



US007327315B2

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

(10) **Patent No.:** **US 7,327,315 B2**
(45) **Date of Patent:** **Feb. 5, 2008**

(54) **ULTRAWIDEBAND ANTENNA**

(75) Inventors: **Timothy John Stefan Starkie**,
Cambridge (GB); **Leslie David Smith**,
Ely (GB)

(73) Assignee: **Artimi Ltd.**, Cambridgeshire (GB)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 173 days.

(21) Appl. No.: **10/931,217**

(22) Filed: **Sep. 1, 2004**

(65) **Prior Publication Data**

US 2005/0110687 A1 May 26, 2005

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/GB03/
05070, filed on Nov. 21, 2003.

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

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

(58) **Field of Classification Search** 343/700 MS,
343/769, 793, 846, 873, 900
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,364,491 A 1/1968 Stohr
3,728,632 A 4/1973 Ross
5,255,002 A 10/1993 Day
5,319,377 A 6/1994 Thomas et al.
5,323,169 A 6/1994 Koslover
5,351,063 A 9/1994 Kim et al.
5,365,242 A 11/1994 Shiina

H1773 H 1/1999 Cheston et al.
5,923,299 A 7/1999 Brown et al.
5,973,653 A 10/1999 Kragalott et al.
6,218,997 B1 4/2001 Lindenmeier et al.
6,351,246 B1 2/2002 McCorkle
6,400,329 B1 6/2002 Barnes
6,437,756 B1 8/2002 Schantz
6,512,488 B2 1/2003 Schantz
6,529,166 B2 3/2003 Kanamaluru
6,590,545 B2* 7/2003 McCorkle 343/830
6,593,886 B2 7/2003 Schantz
6,621,462 B2 9/2003 Barnes

(Continued)

FOREIGN PATENT DOCUMENTS

CN 1367552 9/2002

(Continued)

OTHER PUBLICATIONS

'Antennas' by John D. Kraus and Ronald J. Marhefka, McGraw Hill
2002 3/e, p. 782.

(Continued)

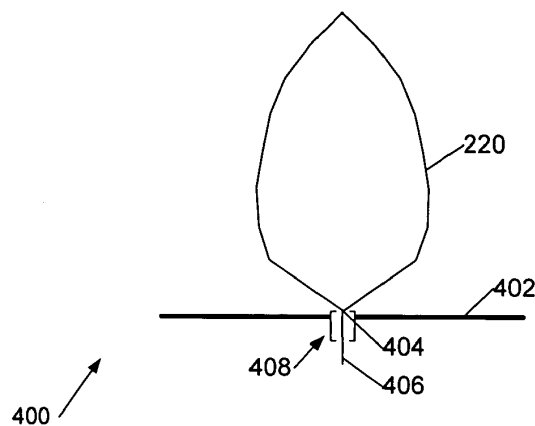
Primary Examiner—Shih-Chao Chen

(74) *Attorney, Agent, or Firm*—Sterne, Kessler, Goldstein &
Fox, P.L.L.C.

(57) **ABSTRACT**

Antennas for transmitting and receiving ultrawideband (UWB) signals are disclosed. A UWB antenna structure includes a planar conductor of substantially uniform resistance. The structure has the shape of a pair of conjoined, generally triangular figures, each with a long side, a short side, and a curved side. The triangular figures have an antenna feed connection at one corner. The structure has an axis of symmetry passing through the antenna feed connection.

20 Claims, 36 Drawing Sheets



Acrobat 文件



US007327316B2

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

(10) **Patent No.:** **US 7,327,316 B2**

(45) **Date of Patent:** **Feb. 5, 2008**

(54) **EMBEDDED PLANAR INVERTED F
ANTENNA (PIFA) TUNED WITH VARIABLE
GROUNDING POINT**

(75) Inventors: **Eric Peter Geoca**, Penfield, NY (US);
Thomas R. Schleef, Palm Bay, FL (US)

(73) Assignee: **Tyco Electronics Corporation**,
Middletown, PA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 197 days.

(21) Appl. No.: **11/229,879**

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

(65) **Prior Publication Data**
US 2007/0063899 A1 Mar. 22, 2007

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

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

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,650,295 B2 11/2003 Ollikainen et al.
6,662,028 B1 * 12/2003 Hayes et al. 455/575.7
6,693,594 B2 2/2004 Pankinaho et al.
6,836,249 B2 * 12/2004 Kenoun et al. 343/700 MS
6,861,986 B2 3/2005 Fang et al. 343/700 MS
7,012,570 B2 * 3/2006 Chen et al. 343/700 MS

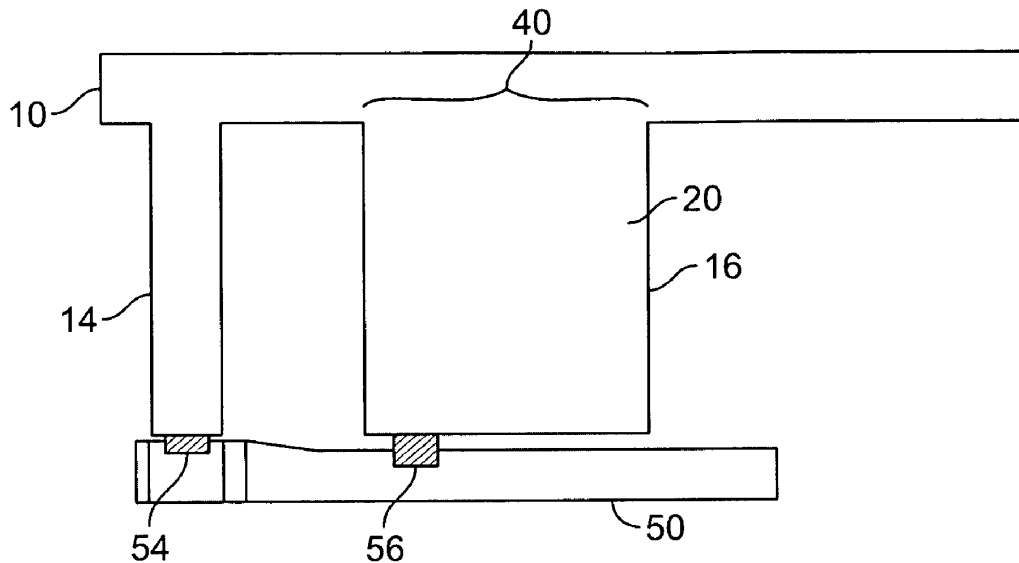
* cited by examiner

Primary Examiner—Tho Phan

(57) **ABSTRACT**

An antenna system is described that includes a radiating
element, a feed point configured for electrical connection to
the radiating element, and a grounding point configured for
electrical connection to the radiating element. At least one of
the feed point and the grounding point are configured to
accommodate a range of distances between the electrical
connections to the radiating element.

5 Claims, 4 Drawing Sheets



Acrobat 文件



US007327317B2

(12) **United States Patent**
Heiniger

(10) **Patent No.:** **US 7,327,317 B2**
(45) **Date of Patent:** **Feb. 5, 2008**

(54) **DUAL-POLARIZED MICROSTRIP PATCH ANTENNA**

(75) Inventor: **Markus Heiniger**, Herisau (CH)

(73) Assignee: **Huber + Suhner AG**, Herisau (CH)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 233 days.

(21) Appl. No.: **11/331,834**

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

(65) **Prior Publication Data**

US 2006/0139215 A1 Jun. 29, 2006

Related U.S. Application Data

(63) Continuation of application No. PCT/CH03/00481, filed on Jul. 16, 2003.

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,191,959 A * 3/1980 Kerr 343/700 MS
5,355,143 A 10/1994 Zürcher et al.
5,453,754 A * 9/1995 Fray 343/789
5,745,080 A 4/1998 Jun
6,031,491 A * 2/2000 Daniel et al. 343/700 MS
6,104,347 A 8/2000 Snygg et al.

6,577,276 B2 6/2003 Lovestead
6,664,932 B2 * 12/2003 Sabet et al. 343/770
2002/0089452 A1 7/2002 Lovestead
2003/0063031 A1 4/2003 Wong et al.

FOREIGN PATENT DOCUMENTS

EP 1 006 608 A1 6/2000
JP 56-160103 A1 12/1981
WO WO 98/54785 A1 12/1998
WO WO 99/17403 A1 4/1999

OTHER PUBLICATIONS

Shu-Shi Zhong et al, "Corner-Fed Microstrip Antenna Element and Arrays for Dual-Polarization Operation," IEEE Transactions on Antennas and Propagation, vol. 50, Issue 10, pp. 1473-1480, no date.

* cited by examiner

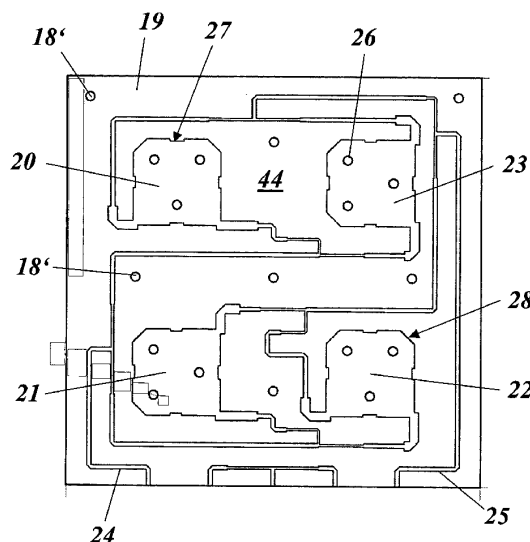
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Burr & Brown

(57) **ABSTRACT**

The invention relates to a dual polarised microstrip patch antenna comprising at least one individual element, each individual element comprising at least one rectangular, preferably quadratic, patch arranged on the upper face of a printed circuit board, having a feed network on the upper side thereof and being metallized on the entire surface of the lower face thereof. The aim of the invention is to improve the polarization isolation, while simultaneously simplifying the feed network. To this end, the feed network is embodied in such a way that the feed is only fed on two corners of the patch, and the at least one patch is modified in such a way that the isolation is improved between the polarizations of at least one antenna element and a plurality of individual antenna elements in relation to a non-modified patch.

21 Claims, 6 Drawing Sheets



Acrobat 文件



US007327318B2

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

(10) **Patent No.:** **US 7,327,318 B2**
(45) **Date of Patent:** **Feb. 5, 2008**

(54) **ULTRA WIDE BAND FLAT ANTENNA**

OTHER PUBLICATIONS

(75) Inventors: **Zvi Henry Frank**, Elkana (IL); **Ran Timar**, Kfar Saba (IL)

(73) Assignees: **MTI Wireless Edge, Ltd.**, Rosh Ha'Ayin (IL); **Camero-Tech Ltd.**, Netanya (IL)

(*) 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.: **11/363,133**

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

(65) **Prior Publication Data**

US 2007/0200762 A1 Aug. 30, 2007

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

(52) **U.S. Cl.** **343/700 MS; 343/745**

(58) **Field of Classification Search** **343/700 MS, 343/745, 795, 821**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,843,403 A 6/1989 Lalezari et al.
5,563,616 A * 10/1996 Dempsey et al. 343/753
6,061,025 A * 5/2000 Jackson et al. 343/700 MS
6,437,756 B1 8/2002 Schantz
6,501,427 B1 * 12/2002 Lilly et al. 343/700 MS
6,845,253 B1 1/2005 Schantz
7,084,816 B2 * 8/2006 Watanabe 343/700 MS
7,176,843 B2 * 2/2007 Simasaki et al. 343/795
2005/0088344 A1 * 4/2005 Saitou et al. 343/700 MS

FOREIGN PATENT DOCUMENTS

WO WO 03/067707 8/2003

T.E. Morgan, "Reduced Size Spiral Antenna", Advanced Electronic Warfare Technology, Edited by John Clarke, Royal Signals & Radar Establishment, Great Malvern, UK, pp. 236-240, date is not available.

Schantz, "Introduction to Ultra-Wideband Antennas", The Proceedings of the 2003 IEEE UWBST Conference.

Schantz, "A Brief History of UWB Antennas", The Proceedings of the 2003 IEEE UWBST Conference.

Schantz, "Bottom Fed Planar Elliptical UWB Antennas", The Proceedings of the 2003 IEEE UWBST Conference.

Schantz, "Planar Elliptical Element Ultra-Wideband Dipole Antennas", The Proceedings of the 2002 IEEE APS/URSI Conference.

Powell et al. Differential and Single Ended Elliptical Antennas for 3.1-10.6 GHz Ultra Wideband Communication, IEEE 2004.

Federal Communications Commission, First Report and Order, pp. 1-118, Feb. 2002.

Federal Communications Commission - News, "FCC Affirms Rules to Authorize the Deployment of Ultra-Wideband Technology", pp. 1-4, Feb. 2003.

* cited by examiner

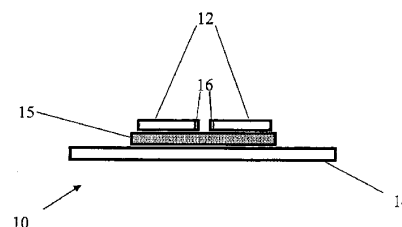
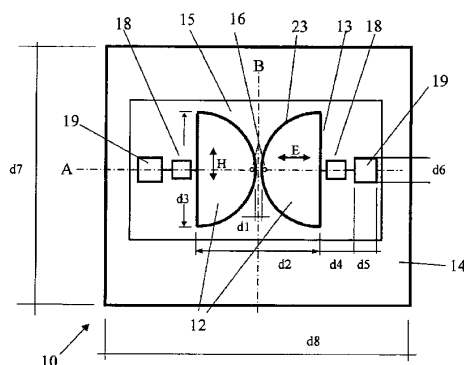
Primary Examiner—Tan Ho

(74) Attorney, Agent, or Firm—Pearl Cohen Zedek Latzer, LLP

(57) **ABSTRACT**

A flat, ultra wideband, unidirectional antenna is disclosed, the antenna may comprise a pair of active elements having the shape of substantially half-circles or half-ellipsoids made of thin conductive material and a ground element made of thin conductive material placed parallel and against to the active electrodes and spaced from them, the antenna having a nominal gain of at least 6 dBi and variations of gain in that range of ± 1.5 dBi at its bore sight.

19 Claims, 8 Drawing Sheets



Acrobat 文件



US007327320B2

(12) **United States Patent**
Dejean

(10) **Patent No.:** **US 7,327,320 B2**

(45) **Date of Patent:** **Feb. 5, 2008**

(54) **BROADBAND ANTENNA ARRANGEMENT**

(75) Inventor: **Cédric Dejean**, St. Gallen (CH)

(73) Assignee: **Huber + Suhner AG**, Herisau (CH)

(*) 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.: **11/257,966**

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

(65) **Prior Publication Data**

US 2006/0033669 A1 Feb. 16, 2006

Related U.S. Application Data

(63) Continuation of application No. PCT/CH03/00275, filed on Apr. 28, 2003.

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

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

(58) **Field of Classification Search** **343/700 M, 343/702, 846, 906, 700 MS, 713, 715**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,508,271 A * 4/1970 Kuecken 343/745

3,605,097 A * 9/1971 Hadik-Barkoczy 343/739
5,294,938 A 3/1994 Matsuo et al.
5,760,744 A 6/1998 Sauer
6,366,260 B1 * 4/2002 Carrender 343/866
6,590,541 B1 * 7/2003 Schultze 343/741
6,734,791 B2 * 5/2004 Kelly et al. 340/445
6,950,068 B2 * 9/2005 Bordi et al. 343/702
2002/0180643 A1 12/2002 Laubner et al.

FOREIGN PATENT DOCUMENTS

GB 2 351 395 B 12/2000
JP 63009206 A * 1/1988
WO 01/26182 A1 4/2001

* cited by examiner

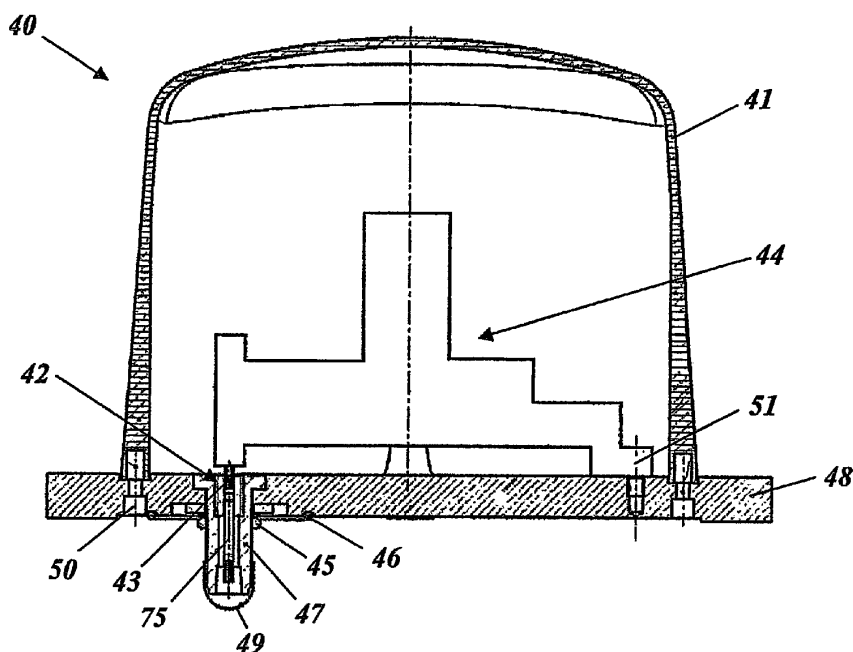
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Burr & Brown

(57) **ABSTRACT**

The invention relates to a compact and robust broadband antenna, for the frequency range from about 800 MHz up to 9 GHz, in particular, for use on railways. The antenna includes a monopole antenna element, extending in a longitudinal direction essentially parallel to and at a distance above a planar electrically-conducting base plate, between two opposing ends of the antenna element. The antenna element is electrically connected to the base plate at the first end thereof and is insulated from the base plate at the second end thereof, creating an injection point by means of which the antenna element may be connected to a device operating at high frequency.

16 Claims, 7 Drawing Sheets



Acrobat 文件



US007327324B2

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

(10) **Patent No.:** **US 7,327,324 B2**
(45) **Date of Patent:** **Feb. 5, 2008**

(54) **MONOPOLE SLOT ANTENNA**

(75) Inventors: **Hanyang Wang**, Witney (GB); **Ming Zheng**, Farnborough (GB); **Su Qing Zhang**, Oxford (GB); **Alan Johnson**, Frimley (GB)

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

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

(21) Appl. No.: **10/498,577**

(22) PCT Filed: **Dec. 16, 2002**

(86) PCT No.: **PCT/IB02/05433**

§ 371 (c)(1),
(2), (4) Date: **Jan. 13, 2005**

(87) PCT Pub. No.: **WO03/052867**

PCT Pub. Date: **Jun. 26, 2003**

(65) **Prior Publication Data**

US 2005/0116870 A1 Jun. 2, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/020,195, filed on Dec. 18, 2001, now Pat. No. 6,618,020.

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

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

(58) **Field of Classification Search** **343/767, 343/770, 700, 702, 829, 846, 700 MS**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,257,661 A * 6/1966 Tanner 343/792.5

4,723,305 A	2/1988	Phillips et al.	455/575.7
4,843,403 A	6/1989	Lalezari et al.	343/767
5,563,617 A	10/1996	Redfern et al.	343/767
5,646,637 A	7/1997	Miller 343/713	
5,677,698 A	10/1997	Snowdon 343/770	
6,031,503 A	2/2000	Preiss, II et al.	343/770
6,043,786 A	3/2000	Vannatta et al.	343/770
6,169,523 B1 *	1/2001	Ploussios 343/895	
6,373,442 B1	4/2002	Thomas et al.	343/767
6,414,642 B2	7/2002	Honda et al. 343/702	
6,424,300 B1	7/2002	Sanford et al.	343/702
6,480,162 B2	11/2002	Sabet et al. 343/767	
6,483,466 B2 *	11/2002	Liu 343/702	
6,600,448 B2 *	7/2003	Ikegaya et al.	343/700 MS
6,618,020 B2 *	9/2003	Wang et al. 343/767	

FOREIGN PATENT DOCUMENTS

EP	0455493 A2	11/1991
EP	0455493 A3	11/1991
EP	0851530 A2	7/1998
GB	1018779 A2	7/2000

OTHER PUBLICATIONS

Patent Abstracts of Japan; Takahashi Hitoshi and Okano Yoshinobu; "Plate Antenna and Portable Communication Terminal Equipped with the Same and Broadcast Receiver"; Pub. No. 2002-246821, Pub. Date Aug. 30, 2002.

* cited by examiner

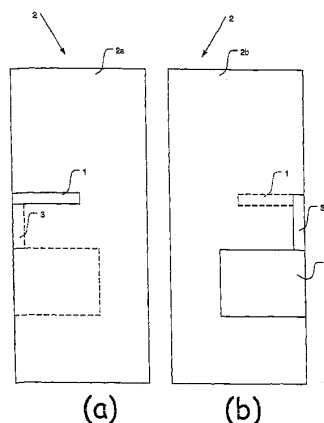
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Harrington & Smith, PC

(57) **ABSTRACT**

A resonant monopole slot antenna comprising a ground plane, having a radiating slot which is dimensioned such that the slot is equivalent electromagnetically to an odd number of quarter wavelengths at the antenna's operating frequency, wherein the antenna's feed is arranged at the open end of the radiating slot.

21 Claims, 5 Drawing Sheets



Acrobat 文件



US007327327B2

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

(10) **Patent No.:** **US 7,327,327 B2**
(45) **Date of Patent:** **Feb. 5, 2008**

(54) **OMNIDIRECTIONAL BROADBAND
MONOPOLE ANTENNA**

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

(73) Assignee: **Industrial Technology Research
Institute**, Hsinchu (TW)

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

(21) Appl. No.: **10/945,046**

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

(65) **Prior Publication Data**
US 2005/0243009 A1 Nov. 3, 2005

(30) **Foreign Application Priority Data**
Apr. 29, 2004 (TW) 93111988 A

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

(52) **U.S. Cl.** **343/829**; 343/900; 343/895

(58) **Field of Classification Search** 343/829
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,466,003 A	8/1984	Royce	
4,644,366 A *	2/1987	Scholz	343/895
5,828,340 A	10/1998	Johnson	
6,339,409 B1	1/2002	Warnagiris	
6,421,014 B1 *	7/2002	Sanad	343/700 MS
6,567,053 B1 *	5/2003	Yablonovitch et al.	343/767
6,650,303 B2 *	11/2003	Kim et al.	343/895

6,710,748 B2 *	3/2004	Yarasi et al.	343/702
6,816,127 B2 *	11/2004	McKivergan et al.	343/895
6,856,286 B2 *	2/2005	Jo et al.	343/700 MS
2002/0015000 A1 *	2/2002	Reece et al.	343/795
2003/0048234 A1 *	3/2003	Alexopoulos et al.	343/895
2003/0117325 A1 *	6/2003	Jo et al.	343/702
2004/0155832 A1 *	8/2004	Yuanzhu	343/895

OTHER PUBLICATIONS

Ammann et al. "Wideband monopole antennas for multi-band
wireless systems", IEEE Antennas and Propagation magazine, vol.
45, No. 2, Apr. 2003.

Anob et al. "Wideband orthogonal square monopole antennas with
semi-circular base", 2001 IEEE Antennas Propagat. Soc. Int. Symp.
Dig., Boston, MA, pp. 294-297.

* cited by examiner

Primary Examiner—Wilson Lee

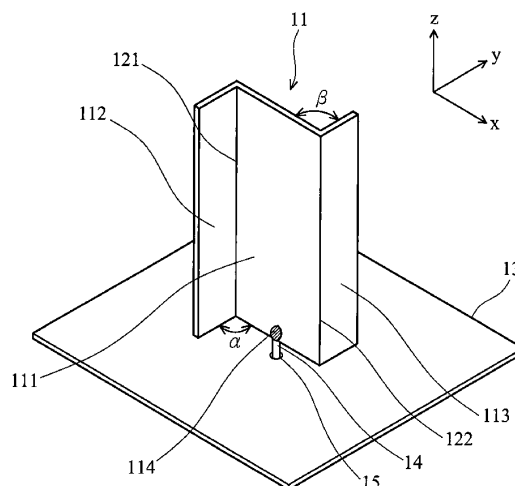
Assistant Examiner—Binh V Ho

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

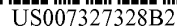
(57) **ABSTRACT**

An omnidirectional broadband monopole antenna comprises
a ground plane, a radiating member, and a feed member. The
ground plane is made of a metal plate. The radiating member
comprises a first sub-radiating member, a second sub-radiating
member connected to one side of the first sub-radiating
member to provide a first angle therebetween, and a third
radiating member connected to another side of the first
sub-radiating member opposite the second sub-radiating
member; a second angle is provided by the first and third
sub-radiating members. The feed member is made of a metal
rod with one end connected to the radiating member and the
other to a signal source. Gain variations of the antenna's
horizontal radiation pattern across the operating bandwidth
are less than 3 dB.

20 Claims, 12 Drawing Sheets



Acrobat 文件



(10) **Patent No.:** US 7,327,328 B2
(45) **Date of Patent:** Feb. 5, 2008

- 5.585.806 A * 12/1996 Ogino et al. 343/700 MS

6,204,825	B1 *	3/2001	Wilz	343/841
6,850,196	B2 *	2/2005	Wong et al.	343/702
6,946,996	B2 *	9/2005	Koyama	343/700 MS
6,975,272	B2 *	12/2005	Yuanzhu	343/700 MS
7,151,503	B2 *	12/2006	Noro et al.	343/872
2003/0103014	A1 *	6/2003	Birnbaum et al.	343/841
2004/0135733	A1 *	7/2004	Chou et al.	343/841
2004/0257281	A1 *	12/2004	Noro et al.	343/700 MS
2005/0068247	A1	3/2005	Yoneya et al.	
2005/0122268	A1 *	6/2005	Suzuki	343/702
2006/0071856	A1 *	4/2006	Shinkai et al.	343/700 MS
2006/0273968	A1 *	12/2006	Noro	343/713

(57) **ABSTRACT**

Mounted on a back surface (21b) of a circuit board (21), a shield cover (24) has a substantially rectangular ceiling portion (241) with four corners which are chamfered, four side wall portions (242-245), and four corner portions (457). The shield cover (24) is mounted on the back surface (21b) of the circuit board by soldering at the four corner portions (247). There is no gap between the four side wall portions (242-245) and the four corner portions (247). The shield cover (24) is formed by bending working of a metal plate (40) and has extension portions (248) at both ends of the four corner portions (247) so as to interpose with the side wall portions (242-245).

13 Claims, 6 Drawing Sheets



Acrobat 文件



US007330152B2

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

(10) **Patent No.:** **US 7,330,152 B2**
(45) **Date of Patent:** **Feb. 12, 2008**

(54) **RECONFIGURABLE, MICROSTRIP ANTENNA APPARATUS, DEVICES, SYSTEMS, AND METHODS**

(75) Inventors: **Shenghui Zhang**, Beijing (CN);
Jennifer T. Bernhard, Champaign, IL (US);
Gregory H. Huff, Champaign, IL (US);
Garvin Cung, Columbia, MD (US)

(73) Assignee: **The Board of Trustees of the University of Illinois**, Urbana, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 34 days.

(21) Appl. No.: **11/257,382**

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

(65) **Prior Publication Data**

US 2007/0229357 A1 Oct. 4, 2007

Related U.S. Application Data

(60) Provisional application No. 60/692,424, filed on Jun. 20, 2005.

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

(52) **U.S. Cl.** **343/700 MS; 343/834**

(58) **Field of Classification Search** **343/700 MS, 343/795, 767, 834, 833**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,933,682 A 6/1990 Vaughan
5,767,807 A * 6/1998 Pritchett 342/374
6,384,797 B1 5/2002 Schaffner et al.
6,501,427 B1 * 12/2002 Lilly et al. 343/700 MS
6,563,467 B1 5/2003 Buris et al.
6,762,719 B2 7/2004 Subotic et al.

6,774,844 B2 8/2004 Subotic et al.
6,816,116 B2 11/2004 Chen
6,844,852 B1 1/2005 Simons
6,864,848 B2 3/2005 Sievenplper
6,876,330 B2 4/2005 Alexeff et al.
6,876,337 B2 4/2005 Larry
7,129,897 B2 * 10/2006 Iigusa et al. 343/700 MS
7,132,992 B2 * 11/2006 Mori 343/770
2006/0240882 A1 * 10/2006 Nagy et al. 455/575.7

OTHER PUBLICATIONS

Harrington, Roger F., Reactively Controlled Directive Arrays, journal, May 1978, vol. AP-26, No. 3, IEEE.
Hirasawa, K., et al., On Electronically-Beam-Controllable-Dipole Antenna, journal, 1980, pp. 692-695, IEEE.

(Continued)

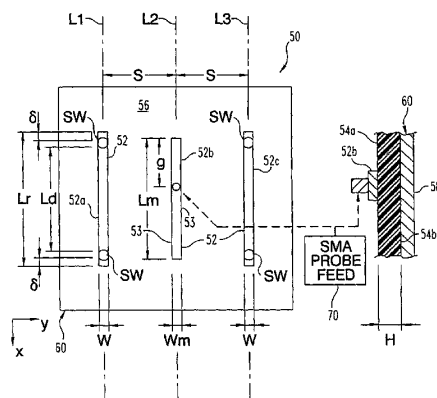
Primary Examiner—Hoanganh Le

(74) *Attorney, Agent, or Firm*—Krieg DeVault LLP; L. Scott Paynter

(57) **ABSTRACT**

An antenna device includes a dielectric layer, an electrical ground layer carried on one side of the dielectric layer, and an antenna arrangement carried on another side of the dielectric layer. This arrangement includes two parasitic microstrip elements and a microstrip signal element. The signal element is structured to radiate an electromagnetic signal in response to application of a corresponding electrical communication signal. The parasitic antenna elements extend along opposing longitudinal sides of the signal element and each includes an adjustable component operatively connected between two microstrips. The adjustable component is structured to selectively adjust operable length of a selected one of the parasitic antenna elements to change a maximum radiation direction of the antenna device.

22 Claims, 18 Drawing Sheets



Acrobat 文件



US007330153B2

(12) **United States Patent**
Rentz

(10) **Patent No.:** **US 7,330,153 B2**

(45) **Date of Patent:** **Feb. 12, 2008**

(54) **MULTI-BAND INVERTED-L ANTENNA**

7,038,626 B2 * 5/2006 Gothard et al. 343/702

7,176,844 B2 * 2/2007 Chiang et al. 343/815

(75) Inventor: **Mark L. Rentz**, Torrance, CA (US)

OTHER PUBLICATIONS

(73) Assignee: **Navcom Technology, Inc.**, Torrance, CA (US)

Rao, B.R., et al., "Triple Band GPS Trap Loaded Inverted L Antenna Array," Microwave and Opti. Tech. Letters, 2002, http://www.mitre.org/work/tech_papers/tech_papers_02/rao_triband/.

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 102 days.

* cited by examiner

Primary Examiner—Hoanganh Le

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

(21) Appl. No.: **11/402,141**

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

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2007/0236400 A1 Oct. 11, 2007

An antenna includes a first antenna element and a second antenna element. The first antenna element and the second antenna element are configured to transmit and receive signals in a first band of frequencies and in a second band of frequencies. A first pair of delay lines is coupled to the first antenna element and a second pair of delay lines coupled to the second antenna element. A first delay line in the first pair of delay lines and the second pair of delay lines is configured to phase shift electrical signals coupled to the first antenna element and the second antenna element such that a first impedance of the antenna is approximately equal in the first band of frequencies and the second band of frequencies. A second delay line in the first pair of delay lines and the second pair of delay lines is configured to convert the first impedance to a second impedance.

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 21/00 (2006.01)

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

(58) **Field of Classification Search** **343/700 MS; 343/850, 853, 860, 864, 865; 333/156, 160**
See application file for complete search history.

(56) **References Cited**

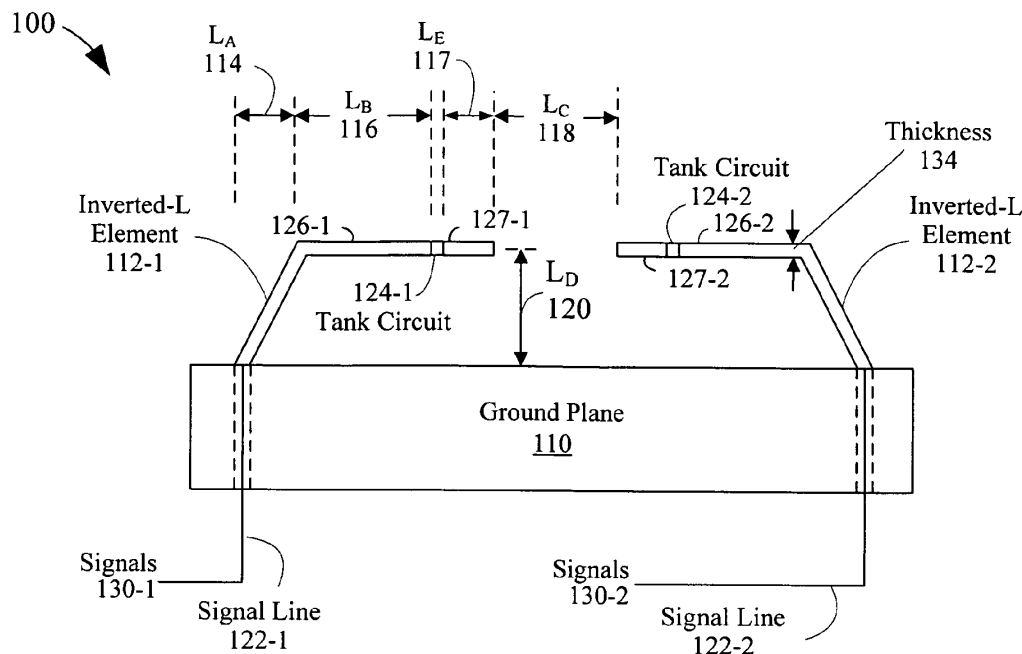
U.S. PATENT DOCUMENTS

6,417,806 B1 * 7/2002 Gothard et al. 343/700 MS

6,483,463 B2 * 11/2002 Kadambi et al. 343/700 MS

6,856,287 B2 2/2005 Rao et al. 343/700

21 Claims, 10 Drawing Sheets



Acrobat 文件



US007330155B2

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

(10) **Patent No.:** **US 7,330,155 B2**
(45) **Date of Patent:** **Feb. 12, 2008**

(54) **ANTENNA SYSTEM**

(75) Inventors: **Yiu K. Chan**, Vernon Hills, IL (US);
Antonio Faraone, Plantation, FL (US);
Carlo DiNallo, Plantation, FL (US);
Istvan J. Szini, Grayslake, IL (US)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 113 days.

(21) Appl. No.: **11/168,950**

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

(65) **Prior Publication Data**

US 2006/0290572 A1 Dec. 28, 2006

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

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

(58) **Field of Classification Search** 343/702,
343/700 MS, 895, 720, 725, 834
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,432,057 A * 12/1947 Wheeler 343/830

5,422,650 A * 6/1995 Hill 343/713
6,028,567 A * 2/2000 Lahti 343/895
6,040,803 A * 3/2000 Spall 343/700 MS
6,124,831 A * 9/2000 Rutkowski et al. .. 343/700 MS
6,232,925 B1 * 5/2001 Fujikawa 343/702
6,359,594 B1 * 3/2002 Junod 343/744
6,456,246 B2 * 9/2002 Saito 343/702
6,677,905 B2 * 1/2004 Deguchi et al. 343/702
6,762,723 B2 7/2004 Nallo et al.
2001/0040528 A1 * 11/2001 Vaisanen et al. 343/700 MS

* cited by examiner

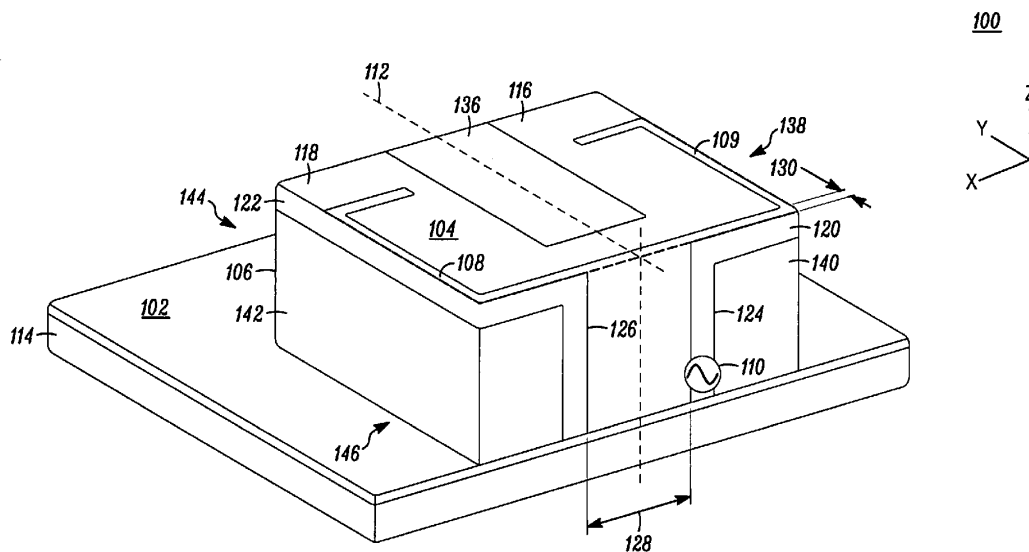
Primary Examiner—Huedung Mancuso

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

(57) **ABSTRACT**

A wireless communication device (600) with an antenna system (602) is disclosed. The antenna system (100) is an internal antenna with broadband characteristics which provides coverage over multiple frequency bands. The antenna system (100) has a finite ground surface (102), an elongated conductor (104) supported by a dielectric spacer (106), and at least one series signal feed (110).

18 Claims, 7 Drawing Sheets



Acrobat 文件



US007330156B2

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

(10) **Patent No.:** **US 7,330,156 B2**
(45) **Date of Patent:** **Feb. 12, 2008**

(54) **ANTENNA ISOLATION USING GROUNDED MICROWAVE ELEMENTS**

(75) Inventors: **Aimo Arkko**, Ruutana (FI); **Jani Ollikainen**, Helsinki (FI); **Shunya Sato**, Tokyo (JP); **Hawk Yin Pang**, Tokyo (JP)

(73) Assignee: **Nokia Corporation**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 5 days.

(21) Appl. No.: **11/179,811**

(22) Filed: **Jul. 11, 2005**

(65) **Prior Publication Data**
US 2006/0044195 A1 Mar. 2, 2006

Related U.S. Application Data
(60) Provisional application No. 60/603,459, filed on Aug. 20, 2004.
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
(52) **U.S. Cl.** **343/702; 343/700 MS**
(58) **Field of Classification Search** **343/702, 343/700 MS, 84.6, 846, 848, 841**
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
4,460,899 A * 7/1984 Schmidt et al. 343/841

6,259,407 B1	7/2001	Tran	
6,560,443 B1 *	5/2003	Vaisanen et al.	455/73
6,765,536 B2 *	7/2004	Phillips et al.	343/702
6,985,114 B2 *	1/2006	Egashira	343/702
7,030,830 B2 *	4/2006	Azoulay et al.	343/815
7,095,371 B2 *	8/2006	Monebhurrun et al.	343/700 MS
2002/0180651 A1	12/2002	Hareyama et al.	
2003/0132883 A1	7/2003	Wong et al.	
2004/0036655 A1	2/2004	Sainati et al.	
2004/0051669 A1 *	3/2004	Rutfors et al.	343/702
2005/0110692 A1 *	5/2005	Andersson	343/702

OTHER PUBLICATIONS

Antennas for All Applications, by John D. Kraus and Ronald J. Marhefka, McGraw-Hill, 3d Edition, 2002, Chapter 23, Baluns, etc. p. 803-826.

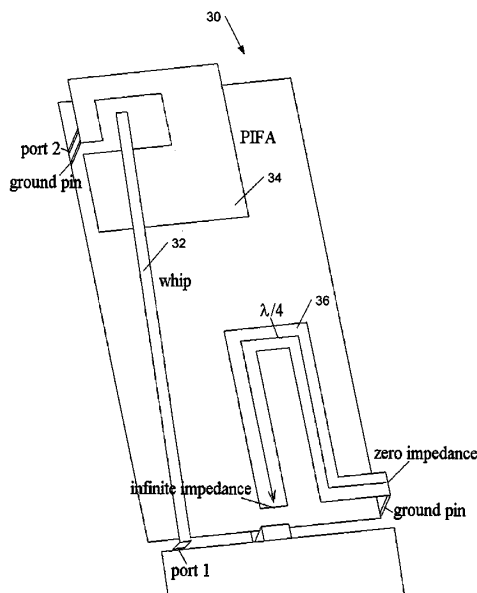
* cited by examiner

Primary Examiner—Hoanganh Le

(57) **ABSTRACT**

This invention describes a method for improving antenna isolation in an electronic communication device using grounded RF microwave elements and patterns (structures). According to embodiments of the present invention, the RF microwave element can be implemented as a short-circuited section of a quarter-wavelength long transmission line (such as a stripline), or the RF microwave element can contain a metallic coupler and two thin striplines with different lengths, or the RF microwave element can be implemented using a balun concept.

27 Claims, 18 Drawing Sheets



Acrobat 文件



US007333057B2

(12) **United States Patent**
Snyder

(10) **Patent No.:** **US 7,333,057 B2**
(45) **Date of Patent:** **Feb. 19, 2008**

- (54) **STACKED PATCH ANTENNA WITH DISTRIBUTED REACTIVE NETWORK PROXIMITY FEED**
- (75) Inventor: **Christopher A. Snyder**, Melbourne, FL (US)
- (73) Assignee: **Harris Corporation**, Melbourne, FL (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/903,930**

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

(65) **Prior Publication Data**
US 2006/0022874 A1 Feb. 2, 2006

- (51) **Int. Cl.**
H01Q 1/38 (2006.01)
- (52) **U.S. Cl.** **343/700 MS; 343/745; 343/815; 343/822; 343/850**
- (58) **Field of Classification Search** **343/860, 343/745**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,101,896 A *	7/1978	Ikrath et al.	343/713
4,386,357 A	5/1983	Patton	343/700
4,835,538 A	5/1989	McKenna et al.	343/700
4,853,703 A	8/1989	Murakami et al.	343/700
5,155,493 A	10/1992	Thursby et al.	343/700
5,243,353 A *	9/1993	Nakahara et al.	343/700 MS
5,309,163 A	5/1994	Ngan et al.	343/700
5,386,214 A	1/1995	Sugwara	343/700
5,396,202 A	3/1995	Scheck	343/700
5,633,645 A	5/1997	Day	343/700

5,874,919 A	2/1999	Rawnick et al.	343/700
5,907,304 A	5/1999	Wilson et al.	343/700
5,931,456 A	8/1999	Laidlaw et al.	271/171
6,069,587 A	5/2000	Lynch et al.	343/700
6,079,973 A	6/2000	Manera et al.	425/556
6,118,406 A	9/2000	Josypenko	343/700
6,320,509 B1	11/2001	Brady et al.	340/572.7
6,366,260 B1	4/2002	Currender	343/866
6,377,216 B1	4/2002	Cheadle et al.	343/700
6,462,710 B1	10/2002	Carson et al.	343/700
6,501,437 B1	12/2002	Gyuorko et al.	343/895
6,597,321 B2	7/2003	Thursby et al.	343/744
6,608,594 B1	8/2003	Kane et al.	343/700
6,639,555 B1	10/2003	Kane et al.	343/700
6,717,549 B2 *	4/2004	Rawnick et al.	343/700 MS
6,741,212 B2	5/2004	Kralovec et al.	343/700
6,765,540 B2 *	7/2004	Toncich	343/860
6,873,299 B2 *	3/2005	Dakeya et al.	343/745
2002/0149535 A1 *	10/2002	Toncich	343/860

OTHER PUBLICATIONS

"Survey of Broadband Microstrip Patch Antennas", *Microwave Journal*, Sep. 1996.
"Patent Review, C-L-C Feed for Stacked Patch", Harris Proprietary Information Jan. 2004.
"Increasing the Bandwidth of Microstrip Antenna by Proximity Coupling", *Electronic Letters*, vol. 23, No. 8, Apr. 9, 1987.

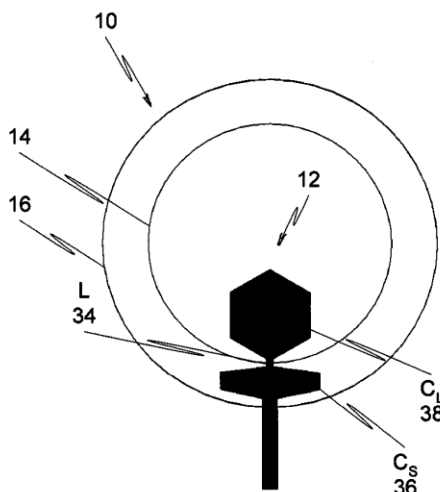
(Continued)

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

(57) **ABSTRACT**

A stacked patch antenna including a distributed reactive network proximity feed, preferably implemented in a microstrip metallization network, coupled to an active antenna patch element to feed the active antenna patch element to emit a field to parasitically stimulate a parasitic antenna patch element.

10 Claims, 5 Drawing Sheets



Acrobat 文件



US007333059B2

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

(10) **Patent No.:** **US 7,333,059 B2**

(45) **Date of Patent:** **Feb. 19, 2008**

(54) **COMPACT CIRCULARLY-POLARIZED
PATCH ANTENNA**

(75) Inventors: **Qian Li**, Ann Arbor, MI (US);
Wladimiro Villarroel, Worthington,
OH (US)

(73) Assignee: **AGC Automotive Americas R&D,
Inc.**, Ypsilanti, MI (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 188 days.

(21) Appl. No.: **11/190,445**

(22) Filed: **Jul. 27, 2005**

(65) **Prior Publication Data**

US 2007/0024511 A1 Feb. 1, 2007

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,500,887 A 2/1985 Nester
4,575,725 A * 3/1986 Tresselt 343/700 MS
4,823,145 A 4/1989 Mayes et al.
4,843,403 A 6/1989 Lalezari et al.
5,036,335 A 7/1991 Jairam
5,081,466 A 1/1992 Bitter, Jr.
5,270,722 A * 12/1993 Delestre 343/700 MS
5,410,323 A 4/1995 Kuroda
5,519,408 A 5/1996 Schnetzer
5,541,611 A 7/1996 Peng et al.
5,568,159 A 10/1996 Pelton et al.
5,734,350 A 3/1998 Deming et al.
6,054,961 A * 4/2000 Gong et al. 343/713

6,191,750 B1 2/2001 Bonebright
6,278,410 B1 8/2001 Soliman et al.
6,392,599 B1 5/2002 Ganeshmoorthy et al.
6,496,155 B1 12/2002 Sievenpiper et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0993069 A2 12/2000
EP 1362614 A1 11/2003

OTHER PUBLICATIONS

"Dual Frequency Circularly-Polarized Proximity-Fed Microstrip
Antenna", A Hoorfar et al., Electronics Letters, May 13, 1999, vol.
35, No. 10, pp. 759-761.

(Continued)

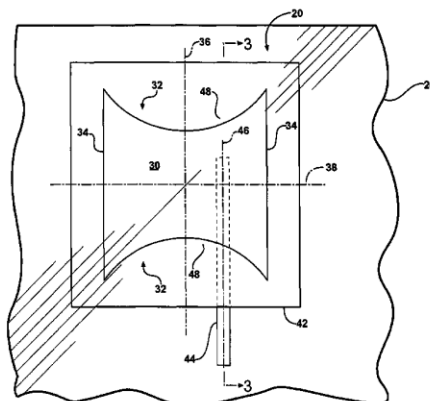
Primary Examiner—Michael C. Wimer

(74) *Attorney, Agent, or Firm*—Howard & Howard
Attorneys, P.C.

(57) **ABSTRACT**

An antenna for receiving and/or transmitting circularly polarized RF signals includes a patch element, a ground plane, a dielectric, and a feed line. The patch element is disposed on a pane of glass and includes a pair of radiating sides disposed opposite each other and a pair of spacer sides disposed opposite each other. The radiating sides form an angle less than 90 degrees with the spacer sides. A first axis is defined through a center of the radiating sides and a second axis defined through a center of the spacer sides. The ground plane is disposed substantially parallel to and spaced from the patch element. The dielectric substrate is sandwiched between the patch element and the ground plane. The feed line is disposed substantially parallel to and offset from the first axis for providing the antenna with a circular polarization radiation characteristic. The antenna is compact in size and generally conformal to the pane of glass.

40 Claims, 9 Drawing Sheets



Acrobat 文件



US007333060B2

(12) **United States Patent**
Ando

(10) **Patent No.:** **US 7,333,060 B2**

(45) **Date of Patent:** **Feb. 19, 2008**

(54) **PLANAR ANTENNA**

(75) Inventor: **Koji Ando**, Kyoto-Fu (JP)

(73) Assignee: **Omron Corporation**, Kyoto (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.: **11/330,319**

(22) Filed: **Jan. 12, 2006**

(65) **Prior Publication Data**

US 2006/0187123 A1 Aug. 24, 2006

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

(52) **U.S. Cl.** **343/700 MS; 343/752; 343/846**

(58) **Field of Classification Search** **343/700 MS, 343/752**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,181,044 A 1/1993 Matsumoto et al.
2002/0104615 A1 8/2002 Lebaric et al.
2004/0147288 A1 7/2004 Belhora

2005/0190106 A1* 9/2005 Anguera et al. 343/700 MS
2006/0227052 A1* 10/2006 Tavassoli Hozouri 343/700 MS

FOREIGN PATENT DOCUMENTS

EP 0 346 922 12/1989
EP 1 130 678 A2 9/2001
WO WO 01/08261 A1 2/2001
WO WO 2005/093898 10/2005

OTHER PUBLICATIONS

Naftali Herscovici, "New Considerations in the Design of Microstrip Antennas", IEEE Transcriptions on Antennas and Propagation, vol. 46, No. 6, Jun. 1998.

* cited by examiner

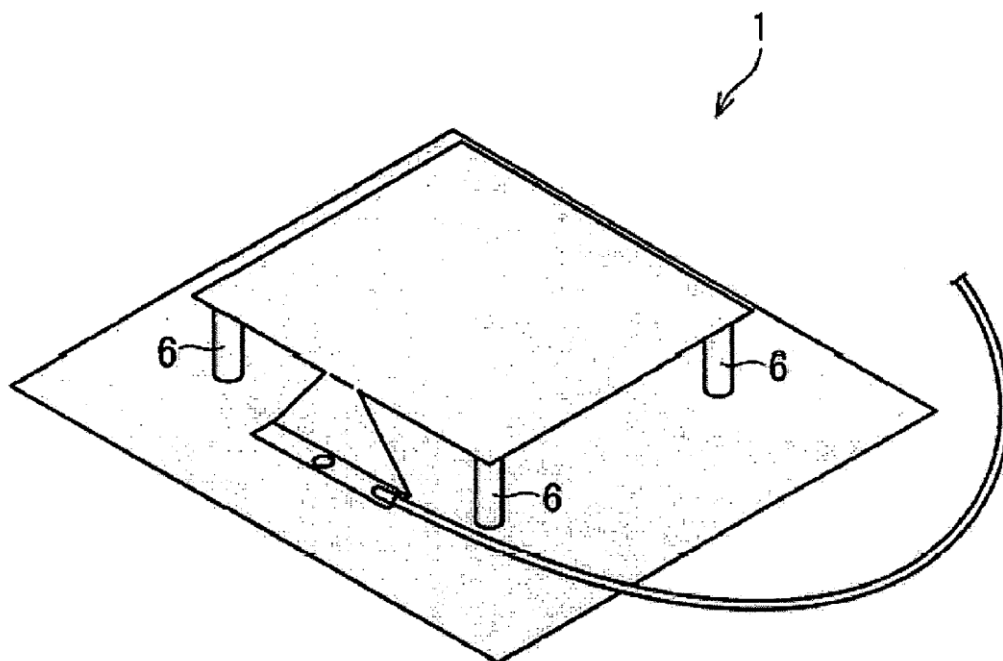
Primary Examiner—Trinh Vo Dinh

(74) Attorney, Agent, or Firm—Dickstein Shapiro LLP

(57) **ABSTRACT**

A planar antenna able to secure a wide frequency band and having high reliability. Therefore, the planar antenna has at least a grounding plate, a radiating conductor, a matching portion, a power supply portion, a spacer, a central conductor and a coaxial connector. The matching portion is a flat plate having a taper shape (an inverse taper shape) narrowed in width from the power supply portion to the radiating conductor. Further, the matching portion is slantingly arranged with respect to the grounding plate.

16 Claims, 10 Drawing Sheets



Acrobat 文件



US007333062B2

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

(10) **Patent No.:** **US 7,333,062 B2**

(45) **Date of Patent:** **Feb. 19, 2008**

(54) **WIRELESS COMMUNICATION DEVICE
WITH INTEGRATED ANTENNA**

(75) Inventors: **Gustavo D. Leizerovich**, Aventura, FL
(US); **Donald W. Burnette**, Sunrise, FL
(US); **Julio C. Castaneda**, Coral
Springs, FL (US); **Orlando Gomez**,
Hialeah, FL (US)

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 98 days.

(21) Appl. No.: **11/227,367**

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

(65) **Prior Publication Data**

US 2007/0057852 A1 Mar. 15, 2007

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

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

(58) **Field of Classification Search** 343/702,
343/741, 866, 872, 742, 867, 873
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,710,987 A * 1/1998 Paulick 455/575.7
2005/0064814 A1 3/2005 Matsuo et al.
2005/0075079 A1 4/2005 Jei et al.

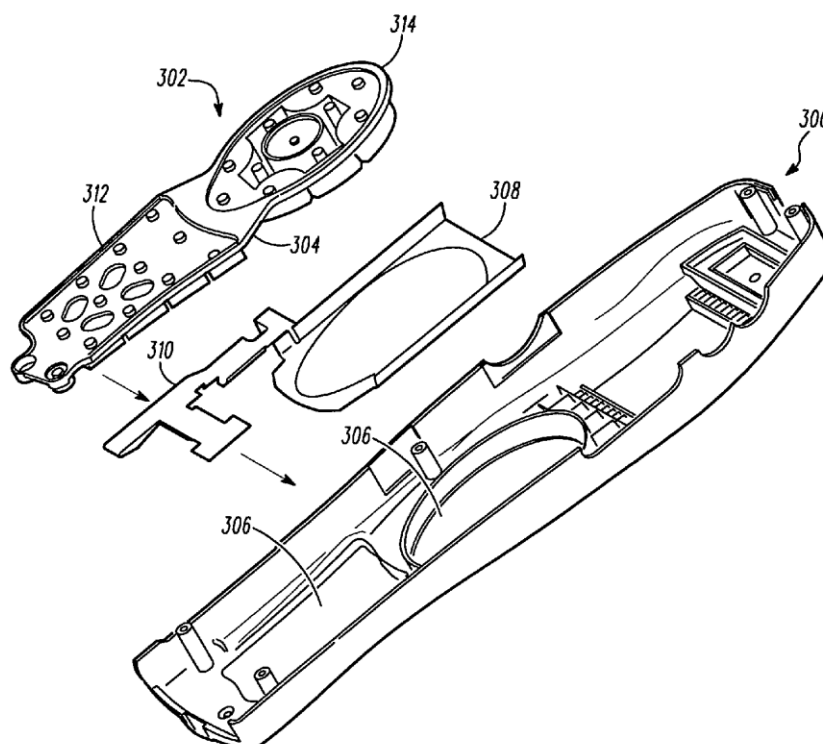
* cited by examiner

Primary Examiner—Hoanganh Le

(57) **ABSTRACT**

A near field communication loop antenna (308) is mechanically coupled to the cover (300) of a cellular telephone. The antenna (308) is coupled on the inside of the cover (300) between a keypad (302) and the cover (300), whereby the antenna (308) surrounds the keys (314) and is sandwiched between the keypad assembly (302) and the cover (300). A near field communication antenna (406) is coupled to the outside surface of the cover (300) surrounding a display and sandwiched between a lens (400) and the phone cover (300). A near field communication antenna embedded in the phone cover material, whereby the antenna surrounds either the keys or the display, is disclosed as well.

7 Claims, 4 Drawing Sheets



Acrobat 文件



US007333063B2

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

(10) **Patent No.:** **US 7,333,063 B2**

(45) **Date of Patent:** ***Feb. 19, 2008**

(54) **ELECTRONIC DEVICE AND ANTENNA APPARATUS**

(75) Inventors: **Junro Yano**, Hamura (JP); **Soh Kimura**, Kodaira (JP); **Makoto Sawada**, Ome (JP)

(73) Assignee: **Casio Computer Co., Ltd.**, Tokyo (JP)

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/516,918**

(22) Filed: **Sep. 7, 2006**

(65) **Prior Publication Data**

US 2007/0001917 A1 Jan. 4, 2007

Related U.S. Application Data

(63) Continuation of application No. 11/002,348, filed on Dec. 1, 2004, now Pat. No. 7,126,548.

(30) **Foreign Application Priority Data**

Dec. 2, 2003 (JP) 2003-402675
Apr. 21, 2004 (JP) 2004-125922

(51) **Int. Cl.**

H01Q 1/22 (2006.01)

H01Q 7/00 (2006.01)

G04B 47/00 (2006.01)

(52) **U.S. Cl.** **343/702; 343/718; 343/788; 368/10**

(58) **Field of Classification Search** 343/702, 343/718, 788; 455/575.7; 368/10
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,541,610 A	7/1996	Imanishi et al.
6,657,922 B2	12/2003	Sato
6,825,751 B1	11/2004	Kita et al.
2003/0179151 A1	9/2003	Senba
2003/0231020 A1	12/2003	Yonezawa et al.
2005/0162331 A1	7/2005	Endo et al.

FOREIGN PATENT DOCUMENTS

EP	1288016 A1	3/2003
JP	59-14086 U	1/1984
JP	07-191157 A	7/1995
JP	08-016745 A	1/1996
JP	2000-082891 A	3/2000
JP	2000-286761 A	10/2000
JP	2001-033571 A	2/2001
JP	2002-158484 A	5/2002
JP	2003-035787 A	2/2003
WO	WO 03/061069 A1	7/2003

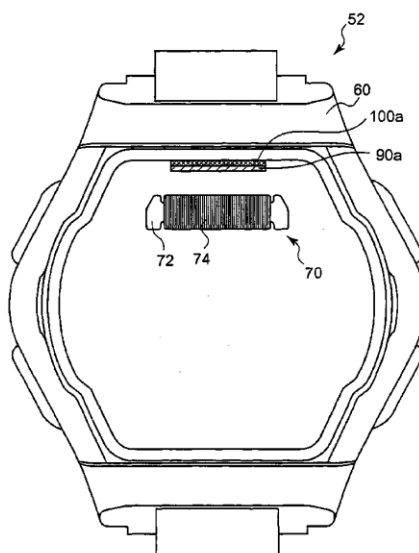
Primary Examiner—Michael C. Wimer

(74) *Attorney, Agent, or Firm*—Frishauf, Holtz, Goodman & Chick, P.C.

(57) **ABSTRACT**

In an electronic device having a metal device case, and an antenna disposed inside the device case, a magnetic member having a magnetic permeability higher than a magnetic permeability of the device case is placed between an inner surface of the device case and the antenna.

23 Claims, 33 Drawing Sheets



Acrobat 文件



US007333065B2

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

(10) **Patent No.:** **US 7,333,065 B2**

(45) **Date of Patent:** **Feb. 19, 2008**

(54) **MODULAR ANTENNA ASSEMBLY FOR
AUTOMOTIVE VEHICLES**

(75) Inventors: **Ralf Lindackers**, Waterford, MI (US);
Hasan Yasin, Holly, MI (US); **Andreas**
D. Fuchs, Lake Orion, MI (US);
Ayman Duzdar, Holly, MI (US)

(73) Assignee: **Receptec Holdings, LLC**, Holly, MI
(US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 95 days.

(21) Appl. No.: **11/271,372**

(22) Filed: **Nov. 10, 2005**

(65) **Prior Publication Data**

US 2007/0103374 A1 May 10, 2007

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

(52) **U.S. Cl.** **343/713; 343/872**

(58) **Field of Classification Search** **343/711,**
343/712, 713, 872, 704

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,023,245	A *	2/2000	Gomez et al.	343/725
D461,796	S	8/2002	Boyer	
D465,480	S	11/2002	Boyer	
6,674,412	B1 *	1/2004	Schmidt et al.	343/872
6,762,727	B2 *	7/2004	Rochford et al.	343/713
6,879,294	B2 *	4/2005	Yuanzhu	343/725
2007/0085361	A1 *	4/2007	Hauser	296/1.08
2007/0171138	A1 *	7/2007	Noro	343/713

* cited by examiner

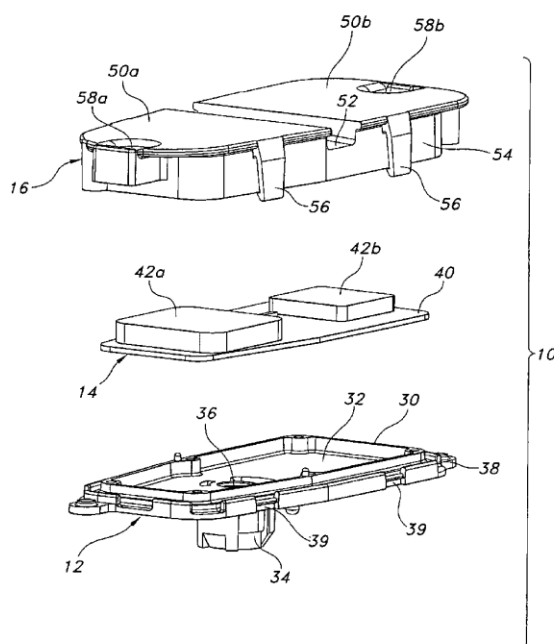
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Harness, Dickey & Pierce,
P.L.C.

(57) **ABSTRACT**

The specification discloses a modular antenna for automot-
ive vehicles. The antenna includes a base assembly that can
be used on a variety of vehicle platforms and a radome
assembly that is specific to a particular vehicle platform. The
radome assembly snap-fits onto the base assembly, and can
be installed during or after vehicle assembly. A wide variety
of radome assemblies of different shapes, styles, and colors
can be used in conjunction with a single base assembly.

8 Claims, 8 Drawing Sheets



Acrobat 文件



US007333067B2

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

(10) **Patent No.:** **US 7,333,067 B2**
(45) **Date of Patent:** **Feb. 19, 2008**

(54) **MULTI-BAND ANTENNA WITH WIDE BANDWIDTH**

(75) Inventors: **Chen-Ta Hung**, Tu-chen (TW);
Lung-Sheng Tai, Tu-Chen (TW); **Hsien**
Chu Lin, Tu-chen (TW); **Yun-Lung**
Ke, 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 226 days.

(21) Appl. No.: **11/026,601**

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

(65) **Prior Publication Data**
US 2005/0259024 A1 Nov. 24, 2005

(30) **Foreign Application Priority Data**
May 24, 2004 (TW) 93114591 A

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

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

(58) **Field of Classification Search** 343/700 MS,
343/702, 767, 770, 829, 846
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,160,513 A *	12/2000	Davidson et al.	343/700 MS
6,166,694 A	12/2000	Ying	
6,218,997 B1 *	4/2001	Lindenmeier et al.	343/725
6,343,208 B1	1/2002	Ying	
7,046,199 B2 *	5/2006	Montgomery et al.	343/700 MS
2004/0169611 A1 *	9/2004	Korva	343/770

* cited by examiner

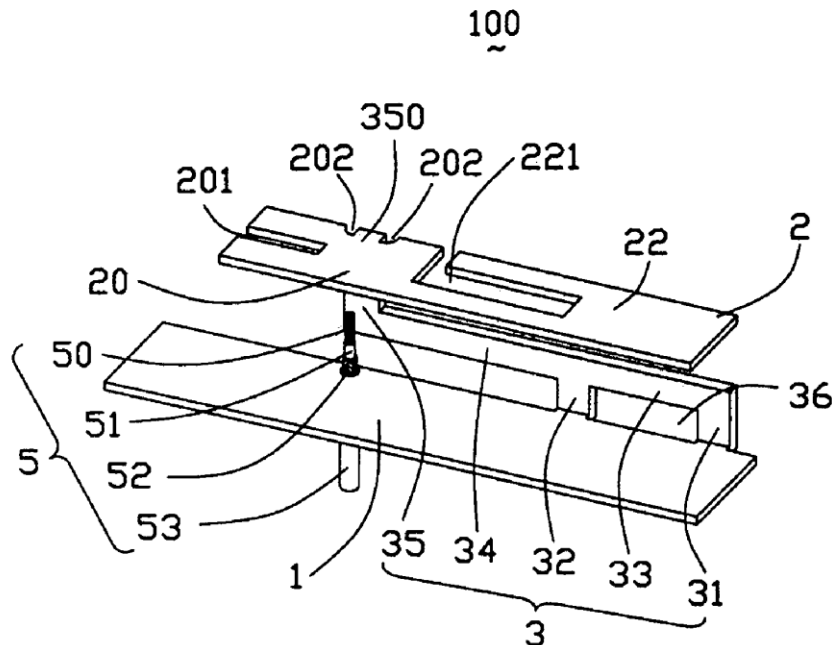
Primary Examiner—Tho Phan

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

(57) **ABSTRACT**

A multi-band antenna (100) used in wireless communications includes a first radiating patch (20) arranged in a first plane and extending in a first direction, a second radiating patch (22) arranged in the first plane and extending in a second direction different from the first direction, a grounding portion (1) arranged in second plane parallel to the first plane, and an inverted F-shaped connecting portion (3) connecting the first and the second radiating patches and the grounding portion. The radiating patches define a plurality of slots (201, 202) for increasing a bandwidth of the antenna. The connecting portion defines a rectangular slot (35) for adjusting an impedance matching of the antenna.

17 Claims, 9 Drawing Sheets



Acrobat 文件



US007333068B2

(12) **United States Patent**
Biddulph

(10) **Patent No.:** **US 7,333,068 B2**
(45) **Date of Patent:** **Feb. 19, 2008**

(54) **PLANAR ANTI-REFLECTIVE
INTERFERENCE ANTENNAS WITH
EXTRA-PLANAR ELEMENT EXTENSIONS**

(75) Inventor: **Stuart Biddulph**, Provo, UT (US)

(73) Assignee: **ClearOne Communications, Inc.**, Salt
Lake City, UT (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 31 days.

(21) Appl. No.: **11/274,644**

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

(65) **Prior Publication Data**

US 2007/0109194 A1 May 17, 2007

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

(52) **U.S. Cl.** **343/794**; 343/846; 343/799;
343/700 MS; 343/802; 343/834; 343/836

(58) **Field of Classification Search** 343/844,
343/810, 814, 872, 834, 836, 793, 795, 853,
343/846

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,060,810 A 11/1977 Kerr et al.
4,167,010 A 9/1979 Kerr
4,816,835 A 3/1989 Abiko et al.
4,857,938 A 8/1989 Tsukamoto et al.
4,937,585 A 6/1990 Shoemaker
5,185,611 A 2/1993 Bitter, Jr.
5,241,323 A 8/1993 Kelly
5,268,702 A 12/1993 Amano et al.
5,418,543 A 5/1995 Bolton
5,548,813 A 8/1996 Charas et al.
5,600,331 A 2/1997 Buralli
5,708,971 A 1/1998 Dent
5,724,666 A 3/1998 Dent

5,754,145 A 5/1998 Evans
5,784,032 A * 7/1998 Johnston et al. 343/702
5,832,389 A 11/1998 Dent
5,854,986 A 12/1998 Dorren et al.
5,917,456 A 6/1999 Teunisse
5,940,742 A 8/1999 Dent
5,966,102 A * 10/1999 Runyon 343/820
5,986,616 A 11/1999 Edvardsson
6,002,359 A 12/1999 Chen
6,049,305 A 4/2000 Tassoudji et al.
6,057,802 A 5/2000 Nealy et al.
6,075,501 A 6/2000 Kuramoto et al.
6,088,593 A 7/2000 Dent

(Continued)

Primary Examiner—Douglas W. Owens

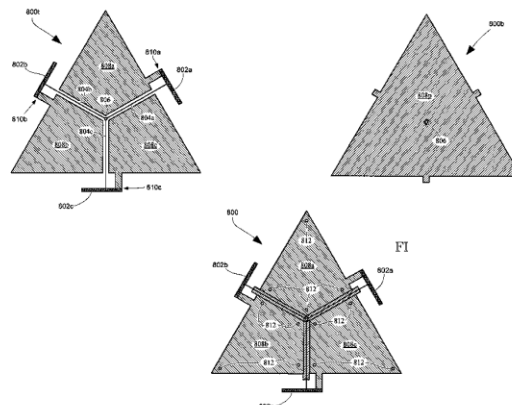
Assistant Examiner—Chuc Tran

(74) *Attorney, Agent, or Firm*—Everett D. Robinson;
Echelon IP, LLC

(57) **ABSTRACT**

Disclosed herein are wireless products adapted to be positioned in a normal or resting position, that also include an antenna composed of a set of elements arranged in a plane in a radially symmetrical configuration providing a reduction in the susceptibility of reflected waves having the potential to cancel or weaken a main wave or signal, the plane positioned with respect to the normal position to direct a main communication line with a second wireless device into the plane and provide reception of a main and/or secondary signal at a plurality of phases. One exemplary product is a wireless conferencing device configured to rest on a tabletop, the antenna array oriented in a horizontal plane. Detailed information on various example embodiments of the inventions are provided in the Detailed Description below, and the inventions are defined by the appended claims.

45 Claims, 27 Drawing Sheets



Acrobat 文件



US007333069B2

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

(10) **Patent No.:** **US 7,333,069 B2**
(45) **Date of Patent:** **Feb. 19, 2008**

(54) **RADIATING ELEMENT DESIGNED TO OPERATE IN A SMALL ANTENNA**

(75) Inventors: **Ali Louzir**, Rennes (FR); **Franck Thudor**, Rennes (FR); **Jean-Luc Robert**, Betton (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.

(21) Appl. No.: **11/348,205**

(22) Filed: **Feb. 6, 2006**

(65) **Prior Publication Data**

US 2006/0176234 A1 Aug. 10, 2006

(30) **Foreign Application Priority Data**

Feb. 7, 2005 (FR) 05 50347

(51) **Int. Cl.**
H01Q 7/00 (2006.01)
H01Q 11/12 (2006.01)

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

(58) **Field of Classification Search** **343/700 MS, 343/741, 748, 866**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,971,303	A *	8/1934	Mann	343/872
3,231,894	A *	1/1966	Nagai	343/806
3,369,243	A *	2/1968	Greiser	343/770
3,576,566	A *	4/1971	Cover et al.	343/705

FOREIGN PATENT DOCUMENTS

GB	2077046	9/1981
JP	2001298319	10/2001
JP	2003332820	11/2003

OTHER PUBLICATIONS

Patent Abstracts of Japan vol. 2002, No. 02, Apr. 2002 & JP 2001 298319 a (DX Antenna Co. Ltd), Oct. 26, 2001.

Patent Abstracts of Japan vol. 203, No. 12, Dec. 5, 2003 & JP 2003 332820 a (FEC INC), 21 Nov. 21, 2003.

Search report dated Sep. 12, 2005.

* cited by examiner

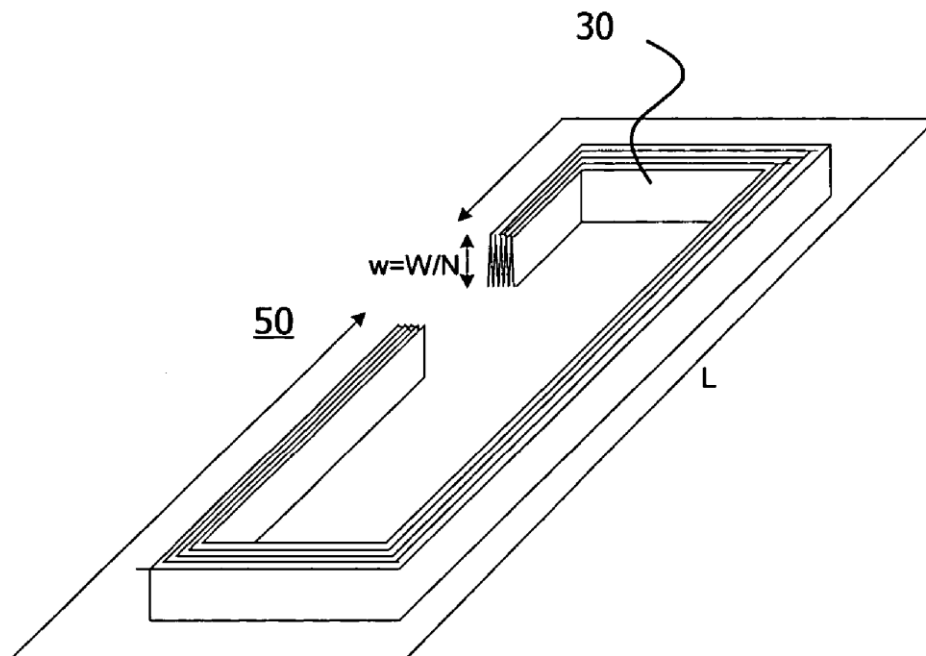
Primary Examiner—Shih-Chao Chen

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

(57) **ABSTRACT**

The present invention relates to a radiating element designed to operate in an electrically small antenna including a conducting strip folded N times like a bellows.

7 Claims, 3 Drawing Sheets



Acrobat 文件



US00D562311S

(12) **United States Design Patent** (10) **Patent No.:** **US D562,311 S**
Chen et al. (45) **Date of Patent:** **** Feb. 19, 2008**

(54) **TRI-BAND MINIATURE ANTENNA FOR WIRELESS HANDSETS**

(75) Inventors: **Li Chen**, Melbourne, FL (US); **Frank M. Caimi**, Vero Beach, FL (US)

(73) Assignee: **Sky Cross, Inc.**, Melbourne, FL (US)

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

(21) Appl. No.: **29/243,371**

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

(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

5,926,139 A 7/1999 Korisch
7,224,312 B2 * 5/2007 Wen et al. 343/700 MS
7,256,743 B2 * 8/2007 Korva 343/702
2002/0030627 A1 * 3/2002 Cassel 343/702

2004/0080457 A1 * 4/2004 Guo et al. 343/700 MS
2005/0248492 A1 * 11/2005 Ryu et al. 343/702
2005/0264447 A1 * 12/2005 Shan 343/700 MS
2005/0270243 A1 * 12/2005 Caimi et al. 343/702
2005/0275592 A1 * 12/2005 Chung et al. 343/700 MS

* cited by examiner

Primary Examiner—Stella M. Reid

Assistant Examiner—John Windmuller

(74) *Attorney, Agent, or Firm*—John DeAngelis; Beusse
Wolter Sanks Mora & Maire, P.A.

(57) **CLAIM**

The ornamental design for a tri-band miniature antenna for wireless handsets, as shown and described.

DESCRIPTION

FIG. 1 is an isometric view of a tri band miniature antenna for wireless handsets showing our new design;

FIG. 2 is a front view thereof;

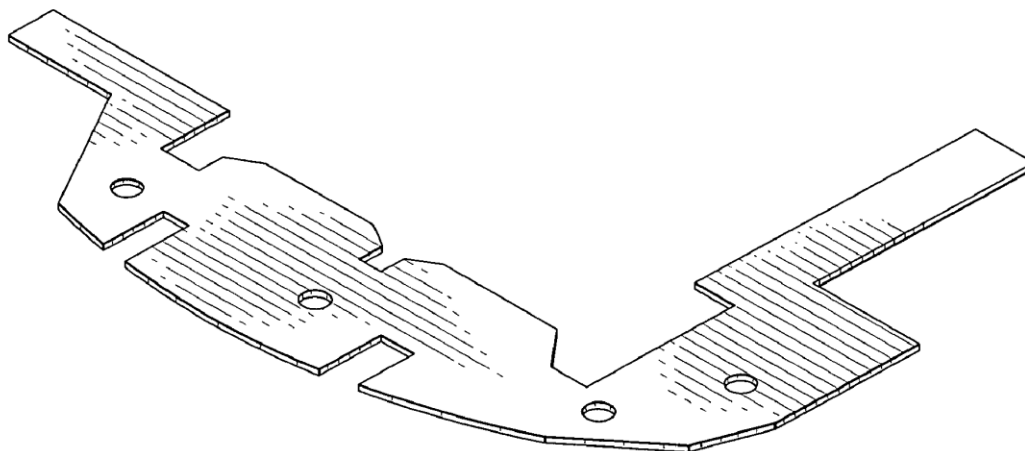
FIG. 3 is a rear view thereof;

FIG. 4 is a top view thereof;

FIG. 5 is a left side view thereof; and,

FIG. 6 is a right side view thereof.

1 Claim, 2 Drawing Sheets



Acrobat 文件



US00D562810S

(12) **United States Design Patent** (10) **Patent No.:** **US D562,810 S**
Oliver (45) **Date of Patent:** **** Feb. 26, 2008**

(54) **RADIO FREQUENCY IDENTIFICATION TAG
ANTENNA ASSEMBLY**

(75) Inventor: **Ronald A. Oliver**, Seattle, WA (US)

(73) Assignee: **Impinj, Inc.**, Seattle, WA (US)

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

(21) Appl. No.: **29/285,827**

(22) Filed: **Apr. 11, 2007**

Related U.S. Application Data

(63) Continuation of application No. 29/220,493, filed on Dec. 30, 2004, now abandoned, which is a continuation-in-part of application No. 10/812,493, filed on Mar. 29, 2004, now abandoned, and a continuation-in-part of application No. 10/815,474, filed on Mar. 31, 2004, now abandoned.

(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

4,315,272 A 2/1982 Vorhaus
4,479,260 A 10/1984 Harrop
4,611,184 A 9/1986 Kumar
4,783,783 A 11/1988 Nagai et al.
4,935,702 A 6/1990 Mead et al.
5,068,668 A 11/1991 Tsuda et al.
5,075,691 A * 12/1991 Garay et al. 343/830
5,280,286 A * 1/1994 Williamson 342/44
5,528,222 A 6/1996 Moskowitz et al.
5,572,226 A 11/1996 Tuttle
5,719,586 A 2/1998 Tuttle
5,805,632 A 9/1998 Leger
5,825,329 A 10/1998 Veghte et al.

5,923,300 A 7/1999 Mejia
5,929,760 A 7/1999 Monahan
5,933,039 A 8/1999 Hui et al.
5,939,945 A 8/1999 Thewes et al.
5,995,048 A 11/1999 Smithgall et al.
6,005,529 A 12/1999 Hutchinson
6,025,784 A 2/2000 Mish
6,043,746 A 3/2000 Sorrells
6,045,652 A 4/2000 Tuttle et al.
6,069,564 A 5/2000 Hatano et al.
6,097,345 A 8/2000 Walton
6,118,379 A 9/2000 Kodukula et al.
6,130,612 A 10/2000 Castellano et al.
6,130,632 A 10/2000 Opris
6,134,182 A 10/2000 Pilo et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 298 618 1/1989

(Continued)

OTHER PUBLICATIONS

Carley, L. Richard, "Trimming Analog Circuits Using Floating Gate Analog MOS Memory", IEEE Journal of Solid-State Circuits, vol. 24, No. 6, Dec. 1989, pp. 1569-1575.

(Continued)

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

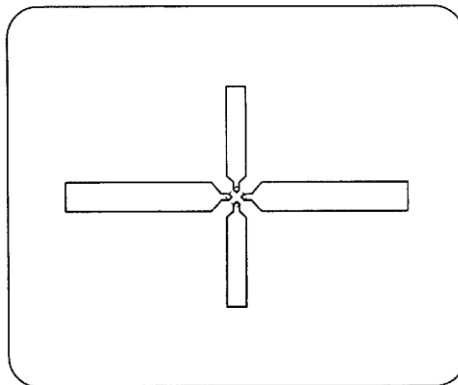
(57) **CLAIM**

The ornamental design for a radio frequency identification tag antenna assembly, as shown and described.

DESCRIPTION

The FIGURE is a top plan view of a radio frequency identification tag antenna assembly showing my new design.

1 Claim, 1 Drawing Sheet



Acrobat 文件



US007334736B2

(12) **United States Patent**
Uesaka

(10) **Patent No.:** **US 7,334,736 B2**
(45) **Date of Patent:** **Feb. 26, 2008**

(54) **ANTENNA-COIL DESIGN APPARATUS AND DESIGN METHOD**

(75) Inventor: **Kouichi Uesaka**, Yokohama (JP)

(73) Assignee: **Hitachi, Ltd.**, Tokyo (JP)

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

(21) Appl. No.: **10/890,320**

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

(65) **Prior Publication Data**

US 2005/0011961 A1 Jan. 20, 2005

(30) **Foreign Application Priority Data**

Jul. 14, 2003 (JP) 2003-196179

(51) **Int. Cl.**

G06K 19/06 (2006.01)

(52) **U.S. Cl.** **235/492**; 235/451; 235/487; 235/380

(58) **Field of Classification Search** 235/492, 235/451, 487, 380; 343/855, 867
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,430,729 A * 2/1984 Toyooka et al. 365/6
6,593,841 B1 * 7/2003 Mizoguchi et al. 336/200
2002/0014859 A1 * 2/2002 Boulesteix 315/219

2002/0053598 A1 * 5/2002 Kobayashi et al. 235/492
2002/0096568 A1 * 7/2002 Arisawa 235/492
2003/0016506 A1 * 1/2003 Fujii 361/737
2005/0272371 A1 * 12/2005 Komatsuzaki et al. 455/41.2
2006/0097874 A1 * 5/2006 Salesky et al. 340/572.1
2006/0164249 A1 * 7/2006 Lutz et al. 340/572.7
2006/0220863 A1 * 10/2006 Koyama 340/572.1
2006/0283948 A1 * 12/2006 Naito 235/451

FOREIGN PATENT DOCUMENTS

JP 07-022976 1/1995
JP 7-22976 1/1995
JP 10-079613 3/1998
JP 11-272826 10/1999
WO 02/095870 11/2002

* cited by examiner

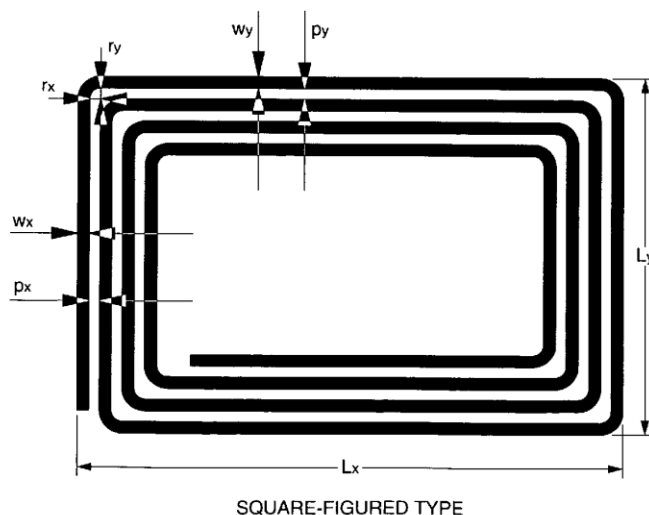
Primary Examiner—Steven S. Paik

(74) *Attorney, Agent, or Firm*—Antonelli, Terry, Stout & Kraus, LLP.

(57) **ABSTRACT**

A method of designing on a short-time basis an antenna which satisfies desired electrical characteristic values. There is provided the method of designing the antenna coil used in a non-contact IC card or a RFID. Here, the antenna-coil design method includes the following steps: Inputting information about plural configurations of the antenna coil and materials thereof, analyzing resistance, inductance, and stray capacitance of the antenna coil relative to the number of turns of the antenna coil in the inputted plural configurations of the antenna coil, and, based on the analysis result, selecting one of the plural configurations of the antenna coil.

10 Claims, 7 Drawing Sheets



Acrobat 文件



US007336229B1

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

(10) **Patent No.:** **US 7,336,229 B1**

(45) **Date of Patent:** **Feb. 26, 2008**

(54) **ANTENNA CAPABLE OF ADJUSTING
IMPEDANCE MATCHING**

7,292,194 B2 * 11/2007 Tai et al. 343/702
2007/0030198 A1 * 2/2007 Wei 343/700 MS
2007/0188388 A1 * 8/2007 Feng et al. 343/700 MS

(75) Inventors: **Kuan-Hsueh Tseng**, Taipei Hsien
(TW); **Feng-Chi Eddie Tsai**, Taipei
Hsien (TW)

(73) Assignee: **Wistron NeWeb Corporation**,
Hsi-Chih, Taipei Hsien (TW)

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

* cited by examiner

Primary Examiner—Trinh Dinh

Assistant Examiner—Dieu Hien T Duong

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

(57) **ABSTRACT**

(21) Appl. No.: **11/670,422**

(22) Filed: **Feb. 2, 2007**

(30) **Foreign Application Priority Data**

Dec. 18, 2006 (TW) 95222262 U

(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

See application file for complete search history.

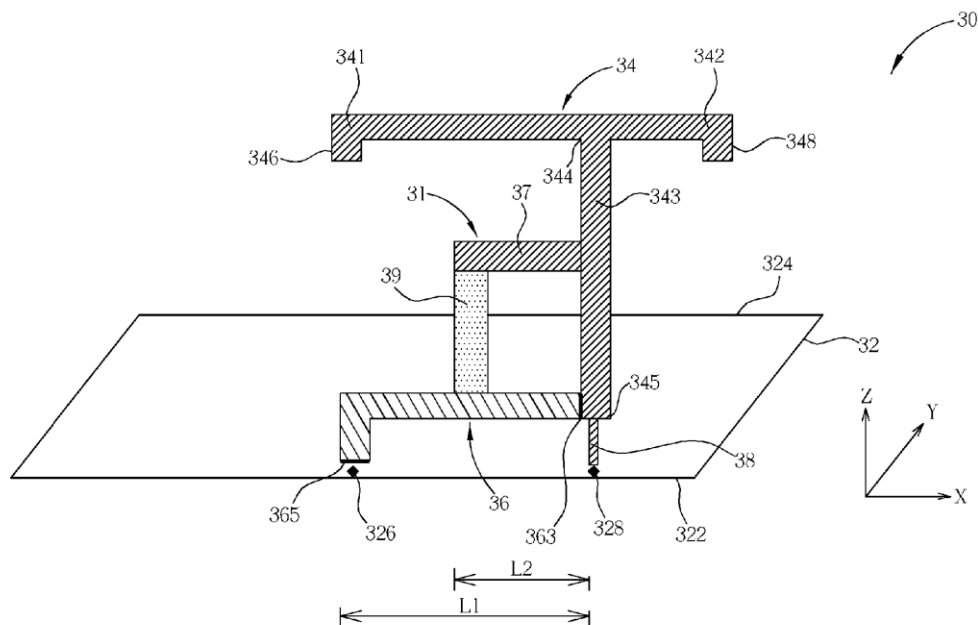
(56) **References Cited**

U.S. PATENT DOCUMENTS

6,844,853 B2 * 1/2005 Tai et al. 343/700 MS

An antenna includes a substrate, a radiation element, a feeding element, a connection element, and a matching circuit. The substrate includes a first side and a second side. The first side includes a short point and a grounding point. The radiation element includes a first radiator, a second radiator, and a first metal arm. The first radiator and the second radiator are parallel to the first side. The first metal arm is coupled to a joint of the first radiator and the second radiator. The feeding element is coupled between the first metal arm and the grounding point. The connection element is coupled between the first metal arm and the short point. The matching circuit includes a second metal arm and a matching element. The second metal arm extends from the first metal arm. The matching element is coupled to the second metal arm.

19 Claims, 10 Drawing Sheets



Acrobat 文件



US007336233B2

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

(10) **Patent No.:** **US 7,336,233 B2**

(45) **Date of Patent:** **Feb. 26, 2008**

(54) **RADIATION DIVERSITY ANTENNAS**

6,864,848 B2 * 3/2005 Sievenpiper 343/767
6,885,344 B2 * 4/2005 Mohamadi 343/700 MS

(75) Inventors: **Franck Thudor**, Rennes (FR);
Françoise Le Bolzer, Rennes (FR);
Bernard Denis, Saint Senoux (FR)

FOREIGN PATENT DOCUMENTS

SU 1675980 A1 9/1991

(73) Assignee: **Thomson Licensing**,
Boulogne-Billancourt (FR)

OTHER PUBLICATIONS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 456 days.

D. T. Shahani et al., "Radiation Characteristics of Printed Slot Antenna with a Switchable Parasitic Slot," Int. Conf. on Antennas and Propagation, Nov. 28-30, 1978, pp. 435-437, XP001154972.

A. T. Kolsrud et al., "Electronically Switchable Slot Antenna Fed by Microstrip Line," IEEE, Atlanta, GA, Jun. 21-26, 1998, pp. 1180-1183, XP010292351.

D. Peroulis et al., "A Planar VHF Reconfigurable Slot Antenna," IEEE Boston, MA, Jul. 8-13, 2001, pp. 154-157, XP001072179.

(21) Appl. No.: **10/791,978**

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

* cited by examiner

(65) **Prior Publication Data**
US 2005/0237252 A1 Oct. 27, 2005

Primary Examiner—Huedung Mancuso

(74) Attorney, Agent, or Firm—Joseph J. Laks; Robert D. Shedd; Brian J. Cromarty

(30) **Foreign Application Priority Data**
Mar. 7, 2003 (FR) 03 02842

(57) **ABSTRACT**

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
(52) **U.S. Cl.** **343/767**
(58) **Field of Classification Search** **343/767**,
343/700 MS, 795, 768, 770, 876
See application file for complete search history.

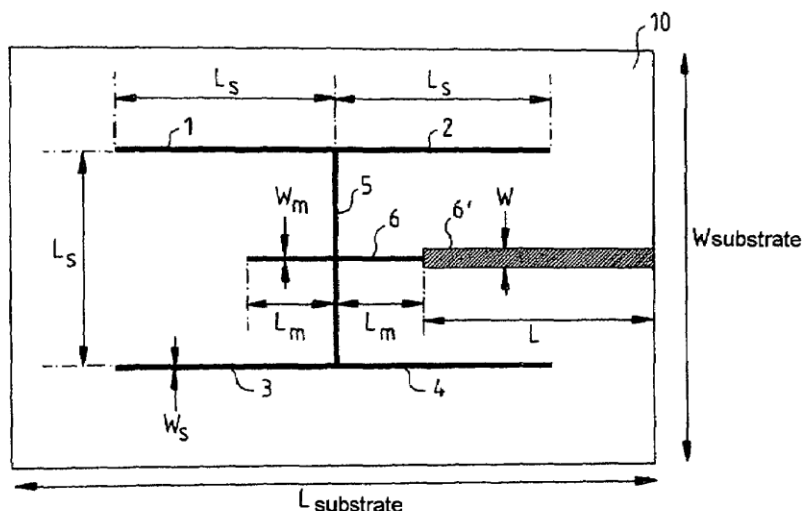
The present invention relates to a radiation diversity antenna consisting of radiating elements of the slot-line type coupled electromagnetically to a feed line, in which the radiating elements have a tree structure, each radiating element having a length equal to $k\lambda_s/2$ where k is an identical or different integer from one element to the next and λ_s is the guided wavelength in the slot-line constituting the radiating element with at least one radiating element comprising a switching means positioned in the slot-line constituting the said radiating element in such a way as to control the coupling between the said radiating element and the feed line as a function of a command. The invention applies chiefly to wireless transmissions.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,604,012 A 9/1971 Lindley 343/768
6,188,360 B1 2/2001 Kato et al. 343/700
6,344,829 B1 * 2/2002 Lee 343/753
6,531,984 B1 * 3/2003 Johannisson et al. 343/700 MS
6,670,921 B2 * 12/2003 Sievenpiper et al. . 343/700 MS

8 Claims, 9 Drawing Sheets



Acrobat 文件



US007336236B2

(12) **United States Patent**
Lee

(10) **Patent No.:** **US 7,336,236 B2**

(45) **Date of Patent:** **Feb. 26, 2008**

(54) **TRIANGULAR DIPOLE ANTENNA**

(75) Inventor: **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 0 days.

(21) Appl. No.: **11/209,807**

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

(65) **Prior Publication Data**

US 2007/0052610 A1 Mar. 8, 2007

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

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

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,020,550 A * 2/1962 Beever 343/795

5,229,782 A * 7/1993 Hemmie et al. 343/795

5,293,175 A * 3/1994 Hemmie et al. 343/795

5,438,697 A * 8/1995 Fowler et al. 455/347

5,986,609 A * 11/1999 Spall 343/702

6,037,911 A * 3/2000 Brankovic et al. 343/795

6,342,866 B1 * 1/2002 Ho et al. 343/795

6,664,926 B1 * 12/2003 Zinanti et al. 343/700 MS

* cited by examiner

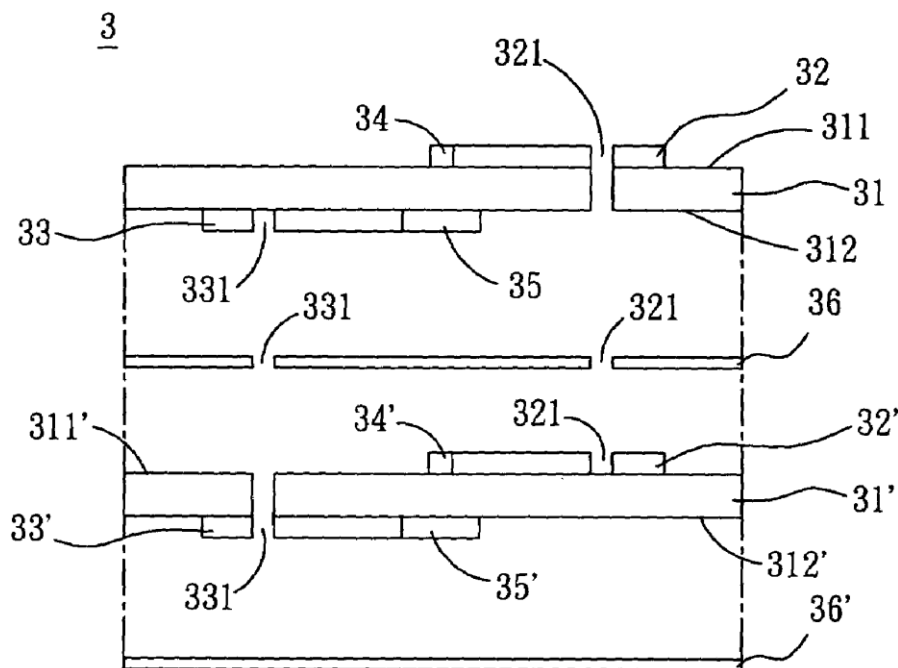
Primary Examiner—Hoanganh Le

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

(57) **ABSTRACT**

A triangle dipole antenna includes a first substrate, a first radiating part, and a second radiating part. The first substrate has a first surface and a second surface, which is opposite to the first surface. In this case, the first surface has a first feeding point and the second surface has a first grounding. The first radiating part is triangular and disposed on the first surface of the first substrate. The first radiating part has a first interior angle electrically connected to the first feeding point. The second radiating part is triangular and disposed on the second surface of the first substrate. The second radiating part has a second interior angle electrically connected to the first grounding.

17 Claims, 6 Drawing Sheets



Acrobat 文件



US007336238B2

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

(10) **Patent No.:** **US 7,336,238 B2**

(45) **Date of Patent:** **Feb. 26, 2008**

(54) **SHAPED GROUND PLANE FOR
DYNAMICALLY RECONFIGURABLE
APERTURE COUPLED ANTENNA**

(75) Inventors: **James J. Rawnick**, Palm Bay, FL (US);
Timothy E. Durham, Palm Bay, FL
(US); **Stephen B. Brown**, Palm Bay,
FL (US)

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

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

(21) Appl. No.: **11/489,759**

(22) Filed: **Jul. 20, 2006**

(65) **Prior Publication Data**
US 2006/0256027 A1 Nov. 16, 2006

Related U.S. Application Data

(62) Division of application No. 10/648,887, filed on Aug.
27, 2003, now Pat. No. 7,084,828.

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

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

(58) **Field of Classification Search** 343/846,
343/700 MS, 702, 789, 793
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,545,511 A * 8/1996 Hulderman et al. 430/315
5,792,236 A 8/1998 Taylor et al.
5,957,969 A 9/1999 Warner et al.

6,396,441 B2 * 5/2002 Perrott et al. 343/700 MS
6,512,496 B2 1/2003 Alexeff et al.
6,633,161 B1 10/2003 Vaughan, Jr.
6,710,746 B1 3/2004 Anderson et al.
6,781,562 B1 8/2004 Lungwitz
6,833,772 B1 12/2004 Brown et al.
6,842,146 B2 1/2005 Alexeff et al.
6,859,189 B1 2/2005 Ramirez et al.
6,876,330 B2 4/2005 Alexeff et al.
6,906,680 B2 6/2005 Rawnick et al.
6,914,575 B2 7/2005 Rawnick et al.
6,952,145 B2 10/2005 Brown et al.
6,952,146 B2 10/2005 Brown et al.
6,960,965 B2 11/2005 Rawnick et al.
6,965,286 B2 11/2005 Rawnick et al.
6,967,628 B2 11/2005 Rawnick et al.

(Continued)

OTHER PUBLICATIONS

U.S. Appl. No. 10/330,756, filed Dec. 27, 2002, Rawnick et al.

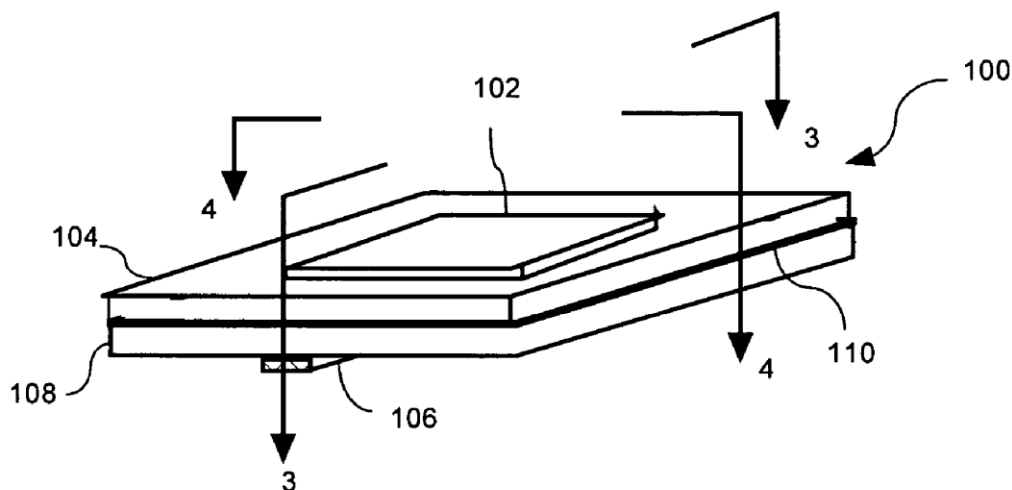
Primary Examiner—Huedung Mancuso

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

(57) **ABSTRACT**

Method for controlling an input impedance of an antenna
(100). The method can include the steps of coupling RF
energy from an input RF transmission line (106) to an
antenna radiating element (102) through an aperture (112)
defined in a ground plane (110). For example, the aperture
(112) can be a slot and the radiating element (102) can be a
patch type element. The input impedance can thereafter be
controlled by selectively varying a volume or a position of
a conductive fluid (128) disposed in a predetermined region
between the RF transmission line and the antenna radiating
element. The volume of conductive fluid (128) can be
automatically varied in response to at least one control
signal (132).

10 Claims, 6 Drawing Sheets



Acrobat 文件



US007336239B2

(12) **United States Patent**
Takei

(10) **Patent No.:** **US 7,336,239 B2**

(45) **Date of Patent:** **Feb. 26, 2008**

(54) **SMALL MULTI-MODE ANTENNA AND RF
MODULE USING THE SAME**

(75) Inventor: **Ken Takei**, Kawasaki (JP)

(73) Assignee: **Hitachi, Ltd.**, Tokyo (JP)

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

(21) Appl. No.: **10/525,378**

(22) PCT Filed: **Oct. 15, 2002**

(86) PCT No.: **PCT/JP02/10608**

§ 371 (c)(1),
(2), (4) Date: **Jul. 12, 2006**

(87) PCT Pub. No.: **WO2004/036687**

PCT Pub. Date: **Apr. 29, 2004**

(65) **Prior Publication Data**

US 2006/0262028 A1 Nov. 23, 2006

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

(52) **U.S. Cl.** **343/850; 343/851; 343/858**

(58) **Field of Classification Search** 343/702,
343/850, 895, 722, 749, 851, 858, 860
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,096,782 A 10/1937 Brown et al.
4,085,405 A * 4/1978 Barlow 343/858
4,145,693 A * 3/1979 Fenwick 343/722

4,217,589 A * 8/1980 Stahler 343/722

4,494,122 A 1/1985 Garay et al.

5,963,170 A 10/1999 Garner et al.

6,025,813 A * 2/2000 Hatley et al. 343/867

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 650 215 A2 9/1994

(Continued)

OTHER PUBLICATIONS

James, Jr, et al. "Handbook of Microstrip Antennas", Peter
Peregrinus Ltd., 1989, p. 1144.

(Continued)

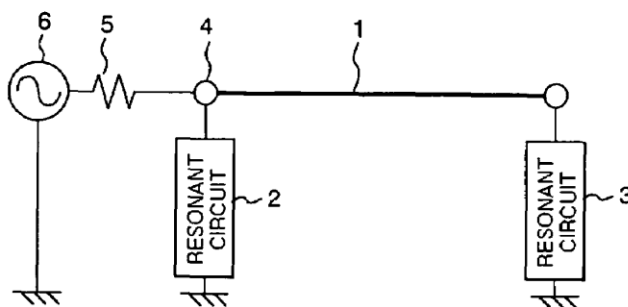
Primary Examiner—Tho Phan

(74) *Attorney, Agent, or Firm*—Reed Smith LLP; Stanley P.
Fisher, Esq.; Juan Carlos A. Marquez, Esq.

(57) **ABSTRACT**

A small multi-mode antenna in which a single feeding point
can be used commonly for multiple frequencies and an RF
module using such antenna for use in less-costly and small
multimedia wireless apparatus is provided. The antenna is
configured such that a single feeding point 4 which is
common for multiple frequencies is set up at one end of a
radiating conductor 1, a first one-port resonant circuit 2 is
connected to the one end thereof, and a second one-port
resonant circuit 3 is connected to the other end of the
radiating conductor 1. With a conductance component of
admittance in view from the feeding point 4 toward free
space equaling the characteristic admittance in the RF
circuit, a susceptance component of the admittance is can-
celed out by the resonant circuit 2 connected to the feeding
point 4 for multiple frequencies.

15 Claims, 23 Drawing Sheets



Acrobat 文件