



US008231059B2

(12) **United States Patent**
Sakama

(10) **Patent No.:** **US 8,231,059 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **RADIO FREQUENCY IC TAG**

(75) Inventor: **Isao Sakama**, Hiratsuka (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 378 days.

(21) Appl. No.: **12/575,932**

(22) Filed: **Oct. 8, 2009**

(65) **Prior Publication Data**

US 2010/0090015 A1 Apr. 15, 2010

(30) **Foreign Application Priority Data**

Oct. 9, 2008 (JP) 2008-262352

(51) **Int. Cl.**

G06K 19/06 (2006.01)

G08B 13/14 (2006.01)

H01Q 1/38 (2006.01)

H01Q 9/04 (2006.01)

H01Q 5/00 (2006.01)

(52) **U.S. Cl.** **235/492**; 340/572.7; 343/700 MS

(58) **Field of Classification Search** 235/492;
340/572.1, 572.7, 572.8; 343/700 MS, 860,
343/795, 873

See application file for complete search history.

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Primary Examiner — Michael G Lee

Assistant Examiner — Suez Ellis

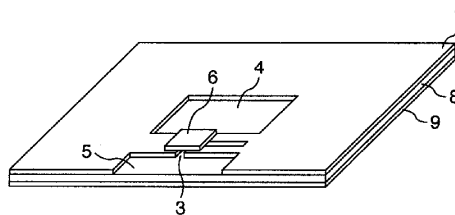
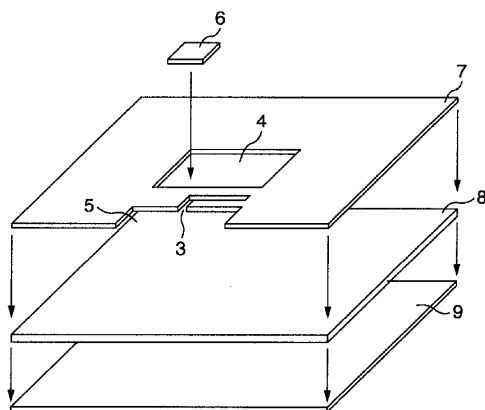
(74) *Attorney, Agent, or Firm* — Foley & Lardner LLP

(57)

ABSTRACT

A micro-strip antenna includes two conductors. One of the conductors is a radiation electrode including a first radiation electrode including an IC chip and a slit and a U-shaped second radiation electrode. The antenna further includes an opening and a cutout formed by the first and second radiation electrodes and a radiation electrode.

8 Claims, 12 Drawing Sheets



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US008232919B2

(12) **United States Patent**
Rofougaran

(10) **Patent No.:** **US 8,232,919 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **INTEGRATED CIRCUIT MEMS ANTENNA STRUCTURE**

(75) Inventor: **Ahmadreza (Reza) Rofougaran**,
Newport Coast, CA (US)

(73) Assignee: **Broadcom Corporation**, Irvine, CA
(US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1040 days.

(21) Appl. No.: **11/648,828**

(22) Filed: **Dec. 29, 2006**

(65) **Prior Publication Data**

US 2008/0158094 A1 Jul. 3, 2008

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

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

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

See application file for complete search history.

(56) **References Cited**

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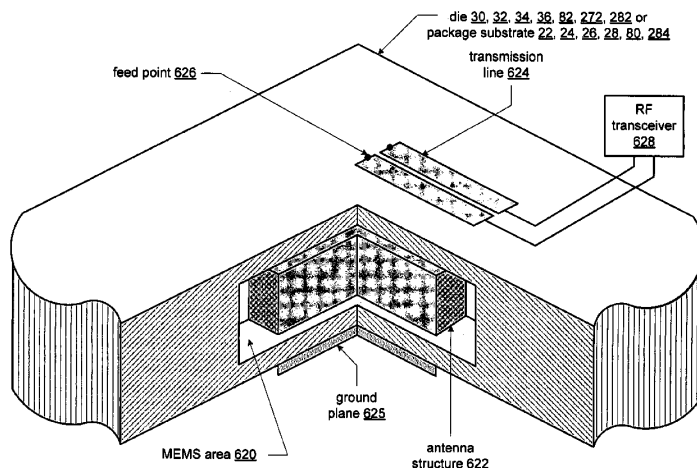
Primary Examiner — Dieu H Duong

(74) *Attorney, Agent, or Firm* — Garlick & Markison; Holly L. Rudnick

(57) **ABSTRACT**

An integrated circuit (IC) antenna structure includes a micro-electromechanical (MEM) area, a feed point, and a transmission line. The micro-electromechanical (MEM) area includes a three-dimensional shape, wherein the three dimensional-shape provides an antenna structure. The feed point is coupled to provide an outbound radio frequency (RF) signal to the antenna structure for transmission and to receive an inbound RF signal from the antenna structure. The transmission line electrically coupled to the feed point.

19 Claims, 38 Drawing Sheets



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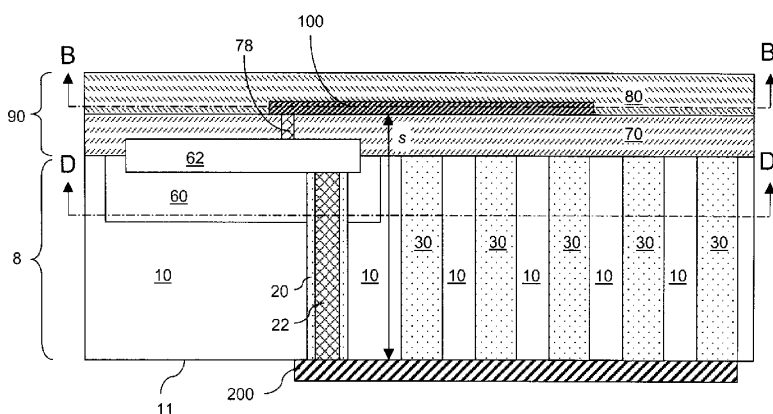


(10) **Patent No.:** **US 8,232,920 B2**
(45) **Date of Patent:** ***Jul. 31, 2012**

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| 6,933,906 | B2 | 8/2005 | Stolle et al. | |

- A semiconductor chip integrating a transceiver, an antenna, and a receiver is provided. The transceiver is located on a front side of a semiconductor substrate. A through substrate via provides electrical connection between the transceiver and the receiver located on a backside of the semiconductor substrate. The antenna connected to the transceiver is located in a dielectric layer located on the front side of the substrate. The separation between the reflector plate and the antenna is about the quarter wavelength of millimeter waves, which enhances radiation efficiency of the antenna. An array of through substrate dielectric vias may be employed to reduce the effective dielectric constant of the material between the antenna and the reflector plate, thereby reducing the wavelength of the millimeter wave and enhance the radiation efficiency. A design structure for designing, manufacturing, or testing a design for such a semiconductor chip is also provided.

17 Claims, 18 Drawing Sheets





US008232921B2

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

(10) **Patent No.:** **US 8,232,921 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **HALF-MODE SUBSTRATE INTEGRATED
ANTENNA STRUCTURE**

FOREIGN PATENT DOCUMENTS

CN 101 026 263 A 8/2007

(75) Inventors: **Marc Guthoerl**, Stetten (DE); **Stefan Koch**, Oppenweiler (DE)

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Wei Hong, et al., "Design and Implementation of Low Sidelobe Slot Array Antennas with Full and Half Mode Substrate Integrated Waveguide Technology", Proceedings of the 37th European Microwave Conference, IEEE, XP002486402, Dec. 17, 2007, 2 pgs.

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 453 days.

(21) Appl. No.: **12/349,075**

(Continued)

(22) Filed: **Jan. 6, 2009**

(65) **Prior Publication Data**

US 2009/0243941 A1 Oct. 1, 2009

Primary Examiner — Hoanganh Le

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

(30) **Foreign Application Priority Data**

Mar. 31, 2008 (EP) 08153742

(57) **ABSTRACT**

The present invention relates to a half mode substrate integrated antenna structure **1**, **10**, **11** for electromagnetic signals, comprising a substrate **2** with a top **2a** and a bottom side **2b**, said substrate being essentially of a flat shape with a main plane M, a conductive layer **3a** arranged on said top and a conductive layer **3b** arranged on said bottom side, a series of conductive vias **4** extending between the conductive layers **3a**, **3b** of the top and the bottom side of the substrate so that a waveguide having a feeding end **5** and an antenna end **6** is formed, wherein said antenna end **6** is formed by end regions **7** of said conductive layers **3a**, **3b** and said substrate **2** so that a radiation pattern of said antenna structure **1** essentially extends in the main plane M.

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

(52) **U.S. Cl.** **343/700 MS**; 343/772

(58) **Field of Classification Search** 343/700 MS,
343/770, 771, 772

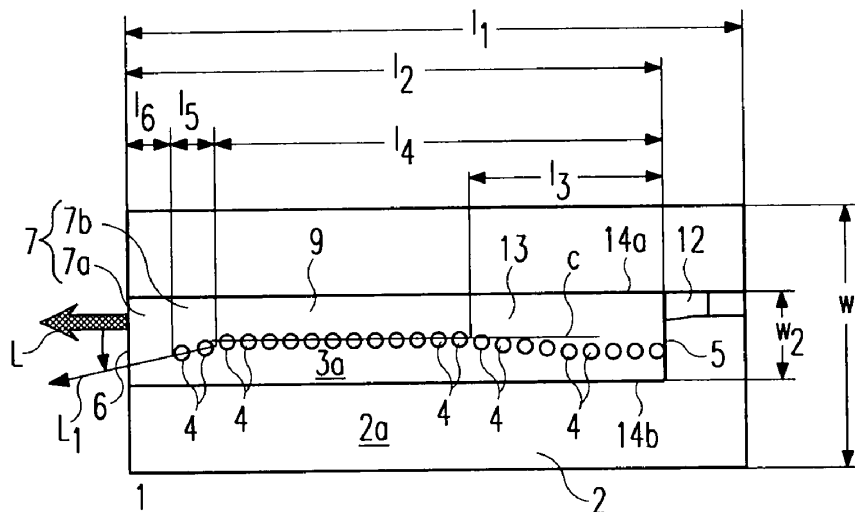
See application file for complete search history.

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19 Claims, 3 Drawing Sheets





US008232923B2

(12) **United States Patent**
Yang

(10) **Patent No.:** **US 8,232,923 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **ANTENNA STRUCTURE OF A RADIO
FREQUENCY IDENTIFICATION SYSTEM
TRANSPONDER**

(75) Inventor: **Yung-Shu Yang**, Taipei (TW)

(73) Assignee: **Polychem UV/EB International 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 0 days.

(21) Appl. No.: **12/426,254**

(22) Filed: **Apr. 19, 2009**

(65) **Prior Publication Data**

US 2011/0284641 A1 Nov. 24, 2011

(30) **Foreign Application Priority Data**

Sep. 16, 2008 (TW) 97135536 A

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

(52) **U.S. Cl.** **343/700 MS; 343/793; 343/795;**
340/572.7

(58) **Field of Classification Search** 340/572.7;
343/700 MS, 793, 795, 803, 805
See application file for complete search history.

(56) **References Cited**

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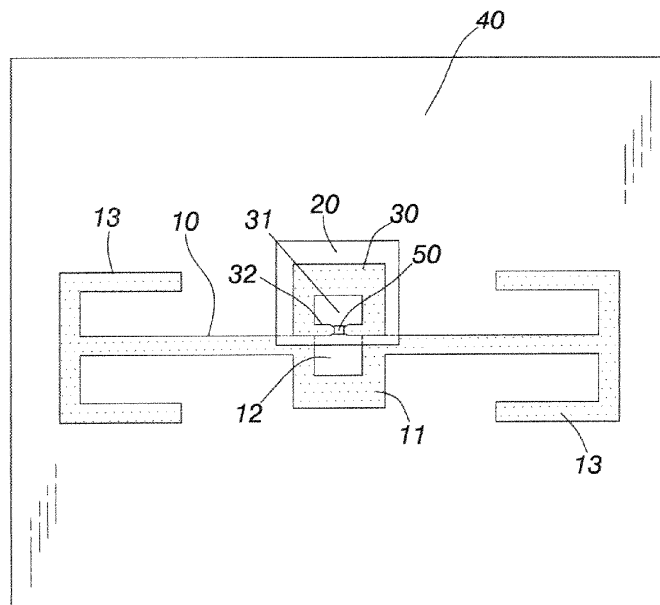
Primary Examiner — Dieu H Duong

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

(57) **ABSTRACT**

The present invention is an antenna structure of a radio frequency identification system transponder, especially an antenna structure wherein an insulation layer and a foldback circuit, an opening of which faces toward a coupling part, are provided at corresponding positions of an antenna body which is provided with the coupling part. The foldback circuit is provided with a radio frequency integrated circuit, such that radio signals can be transmitted by induction by the foldback circuit and the coupling part. By this foldback circuit, an issue of directivity of the radio signals can be reduced, an effective read range of the radio signals can be increased, as well as a near field induction function and a far field induction function can be provided at a same time. Therefore, when manufacturing an RFID transponder, a production speed can be increased and production cost can be reduced.

24 Claims, 11 Drawing Sheets



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US008232924B2

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

(10) **Patent No.:** **US 8,232,924 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **BROADBAND PATCH ANTENNA AND ANTENNA SYSTEM**

(75) Inventors: **Steven Bucca**, Westminster, CO (US);
Mike Gawronski, Minneapolis, MN (US)

(73) Assignee: **Alliant Techsystems Inc.**, Arlington, VA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 442 days.

(21) Appl. No.: **12/465,835**

(22) Filed: **May 14, 2009**

(65) **Prior Publication Data**

US 2010/0007561 A1 Jan. 14, 2010

Related U.S. Application Data

(60) Provisional application No. 61/055,728, filed on May 23, 2008.

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

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

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

(56) **References Cited**

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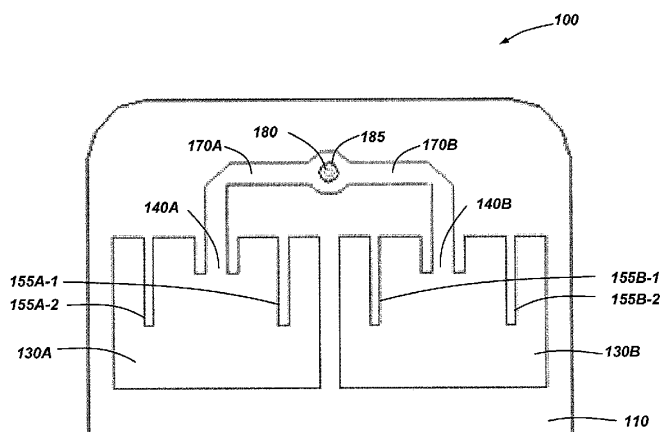
Primary Examiner — Tan Ho

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

(57) **ABSTRACT**

A patch antenna includes a ground plane on a surface of a substrate. Patch radiators are formed on another surface of the substrate. Each patch radiator includes tuning slots extending from an edge of the patch radiator toward an interior section such that the slot is separate from a feed point of the patch radiator. In some embodiments, the patch antenna includes a first feed-through conductor disposed through the ground plane and substrate and coupled to the patch radiator. In some embodiments the patch antenna with the first feed-through conductor is a razor patch antenna. An antenna system includes a patch antenna and a transceiver board, which includes a substrate and a ground plane on the substrate. A second feed-through conductor runs through the ground plane and transceiver substrate to connect to a transceiver device. The transceiver board and patch antenna are abutted such that the first and second feed-through conductors connect.

23 Claims, 6 Drawing Sheets



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US008232925B2

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

(10) **Patent No.:** **US 8,232,925 B2**

(45) **Date of Patent:** **Jul. 31, 2012**

(54) **IMPEDANCE TUNING OF TRANSMITTING AND RECEIVING ANTENNAS**

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(75) Inventors: **Mikael Bergholz Knudsen**, Gistrup (DK); **Peter Bundgaard**, Aalborg (DK); **Jan-Erik Mueller**, Ottobrunn (DE); **Gert F Pedersen**, Storvorde (DK); **Mauro Pelosi**, Picinisco (IT)

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(73) Assignee: **Intel Mobile Communications GmbH**, Neubiberg (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 550 days.

(21) Appl. No.: **12/475,366**

(22) Filed: **May 29, 2009**

(65) **Prior Publication Data**

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H01Q 1/24 (2006.01)

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

(58) **Field of Classification Search** 343/702,
343/850, 853, 860; 455/283

See application file for complete search history.

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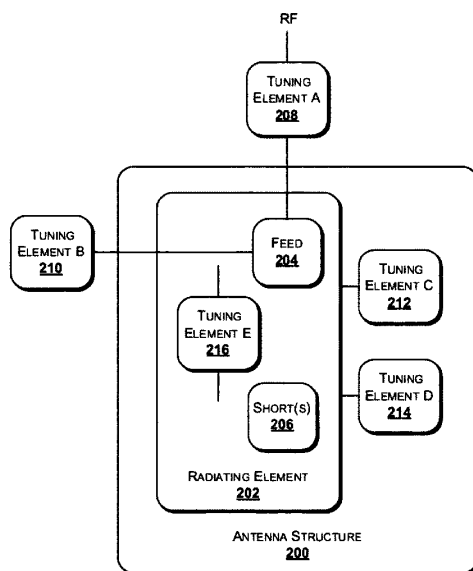
Primary Examiner — Huedung Mancuso

(74) *Attorney, Agent, or Firm* — SpryIP, LLC

(57) **ABSTRACT**

The present disclosure relates to impedance tuning of transmitting and receiving antennas.

18 Claims, 8 Drawing Sheets



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US008232926B2

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

(10) **Patent No.:** **US 8,232,926 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **MOBILE WIRELESS DEVICE**

(75) Inventors: **Nobuhiro Iwai**, Kanagawa (JP);
Yasuhiro Kitajima, Kanagawa (JP);
Kenshi Horihata, Kanagawa (JP);
Kenichi Sato, Miyagi (JP); **Hironori Kikuchi**, Miyagi (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 259 days.

(21) Appl. No.: **12/863,039**

(22) PCT Filed: **Dec. 25, 2008**

(86) PCT No.: **PCT/JP2008/003977**

§ 371 (c)(1),
(2), (4) Date: **Jul. 15, 2010**

(87) PCT Pub. No.: **WO2009/090720**

PCT Pub. Date: **Jul. 23, 2009**

(65) **Prior Publication Data**

US 2011/0057847 A1 Mar. 10, 2011

(30) **Foreign Application Priority Data**

Jan. 15, 2008 (JP) 2008-006001

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/00 (2006.01)

(52) **U.S. Cl.** **343/702; 455/575.3**

(58) **Field of Classification Search** **343/702; 343/872, 876; 455/575.1, 575.3, 575.7**

See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Jacob Y Choi

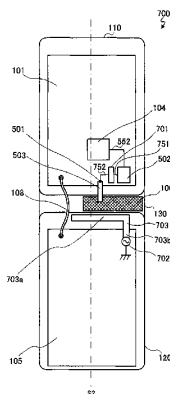
Assistant Examiner — Hasan Islam

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

(57) **ABSTRACT**

There is provided a mobile wireless device capable of preventing antenna characteristics from degrading by feeding electric power at a position hardly affected by a human body such as a hand or other body part. In the mobile wireless device, a first circuit board (101) is provided on a first chassis (110) and has a ground layer; a second circuit board (105) is provided on a second chassis (120) and has a ground layer. A ground terminal of a wireless portion (104) is connected to the ground layer of the first circuit board (101) at the same voltage level and is also electrically connected through the wireless portion (104) to a matching circuit (103). The ground layer of the second circuit board (105) is electrically connected to a hinge conducting portion (106) by electrostatic capacitance coupling. The hinge conducting portion (106) is connected through a third conduction portion (107) to a board connection portion (102) and feeds power to the wireless portion through the matching circuit (103). This enables the ground layer of the first circuit board (101), the third conduction portion (107), the hinge conducting portion (106), and the ground layer of the second circuit board (105) to function as an antenna resonating at a predetermined resonant frequency.

6 Claims, 10 Drawing Sheets



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US008232927B2

(12) **United States Patent**
Yoshioka

(10) **Patent No.:** **US 8,232,927 B2**
(45) **Date of Patent:** **Jul. 31, 2012**

(54) **ANTENNA ELEMENT**

(75) Inventor: **Hiroki Yoshioka**, Tokyo (JP)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 435 days.

(21) Appl. No.: **12/372,249**

(22) Filed: **Feb. 17, 2009**

(65) **Prior Publication Data**

US 2009/0207089 A1 Aug. 20, 2009

(30) **Foreign Application Priority Data**

Feb. 18, 2008 (JP) P2008-35559

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 13/10 (2006.01)

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

(58) **Field of Classification Search** 343/702,
343/746, 899, 700 MS, 846, 767
See application file for complete search history.

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Primary Examiner — Jacob Y Choi

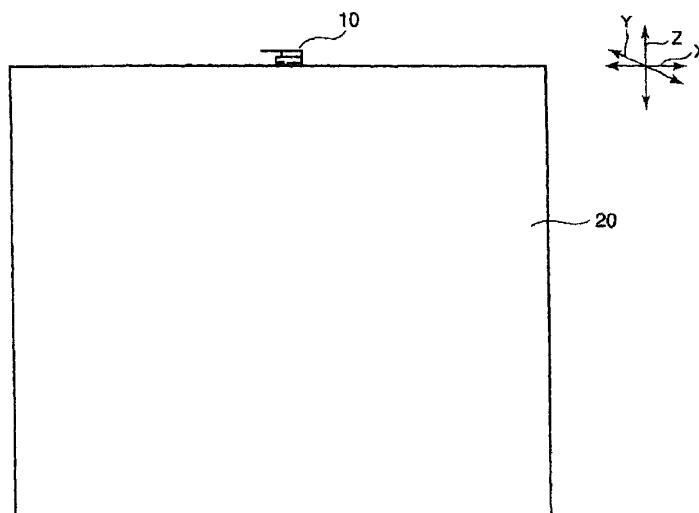
Assistant Examiner — Hasan Islam

(74) *Attorney, Agent, or Firm* — Whitham, Curtis, Christofferson & Cook, PC

(57) **ABSTRACT**

An antenna element is disclosed. A conductive plate is adapted to be electrically connected to an electric ground, and has a first edge. A second edge opposes the first edge and is formed with a first slit elongated in a first direction. A third edge intersects the first edge. A recessed part intersects the first edge and the third edge. A conductive member elongates from the second edge in the first direction.

7 Claims, 8 Drawing Sheets



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US008232929B2

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

(10) **Patent No.:** **US 8,232,929 B2**

(45) **Date of Patent:** **Jul. 31, 2012**

(54) **MICROWAVE ANTENNA FOR WIRELESS
NETWORKING OF DEVICES IN
AUTOMATION TECHNOLOGY**

(75) Inventors: **Alois Ineichen**, Ruswil (CH); **Thorsten
Godau**, Suessen (DE)

(73) Assignee: **Pilz GmbH & Co. KG**, Ostfildern (DE)

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

(21) Appl. No.: **12/786,801**

(22) Filed: **May 25, 2010**

(65) **Prior Publication Data**

US 2011/0043432 A1 Feb. 24, 2011

Related U.S. Application Data

(63) Continuation of application No. PCT/EP2008/
009688, filed on Nov. 15, 2008.

(30) **Foreign Application Priority Data**

Nov. 26, 2007 (DE) 10 2007 058 257

(51) **Int. Cl.**
H01Q 21/00 (2006.01)
H01Q 3/00 (2006.01)
H01Q 3/24 (2006.01)

(52) **U.S. Cl.** **343/867**; 343/765; 343/876; 343/866;
343/732

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

(56) **References Cited**

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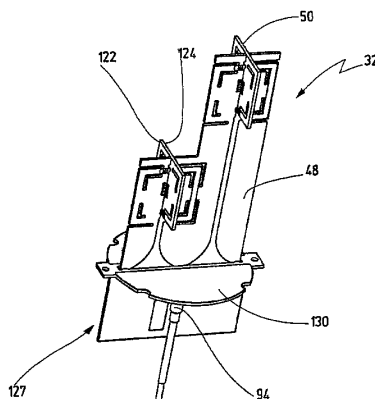
Primary Examiner — Trinh Dinh

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

(57) **ABSTRACT**

A microwave antenna for wireless interconnection of auto-
mation devices has a first printed circuit board, on which a
first conductor loop is arranged as a printed conductor track.
A second printed circuit board having a second conductor
loop in the form of a printed conductor track is arranged
transversely with respect to the first printed circuit board. The
second printed circuit board is attached to the first printed
circuit board. The conductor loops are connected to a com-
mon feed connection. A bypass line connects one end of each
the first and the second conductor loops.

18 Claims, 4 Drawing Sheets



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US008237614B2

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

(10) **Patent No.:** **US 8,237,614 B2**

(45) **Date of Patent:** **Aug. 7, 2012**

(54) **PLANAR ANTENNA, AND COMMUNICATION
DEVICE AND CARD-TYPE TERMINAL
USING THE ANTENNA**

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(75) Inventors: **Akio Kuramoto**, Tokyo (JP); **Junichi
Fukuda**, Tokyo (JP)

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

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 361 days.

International Search Report for PCT/JP2008/054358 mailed May 27,
2008.

(Continued)

(21) Appl. No.: **12/528,141**

(22) PCT Filed: **Mar. 11, 2008**

Primary Examiner — Tho G Phan

(86) PCT No.: **PCT/JP2008/054358**

§ 371 (c)(1),
(2), (4) Date: **Aug. 20, 2009**

(57) **ABSTRACT**

(87) PCT Pub. No.: **WO2008/111578**

PCT Pub. Date: **Sep. 18, 2008**

(65) **Prior Publication Data**

US 2010/0026586 A1 Feb. 4, 2010

(30) **Foreign Application Priority Data**

Mar. 12, 2007 (JP) 2007-061900

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

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

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

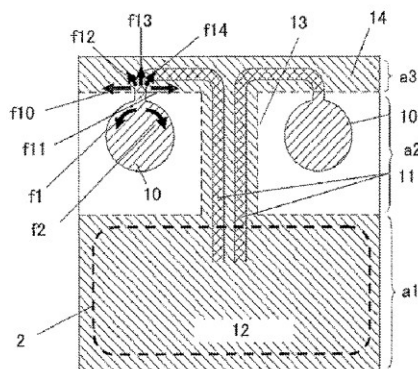
See application file for complete search history.

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14 Claims, 19 Drawing Sheets



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US008237621B2

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

(10) **Patent No.:** **US 8,237,621 B2**
(45) **Date of Patent:** **Aug. 7, 2012**

(54) **SPIRAL ANTENNA**

- (75) Inventors: **Yasuharu Masuda**, Kawasaki (JP);
Masahiro Tanabe, Kawasaki (JP)
- (73) Assignee: **Kabushiki Kaisha Toshiba**, Tokyo (JP)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 301 days.

(21) Appl. No.: **12/466,874**

(22) Filed: **May 15, 2009**

(65) **Prior Publication Data**
US 2010/0066624 A1 Mar. 18, 2010

(30) **Foreign Application Priority Data**
Sep. 12, 2008 (JP) 2008-235645

- (51) **Int. Cl.**
H01Q 1/36 (2006.01)
- (52) **U.S. Cl.** **343/895**
- (58) **Field of Classification Search** 343/700 MS,
343/702, 895, 873, 787-788
See application file for complete search history.

(56) **References Cited**

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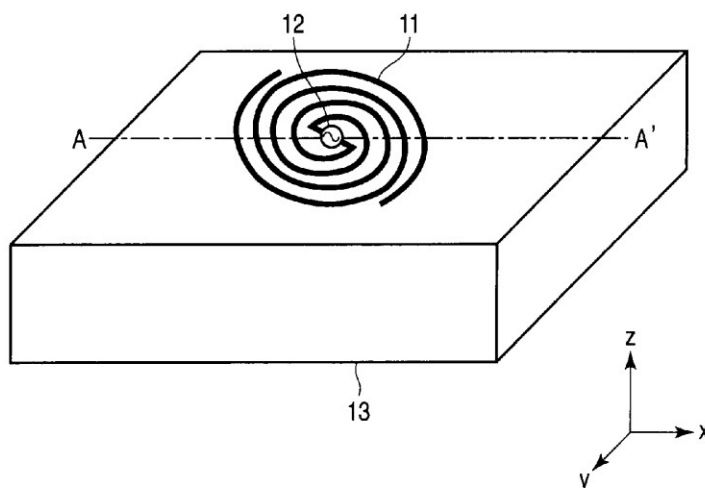
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Primary Examiner — Huedung Mancuso
(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

A spiral antenna includes an antenna element which is formed in a spiral pattern on a dielectric substrate, a cavity which is formed with a space provided between the antenna element, and a magnetic material which is arranged between the antenna element and the cavity. The cross-section of the spiral antenna is formed in a manner which the sum of a distance between the antenna element and the magnetic material and a thickness of the magnetic material increases from the center portion towards the outer circumference of the spiral.

6 Claims, 2 Drawing Sheets



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US008237623B2

(12) **United States Patent**
Hung

(10) **Patent No.:** **US 8,237,623 B2**

(45) **Date of Patent:** **Aug. 7, 2012**

(54) **HEADSET ANTENNA AND CONNECTOR
FOR THE SAME**

(75) Inventor: **Chung-Ting Hung**, Taoyuan County
(TW)

(73) Assignee: **HTC Corporation**, Taoyuan County
(TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 676 days.

(21) Appl. No.: **12/036,276**

(22) Filed: **Feb. 24, 2008**

(65) **Prior Publication Data**

US 2009/0033574 A1 Feb. 5, 2009

(30) **Foreign Application Priority Data**

Jul. 30, 2007 (TW) 96127761 A

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

(52) **U.S. Cl.** **343/906**; 343/718; 343/702; 343/860;
381/384

(58) **Field of Classification Search** 343/718,
343/720, 905, 906, 702, 787, 860; 381/384
See application file for complete search history.

(56) **References Cited**

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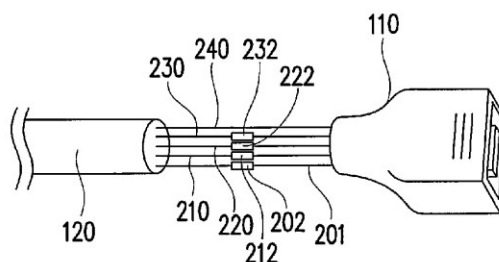
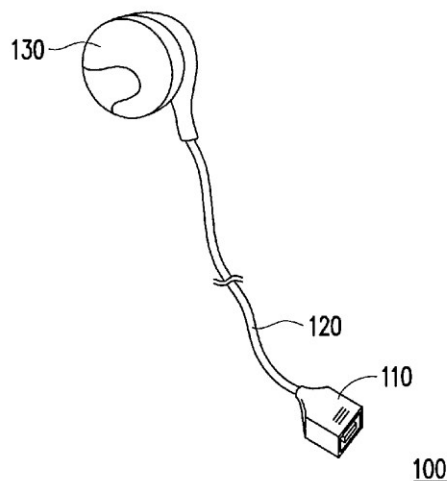
Primary Examiner — Dieu H Duong

(74) *Attorney, Agent, or Firm* — Jianq Chyun IP Office

(57) **ABSTRACT**

A headset antenna and a connector for the same are provided.
The headset antenna includes an audio signal line, an antenna
and a high impedance element in specified application fre-
quency ranges. The audio signal line is adapted for transmit-
ting an audio signal and the antenna is adapted for receiving
an RF signal. The high impedance element is disposed on a
transmission path of the audio signal and generates a high
impedance at a specified frequency band of the RF signal, so
that the audio signal line is equivalent to an open circuit and
the antenna obtains a better receiving capability.

12 Claims, 5 Drawing Sheets



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US008238842B2

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

(10) **Patent No.:** **US 8,238,842 B2**
(45) **Date of Patent:** **Aug. 7, 2012**

(54) **METHOD AND SYSTEM FOR AN ON-CHIP
AND/OR AN ON-PACKAGE
TRANSMIT/RECEIVE SWITCH AND
ANTENNA**

(75) Inventors: **Ahmadreza Rofougaran**, Newport
Coast, CA (US); **Maryam Rofougaran**,
Palos Verdes, CA (US)

(73) Assignee: **Broadcom Corporation**, Irvine, CA
(US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 612 days.

(21) Appl. No.: **12/397,024**

(22) Filed: **Mar. 3, 2009**

(65) **Prior Publication Data**

US 2010/0225557 A1 Sep. 9, 2010

(51) **Int. Cl.**
H04B 1/44 (2006.01)

(52) **U.S. Cl.** **455/78**; 343/860

(58) **Field of Classification Search** 343/850,
343/860; 455/78

See application file for complete search history.

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Primary Examiner — Lincoln Donovan

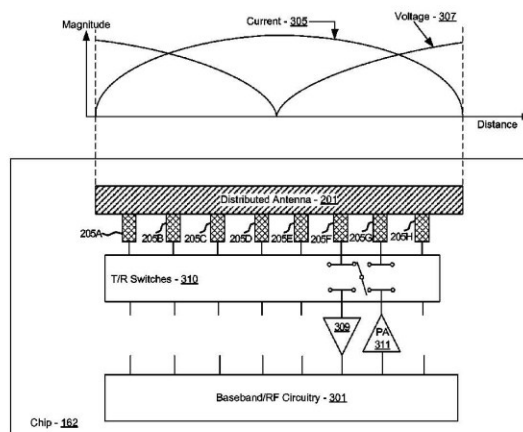
Assistant Examiner — William Hernandez

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

(57) **ABSTRACT**

Methods and systems for an on-chip and/or on-package T/R switch and antenna are disclosed and may include selectively coupling one or more low noise amplifiers (LNAs) and/or one or more power amplifiers (PAs) to one or more ports of a multi-port distributed antenna utilizing configurable transmit/receive (T/R) switches integrated on a chip with the LNAs and PAs. The LNAs and PAs may be impedance matched to the antenna by coupling them to a port based on a characteristic impedance at the port. The T/R switches may be integrated on a package to which the chip may be coupled. The signals transmitted and received by the antenna may be time division duplexed. The antenna, which may include a microstrip antenna, may be integrated on the chip or the package. The LNA and the PA may be coupled to different ports on the antenna via the T/R switches.

20 Claims, 5 Drawing Sheets





US008238987B2

(12) **United States Patent**
De Vos et al.

(10) **Patent No.:** **US 8,238,987 B2**

(45) **Date of Patent:** **Aug. 7, 2012**

(54) **RETRACTABLE ANTENNA STRUCTURE FOR
USE IN TELECOMMUNICATIONS DEVICE**

(75) Inventors: **Chris De Vos**, Wemmel (BE); **Thomas
Stevens**, Schaarbeek (BE); **Jan Wijnen**,
Hasselt (BE)

(73) Assignee: **Option**, Leuven (BE)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 837 days.

(21) Appl. No.: **11/816,673**

(22) PCT Filed: **Feb. 17, 2006**

(86) PCT No.: **PCT/EP2006/060080**

§ 371 (c)(1),

(2), (4) Date: **Nov. 18, 2008**

(87) PCT Pub. No.: **WO2006/087384**

PCT Pub. Date: **Aug. 24, 2006**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Feb. 18, 2005 (EP) 05447036.4

(51) **Int. Cl.**
H04M 1/00 (2006.01)

(52) **U.S. Cl.** **455/575.7**

(58) **Field of Classification Search** **455/575.7**
See application file for complete search history.

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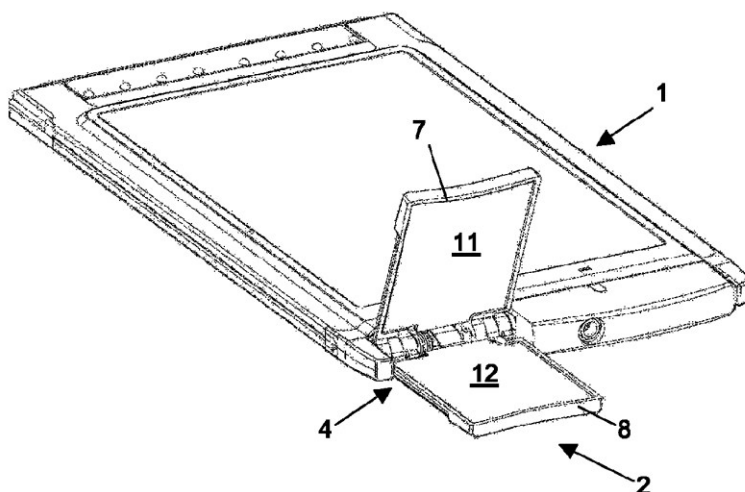
Primary Examiner — Nathan Mitchell

(74) *Attorney, Agent, or Firm* — Browdy and Neimark,
PLLC

(57) **ABSTRACT**

The invention relates to a retractable antenna structure for use in a telecommunications device. The antenna structure comprising a slide portion adapted for movably mounting the antenna structure in a cavity of a telecommunications device, such that the antenna structure is retractable into the cavity for storage and extensible from the cavity for operation, and an antenna portion carrying a flat radiation element for establishing at least one wireless network connection. The antenna portion comprises a first wing carrying a first part of the radiation element and a second wing carrying a second part of the radiation element. The wings are pivotally connected to each other between a storage position in which the wings lie on top of each other and an operational position in which the wings are spaced apart. The antenna portion further comprises at least one resilient member acting on at least one of the wings for spacing the wings apart. The invention further relates to a telecommunications device equipped with the antenna structure, such as a PCMCIA telecommunications card or a laptop computer.

17 Claims, 6 Drawing Sheets



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US008240562B2

(12) **United States Patent**
Washiro

(10) **Patent No.:** **US 8,240,562 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **COMMUNICATION APPARATUS,
COMMUNICATION METHOD, ANTENNA
MODULE AND COMMUNICATION SYSTEM**

(75) Inventor: **Takanori Washiro**, Kanagawa (JP)
(73) Assignee: **Sony Corporation**, Tokyo (JP)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 894 days.

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Primary Examiner — Kristy A Haupt

(74) *Attorney, Agent, or Firm* — Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.

(21) Appl. No.: **12/266,702**

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

(65) **Prior Publication Data**

US 2009/0121949 A1 May 14, 2009

(30) **Foreign Application Priority Data**

Nov. 9, 2007 (JP) P2007-292586

(51) **Int. Cl.**
G06K 5/00 (2006.01)

(52) **U.S. Cl.** **235/382**; 235/492

(58) **Field of Classification Search** 235/382,
235/492

See application file for complete search history.

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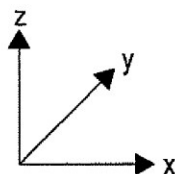
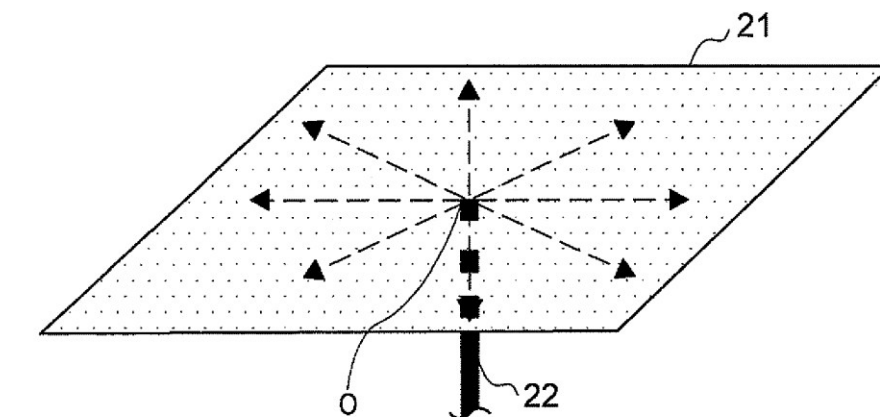
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(57) **ABSTRACT**

A communication apparatus has a first communication section which makes contactless communication by means of magnetic field coupling and a second communication section which makes contactless communication by means of electric field coupling, and the second communication section generates an electric field which oscillates to a direction approximately parallel with an oscillation direction of a magnetic field on a position where the magnetic field crosses the second communication section.

8 Claims, 12 Drawing Sheets



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US008240576B2

(12) **United States Patent**
Irwin, Jr.

(10) **Patent No.:** **US 8,240,576 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **CARD WITH A DETACHABLE WIRELESS ANTENNA-BASED PAYMENT DEVICE**

(75) Inventor: **Joseph L. Irwin, Jr.**, Charlotte, NC (US)

(73) Assignee: **Bank of America Corporation**,
Charlotte, NC (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.: **12/857,278**

(22) Filed: **Aug. 16, 2010**

(65) **Prior Publication Data**

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(51) **Int. Cl.**

G06K 19/06 (2006.01)

(52) **U.S. Cl.** **235/492; 235/488**

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

(56) **References Cited**

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Primary Examiner — Thien M. Le

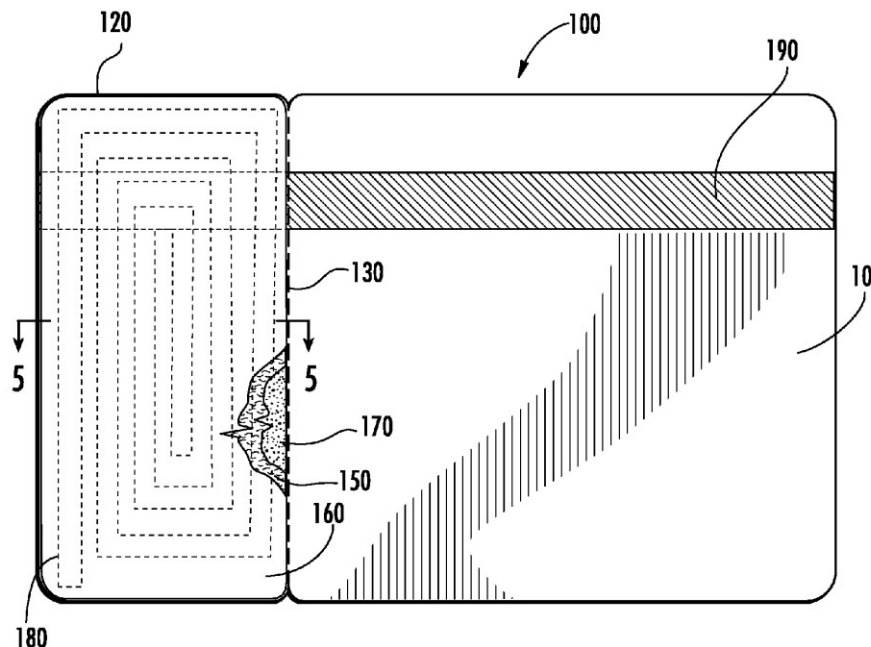
Assistant Examiner — Sonji Johnson

(74) *Attorney, Agent, or Firm* — Michael A. Springs; Moore & Van Allen PLLC; James C. Edwards

(57) **ABSTRACT**

Embodiments of the invention relate to for a card that includes a detachable wireless antenna-based payment device, such as a contactless Radio Frequency Identification (RFID) payment device or the like. The card is configured so as to alleviate or eliminate production problems associated with the adhesive-protecting backing being lifted or otherwise removed during handling of the card by the embossing equipment. In specific embodiments, the detachable wireless communication device is formed vertically along the width of the card, such that the detachment line extends along the width of the card. In such embodiments, by limiting the width of the wireless communication payment device to about one-third of the length of the card, the detachable wireless communication payment device is formed outside of the center region of the card, which is the region handled during the embossing procedure.

24 Claims, 6 Drawing Sheets



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US008242592B2

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

(10) **Patent No.:** **US 8,242,592 B2**

(45) **Date of Patent:** **Aug. 14, 2012**

(54) **IC CHIP, ANTENNA, AND MANUFACTURING METHOD OF THE IC CHIP AND THE ANTENNA**

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7,070,114 B2 7/2006 Cho
2005/0173541 A1* 8/2005 Inoue et al. 235/492

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(75) Inventors: **Naoto Kusumoto**, Isehara (JP); **Takuya Tsurume**, Tochigi (JP)

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JP 2001-217380 8/2001
JP 2002-352203 12/2002

(73) Assignee: **Semiconductor Energy Laboratory Co., Ltd.**, Atsugi-shi, Kanagawa-ken (JP)

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

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(21) Appl. No.: **13/053,241**

(22) Filed: **Mar. 22, 2011**

(65) **Prior Publication Data**

US 2011/0171776 A1 Jul. 14, 2011

Related U.S. Application Data

(62) Division of application No. 11/667,072, filed as application No. PCT/JP2005/020664 on Nov. 4, 2005, now Pat. No. 7,928,554.

Primary Examiner — Thao Le

Assistant Examiner — Matthew Gordon

(74) *Attorney, Agent, or Firm* — Eric J. Robinson; Robinson Intellectual Property Law Office, P.C.

(30) **Foreign Application Priority Data**

Nov. 9, 2004 (JP) 2004-324948

(51) **Int. Cl.**
H01L 23/48 (2006.01)

(52) **U.S. Cl.** 257/692; 257/E31.117; 438/110

(58) **Field of Classification Search** 257/692,
257/E31.117; 438/110

See application file for complete search history.

(56) **References Cited**

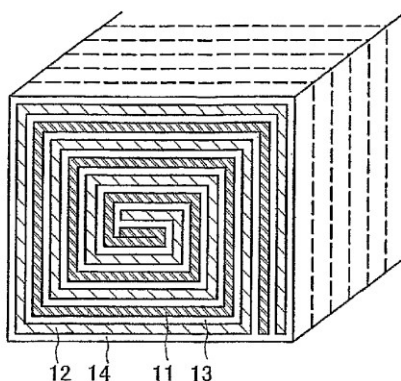
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(57) **ABSTRACT**

An antenna used for an ID chip or the like is disclosed with planarized antenna unevenness and an IC chip having such the antenna with a flat surface is disclosed. Manufacturing an integrated circuit mounted with an antenna is facilitated. A laminated body formed by stacking a conductive film 11, a resin film 13, an integrated circuit 12, and a resin film 14 are rolled so that the resin film 14 is outside. Then, the laminated body is integrated in a roll form by softening the resin films 13, 14 by applying heat. By slicing the rolled laminated body along with the direction in which the rolled conductive film 31 appears in the cross section, an IC chip with antenna formed by the rolled conductive film 11 is formed.

12 Claims, 13 Drawing Sheets



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US008242860B2

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

(10) **Patent No.:** **US 8,242,860 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **SEQUENTIAL ROTATED FEEDING CIRCUIT**

(56) **References Cited**

(75) Inventors: **Shih-Kai Lin**, Taipei (TW); **Yi-Cheng Lin**, Taipei (TW)

U.S. PATENT DOCUMENTS

(73) Assignee: **National Taiwan University**, Taipei (TW)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 499 days.

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Primary Examiner — Robert Pascal
Assistant Examiner — Kimberly Glenn

(21) Appl. No.: **12/574,639**

(57) **ABSTRACT**

(22) Filed: **Oct. 6, 2009**

A sequential rotated feeding circuit for sequential rotated feeding of a signal with a wavelength λ_g is provided. The sequential rotated feeding circuit comprises a feed transformer, a resistance transforming unit, a first antenna transformer, a second antenna transformer, a third antenna transformer and a fourth antenna transformer. The feed transformer has a feed line width resistance Z_{in} . The resistance transforming unit is connected to the feed transformer, the first antenna transformer, the second antenna transformer, the third antenna transformer and the fourth antenna transformer. The resistance transforming unit has a transforming line width resistance Z_p . The first antenna transformer, the second antenna transformer, the third antenna transformer and the fourth antenna transformer have an antenna line width resistance Z_a , and the feed line width resistance Z_{in} , the transforming line width resistance Z_p , and the antenna line width resistance Z_a satisfy the following formula:

(65) **Prior Publication Data**

US 2011/0001577 A1 Jan. 6, 2011

(30) **Foreign Application Priority Data**

Jul. 2, 2009 (TW) 98122372 A

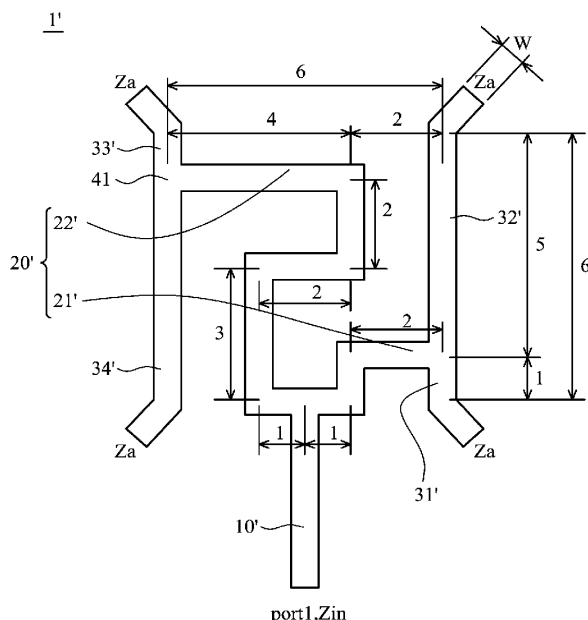
(51) **Int. Cl.**
H01P 5/12 (2006.01)

(52) **U.S. Cl.** 333/125; 333/127; 333/128; 333/33

(58) **Field of Classification Search** 333/125–129, 333/32, 334; 343/700 MS, 829
See application file for complete search history.

$$Z_p = \sqrt{Z_a Z_{in}}$$

12 Claims, 5 Drawing Sheets



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US008242962B2

(12) **United States Patent**
Chang

(10) **Patent No.:** **US 8,242,962 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **SUPPER-BROADBAND ANTENNA
STRUCTURE**

(75) Inventor: **Ching Wei Chang**, Pa-Te (TW)

(73) Assignee: **Auden Techno Corp.**, Pa-Te, Tao-Yuan
Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 316 days.

(21) Appl. No.: **12/782,136**

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

(65) **Prior Publication Data**

US 2011/0285594 A1 Nov. 24, 2011

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

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

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

See application file for complete search history.

(56) **References Cited**

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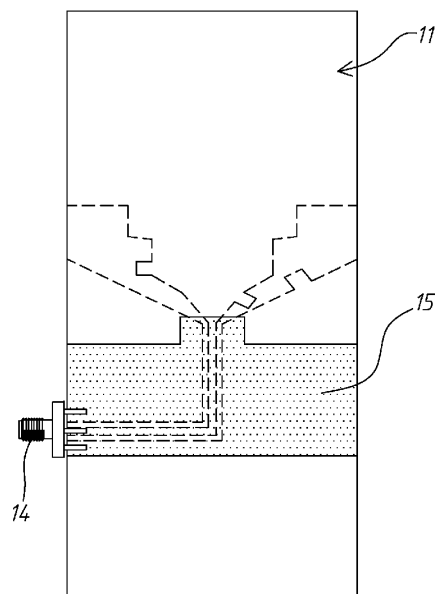
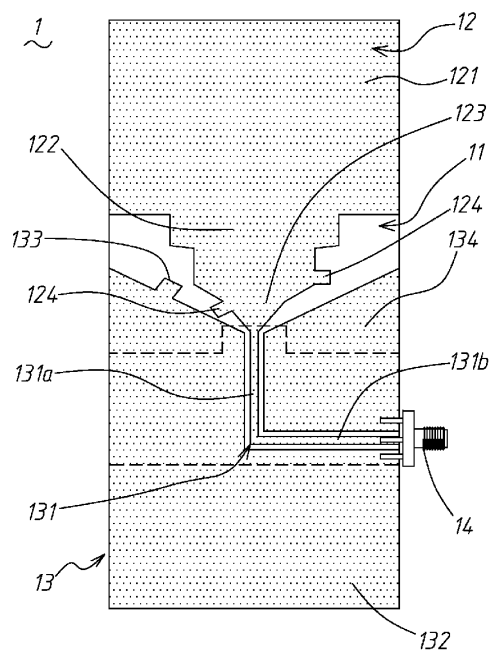
Primary Examiner — Tan Ho

(74) *Attorney, Agent, or Firm* — Guice Patents PLLC

(57) **ABSTRACT**

A supper-broadband antenna structure designed with a specific coplanar waveguide (CPW) mode to make its covering range of frequency be in a range of about 300 MHz~9 GHz., of which the covering range of frequency is in a range of 300 MHz~9 GHz having a rational efficiency of above 40% within the range of frequency band, and the return loss is better than the value -5 dB. The structure of a single supper-broadband antenna designed according to the present invention can be applied to many usages easily and accurately, e.g., for checking chamber stability, chamber to chamber verification etc.

5 Claims, 7 Drawing Sheets



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

- | | | | | | | |
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| | | 5,117,240 | A * | 5/1992 | Anderson et al. | 343/786 |
| (75) | Inventors: Michael Gerding , Bochum (DE);
Thomas Musch , Bochum (DE); Nils Pohl , Bochum (DE) | 6,353,417 | B1 * | 3/2002 | Yuanzhu | 343/785 |
| | | 6,661,389 | B2 * | 12/2003 | Griessbaum et al. | 343/786 |
| | | 6,859,187 | B2 | 2/2005 | Ohlsson | |
| | | 6,992,639 | B1 * | 1/2006 | Lier | 343/786 |
| | | 7,190,324 | B2 * | 3/2007 | Henderson | 343/909 |
| (73) | Assignee: KROHNE Messtechnik GmbH & Co. KG , Duisburg (DE) | 7,864,104 | B2 * | 1/2011 | Chen et al. | 342/124 |
| | | 2009/0212996 | A1 | 8/2009 | Chen et al. | |

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 480 days.

(21) Appl. No.: 12/426,374

(22) Filed: **Apr. 20, 2009**

(65) **Prior Publication Data**

US 2009/0262038 A1 Oct. 22, 2009

(30) **Foreign Application Priority Data**

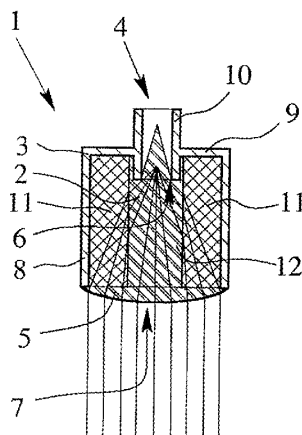
Apr. 21, 2008 (DE) 10 2008 020 036

- (51) **Int. Cl.**
H01Q 13/00 (2006.01)
H01Q 19/06 (2006.01)
- (52) **U.S. Cl.** 343/783; 343/785; 343/753
- (58) **Field of Classification Search** 343/783,
343/785, 786, 911 R, 753, 907-910; 342/124
See application file for complete search history.

(56) **References Cited**

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18 Claims, 4 Drawing Sheets



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US008242966B2

(12) **United States Patent**
Liu

(10) **Patent No.:** **US 8,242,966 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **ANTENNA ARRAY**

(75) Inventor: **Ming-Yen Liu**, Taipei (TW)

(73) Assignee: **ASUSTek Computer Inc.**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 551 days.

(21) Appl. No.: **12/408,655**

(22) Filed: **Mar. 20, 2009**

(65) **Prior Publication Data**

US 2009/0284430 A1 Nov. 19, 2009

(30) **Foreign Application Priority Data**

May 16, 2008 (TW) 97118074 A

(51) **Int. Cl.**
H01Q 21/26 (2006.01)

(52) **U.S. Cl.** **343/797; 343/795**

(58) **Field of Classification Search** 343/700 MS,
343/795, 797, 805, 810, 821, 848, 852, 860
See application file for complete search history.

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Primary Examiner — Jacob Y Choi

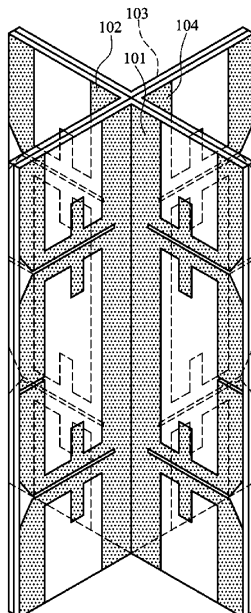
Assistant Examiner — Kyana R McCain

(57) **ABSTRACT**

An antenna array is provided. The antenna comprises a first antenna unit, a second antenna unit, a third antenna unit and a fourth antenna unit. The first antenna unit, the second antenna unit, the third antenna unit and the fourth antenna unit have L-shaped cross-sections. The second antenna unit is close to the first antenna unit. The third antenna unit is close to the second antenna unit. The fourth antenna unit is close to the third antenna unit and the first antenna unit. The fourth antenna unit is opposite to the second antenna unit. The third antenna unit is opposite to the first antenna unit.

7 Claims, 7 Drawing Sheets

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(10) **Patent No.:** US 8,242,968 B2
(45) **Date of Patent:** Aug. 14, 2012

(56) **References Cited**

US 2010/0117925 A1 May 13, 2010

See application file for complete search history.

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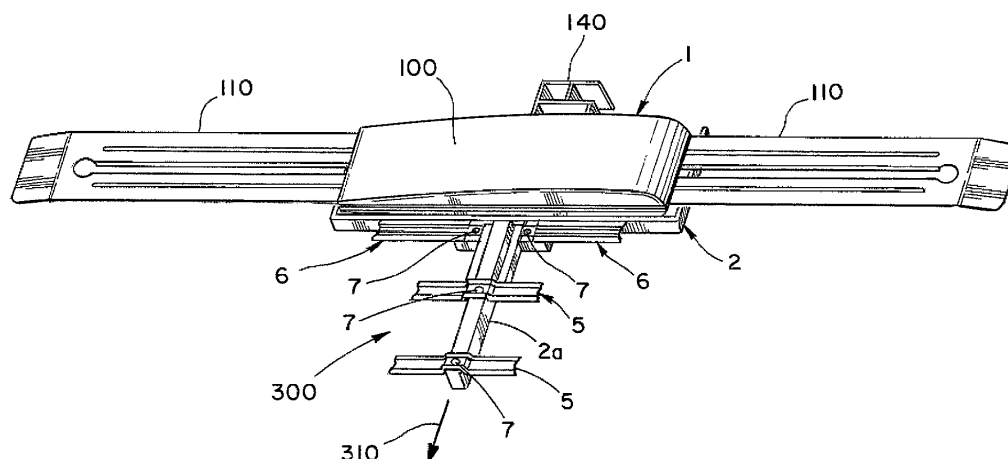
Primary Examiner — Tan Ho

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

(57) **ABSTRACT**

A mobile television antenna having an antenna element outwardly extending from opposing ends of a housing. An UHF digital booster extends perpendicularly from one side of the housing between the opposing ends carrying the antenna element. At least one UHF parasitic antenna element is connected on a boom which is integrally connected to the mobile television antenna housing. The ultra high frequency parasitic antenna element is held in a plane near the plane in which the antenna element is held by the housing.

17 Claims, 12 Drawing Sheets



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US008242970B2

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

(10) **Patent No.:** **US 8,242,970 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **ANTENNA APPARATUS**

(75) Inventors: **Shinji Fukui**, Okazaki (JP); **Mitsuru Fujita**, Toyohashi (JP)

(73) Assignees: **Denso Corporation**, Kariya (JP);
Nippon Soken, Inc., Nishio (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 416 days.

(21) Appl. No.: **12/462,415**

(22) Filed: **Aug. 4, 2009**

(65) **Prior Publication Data**

US 2010/0045536 A1 Feb. 25, 2010

(30) **Foreign Application Priority Data**

Aug. 20, 2008 (JP) 2008-211951

(51) **Int. Cl.**

H01Q 15/02 (2006.01)

H01Q 9/38 (2006.01)

H01Q 1/38 (2006.01)

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

(58) **Field of Classification Search** 343/700 MS,
343/702, 846, 909, 829

See application file for complete search history.

(56) **References Cited**

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Sievenpiper et al., "Two-Dimensional Beam Steering Using an Electrically Tunable Impedance Surface", IEEE Transactions on Antennas and Propagation, vol. 51, No. 10, Oct. 2003.

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Primary Examiner — Jacob Y Choi

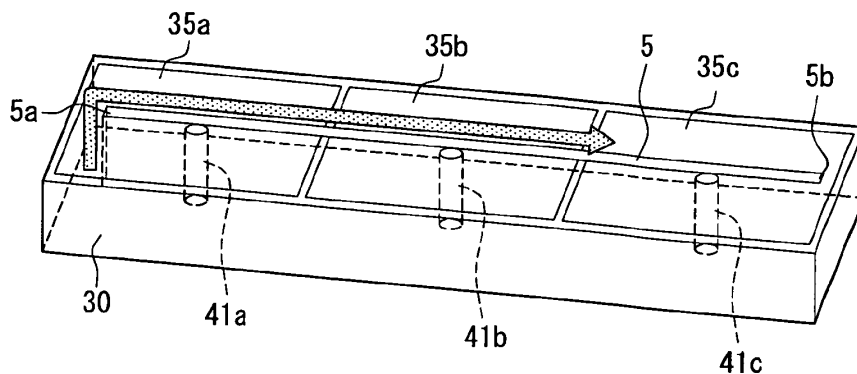
Assistant Examiner — Hasan Islam

(74) *Attorney, Agent, or Firm* — Harness, Dickey & Pierce, PLC

(57) **ABSTRACT**

An antenna apparatus is disclosed. The antenna apparatus includes a board and a line antenna. The board includes: a base part having dielectric layers and a conductive layer disposed between the dielectric layers; multiple metal plates arranged on one surface of the base part while being spaced apart at even intervals so as to provide a band-gap surface; and a connection part via which the conductive layer is electrically connectable with the multiple metal plates. The line antenna is located on a band-gap surface side of the board, is arranged along the band gap surface, and is configured to receive and transmit the electromagnetic wave within an operating frequency band. The connection part includes a first adjustment circuit that is configured to individually adjust an impedance between the conductive layer and each of the plurality of metal plates.

8 Claims, 5 Drawing Sheets



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US008244321B2

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

(10) **Patent No.:** **US 8,244,321 B2**
(45) **Date of Patent:** **Aug. 14, 2012**

(54) **CASING FOR A PORTABLE TERMINAL**

(56) **References Cited**

(75) Inventors: **Ki-Hoon Kim**, Seoul (KR); **Han-Seok Chae**, Seoul (KR)

U.S. PATENT DOCUMENTS

(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 206 days.

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(21) Appl. No.: **12/699,454**

Primary Examiner — April G Gonzales

(22) Filed: **Feb. 3, 2010**

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

(65) **Prior Publication Data**

US 2011/0021255 A1 Jan. 27, 2011

(30) **Foreign Application Priority Data**

Jul. 21, 2009 (KR) 10-2009-0066530

(57) **ABSTRACT**

(51) **Int. Cl.**
H04M 1/00 (2006.01)

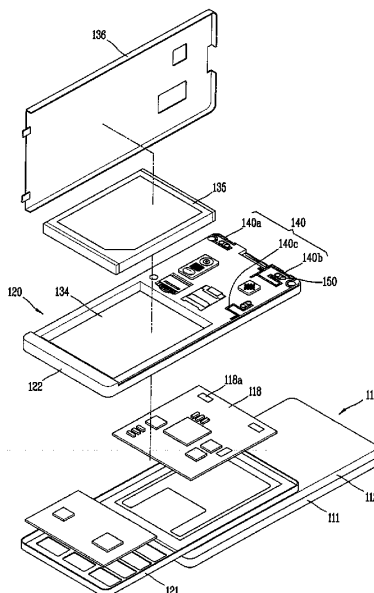
A mobile communication terminal comprises a case having internal and external surfaces. The mobile communication device further comprises a first layer formed over the external surface of the case, the first layer comprising conductors for allowing plating on the outer surface of the case; a second layer formed over the first layer, the second layer comprising an antenna pattern for transmitting and receiving radio signals corresponding to one or more frequency bands; a third layer formed over the second layer to protect the case; a circuit board configured to process signals conformable to the radio signals, wherein the circuit board is disposed within an inner surface of the case; and a connection unit formed through the case and configured to electrically connect the second layer to the circuit board.

(52) **U.S. Cl.** **455/575.5**; 455/575.1; 455/575.4; 455/566; 455/562.1; 455/575.7; 455/90.3; 361/720

(58) **Field of Classification Search** 455/575.1, 455/575.4, 566, 562.1, 575.5, 575.7, 90.3; 361/720

See application file for complete search history.

17 Claims, 11 Drawing Sheets



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US008248307B2

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

(10) **Patent No.:** **US 8,248,307 B2**

(45) **Date of Patent:** **Aug. 21, 2012**

(54) **PLANAR ANTENNA AND
ELECTROMAGNETIC BAND GAP
STRUCTURE THEREOF**

(58) **Field of Classification Search** 343/700 MS,
343/749, 909, 793
See application file for complete search history.

(75) Inventors: **Shyh-Jong Chung**, Hsinchu County
(TW); **Ching-Wei Ling**, Tainan County
(TW); **Tzu-Hsien Yang**, Taipei (TW)

(56) **References Cited**

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* cited by examiner

(73) Assignee: **National Chiao Tung University**,
Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 400 days.

Primary Examiner — Dieu H Duong

(74) *Attorney, Agent, or Firm* — CKC & Partners Co., Ltd.

(21) Appl. No.: **12/628,182**

(22) Filed: **Nov. 30, 2009**

(65) **Prior Publication Data**

US 2011/0057851 A1 Mar. 10, 2011

(30) **Foreign Application Priority Data**

Sep. 8, 2009 (TW) 98130267 A

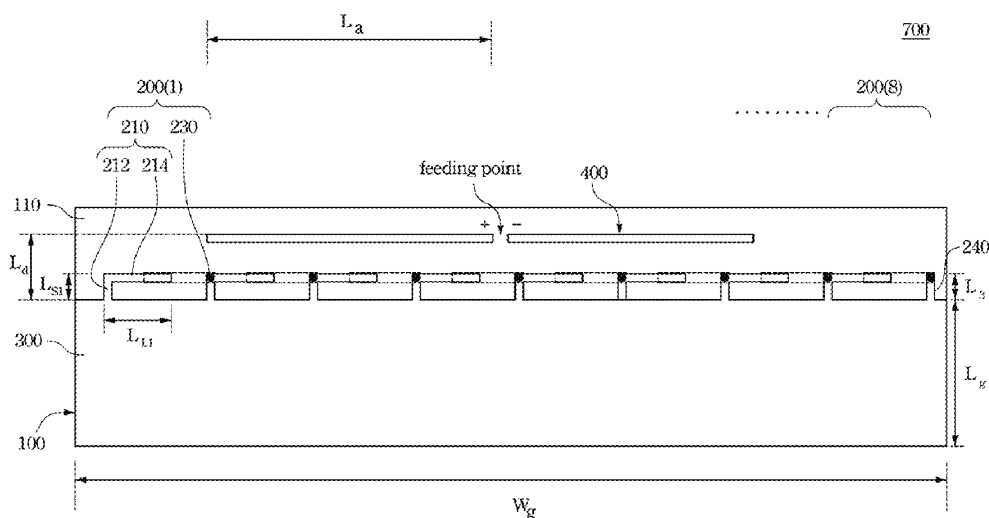
(51) **Int. Cl.**
H01Q 1/38 (2006.01)

(52) **U.S. Cl.** **343/700 MS; 343/749; 343/909;**
343/793

(57) **ABSTRACT**

An electromagnetic band-gap structure includes a circuit board, a ground plane and a plurality of electromagnetic band-gap units. The circuit board includes a first side and a second surface, and the ground plane disposed on the first side. The plurality of electromagnetic band-gap units are located on both the first surface and the second surface and connected to each other along an edge of the ground plane. Every electromagnetic band-gap unit includes a first strip line, a second strip line and a via. The first strip line is located on the first side, including a first relative long strip line and a first relative short strip line connected to the ground. The second strip line is located on the second side. The second strip line is connected to the first strip line of the adjacent electromagnetic band-gap unit through the via.

20 Claims, 9 Drawing Sheets



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

- (54) **OUTER COVER FOR COMMUNICATION
DEVICE AND METHOD FOR FABRICATING
THE SAME**

- (75) Inventors: **Chien-Ming Hung**, Taipei (TW);
Shen-Yuan Lee, Taipei (TW)

- (73) Assignee: **Asustek Computer Inc.**, Taipei (TW)

- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 321 days.

- (21) Appl. No.: 12/432,368

- (22) Filed: **Apr. 29, 2009**

- (65) **Prior Publication Data**

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- (30) **Foreign Application Priority Data**

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- (58) **Field of Classification Search** 343/702.





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

(10) **Patent No.:** **US 8,248,312 B2**

(45) **Date of Patent:** **Aug. 21, 2012**

(54) **ANTENNA AND WIRELESS
COMMUNICATION APPARATUS**

(75) Inventors: **Ning Guan**, Chiba (JP); **Koichi Ito**,
Chiba (JP)

(73) Assignees: **Fujikura Ltd.**, Tokyo (JP); **Chiba
University**, Chiba-shi, Chiba (JP)

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

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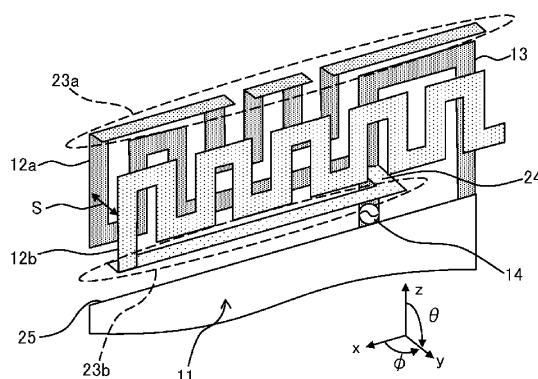
Primary Examiner — Hoang V Nguyen

(74) *Attorney, Agent, or Firm* — Westerman, Hattori,
Daniels & Adrian, LLP

(57) **ABSTRACT**

The present invention provides an antenna that is small in size
and has band frequencies corresponding to multibands, and a
wireless communication apparatus including the antenna.
The antenna according to the present invention has two radiation
elements **12a** and **12b** connected to a ground plate **11** via
a shorting pin. The two radiation elements **12a** and **12b** each
have a lower arm and an upper arm that are formed through
bending. The lower arm is connected to the shorting pin and
is located closer to the ground plate **11** than the upper arm is.
At least one of the lower arm and the upper arm has a meandered
structure.

8 Claims, 20 Drawing Sheets



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(12) **United States Patent**
Ash, Jr. et al.

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(45) **Date of Patent:** **Aug. 21, 2012**

(54) **INDUCTIVELY COUPLED SIGNAL BOOSTER
FOR A WIRELESS COMMUNICATION
DEVICE AND IN COMBINATION
THEREWITH**

(76) Inventors: **Daniel R. Ash, Jr.**, Laguna Niguel, CA
(US); **Daniel R. Ash, Sr.**, Drain, OR
(US)

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patent is extended or adjusted under 35
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(65) **Prior Publication Data**

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Related U.S. Application Data

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(52) **U.S. Cl.** **343/702; 455/571; 343/718**

(58) **Field of Classification Search** 455/571,
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See application file for complete search history.

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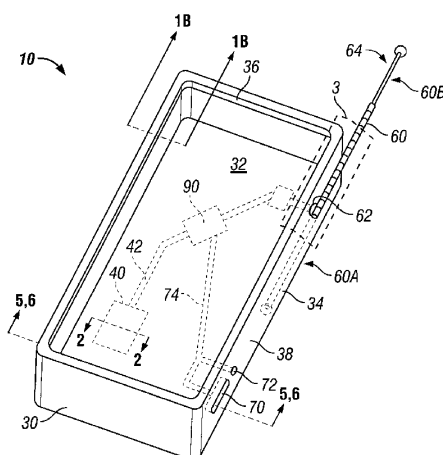
Primary Examiner — Sonny Trinh

(74) *Attorney, Agent, or Firm* — Gene Scott; Patent Law &
Venture Group

(57) **ABSTRACT**

A passively re-radiating cell phone sleeve assembly capable of conforming to and nesting with a cell phone provides a partial enclosure capable of fitting over at least a portion of the cell phone. A multi-layer radio frequency (RF) coupling probe is fully embedded within the enclosure in a position that is in close proximity to an internal antenna of the cell phone when the enclosure is nested with the cell phone. A coupling probe is inductively coupled to the internal antenna for sharing RF signals and is desensitized from de-tuning the internal antenna of the cell phone. An external antenna is mounted on the enclosure; and a transmission line embedded within the enclosure joins the coupling probe and the external antenna for RF signal transfer. RF transmission signals of the cell phone are radiated from both the internal and the external antennae simultaneously and without mutual interference.

12 Claims, 3 Drawing Sheets



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