



US007750850B2

(12) **United States Patent**
Mei

(10) **Patent No.:** **US 7,750,850 B2**

(45) **Date of Patent:** **Jul. 6, 2010**

(54) **PRINTED ANTENNA**

(75) Inventor: **Chia-Hao Mei**, Taipei Hsien (TW)

(73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
Tu-Cheng, 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 365 days.

(21) Appl. No.: **11/752,314**

(22) Filed: **May 23, 2007**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jan. 12, 2007 (CN) 2007 1 0200052

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

(52) **U.S. Cl.** **343/700 MS**; 343/846;
343/895

(58) **Field of Classification Search** 343/700 MS,
343/702, 829, 846, 895
See application file for complete search history.

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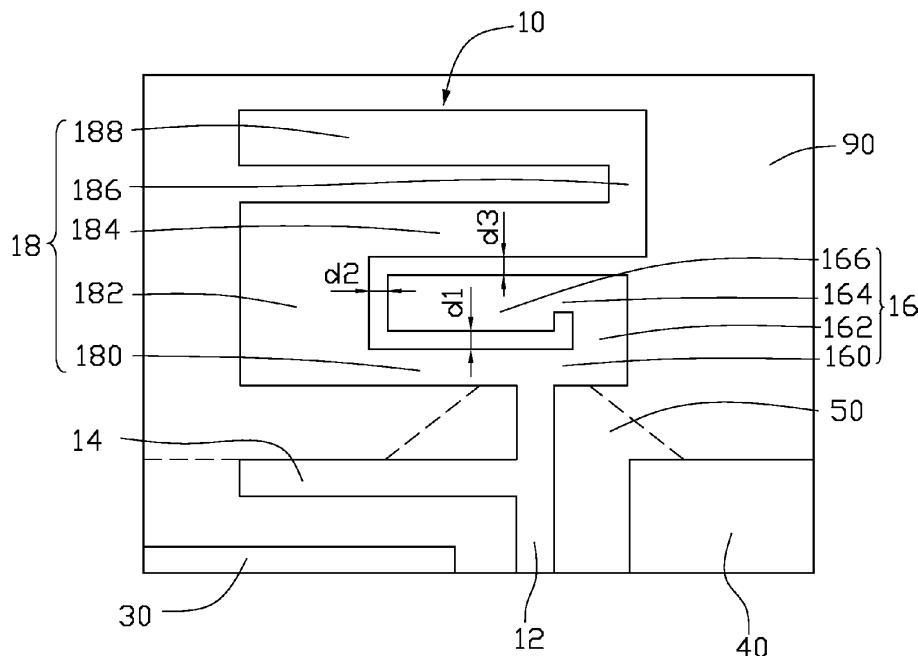
Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—Frank R. Niranjana

(57) **ABSTRACT**

A printed antenna (10) disposed on a substrate (90) includes a feeding portion (12), a first radiation portion (16), a second radiation portion (18), a matching portion (14), and a grounded portion. The feeding portion feeds electromagnetic signals. One end of the first radiation portion is electronically connected to the feeding portion, and the other end of the first radiation portion is a free end. One end of the second radiation portion is electronically connected to the feeding portion and the first radiation portion, and the other end of the second radiation portion is a free end. The second radiation portion includes a plurality of radiation segments forming at least one space, and the first radiation portion is accommodated in the space formed by the radiation segments. The matching portion is electronically connected to the feeding portion, for impedance matching. The grounded portion is located adjacent to the feeding portion.

16 Claims, 8 Drawing Sheets



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US007750854B2

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

(10) **Patent No.:** **US 7,750,854 B2**

(45) **Date of Patent:** **Jul. 6, 2010**

(54) **COMBINED SPEAKER AND ANTENNA COMPONENT**

(75) Inventors: **Martin Wedel**, Malmö (SE); **Georgeta Anton**, Malmö (SE)

(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)

(*) 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.: **10/544,121**

(22) PCT Filed: **Feb. 4, 2004**

(86) PCT No.: **PCT/EP2004/001003**

§ 371 (c)(1),

(2), (4) Date: **Aug. 2, 2005**

(87) PCT Pub. No.: **WO2004/070871**

PCT Pub. Date: **Aug. 19, 2004**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 60/449,701, filed on Feb. 24, 2003.

(30) **Foreign Application Priority Data**

Feb. 10, 2003 (EP) 03445020

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

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

(58) **Field of Classification Search** **343/702,**
343/795, 846; 455/575.1–575.9, 90.1–90.3

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Hoang V Nguyen

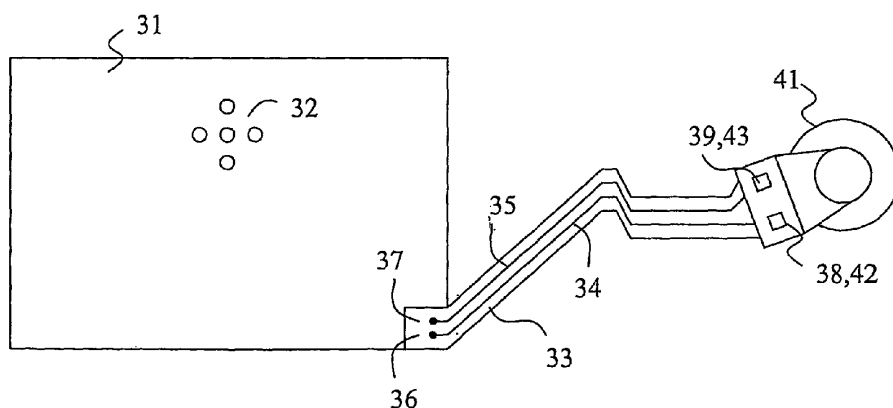
Assistant Examiner—Robert Karacsony

(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec, P.A.

(57) **ABSTRACT**

A combined speaker and antenna arrangement for a communication terminal, includes a support structure carrying a first antenna element, and a second antenna element arranged at a predetermined distance from said first antenna element. The second antenna element is a conductive first portion of a sheet of flexible film. An elongated second portion of the flexible film, carrying a conductive lead, extends from adjacent to the first portion to a speaker connected to an outer end of the elongated second portion. The second, elongated portion, is bent such that the speaker is positioned between the film and the support structure, adjacent to an aperture in the first portion.

21 Claims, 5 Drawing Sheets



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US007750865B2

(12) **United States Patent**
Hilgers

(10) **Patent No.:** **US 7,750,865 B2**

(45) **Date of Patent:** **Jul. 6, 2010**

(54) **MULTIPURPOSE ANTENNA
CONFIGURATION FOR A CONTACTLESS
DATA CARRIER**

(75) Inventor: **Achim Hilgers**, Alsdorf (DE)

(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 680 days.

(21) Appl. No.: **11/658,225**

(22) PCT Filed: **Jul. 14, 2005**

(86) PCT No.: **PCT/IB2005/052336**

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(2), (4) Date: **Jan. 22, 2007**

(87) PCT Pub. No.: **WO2006/011091**

PCT Pub. Date: **Feb. 2, 2006**

(65) **Prior Publication Data**

US 2009/0002253 A1 Jan. 1, 2009

(30) **Foreign Application Priority Data**

Jul. 20, 2004 (EP) 04103456

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

(52) **U.S. CL.** **343/806; 343/807**

(58) **Field of Classification Search** 343/795,
343/805, 806, 807, 808, 809, 792.5, 828,
343/700 MS, 726, 857, 735, 736, 743
See application file for complete search history.

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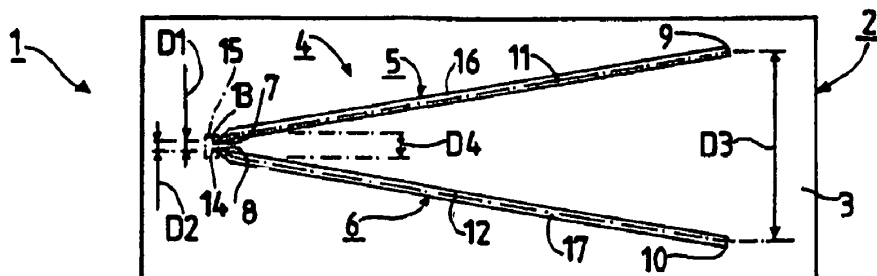
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Primary Examiner—Michael C Wimer
Assistant Examiner—Kyana R Robinson

(57) **ABSTRACT**

In an antenna configuration (4) with two antenna arms (5, 6) arranged in a V-shape, two coupling zones (13, 14) for electrically coupling to respective terminals of an integrated component (15) are provided in the region of the ends (7, 8) of the antenna arms (5, 6) lying close together, wherein each of the two antenna arms (5, 6) in addition comprises a coupling region (20, 21) at a distance from its coupling zone (13, 14), and each coupling region (20, 21) is designed for electrically coupling to a terminal of a further electronic component (22).

4 Claims, 2 Drawing Sheets



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US007750866B2

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

(10) **Patent No.:** **US 7,750,866 B2**

(45) **Date of Patent:** **Jul. 6, 2010**

(54) **DIVERSITY ANTENNA ASSEMBLY FOR WIRELESS COMMUNICATION EQUIPMENT**

(75) Inventors: **Vincent Rambeau**, Cormelles le Royal (FR); **Jan Van Sinderen**, Liempde (NL); **Johannes H. A. Brekelmans**, Nederweert (NL); **Marc G. M Notten**, Elsloo (NL)

(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 0 days.

(21) Appl. No.: **11/915,812**

(22) PCT Filed: **May 16, 2006**

(86) PCT No.: **PCT/IB2006/051527**

§ 371 (c)(1),

(2), (4) Date: **Apr. 8, 2009**

(87) PCT Pub. No.: **WO2006/129210**

PCT Pub. Date: **Dec. 7, 2006**

(65) **Prior Publication Data**

US 2009/0195472 A1 Aug. 6, 2009

(30) **Foreign Application Priority Data**

May 30, 2005 (EP) 05300431

(51) **Int. Cl.**

H01Q 7/00 (2006.01)

H01Q 9/16 (2006.01)

H01Q 3/24 (2006.01)

(52) **U.S. Cl.** **343/866**; 343/793; 343/876

(58) **Field of Classification Search** 343/793, 343/846, 866, 876, 893
See application file for complete search history.

(56) **References Cited**

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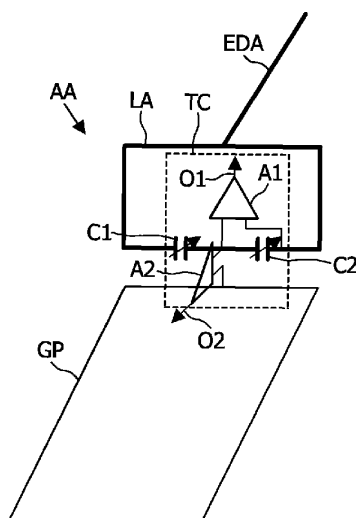
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Primary Examiner—Shih-Chao Chen

(57) **ABSTRACT**

An antenna assembly for wireless communication equipment comprises an antenna structure comprising at least a loop type antenna arranged to deliver a first current when it is used in a balanced mode and/or a second current when it is used in an unbalanced mode with respect to a ground plane from received radio signals, and current extraction device coupled to the antenna structure and arranged to be placed in at least a first state in which the current extraction device delivers the first or second current and a second state in which the current extraction device simultaneously delivers the first and second currents either separately or mixed together.

10 Claims, 5 Drawing Sheets



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US00775546B2

(12) **United States Patent**
Ishimiya

(10) **Patent No.:** **US 7,755,546 B2**

(45) **Date of Patent:** **Jul. 13, 2010**

(54) **ANTENNA DEVICE AND MOBILE
TERMINAL APPARATUS EQUIPPED WITH
THE ANTENNA 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
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(21) Appl. No.: **11/322,339**

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

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jan. 20, 2005 (JP) 2005-013005

(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, 846, 848

See application file for complete search history.

(56) **References Cited**

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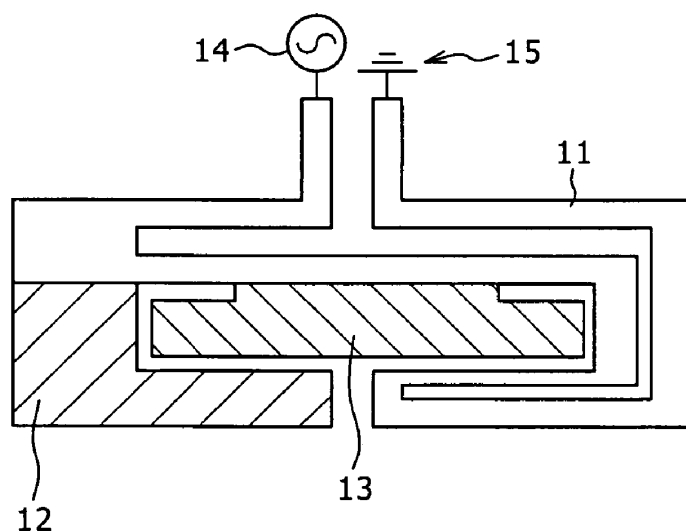
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Primary Examiner—Hoang Anh T Le
(74) *Attorney, Agent, or Firm*—Rader, Fishman & Grauer
PLLC

(57) **ABSTRACT**

There is provided an antenna device which includes: a loop antenna connected at one end to a feed point and connected at the other end to ground, and provided to correspond to a first frequency band; and at least one stub antenna provided in the form of extending a part of the loop antenna and provided to correspond to a second frequency band overlapping with a partial frequency band of the first frequency band to which the loop antenna corresponds.

14 Claims, 5 Drawing Sheets



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US007755548B2

(12) **United States Patent**
Lev

(10) **Patent No.:** **US 7,755,548 B2**

(45) **Date of Patent:** **Jul. 13, 2010**

(54) **CABLE TENSION MECHANISM FOR AN ANTENNA**

(75) Inventor: **Jeffrey A. Lev**, Cypress, TX (US)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 595 days.

(21) Appl. No.: **11/745,297**

(22) Filed: **May 7, 2007**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 3/02 (2006.01)

(52) **U.S. Cl.** **343/702; 343/882**

(58) **Field of Classification Search** 343/702, 343/882, 900

See application file for complete search history.

(56) **References Cited**

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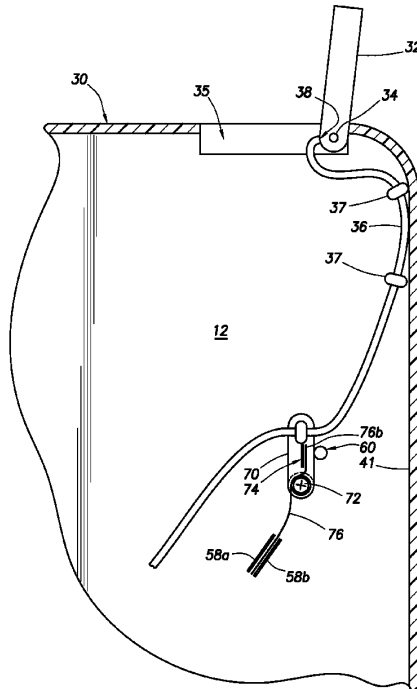
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Primary Examiner—Shih-Chao Chen

(57) **ABSTRACT**

A system comprises a hinged antenna adapted to reside within a slot, an electrical cable connected to the antenna, and a cable tension mechanism. The cable tension mechanism receives the electrical cable from the antenna and pulls on the cable when the hinged antenna is in the slot and also when the hinged antenna is rotated to a deployed position at least partially outside the slot.

20 Claims, 3 Drawing Sheets



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US00775554B2

(12) **United States Patent**
Shih

(10) **Patent No.:** **US 7,755,554 B2**

(45) **Date of Patent:** **Jul. 13, 2010**

(54) **ANTENNA**

(75) Inventor: **Yen-Yi Shih**, Taipei Hsien (TW)

(73) Assignee: **Hon Hai Precision Industry Co., Ltd.**,
Tu-Cheng, 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 25 days.

(21) Appl. No.: **12/164,129**

(22) Filed: **Jun. 30, 2008**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Nov. 16, 2007 (CN) 2007 1 0202575

(51) **Int. Cl.**

H01Q 1/38 (2006.01)

H01Q 1/24 (2006.01)

(52) **U.S. Cl.** **343/729; 343/702; 343/828**

(58) **Field of Classification Search** **343/700 MS,**
343/702, 725, 729, 828, 846

See application file for complete search history.

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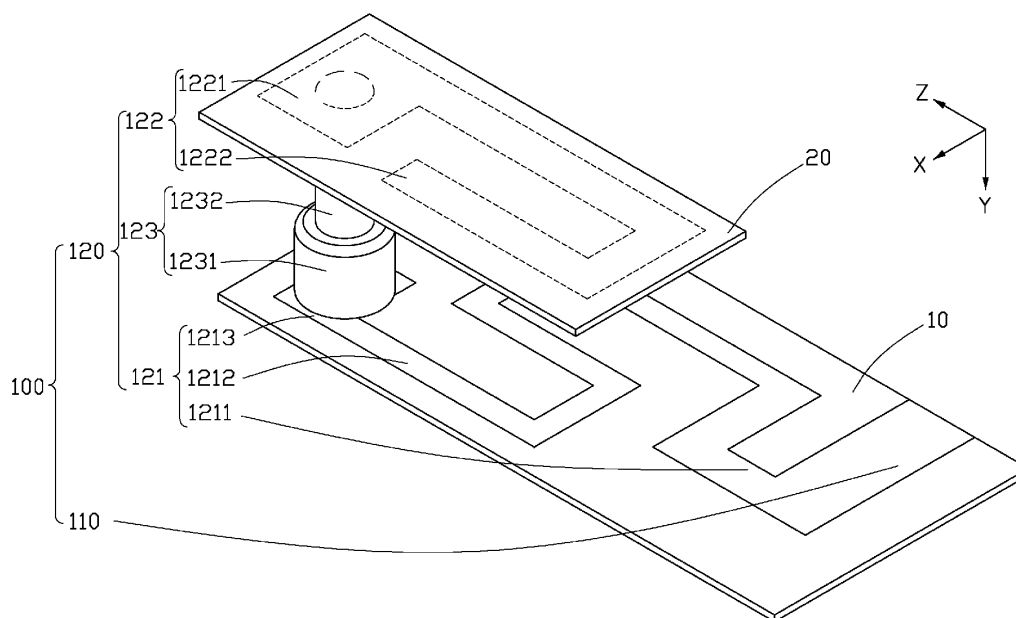
Primary Examiner—Michael C Wimer

(74) *Attorney, Agent, or Firm*—Frank R. Niranjan

(57) **ABSTRACT**

An antenna (100) disposed on a first substrate (10) and a second substrate (20) includes a feeding portion (110) and a radiating portion (120). The feeding portion (110) is disposed on a first surface of the first substrate (10), for feeding electromagnetic signals. The radiating portion (120) connected to the feeding portion (110) for transceiving electromagnetic signals includes a first radiator (121), a second radiator (122) and a third radiator (123). The first radiator (121) is disposed on the first surface and connected to the feeding portion (110). The second radiator (122) is disposed on a second surface of the second substrate (20). The third radiator (123) includes a first cylinder portion (1231) and a second cylinder portion (1232) connected to the first cylinder portion (1231). The first cylinder portion (1231) and the second cylinder portion (1232) are connected to the first radiator (121) and the second radiator (122), respectively.

9 Claims, 5 Drawing Sheets



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US00775559B2

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

(10) **Patent No.:** **US 7,755,559 B2**

(45) **Date of Patent:** **Jul. 13, 2010**

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

(56)

References Cited

U.S. PATENT DOCUMENTS

(75) Inventors: **Daniel Pakosz**, Elgin, IL (US); **Randy Posluszny**, Brookfield, IL (US); **Clifford Raiman**, Roselle, IL (US)

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(73) Assignee: **Mobile Mark, Inc.**, Schiller Park, IL (US)

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

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Primary Examiner—Douglas W Owens

Assistant Examiner—Dieu Hien T Duong

(74) *Attorney, Agent, or Firm*—George H. Gerstman; Seyfarth Shaw LLP

(21) Appl. No.: **12/482,001**

(22) Filed: **Jun. 10, 2009**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 61/120,894, filed on Dec. 9, 2008.

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(52) **U.S. Cl.** **343/810**; 343/793; 343/700 MS

(58) **Field of Classification Search** 343/810,
343/793, 700 MS

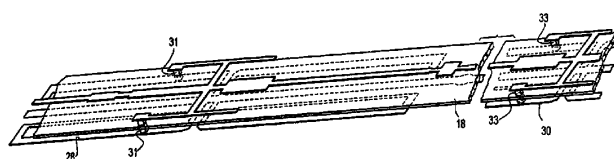
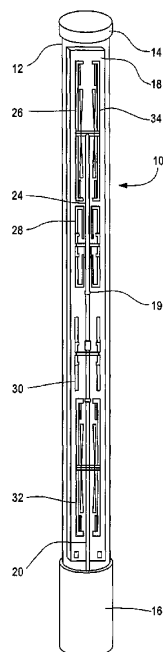
See application file for complete search history.

(57)

ABSTRACT

A dual-band omnidirectional antenna is provided. The antenna comprises a vertically stacked antenna array, in the following order: a first dual-band dipole which resonates at a first frequency band and a second frequency band, a first single-band dipole which resonates only at the first frequency band, a second single-band dipole which resonates only at the first frequency band, and a second dual band dipole which resonates at the first frequency band and second frequency band. The first frequency band is of a higher frequency than the second frequency band.

12 Claims, 4 Drawing Sheets



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US007755560B2

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

(10) **Patent No.:** **US 7,755,560 B2**

(45) **Date of Patent:** **Jul. 13, 2010**

(54) **ANTENNA HAVING PARASITIC ELEMENT**

(56) **References Cited**

(75) Inventors: **Se-hyun Park**, Gyeonggi-do (KR);
Byung-tae Yoon, Gyeonggi-do (KR);
Young-min Moon, Seoul (KR);
Dong-jin Kim, Gyeonggi-do (KR)

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2006/0044205 A1 * 3/2006 Lynch et al. 343/833

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 8 days.

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Primary Examiner—Tho G Phan

(74) *Attorney, Agent, or Firm*—NSIP Law

(21) Appl. No.: **12/099,739**

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(57) **ABSTRACT**

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H01Q 19/10 (2006.01)

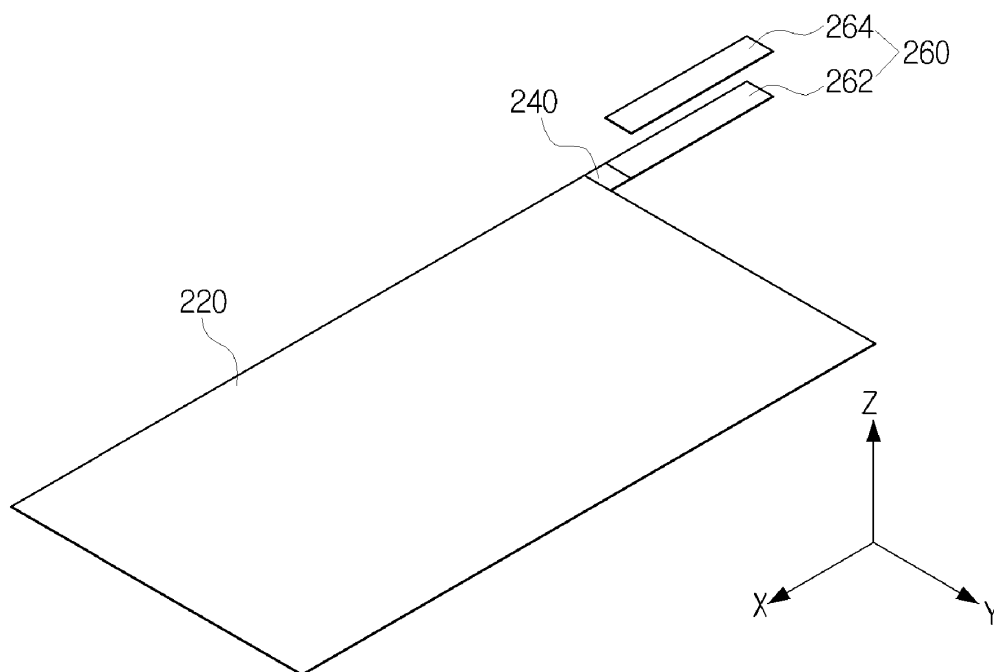
(52) **U.S. Cl.** **343/834**; 343/817; 343/833

(58) **Field of Classification Search** 343/816,
343/817, 833, 834

See application file for complete search history.

An antenna having a parasitic element is disclosed, the antenna including a ground, a radiation unit which is arranged on a different area of the same plane as the ground, and a parasitic element which is selectively connected to the ground, and operates as an antenna element. Where the antenna is in a first mode, electromagnetic waves resonate in the radiation unit, and where the antenna is in a second mode, electromagnetic waves resonate in the radiation unit and the parasitic element.

10 Claims, 9 Drawing Sheets



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US007760140B2

(12) **United States Patent**
Kamgaing

(10) **Patent No.:** **US 7,760,140 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **MULTIBAND ANTENNA ARRAY USING ELECTROMAGNETIC BANDGAP STRUCTURES**

(75) Inventor: **Telesphor Kamgaing**, Chandler, AZ (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 727 days.

(21) Appl. No.: **11/449,915**

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

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 15/02 (2006.01)

(52) **U.S. Cl.** **343/700 MS**; 343/909;
343/829; 343/846; 343/893

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

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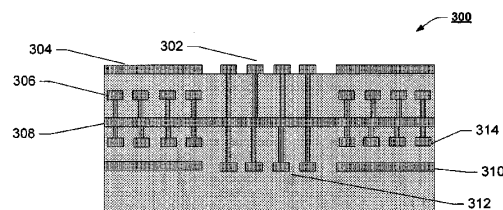
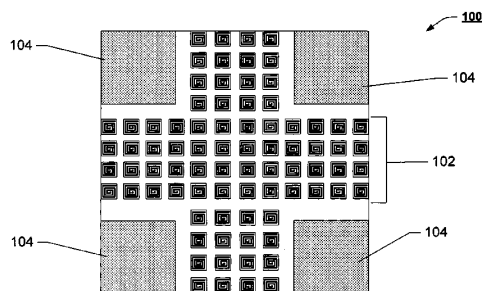
Primary Examiner—Trinh V Dinh

(74) Attorney, Agent, or Firm—David L. Guglielmi

(57) **ABSTRACT**

In some embodiments, a multiband antenna array using electromagnetic bandgap structures is presented. In this regard, an antenna array is introduced having two or more planar antennas situated substantially on a surface of a substrate, a first set of electromagnetic bandgap (EBG) cells situated substantially between and on plane with the antennas, and a second set of EBG cells situated within the substrate below the antennas. Other embodiments are also disclosed and claimed.

19 Claims, 2 Drawing Sheets



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US007760142B2

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

(10) **Patent No.:** **US 7,760,142 B2**

(45) **Date of Patent:** **Jul. 20, 2010**

(54) **VERTICALLY INTEGRATED TRANSCEIVER
ARRAY**

(75) Inventors: **Kazem F. Sabet**, Ann Arbor, MI (US);
Linda P. B. Katehi, Zionsville, IN (US);
Alexandros Margomenos, Ann Arbor,
MI (US)

(73) Assignee: **EMAG Technologies, Inc.**, Ann Arbor,
MI (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 507 days.

(21) Appl. No.: **11/733,564**

(22) Filed: **Apr. 10, 2007**

(65) **Prior Publication Data**

US 2008/0252521 A1 Oct. 16, 2008

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

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

(58) **Field of Classification Search** **343/700 MS,**
343/770, 702, 846, 848, 853; 342/368
See application file for complete search history.

(56) **References Cited**

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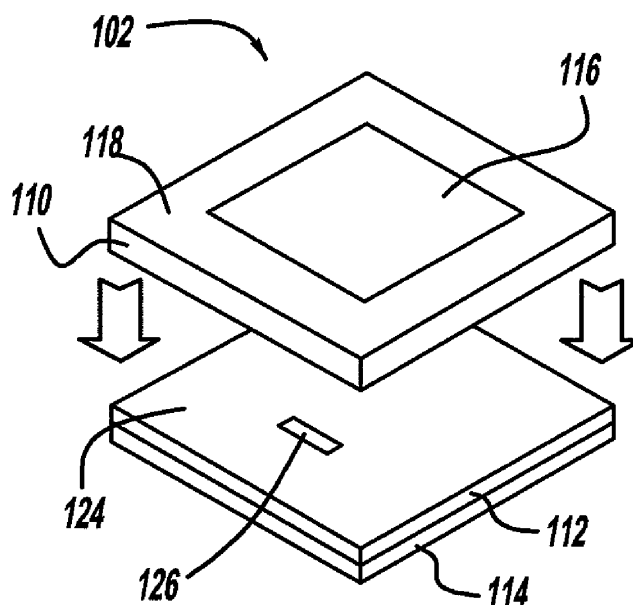
Primary Examiner—Huedung Mancuso

(74) *Attorney, Agent, or Firm*—John A. Miller; Miller IP
Group, PLC

(57) **ABSTRACT**

A transceiver array that employs vertically integrated circuits
in one or more wafers. The array includes a digital wafer
having digital circuits. A plurality of RF cubes are formed to
the digital wafer, where each RF cube includes an antenna
wafer and at least one lower wafer, and where each RF cube
represents a separate channel of the array. The antenna wafer
includes a patch antenna and a resonating cavity. The at least
one lower wafer includes high frequency RF integrated cir-
cuits and intermediate frequency RF integrated circuits. The
array has application as a front-end for a digital beam-form-
ing system.

31 Claims, 4 Drawing Sheets



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US007760143B2

(12) **United States Patent**
Wei

(10) **Patent No.:** **US 7,760,143 B2**

(45) **Date of Patent:** **Jul. 20, 2010**

(54) **MULTI-FREQUENCY ANTENNA AND AN
ELECTRIC DEVICE THEREOF**

(75) Inventor: **Shen-Pin Wei**, Taipei Hsien (TW)

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 54 days.

(21) Appl. No.: **11/882,958**

(22) Filed: **Aug. 8, 2007**

(65) **Prior Publication Data**

US 2008/0231516 A1 Sep. 25, 2008

(30) **Foreign Application Priority Data**

Mar. 20, 2007 (TW) 96109590 A

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

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

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

(56) **References Cited**

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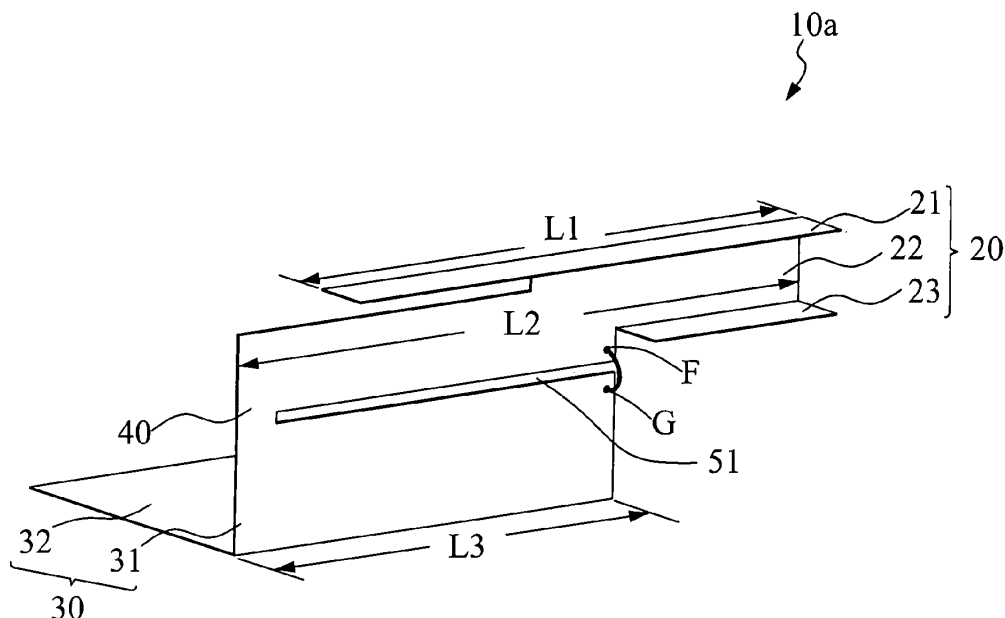
Primary Examiner—Trinh V Dinh

(74) *Attorney, Agent, or Firm*—Muncy, Geissler, Olds &
Lowe, PLLC

(57) **ABSTRACT**

A multi-frequency antenna is disclosed. The multi-frequency antenna is positioned on an electric device for transmitting Wi-Fi and Wimax wireless signals. The multi-frequency antenna comprises a radiating element, a grounding element and a connecting element. The radiating element comprises a first radiating area and a second radiating area, which are perpendicular to each other. The connecting element is connected to the second radiating area of the radiating element and the grounding element.

14 Claims, 9 Drawing Sheets



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US007760145B2

(12) **United States Patent**
Gold

(10) **Patent No.:** **US 7,760,145 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **RAISING ANTENNA EFFICIENCY FOR A PORTABLE COMMUNICATION DEVICE**

(75) Inventor: **Kristina Gold**, Uppsala (SE)

(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 165 days.

(21) Appl. No.: **10/593,997**

(22) PCT Filed: **Feb. 17, 2005**

(86) PCT No.: **PCT/EP2005/001582**

§ 371 (c)(1),

(2), (4) Date: **Jun. 18, 2007**

(87) PCT Pub. No.: **WO2005/096438**

PCT Pub. Date: **Oct. 13, 2005**

(65) **Prior Publication Data**

US 2007/0290945 A1 Dec. 20, 2007

Related U.S. Application Data

(60) Provisional application No. 60/557,593, filed on Mar. 30, 2004.

(30) **Foreign Application Priority Data**

Mar. 22, 2004 (EP) 04006810

(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**

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Douglas W Owens

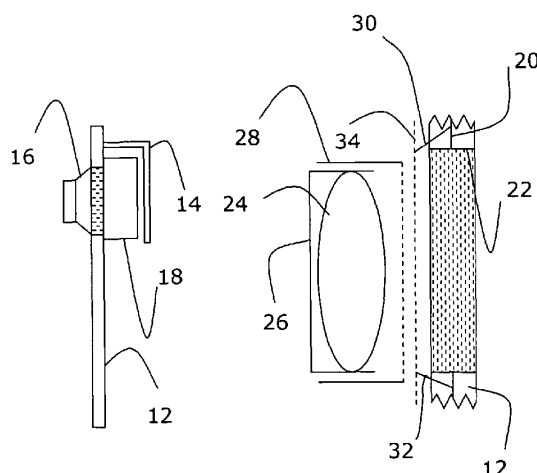
Assistant Examiner—Dieu Hien T Duong

(74) *Attorney, Agent, or Firm*—Myers Bigel Sibley & Sajovec, PA

(57) **ABSTRACT**

Portable communication devices are provided that include a board for receiving electrical circuits and have a ground plane and at least one throughhole. The devices also include an antenna element on one side of the board and an acoustic element placed on the board and aligned with the throughhole. The devices further include a mesh of electrically conducting material positioned between a cover of the acoustic element and the board. The mesh can be connected to the ground plane of the board to enhance the efficiency of the antenna.

12 Claims, 1 Drawing Sheet



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US007760146B2

(12) **United States Patent**
Ollikainen

(10) **Patent No.:** **US 7,760,146 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **INTERNAL DIGITAL TV ANTENNAS FOR
HAND-HELD TELECOMMUNICATIONS
DEVICE**

2005/0186931 A1 * 8/2005 Laiho et al. 455/280
2006/0099993 A1 * 5/2006 Leinonen et al. 455/562.1
2006/0135061 A1 * 6/2006 Ying 455/19
2006/0197538 A1 * 9/2006 Leinonen et al. 324/533

(75) Inventor: **Jani Ollikainen**, Helsinki (FI)

(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 650 days.

(21) Appl. No.: **11/388,802**

(22) Filed: **Mar. 24, 2006**

(65) **Prior Publication Data**

US 2006/0214857 A1 Sep. 28, 2006

Related U.S. Application Data

(60) Provisional application No. 60/665,902, filed on Mar. 24, 2005.

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/50 (2006.01)

H01Q 3/24 (2006.01)

(52) **U.S. Cl.** **343/702**; 343/860; 343/876

(58) **Field of Classification Search** 343/702,
343/700 MS, 876, 850, 860, 895

See application file for complete search history.

(56) **References Cited**

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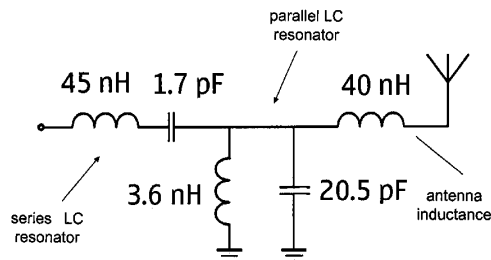
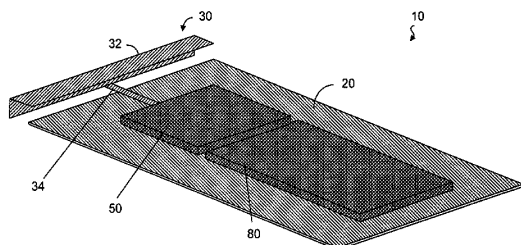
Primary Examiner—Shih-Chao Chen

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

(57) **ABSTRACT**

An antenna structure comprises an unbalanced antenna for receiving digital video broadcasting signals. The antenna is dimensioned to fit within an electronic device, such as a mobile phone. The unbalanced antenna has a radiative element and a feed line connected to a matching circuit so as to achieve two or more resonances within a DVB-H frequency range, such as 470 to 702 MHz. The physical length of the radiative element is always smaller than $\lambda/4$ at the frequencies of interest (470-702 MHz), but the electrical length can be smaller or substantially equal to $\lambda/4$. The matching circuit can comprise one or more LC resonators depending on the number of resonances. The resonators can be series or parallel connected between the feed line and RF circuitry for processing the broadcasting signals. The antenna can be tuned to other bands above the DVB-H frequencies for use as a diversity or MIMO antenna.

21 Claims, 11 Drawing Sheets



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US007760147B2

(12) **United States Patent**
Nam

(10) **Patent No.:** **US 7,760,147 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **ANTENNA AND MOBILE COMMUNICATION
TERMINAL COMPRISING THE SAME**

(75) Inventor: **Soo Hyun Nam**, Seoul (KR)

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 15 days.

(21) Appl. No.: **11/944,297**

(22) Filed: **Nov. 21, 2007**

(65) **Prior Publication Data**

US 2008/0111749 A1 May 15, 2008

(30) **Foreign Application Priority Data**

Nov. 23, 2006 (KR) 10-2006-0116280

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

(52) **U.S. Cl.** **343/702; 343/700 MS;**
343/841; 343/895

(58) **Field of Classification Search** 343/702,
343/700 MS, 841-848, 793, 797, 810-820,
343/850, 778, 864, 872, 860, 895

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—James H. Cho

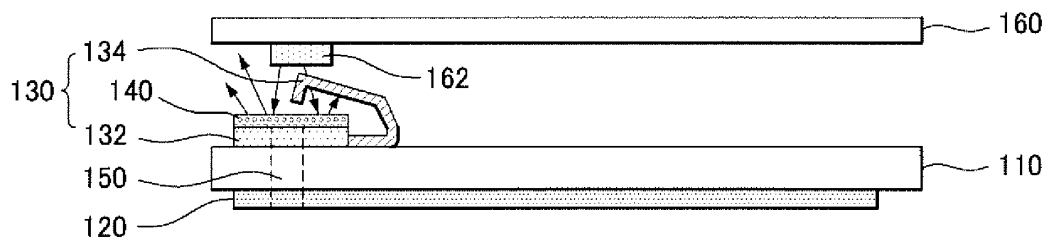
Assistant Examiner—Christopher Lo

(74) *Attorney, Agent, or Firm*—Lee, Hong, Degerman,
Kang & Waimey

(57) **ABSTRACT**

A mobile terminal and antenna including a case configured to include a circuit board and an antenna disposed inside the case. The antenna including an antenna pattern formed on a substrate, a feed unit having a first end connected to the antenna pattern and a second end connected to the circuit board. The feed unit is configured to supply an electrical signal to the antenna pattern, and an Electromagnetic Interference (EMI) attenuation unit is disposed in a location corresponding to the feed unit and configured to attenuate the EMI generated by the feed unit.

19 Claims, 11 Drawing Sheets



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US007760149B2

(12) **United States Patent**
Höök

(10) **Patent No.:** **US 7,760,149 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **HULL OR FUSELAGE INTEGRATED ANTENNA**

FOREIGN PATENT DOCUMENTS

(75) Inventor: **Anders Höök**, Hindås (SE)

WO WO-2005/069442 A1 7/2005
WO WO-2006/091162 A1 8/2006

(73) Assignee: **SAAB AB**, Linköping (SE)

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

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J. L. Volakis et al.; Broadband RCS Reduction of Rectangular Patch by Using Distributed Loading; Electronics Letters; Dec. 3, 1992, vol. 28, No. 25; pp. 2322-2323.

(21) Appl. No.: **12/073,116**

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(22) Filed: **Feb. 29, 2008**

Primary Examiner—Michael C Wimer

(65) **Prior Publication Data**

(74) *Attorney, Agent, or Firm*—Venable LLP; Eric J. Franklin

US 2008/0316124 A1 Dec. 25, 2008

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Mar. 2, 2007 (EP) 07446003

(51) **Int. Cl.**
H01Q 1/28 (2006.01)

(52) **U.S. Cl.** **343/708; 343/770**

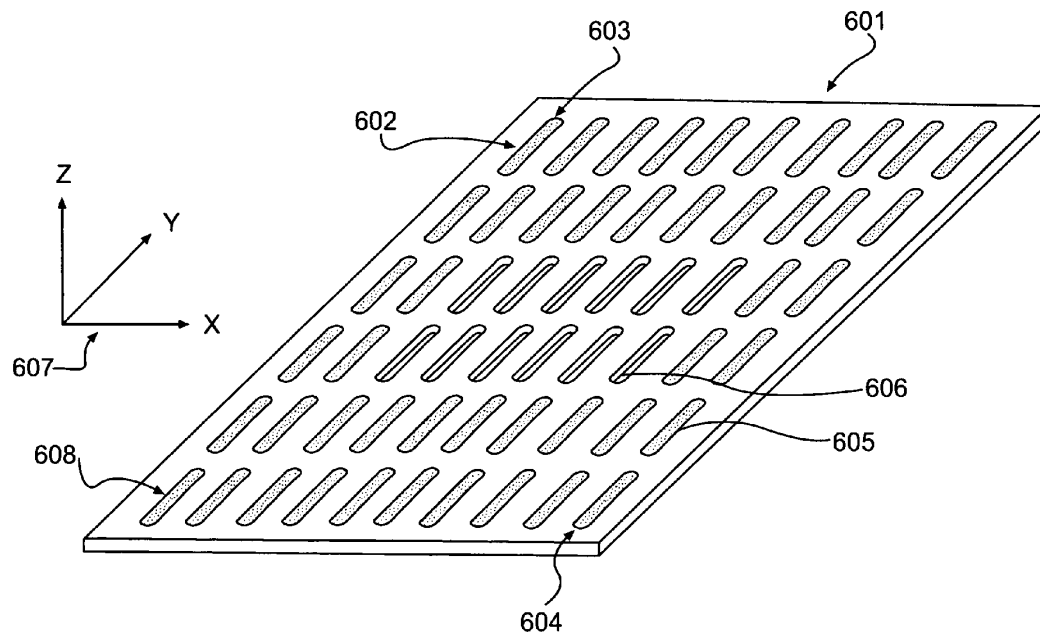
(58) **Field of Classification Search** 343/705,
343/708, 700 MS, 853, 770, 795
See application file for complete search history.

(56) **References Cited**

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31 Claims, 10 Drawing Sheets



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US007760150B2

(12) **United States Patent**
Sato

(10) **Patent No.:** **US 7,760,150 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **ANTENNA ASSEMBLY AND WIRELESS UNIT EMPLOYING IT**

(75) Inventor: **Junji Sato**, Tokyo (JP)

(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 429 days.

(21) Appl. No.: **11/568,985**

(22) PCT Filed: **Apr. 14, 2005**

(86) PCT No.: **PCT/JP2005/007244**

§ 371 (c)(1),

(2), (4) Date: **Nov. 13, 2006**

(87) PCT Pub. No.: **WO2005/112194**

PCT Pub. Date: **Nov. 24, 2005**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

May 18, 2004 (JP) 2004-147267

Feb. 18, 2005 (JP) 2005-042572

(51) **Int. Cl.**

H01Q 1/00 (2006.01)

H01Q 21/00 (2006.01)

H01Q 19/10 (2006.01)

H01Q 19/00 (2006.01)

(52) **U.S. Cl.** **343/724; 343/722; 343/726; 343/729; 343/730; 343/818; 343/833**

(58) **Field of Classification Search** **343/722, 343/724, 726, 729, 730, 741, 748, 818, 833, 343/866, 868, 702**

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Douglas W Owens

Assistant Examiner—Jennifer F Hu

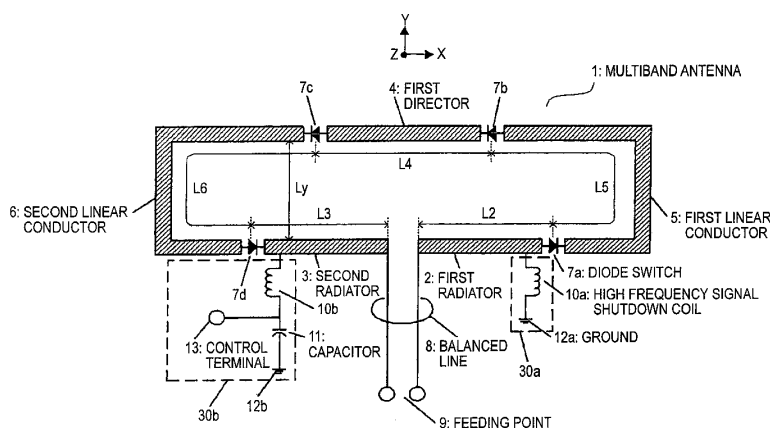
(74) Attorney, Agent, or Firm—Pearne & Gordon LLP

(57) **ABSTRACT**

An object of the invention is to provide an antenna apparatus whose directional characteristic can be switched 90 degrees conforming to the communication mode at the same time as the frequency band can be switched in response to the communication mode for application to a multiband radio for covering different communication modes such as voice communications and data communications, and a radio using the antenna apparatus.

An antenna apparatus 1 of the invention includes linear radiator 2, 3; a first linear director 4; and first and second linear conductors 5 and 6 connected at one end to the radiator 2, 3 and at an opposite end to the first director 4 through switches 7. The first and second conductors 5 and 6 are disposed symmetrically with respect to an orthogonal plane in the length direction of the radiator, and the radiator 2, 3, the first director 4, the first conductor 5, and the second conductor 6 are switched between a loop state in which they are connected like a loop and a separate state in which they are separate by switching the switches 7.

23 Claims, 12 Drawing Sheets



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US007764233B2

(12) **United States Patent**
Wu

(10) **Patent No.:** **US 7,764,233 B2**

(45) **Date of Patent:** **Jul. 27, 2010**

(54) **SYMMETRICAL UNI-PLATED ANTENNA
AND WIRELESS NETWORK DEVICE
HAVING THE SAME**

(75) Inventor: **Jung Tai Wu**, Taipei (TW)

(73) Assignee: **Cameo Communications Inc.** (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.: **11/790,303**

(22) Filed: **Apr. 24, 2007**

(65) **Prior Publication Data**

US 2008/0266180 A1 Oct. 30, 2008

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

(52) **U.S. Cl.** **343/700 MS; 343/702;**
343/767; 343/846

(58) **Field of Classification Search** **343/700 MS;**
343/702, 767, 770, 846

See application file for complete search history.

(56) **References Cited**

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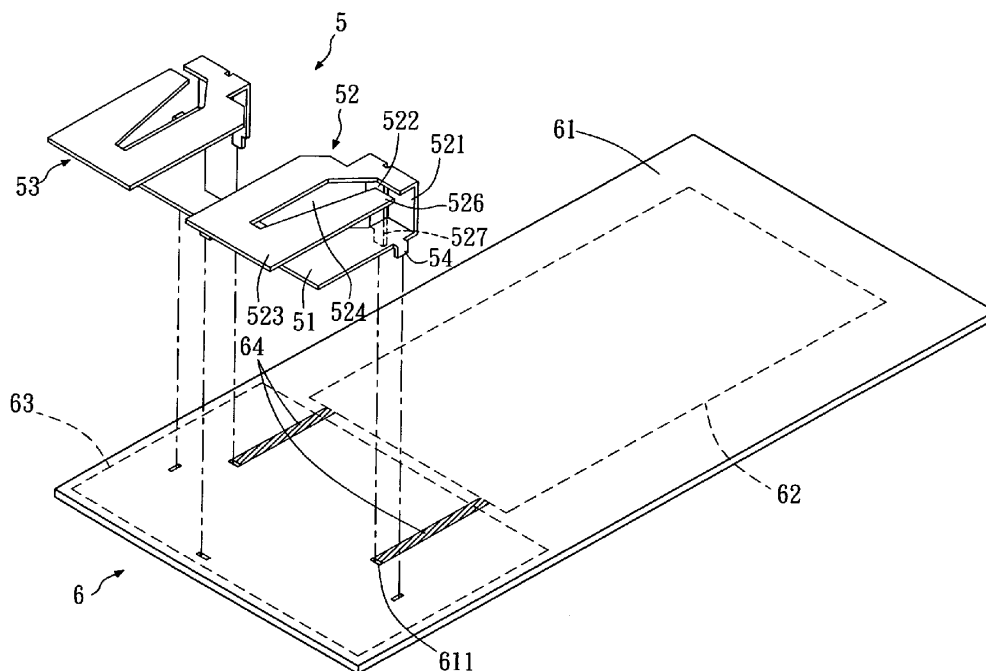
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Primary Examiner—Hoang V Nguyen

(57) **ABSTRACT**

The present invention discloses an antenna adapted for use in a wireless network device. The antenna includes a base and two antenna portions. Each antenna portion includes a radiation section and a ground section. The ground sections of the two antenna portions are connected with the same base and substantially perpendicular to the base. The radiation section is connected with the ground section and substantially parallel to the base with a difference in height formed between the radiation section and the base. The antenna is a single component integrally formed by stamping an electrically conductive thin metal plate, which not only facilitates fabrication thereof, but also the assembly of the antenna to a substrate of the wireless network device, thereby increasing the gain of the wireless network device along a vertical direction.

12 Claims, 8 Drawing Sheets



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US007764234B2

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

(10) **Patent No.:** **US 7,764,234 B2**
(45) **Date of Patent:** **Jul. 27, 2010**

(54) **ANTENNA STRUCTURE**

(75) Inventors: **Tony Tsai**, Taipei (TW); **Ryan Chang**,
Shanghai (CN); **Yanping Gao**, Shanghai
(CN); **Jie Zhou**, Shanghai (CN)

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

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 417 days.

(21) Appl. No.: **11/819,177**

(22) Filed: **Jun. 26, 2007**

(65) **Prior Publication Data**

US 2008/0111744 A1 May 15, 2008

(30) **Foreign Application Priority Data**

Nov. 13, 2006 (TW) 95219974 U

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

(52) **U.S. Cl.** **343/700 MS; 343/702;**
343/745; 343/748; 343/828; 343/895

(58) **Field of Classification Search** 343/700 MS,
343/702, 745, 748, 828, 895
See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Douglas W Owens

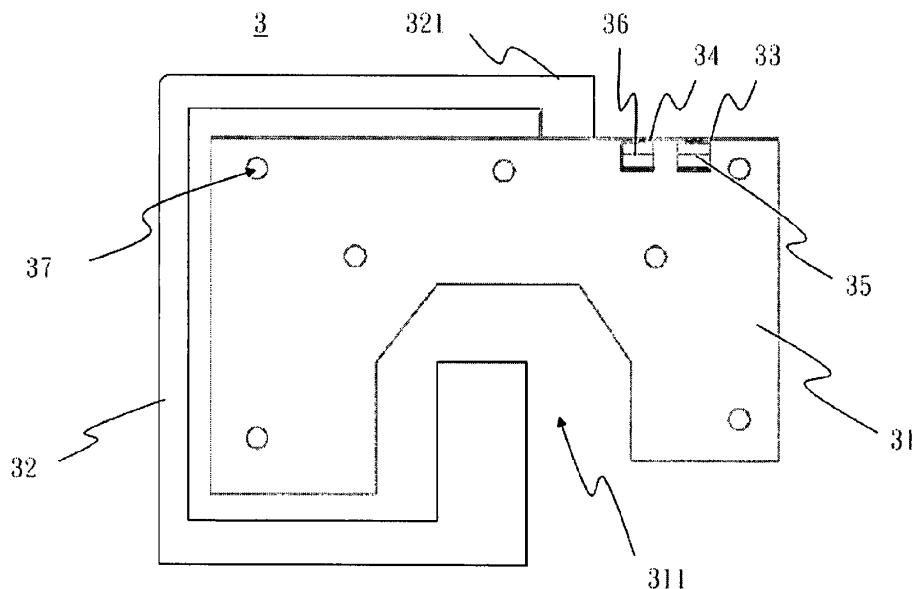
Assistant Examiner—Chuc D Tran

(74) *Attorney, Agent, or Firm*—Wang Law Firm; Li K. Wang

(57) **ABSTRACT**

An antenna structure is disposed on a substrate. The antenna structure includes a $\sqcap$ -shaped radiation body and a first radiation body, and both share a feeding end and a grounding end. The feeding end and the grounding end are disposed to a side edge of the $\sqcap$ -shaped radiation body. The positions of the feeding end and the grounding end allow the $\sqcap$ -shaped radiation body to form the operation of two frequency bands. Moreover, the first radiation body is vertically extended from the side edge near the feeding end disposed to the $\sqcap$ -shaped radiation body, and continuously extended from an end to keep a spacing between periphery of the $\sqcap$ -shaped radiation body and the first radiation body, and extended to a front of an opening of the $\sqcap$ -shaped radiation body, thereby vertically extending toward the opening. Therefore, the first radiation body could provide the operation of another frequency band.

11 Claims, 6 Drawing Sheets



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US007764238B2

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

(10) **Patent No.:** **US 7,764,238 B2**
(45) **Date of Patent:** **Jul. 27, 2010**

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

2009/0009401 A1 * 1/2009 Suzuki et al. 343/700 MS

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(75) Inventors: **Hiroyuki Hotta**, Hamura (JP); **Masao Teshima**, Kunitachi (JP); **Koichi Sato**, Tachikawa (JP)

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(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 0 days.

(21) Appl. No.: **12/415,513**

(22) Filed: **Mar. 31, 2009**

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(65) **Prior Publication Data**

US 2010/0026602 A1 Feb. 4, 2010

Primary Examiner—Tho G Phan

(74) Attorney, Agent, or Firm—Blakely, Sokoloff, Taylor & Zafman LLP

(30) **Foreign Application Priority Data**

Jul. 29, 2008 (JP) 2008-195529

(57) **ABSTRACT**

(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, 843, 846
See application file for complete search history.

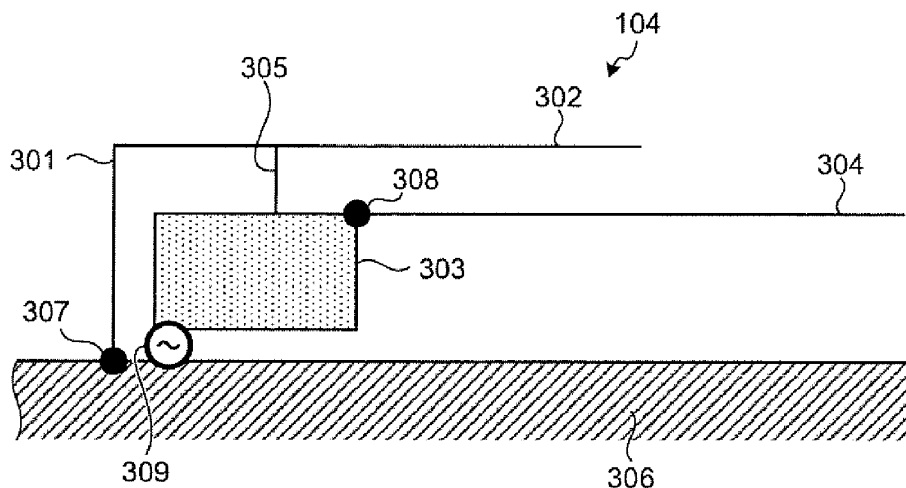
According to one embodiment, an antenna device includes a short circuit path, a first open-ended element, a feed side element, a second open-ended element, and a short circuit element. One end of the short circuit path is connected to a ground point near a feed point. The first open-ended element extends from another end of the short circuit path. The feed side element extends from near the feed point in a direction in which the first open-ended element extends with an edge close to ground. The second open-ended element extends from near an end of the feed side element in the direction in which the first open-ended element extends. The short circuit element connects between an end of the first open-ended element and a point on an edge of the feed side element opposite the edge close to the ground or a point on the second open-ended element.

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10 Claims, 23 Drawing Sheets



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US007764242B2

(12) **United States Patent**
Milyakh

(10) **Patent No.:** **US 7,764,242 B2**
(45) **Date of Patent:** **Jul. 27, 2010**

(54) **BROADBAND ANTENNA SYSTEM**

(75) Inventor: **Yaroslav Milyakh**, Suwon-si (KR)

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

(*) 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.: **12/186,171**

(22) Filed: **Aug. 5, 2008**

(65) **Prior Publication Data**

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Related U.S. Application Data

(62) Division of application No. 11/319,426, filed on Dec. 29, 2005, now Pat. No. 7,425,921.

(30) **Foreign Application Priority Data**

Jun. 13, 2005 (KR) 10-2005-0050516

(51) **Int. Cl.**
H01Q 9/00 (2006.01)
H01Q 9/28 (2006.01)

(52) **U.S. Cl.** **343/752; 343/795**

(58) **Field of Classification Search** 343/752,
343/793, 795, 830

See application file for complete search history.

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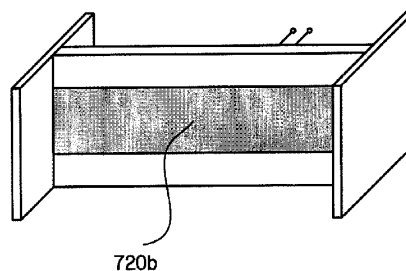
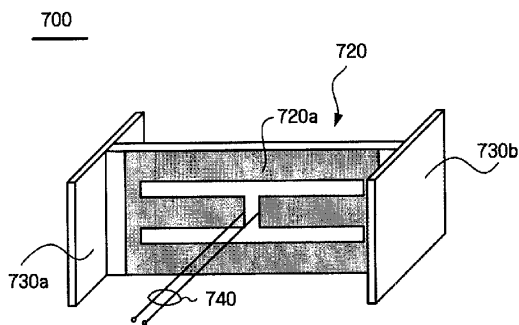
Primary Examiner—Shih-Chao Chen

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

(57) **ABSTRACT**

A broadband antenna system includes a ground plane, a metal plate parallel to the ground plane, and constituting a capacitance load against the ground plane, and a radiation structure connected perpendicularly to the ground plane and the metal plate. The radiation structure includes a feed conductor to supply an electric signal, a short-circuit stub to transfer the supplied electric signal to the ground plane, a conducting bridge to interconnect the feed conductor and the short-circuit stub, which is separated from the metal plate, and a radiating conductor connected to the ground plane the metal plate, and coupled to the supplied electric signal to thereby radiate electromagnetic waves.

4 Claims, 12 Drawing Sheets



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US007764245B2

(12) **United States Patent**
Loyet

(10) **Patent No.:** **US 7,764,245 B2**
(45) **Date of Patent:** **Jul. 27, 2010**

(54) **MULTI-BAND ANTENNA**

(75) Inventor: **Lowell Lee Loyet**, Woodinville, WA
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(73) Assignee: **Cingular Wireless II, LLC**, Atlanta, GA
(US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 628 days.

(21) Appl. No.: **11/424,614**

(22) Filed: **Jun. 16, 2006**

(65) **Prior Publication Data**

US 2007/0290938 A1 Dec. 20, 2007

(51) **Int. Cl.**
H01Q 9/28 (2006.01)
H01Q 1/38 (2006.01)

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

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

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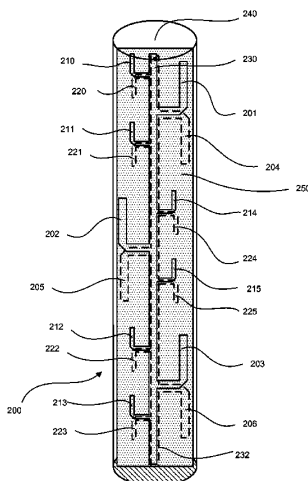
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Primary Examiner—Trinh V Dinh

(57) **ABSTRACT**

A multi-band antenna for use in a wireless communications network provides frequency support for different wireless technologies in a single structure. This substantially reduces installation costs and can be the only solution in limited space installation sites. In one instance, the multi-band antenna has two serial feedlines carrying respective anode and cathode components of RF signals. Each, comprising serial feedline is coupled to two or more different length dipole elements. Each dipole element of a given length attached to the first serial feedline has a corresponding dipole element of approximately equal length attached to the second serial feedline and oriented, with respect to the first dipole element so as to form a dipole. Thus, at least two dipoles of differing lengths are formed, enabling performance in two different bands by the antenna. The gain of the antenna for any particular band is determined by the number of dipoles corresponding to that band contained within the antenna.

16 Claims, 9 Drawing Sheets



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US007764246B2

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

(10) **Patent No.:** **US 7,764,246 B2**
(45) **Date of Patent:** **Jul. 27, 2010**

(54) **WIRELESS DEVICE AND METHOD FOR IMPROVING ANTENNA CHARACTERISTIC OF THE WIRELESS DEVICE**

(75) Inventors: **Chao-Hui Yu**, Taipei Hsien (TW);
Hung-Jen Chen, Taipei Hsien (TW);
Yu-Yuan Wu, Taipei Hsien (TW)

(73) Assignee: **Cheng Uei Precision Industry 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 481 days.

(21) Appl. No.: **11/864,969**

(22) Filed: **Sep. 29, 2007**

(65) **Prior Publication Data**

US 2009/0085822 A1 Apr. 2, 2009

(51) **Int. Cl.**
H01Q 1/52 (2006.01)

(52) **U.S. Cl.** **343/841**; 343/702; 343/872

(58) **Field of Classification Search** 343/841,
343/702, 872

See application file for complete search history.

(56) **References Cited**

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Primary Examiner—Douglas W Owens

Assistant Examiner—Dieu Hien T Duong

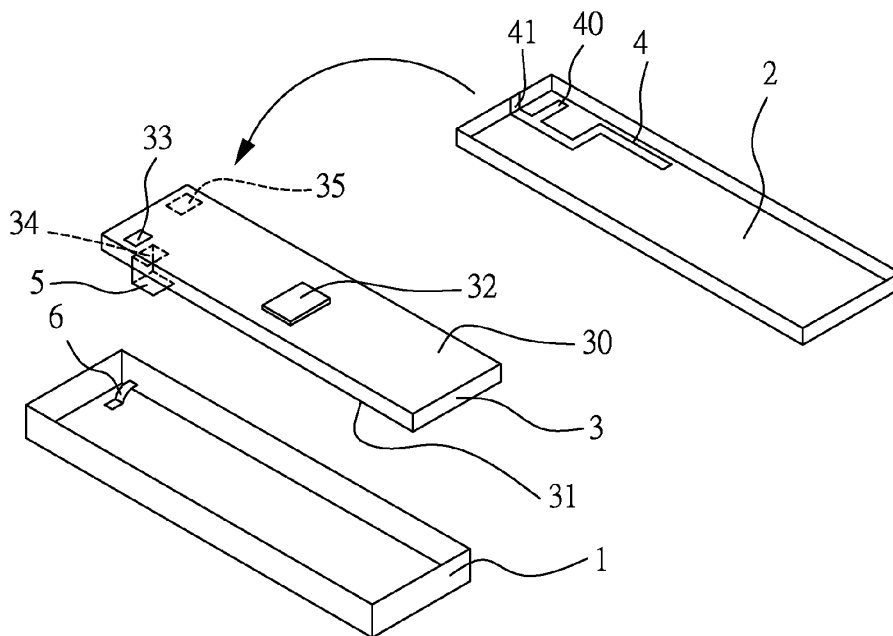
(74) *Attorney, Agent, or Firm*—WPAT, P.C.; Anthony King

(57) **ABSTRACT**

A wireless device includes a housing having a shielding case and a dielectric case. The housing receives a printed circuit board and an antenna element. The printed circuit board has a feeding pad, a first ground pad and a second ground pad. The antenna has a feeding portion electronically coupled with the feeding pad of the printed circuit board and a ground portion electronically coupled with the shielding case for increasing ground dimension to improve antenna characteristic. The first and second ground pads of the printed circuit board electronically coupled with the shielding case for reducing coupling effect to improve antenna characteristic.

9 Claims, 5 Drawing Sheets

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