) **United States Patent**  
**Quagliaro**

(10) **Patent No.:** **US 8,036,288 B2**  
(45) **Date of Patent:** **Oct. 11, 2011**

(54) **ULTRA-WIDEBAND COMMUNICATION SYSTEM PROVIDED WITH A FREQUENCY CONTROLLED DISPERSIVE ANTENNA**

(52) **U.S. Cl.** ..... 375/260; 375/130

(58) **Field of Classification Search** ..... 375/130-131, 375/219, 260, 285, 295; 340/870.18, 870.24, 340/870.26

See application file for complete search history.

(75) Inventor: **Gilles Quagliaro**, Cormeilles En Parisis (FR)

(73) Assignee: **Thales** (FR)

(56) **References Cited**

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 552 days.

U.S. PATENT DOCUMENTS

|              |      |         |                         |         |
|--------------|------|---------|-------------------------|---------|
| 5,351,053    | A *  | 9/1994  | Wicks et al.            | 342/158 |
| 5,471,223    | A *  | 11/1995 | McCorkle                | 343/786 |
| H1773        | H *  | 1/1999  | Cheston et al.          | 342/375 |
| 7,133,646    | B1 * | 11/2006 | Miao                    | 455/73  |
| 2005/0232134 | A1   | 10/2005 | van Nee                 |         |
| 2008/0297415 | A1 * | 12/2008 | Berens et al.           | 342/372 |
| 2009/0079620 | A1 * | 3/2009  | Van Caekenberghe et al. | 342/200 |

\* cited by examiner

(21) Appl. No.: **12/092,728**

(22) PCT Filed: **Nov. 10, 2006**

(86) PCT No.: **PCT/EP2006/068332**

§ 371 (c)(1), (2), (4) Date: **Oct. 15, 2008**

(87) PCT Pub. No.: **WO2007/054559**

PCT Pub. Date: **May 18, 2007**

Primary Examiner — Khanh C Tran

(74) Attorney, Agent, or Firm — Lowe Hauptman Ham & Berner, LLP

(65) **Prior Publication Data**

US 2009/0122840 A1 May 14, 2009

(57) **ABSTRACT**

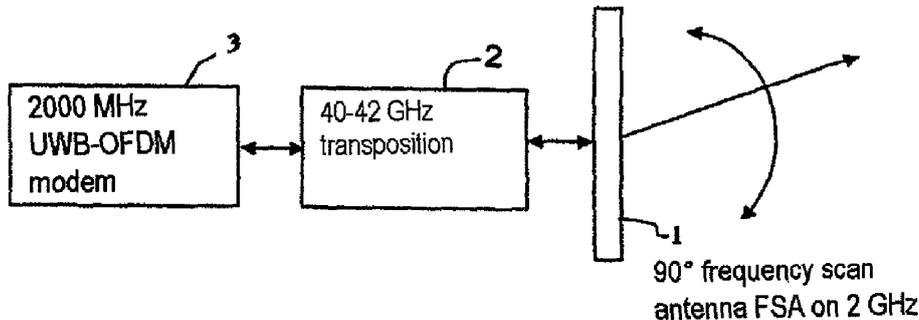
(30) **Foreign Application Priority Data**

Nov. 10, 2005 (FR) ..... 05 11456

Radiocommunication equipment and method comprising at least the following elements: at least one frequency scan antenna connected to a modem adapted to generate a spectrum OFDM modulation-based waveform by increasing the duration of an OFDM symbol by reproducing the FFT pattern.

(51) **Int. Cl.**  
**H04L 27/28** (2006.01)  
**H04B 1/00** (2006.01)

**12 Claims, 6 Drawing Sheets**





US008040283B2

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

(10) **Patent No.:** **US 8,040,283 B2**  
(45) **Date of Patent:** **\*Oct. 18, 2011**

(54) **DUAL BAND ANTENNA**  
(75) Inventors: **Pi-Hsi Cheng**, Hsinchu County (TW);  
**Chang-Jung Lee**, Taoyuan County (TW)  
(73) Assignee: **Arcadyan Technology Corporation**,  
Hsinchu (TW)  
(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 384 days.  
This patent is subject to a terminal dis-  
claimer.

(21) Appl. No.: **12/289,933**  
(22) Filed: **Nov. 7, 2008**

(65) **Prior Publication Data**  
US 2009/0128420 A1 May 21, 2009

(30) **Foreign Application Priority Data**  
Nov. 16, 2007 (TW) ..... 96143571 A

(51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 1/38** (2006.01)  
(52) **U.S. Cl.** ..... **343/702; 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  
7,161,543 B2\* 1/2007 Cheng et al. .... 343/702  
7,375,686 B2\* 5/2008 Ku et al. .... 343/700 MS  
2004/0008146 A1 1/2004 Ikegaya et al.  
2005/0190108 A1 9/2005 Lin et al.  
2007/0001913 A1\* 1/2007 Tsai et al. .... 343/702

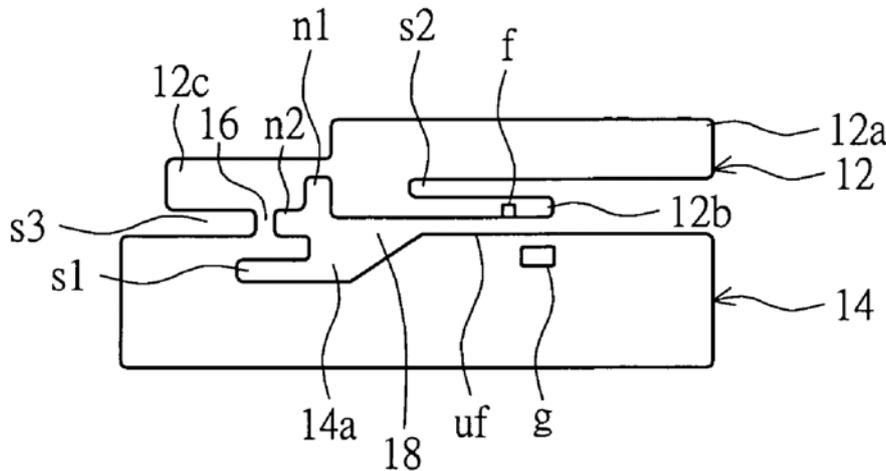
FOREIGN PATENT DOCUMENTS  
GB 2373638 9/2002  
TW 261952 9/2006  
WO 2006/070017 A1 7/2006

OTHER PUBLICATIONS  
Search Report issued in related EP application No. 08019776.7,  
dated Mar. 20, 2009, 7 pages.  
\* cited by examiner

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

(57) **ABSTRACT**  
An antenna applied in a communication device is provided.  
The antenna includes a conductive supporting portion, a  
radiator and a grounding portion. The radiator operates in a  
first frequency band. The grounding portion is connected to  
the radiator through the conductive supporting portion. The  
grounding portion includes a cavity extended from a top  
surface of the grounding portion into the interior of the  
grounding portion. A resonant cavity operating in a second  
frequency band is formed between the radiator and the cavity.

**24 Claims, 3 Drawing Sheets**





US008040284B2

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

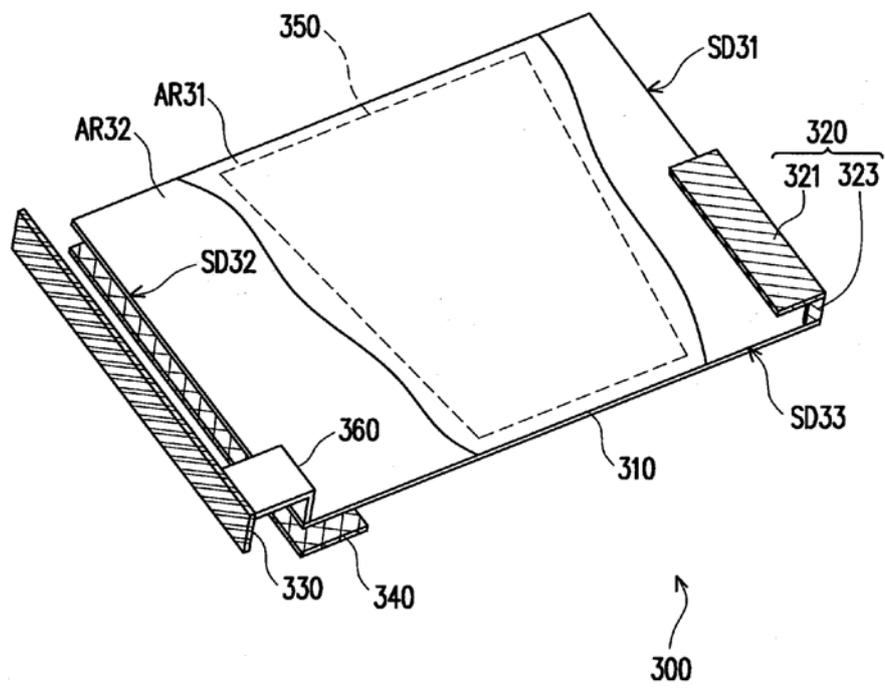
(10) **Patent No.:** **US 8,040,284 B2**  
(45) **Date of Patent:** **Oct. 18, 2011**

- (54) **HANDSET DEVICE**
- (75) Inventors: **Pei-Ling Teng**, Taoyuan County (TW);  
**Yi-Chun Chen**, Taoyuan County (TW)
- (73) Assignee: **HTC Corporation**, Taoyuan County (TW)
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 323 days.
- (21) Appl. No.: **12/371,633**
- (22) Filed: **Feb. 16, 2009**
- (65) **Prior Publication Data**  
US 2010/0052998 A1 Mar. 4, 2010
- (30) **Foreign Application Priority Data**  
Sep. 3, 2008 (TW) ..... 97133801 A
- (51) **Int. Cl.**  
**H01Q 1/24** (2006.01)  
**H01Q 1/48** (2006.01)
- (52) **U.S. Cl.** ..... **343/702; 343/700 MS; 343/846**
- (58) **Field of Classification Search** ..... **343/700 MS, 343/702, 846; 455/90.1, 575.7**  
See application file for complete search history.

- (56) **References Cited**
- U.S. PATENT DOCUMENTS  
7,151,955 B2\* 12/2006 Huber et al. .... 455/575.5  
2008/0252536 A1\* 10/2008 Anguera et al. .... 343/702
- FOREIGN PATENT DOCUMENTS  
EP 1796207 6/2007  
WO 99-54956 10/1999  
WO 02-19671 3/2002  
WO 03-067702 8/2003  
WO 2007-039071 4/2007
- OTHER PUBLICATIONS  
"Search report of Europe counterpart application", issued on Jun. 3, 2009, p. 1-p. 7.  
\* cited by examiner  
*Primary Examiner* — Hoang V Nguyen  
(74) *Attorney, Agent, or Firm* — Jianq Chyun IP Office

(57) **ABSTRACT**  
A handset device including a ground plane, an antenna, a first conductive strip and a second conductive strip is provided. The antenna is electrically connected to the ground plane and forms a current loop with the ground plane. The ground plane forms a current area according to the current loop. The first conductive strip is electrically connected to the current area and changes a current distribution on the ground plane to increase a current density passing through the current area.

**12 Claims, 5 Drawing Sheets**





US008040289B2

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

(10) **Patent No.:** **US 8,040,289 B2**  
(45) **Date of Patent:** **Oct. 18, 2011**

- (54) **LOW-PROFILE WIDE-BANDWIDTH RADIO FREQUENCY ANTENNA**
- (75) Inventors: **Dean Kitchener**, Brentwood (GB);  
**Andrew Urquhart**, Hertfordshire (GB)
- (73) Assignee: **Nortel Networks Limited**, Mississauga, Ontario (CA)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 362 days.
- (21) Appl. No.: **12/415,604**
- (22) Filed: **Mar. 31, 2009**
- (65) **Prior Publication Data**  
US 2009/0273536 A1 Nov. 5, 2009
- Related U.S. Application Data**
- (60) Provisional application No. 61/050,028, filed on May 2, 2008.
- (51) **Int. Cl.**  
**H01Q 1/50** (2006.01)
- (52) **U.S. Cl.** ..... **343/860; 343/700 MS**
- (58) **Field of Classification Search** ..... 343/850,  
343/860, 700 MS  
See application file for complete search history.

- (56) **References Cited**
- U.S. PATENT DOCUMENTS**
- 6,317,084 B1 11/2001 Chen et al.
- 6,426,723 B1 7/2002 Smith et al.
- 6,831,607 B2 \* 12/2004 Hebron et al. .... 343/700 MS
- 7,256,743 B2 8/2007 Korva
- 2002/0126051 A1 \* 9/2002 Jha ..... 343/702
- 2005/0280589 A1 12/2005 Chiang et al.

**OTHER PUBLICATIONS**

Kitchener, D et al., "Low Cost Diversity Antennas for Low Power Wireless Basestations," Proceedings of the 10th International Con-

ference on Antennas and Propagation, Apr. 14-17, 1997, pp. 1.445-1.447, Conference Publication No. 436, IEE.

Liu, Duixian et al., "Laptop Antenna Design and Evaluation," Chapter 4 of Antennas for Portable Devices, 2007, Edited by Zhi Ning Chen, pp. 113-166, John Wiley & Sons, Ltd.

Manteghi, Majid et al., "Novel Compact Tri-Band Two-Element and Four-Element MIMO Antenna Designs," Proceedings of the Antennas and Propagation Society International Symposium, Jul. 9-14, 2006, pp. 4443-4446, IEEE.

Martinez-Vazquez, Marta, "ACE Small Terminal Antennas Activities: a Review of the State of the Art," Proceedings of the 18th International Conference on Applied Electromagnetics and Communications, Oct. 12-14, 2005, pp. 1-4, IEEE.

Schulteis, S. et al., "Performance of a PDAda Equipped with 3 Dual-band Inverted F Antennas for MIMO and Diversity Systems," Proceedings of the 2006 ITG Workshop on Smart Antennas, Mar. 2006, Ulm, Germany.

International Search Report for PCT/IB2009/005139, mailed Aug. 24, 2009.

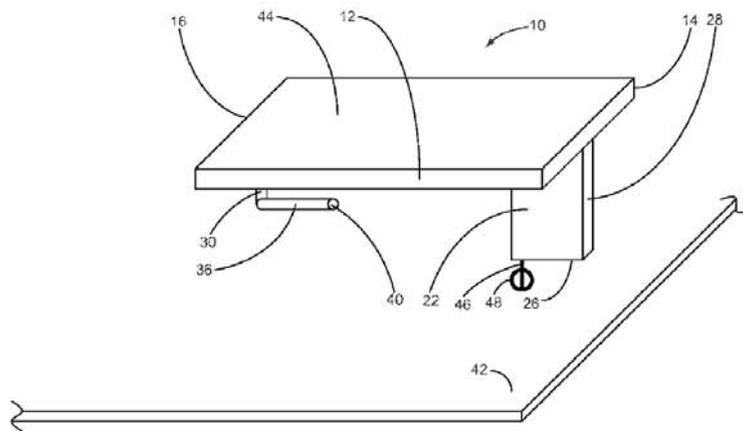
\* cited by examiner

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

(57) **ABSTRACT**

The present invention relates to an RF antenna structure that includes a planar structure and a loading plate, such that the planar structure is mounted between a ground plane and the loading plate to form an RF antenna. The loading plate may be about parallel to the ground plane and the planar structure may be about perpendicular to the loading plate and the ground plane. The loading plate may allow the height of the RF antenna structure above the ground plane to be relatively small. For example, the height may be significantly less than one-quarter of a wavelength of RF signals of interest. The planar structure may include two conductive matching elements to help increase the bandwidth of the RF antenna structure.

**28 Claims, 29 Drawing Sheets**





US008041324B2

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

(10) **Patent No.:** **US 8,041,324 B2**  
(45) **Date of Patent:** **Oct. 18, 2011**

- (54) **ANTENNA APPARATUS**
- (75) Inventors: **Junichi Noro**, Akita (JP); **Satoshi Kohno**, Katagami (JP)
- (73) Assignee: **Mitsumi Electric Co., Ltd.**, Tama-shi, Tokyo (JP)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 712 days.

|                |         |              |            |
|----------------|---------|--------------|------------|
| 6,903,687 B1 * | 6/2005  | Fink et al.  | 343/700 MS |
| 7,620,421 B2 * | 11/2009 | Kato et al.  | 455/562.1  |
| 7,683,837 B2 * | 3/2010  | Noro         | 343/700 MS |
| 7,835,776 B2 * | 11/2010 | Boyle et al. | 455/575.7  |

**FOREIGN PATENT DOCUMENTS**

|    |               |         |
|----|---------------|---------|
| JP | 9-102975 A    | 4/1997  |
| JP | 2003-264424 A | 9/2003  |
| JP | 2004-048367 A | 2/2004  |
| JP | 2004-282263 A | 10/2004 |
| JP | 2005-203879 A | 7/2005  |

**OTHER PUBLICATIONS**

Japanese Office Action dated Jan. 18, 2011 (and English translation thereof) in counterpart Japanese Application No. 2006-254467.  
 Japanese Office Action dated Jul. 19, 2011 (and English translation thereof) in counterpart Japanese Application No. 2006-254467.

- (21) Appl. No.: **11/901,579**
- (22) Filed: **Sep. 18, 2007**
- (65) **Prior Publication Data**  
US 2008/0070513 A1 Mar. 20, 2008
- (30) **Foreign Application Priority Data**  
Sep. 20, 2006 (JP) ..... 2006-254467

\* cited by examiner

*Primary Examiner* — Thanh C Le

(74) *Attorney, Agent, or Firm* — Holtz, Holtz, Goodman & Chick, PC

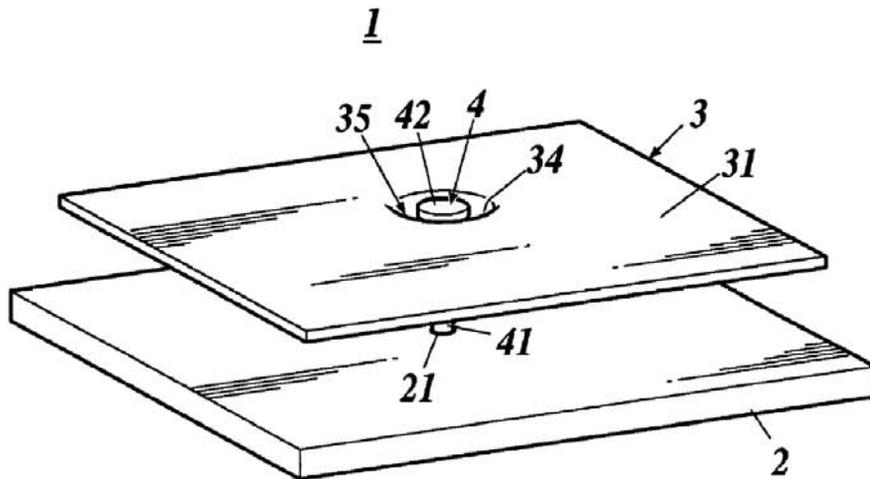
- (51) **Int. Cl.**  
**H04B 1/38** (2006.01)
- (52) **U.S. Cl.** ..... **455/269**; 343/700 MS
- (58) **Field of Classification Search** ..... 455/73, 455/80, 550.1, 562.1, 575.1, 269; 343/700 MS, 343/702, 846  
See application file for complete search history.

(57) **ABSTRACT**

An antenna apparatus, including: a power supply pin; a circuit substrate having a first through hole through which the power supply pin passes; and an antenna element having a second through hole which faces with the first through hole and through which the power supply pin passes, the antenna element being disposed at a distance from the circuit substrate; wherein the second through hole is formed smaller than a shaft diameter of the power supply pin and is widened by the power supply pin; and a periphery of the second through hole of the antenna element is curved to be convex toward the circuit substrate, and the power supply pin is fixedly nipped by a tip end of the periphery.

- (56) **References Cited**  
**U.S. PATENT DOCUMENTS**  
5,678,216 A \* 10/1997 Matai ..... 455/269  
6,288,680 B1 \* 9/2001 Tsuru et al. .... 455/575.7  
6,559,802 B2 \* 5/2003 Goto et al. .... 343/702

**2 Claims, 1 Drawing Sheet**





US008044860B2

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

(10) **Patent No.:** **US 8,044,860 B2**  
(45) **Date of Patent:** **Oct. 25, 2011**

(54) **INTERNAL ANTENNA FOR MOBILE DEVICE**

(75) Inventors: **Chia-Lun Tang**, Miaoli (TW); **Kin-Lu Wong**, Kaohsiung (TW); **Saou-wen Su**, Taipei (TW)

(73) Assignees: **Industrial Technology Research Institute**, Chutung, Hsinchu (TW); **National Sun Yatsen University**, Chutung, Hsinchu (TW)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 119 days.

(21) Appl. No.: **11/279,588**

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

(65) **Prior Publication Data**

US 2007/0115179 A1 May 24, 2007

**Related U.S. Application Data**

(60) Provisional application No. 60/739,628, filed on Nov. 23, 2005.

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

(52) **U.S. Cl.** ..... **343/700 MS**; 343/702; 343/798; 343/806; 343/895

(58) **Field of Classification Search** ..... 343/700 MS, 343/702, 806, 895, 846, 848  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|              |      |         |                  |            |
|--------------|------|---------|------------------|------------|
| 5,365,246    | A *  | 11/1994 | Rasinger et al.  | 343/702    |
| 5,936,583    | A *  | 8/1999  | Sekine et al.    | 343/702    |
| 6,046,700    | A *  | 4/2000  | Kitchener et al. | 343/725    |
| 6,246,371    | B1 * | 6/2001  | Kurz et al.      | 343/702    |
| 6,433,746    | B2 * | 8/2002  | Kushihi et al.   | 343/700 MS |
| 6,812,892    | B2 * | 11/2004 | Tai et al.       | 343/700 MS |
| 6,891,504    | B2 * | 5/2005  | Cheng et al.     | 343/700 MS |
| 6,911,944    | B2 * | 6/2005  | Sekine et al.    | 343/702    |
| 6,972,722    | B2 * | 12/2005 | Katoh et al.     | 343/702    |
| 7,084,813    | B2 * | 8/2006  | Pathak et al.    | 343/700 MS |
| 7,119,746    | B2 * | 10/2006 | Luk et al.       | 343/702    |
| 7,119,747    | B2 * | 10/2006 | Lin et al.       | 343/702    |
| 7,289,071    | B2 * | 10/2007 | Hung et al.      | 343/702    |
| 2004/0207557 | A1 * | 10/2004 | Chen et al.      | 343/702    |

FOREIGN PATENT DOCUMENTS

|    |                 |   |         |
|----|-----------------|---|---------|
| JP | 11-274843       | A | 10/1999 |
| KR | 10-2004-0000535 |   | 1/2004  |

\* cited by examiner

*Primary Examiner* — Douglas W Owens

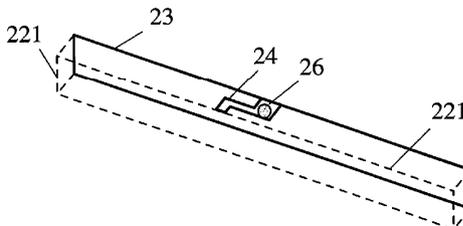
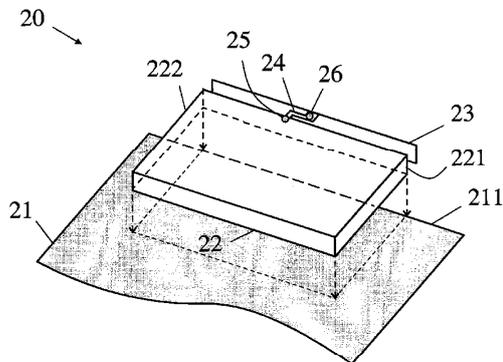
*Assistant Examiner* — Chuc Tran

(74) *Attorney, Agent, or Firm* — Alston & Bird LLP

(57) **ABSTRACT**

A mobile device includes a ground plane, a conductive housing disposed on the ground plane including a sidewall, a first conductive strip spaced apart from the conductive housing, and a second conductive strip electrically connecting the first conductive strip to the conductive housing.

**13 Claims, 10 Drawing Sheets**





US008044863B2

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

(10) **Patent No.:** **US 8,044,863 B2**  
(45) **Date of Patent:** **Oct. 25, 2011**

(54) **LOW PROFILE, FOLDED ANTENNA ASSEMBLY FOR HANDHELD COMMUNICATION DEVICES**

(75) Inventors: **Shirook M. Ali**, Mississauga (CA);  
**Houssam Kanj**, Waterloo (CA)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 546 days.

(21) Appl. No.: **12/323,664**

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

(65) **Prior Publication Data**  
US 2010/0127938 A1 May 27, 2010

(51) **Int. Cl.**  
**H01Q 5/00** (2006.01)

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

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

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

|           |     |         |              |         |
|-----------|-----|---------|--------------|---------|
| 5,547,100 | A   | 8/1996  | Johnson      |         |
| 5,633,646 | A   | 5/1997  | Strickland   |         |
| 6,593,887 | B2  | 7/2003  | Luk et al.   |         |
| 6,950,071 | B2  | 9/2005  | Wen et al.   |         |
| 7,023,387 | B2  | 4/2006  | Wen et al.   |         |
| 7,038,627 | B2  | 5/2006  | Ikuta et al. |         |
| 7,283,097 | B2  | 10/2007 | Wen et al.   |         |
| 7,352,328 | B2  | 4/2008  | Moon et al.  |         |
| 7,369,089 | B2  | 5/2008  | Wen et al.   |         |
| 7,400,300 | B2  | 7/2008  | Qi et al.    |         |
| 7,403,165 | B2  | 7/2008  | Qi et al.    |         |
| 7,619,571 | B2* | 11/2009 | Vesterinen   | 343/702 |

|              |    |         |                 |
|--------------|----|---------|-----------------|
| 2004/0085245 | A1 | 5/2004  | Miyata et al.   |
| 2007/0109204 | A1 | 5/2007  | Phillips et al. |
| 2008/0062058 | A1 | 3/2008  | Bishop          |
| 2008/0231530 | A1 | 9/2008  | Rao et al.      |
| 2008/0284661 | A1 | 11/2008 | He              |
| 2008/0287171 | A1 | 11/2008 | Qi et al.       |

**FOREIGN PATENT DOCUMENTS**

|    |             |    |         |
|----|-------------|----|---------|
| EP | 1077505     | A2 | 2/2001  |
| EP | 1162688     | A1 | 12/2001 |
| JP | 20080167393 |    | 7/2008  |
| WO | 2004015810  | A1 | 2/2004  |
| WO | 2008001169  | A2 | 1/2008  |

(Continued)

**OTHER PUBLICATIONS**

Chuo, et al.; Investigations of Isolation Improvement Techniques for Multiple Input Multiple Output (MIMO) WLAN Portable Terminal Applications; Progress in Electromagnetics Research, PIER 85, 349-366, 2008.

(Continued)

*Primary Examiner* — Jacob Y Choi

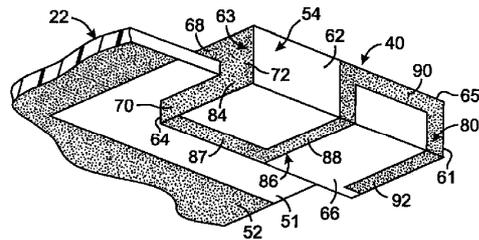
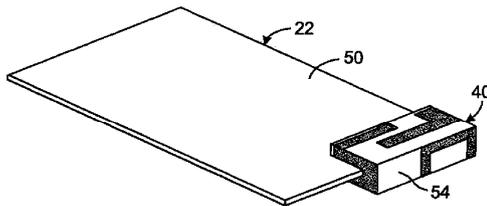
*Assistant Examiner* — Shawn Buchanan

(74) *Attorney, Agent, or Firm* — Hamilton & Terrile, LLP

(57) **ABSTRACT**

An antenna assembly is formed on a rectangular polyhedron support that has two sections projecting away from opposite sides of an electrically non-conductive substrate. An electrically conductive stripe wraps around the support and comprises a plurality of segments on different surfaces of the support. A conductive patch is located on two surfaces of the support to provide impedance matching between the antenna and a radio frequency circuit. By placing sections of the antenna assembly on both sides of the substrate and wrapping the conductive stripe around those sections, the space required to accommodate the antenna assembly within a housing of a communication device is reduced, as compared to some prior antenna designs.

**18 Claims, 4 Drawing Sheets**





US008044867B2

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

(10) **Patent No.:** **US 8,044,867 B2**

(45) **Date of Patent:** **Oct. 25, 2011**

(54) **COMMUNICATION TERMINAL APPARATUS**

(56) **References Cited**

(75) Inventors: **Hironori Kikuchi**, Miyagi (JP); **Kenichi Sato**, Miyagi (JP); **Nobuaki Tanaka**, Kanagawa (JP)

U.S. PATENT DOCUMENTS

|              |      |         |                 |            |
|--------------|------|---------|-----------------|------------|
| 6,166,694    | A *  | 12/2000 | Ying            | 343/702    |
| 6,819,287    | B2 * | 11/2004 | Sullivan et al. | 343/700 MS |
| 7,136,019    | B2 * | 11/2006 | Mikkola et al.  | 343/702    |
| 7,518,561    | B2 * | 4/2009  | Mei             | 343/702    |
| 2007/0164909 | A1 * | 7/2007  | Ogawa et al.    | 343/702    |

(73) Assignee: **Panasonic Corporation**, Osaka (JP)

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

FOREIGN PATENT DOCUMENTS

|    |             |         |
|----|-------------|---------|
| JP | 06-334420   | 12/1994 |
| JP | 2000-261243 | 9/2000  |
| JP | 2001-077611 | 3/2001  |
| JP | 2002-185238 | 6/2002  |
| JP | 2002-223107 | 8/2002  |
| JP | 2004-088218 | 3/2004  |
| JP | 2004-166284 | 6/2004  |

(21) Appl. No.: **12/162,837**

(22) PCT Filed: **Jan. 30, 2007**

OTHER PUBLICATIONS

International Search Report for PCT/JP2007/051513; Mar. 1, 2007.

\* cited by examiner

*Primary Examiner* — Tan Ho

(74) *Attorney, Agent, or Firm* — Seed IP Law Group PLLC

(86) PCT No.: **PCT/JP2007/051513**

§ 371 (c)(1),

(2), (4) Date: **Oct. 28, 2009**

(87) PCT Pub. No.: **WO2007/091452**

PCT Pub. Date: **Aug. 16, 2007**

(57) **ABSTRACT**

A problem of the invention is to provide a small-size communication terminal apparatus capable of reducing an SAR and also widening a band of an antenna and further achieving thinning.

The communication terminal apparatus has a substrate (13) disposed inside a housing, a power feeding part (12) disposed in the substrate (13), a monopole antenna (11) having plural elements of multi-frequency sharing, the monopole antenna for feeding power by electrically connecting one end to the power feeding part, and a ground wire (14) electrically connected to a wireless ground of the substrate (13), and the monopole antenna (11) having the plural elements is arranged in a direction vertical to a surface of the substrate (13) and in a back surface direction of the housing so as to be opposed to a human body at the time of a call.

(65) **Prior Publication Data**

US 2010/0149045 A1 Jun. 17, 2010

(30) **Foreign Application Priority Data**

Feb. 10, 2006 (JP) ..... P. 2006-034059

**6 Claims, 12 Drawing Sheets**

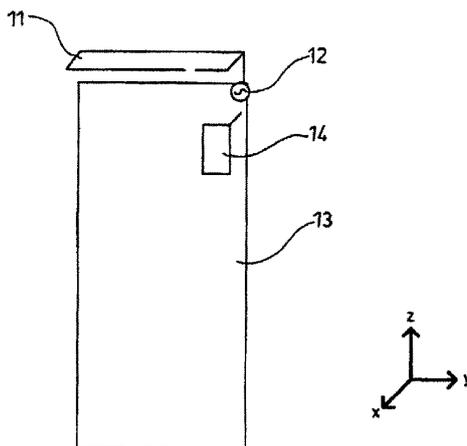
(51) **Int. Cl.**

**H01Q 1/24** (2006.01)

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

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

See application file for complete search history.





US008044876B2

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

(10) **Patent No.:** **US 8,044,876 B2**  
(45) **Date of Patent:** **Oct. 25, 2011**

(54) **SUBSTRATE PROVIDED WITH AN ELECTROCONDUCTIVE ELEMENT HAVING AN ANTENNA FUNCTION**

(52) **U.S. Cl.** ..... 343/873; 343/700 MS; 343/713  
(58) **Field of Classification Search** ..... 343/700 MS, 343/713, 873

See application file for complete search history.

(75) Inventors: **Sebastien Collinet**, Barcelona (ES);  
**Jose Jaime Cruzado**, Vilanova (ES)

(56) **References Cited**

(73) Assignee: **Saint-Gobain Glass France**,  
Courbevoie (FR)

U.S. PATENT DOCUMENTS

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 543 days.

2003/0034926 A1 2/2003 Veerasamy  
2003/0080921 A1 5/2003 Wen et al.  
2003/0112190 A1 6/2003 Baliarda et al.  
2005/0179594 A1 8/2005 Morikawa et al.  
2006/0022880 A1 2/2006 Chiang

(21) Appl. No.: **12/293,100**

FOREIGN PATENT DOCUMENTS

(22) PCT Filed: **Mar. 26, 2007**

EP 1 313 166 5/2003  
EP 1 427 055 6/2004  
WO 03 038947 5/2003

(86) PCT No.: **PCT/FR2007/051015**

§ 371 (c)(1),  
(2), (4) Date: **Sep. 16, 2008**

*Primary Examiner* — David G Phan  
(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(87) PCT Pub. No.: **WO2007/110544**

PCT Pub. Date: **Oct. 4, 2007**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2009/0079641 A1 Mar. 26, 2009

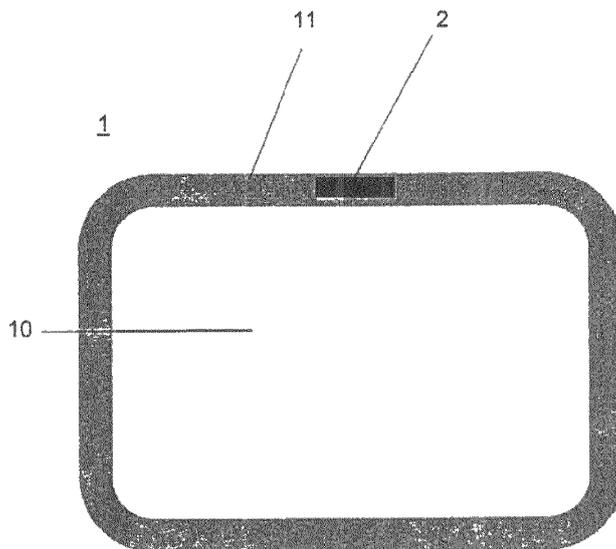
A rigid substrate including at least one electrically conducting element that provides an antenna function to transmit and/or receive electromagnetic signals, the electrically conducting element having a pattern with a fractal geometry. The electrically conducting element is formed from an electrically conductive ink or enamel that is printed directly on the substrate.

(30) **Foreign Application Priority Data**

Mar. 28, 2006 (FR) ..... 06 51057

**23 Claims, 2 Drawing Sheets**

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





US00D646669S

(12) **United States Design Patent**  
**Suleiman**

(10) **Patent No.:** **US D646,669 S**  
(45) **Date of Patent:** **\*\* Oct. 11, 2011**

(54) **OMNI-DIRECTIONAL ANTENNA**

(75) Inventor: **Shady Hasan Suleiman**, Burlington, IA (US)

(73) Assignee: **Winegard Company**, Burlington, IA (US)

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

(21) Appl. No.: **29/382,482**

(22) Filed: **Jan. 4, 2011**

(51) **LOC (9) Cl.** ..... **14-03**

(52) **U.S. Cl.** ..... **D14/234**

(58) **Field of Classification Search** ..... D14/230-238, D14/299; 343/700 R, 840, 841, 908; 455/3.02, 455/FOR. 215, 575.2

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

|               |         |                   |       |         |
|---------------|---------|-------------------|-------|---------|
| D179,111 S *  | 11/1956 | Ballan et al.     | ..... | D14/234 |
| D184,082 S *  | 12/1958 | Colton            | ..... | D14/236 |
| D195,513 S *  | 6/1963  | Liu               | ..... | D14/235 |
| D211,025 S *  | 5/1968  | Callaghan         | ..... | D14/234 |
| D211,179 S *  | 5/1968  | Rosenberry et al. | ..... | D14/234 |
| 3,560,983 A   | 2/1971  | Willie et al.     |       |         |
| 3,719,950 A   | 3/1973  | Bukhman et al.    |       |         |
| 3,787,865 A * | 1/1974  | MacDowell et al.  | ..... | 343/703 |
| 4,479,127 A   | 10/1984 | Barbano           |       |         |
| D293,786 S *  | 1/1988  | Redaelli          | ..... | D14/234 |
| D293,787 S *  | 1/1988  | Redaelli          | ..... | D14/235 |

|                 |         |                  |       |         |
|-----------------|---------|------------------|-------|---------|
| 4,785,303 A     | 11/1988 | Clark et al.     |       |         |
| 6,154,182 A *   | 11/2000 | McLean           | ..... | 343/773 |
| 6,163,305 A     | 12/2000 | Murakami et al.  |       |         |
| 6,281,857 B1    | 8/2001  | Dobrovolny       |       |         |
| 6,317,099 B1    | 11/2001 | Zimmerman et al. |       |         |
| 6,650,301 B1    | 11/2003 | Zimmerman        |       |         |
| 6,888,511 B2 *  | 5/2005  | Cake             | ..... | 343/803 |
| D523,850 S *    | 6/2006  | Godar            | ..... | D14/235 |
| 7,180,462 B2    | 2/2007  | Kaneko et al.    |       |         |
| 7,205,955 B2 *  | 4/2007  | Shirosaka et al. | ..... | 343/850 |
| 7,535,432 B1 *  | 5/2009  | Dean et al.      | ..... | 343/850 |
| D612,370 S *    | 3/2010  | Suleiman et al.  | ..... | D14/234 |
| D623,175 S *    | 9/2010  | Suleiman et al.  | ..... | D14/230 |
| 2003/0231138 A1 | 12/2003 | Weinstein        |       |         |

\* cited by examiner

*Primary Examiner* — Celia Murphy

*Assistant Examiner* — John Windmuller

(74) *Attorney, Agent, or Firm* — Dorr, Carson & Birney, P.C.

(57) **CLAIM**

The ornamental design for an omni-directional antenna, as shown and described.

**DESCRIPTION**

FIG. 1 is a front elevational view of an omni-directional antenna showing my new design, the rear elevational view being the same as FIG. 1.

FIG. 2 is a right side elevational view thereof, with the left side elevational view being the same as FIG. 2.

FIG. 3 is a bottom plan view thereof; and,

FIG. 4 is a top plan view thereof.

**1 Claim, 1 Drawing Sheet**

