

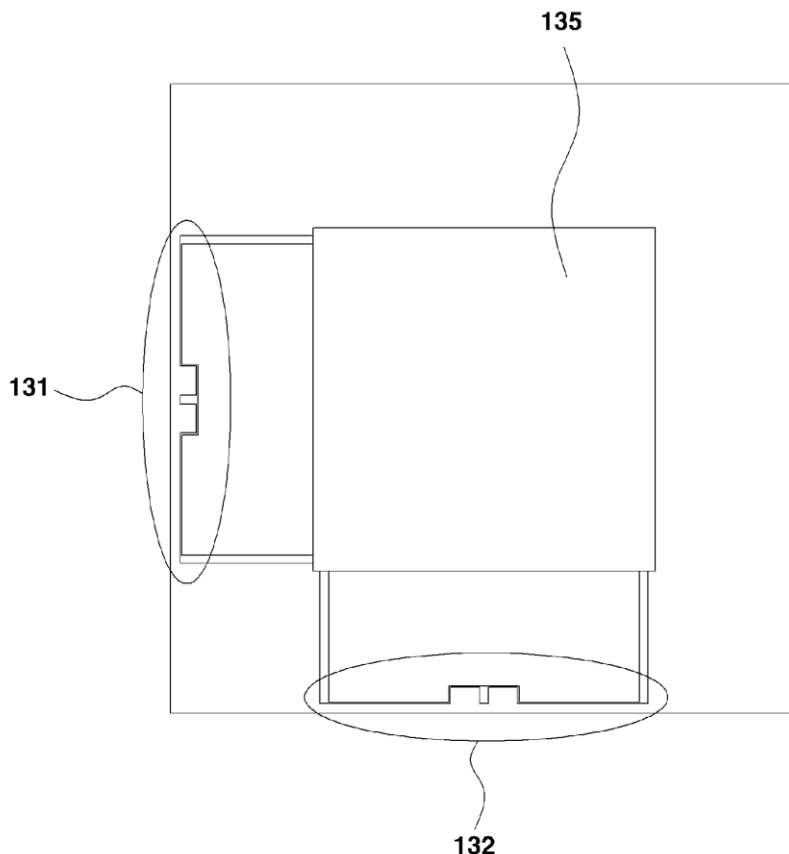


US 20140176369A1

(19) **United States**(12) **Patent Application Publication**
CHOI et al.(10) **Pub. No.: US 2014/0176369 A1**(43) **Pub. Date: Jun. 26, 2014**(54) **PATCH ANTENNA HAVING A PATCH FED WITH MULTIPLE SIGNAL****Publication Classification**(71) Applicant: **KOREA ELECTRONICS TECHNOLOGY INSTITUTE, (US)**(51) **Int. Cl.**
H01Q 1/50 (2006.01)(72) Inventors: **Se Hwan CHOI, Seongnam-si (KR);**
Jae Young LEE, Suwon-si (KR)(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/700 MS**(73) Assignee: **KOREA ELECTRONICS TECHNOLOGY INSTITUTE,**
Seongnam-si (KR)(57) **ABSTRACT**(21) Appl. No.: **13/886,316**(22) Filed: **May 3, 2013**(30) **Foreign Application Priority Data**

Dec. 26, 2012 (KR) 1020120153117

A patch antenna having a single patch fed with multiple signals is provided. The patch antenna includes: a first patch; a first feeder and a second feeder which are connected to the first patch; and a second patch which is parallel to the first patch. Accordingly, since multiple signals can be fed into a single patch, a MIMO antenna can be embodied by using a patch antenna which has high isolation between feeders without increasing its size.

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US 20140176370A1

(19) **United States**

(12) **Patent Application Publication**

LEE et al.

(10) **Pub. No.: US 2014/0176370 A1**

(43) **Pub. Date: Jun. 26, 2014**

(54) **ANTENNA, ELECTRONIC APPARATUS WITH THE SAME, AND ANTENNA MANUFACTURING METHOD**

(71) Applicant: **Samsung Electronics Co., Ltd.**, Suwon-si (KR)

(72) Inventors: **In-young LEE**, Hwaseong-si (KR);
Chee-hwan YANG, Yongin-si (KR);
Tae-young KIM, Suwon-si (KR);
Sang-hoon CHOI, Suwon-si (KR)

(21) Appl. No.: **13/906,820**

(22) Filed: **May 31, 2013**

(30) **Foreign Application Priority Data**

Dec. 24, 2012 (KR) 10-2012-0152406

Publication Classification

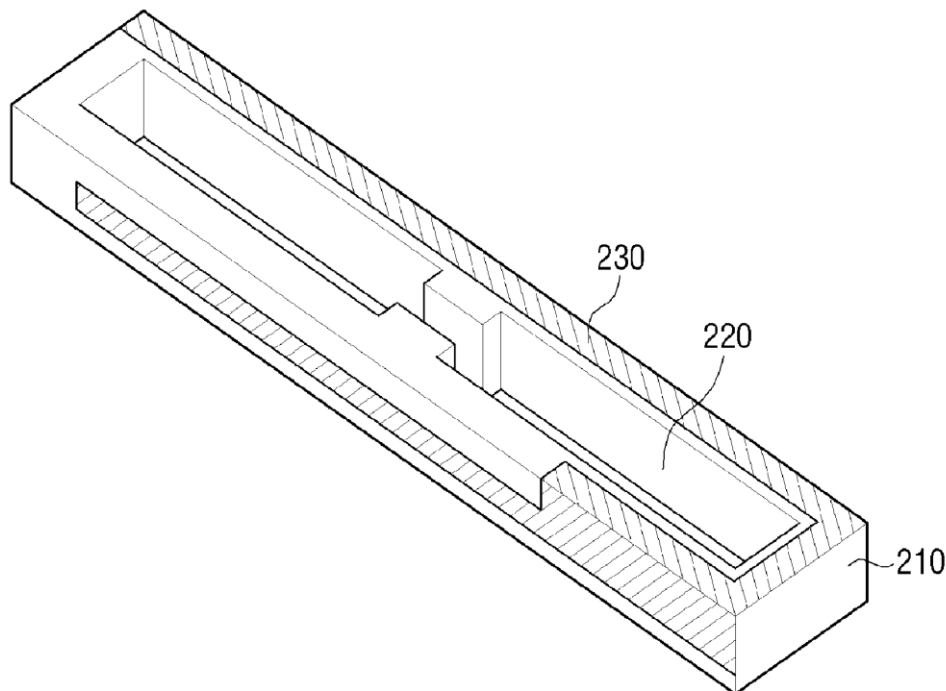
(51) **Int. Cl.**
H01Q 1/38 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 1/38** (2013.01)
USPC **343/700 MS; 29/600**

(57) **ABSTRACT**

An antenna includes a sintered body block with a predetermined magnetic permeability or a predetermined dielectric constant, the sintered body block having at least one air cavity; and an antenna pattern formed on a surface of the sintered body block.

200

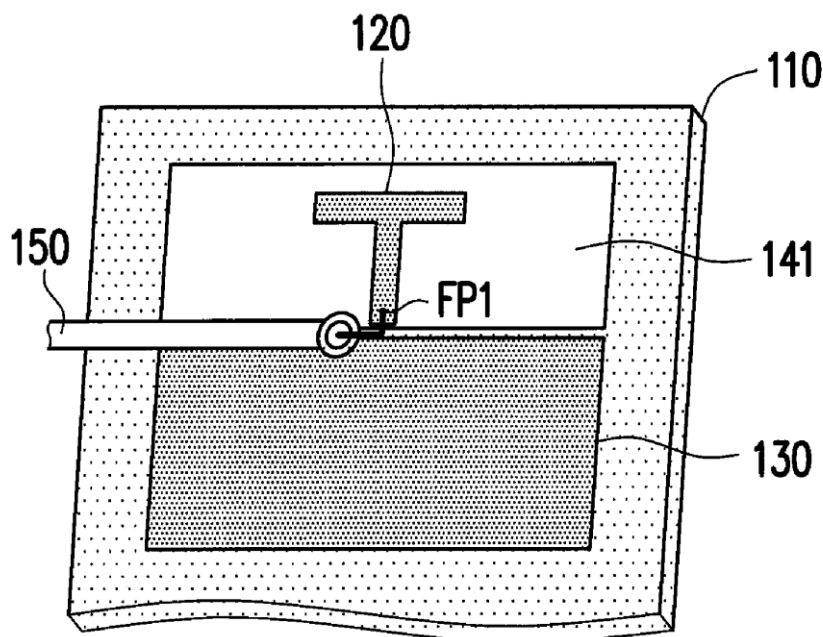




US 20140176378A1

(19) **United States**(12) **Patent Application Publication****Yu et al.**(10) **Pub. No.: US 2014/0176378 A1**(43) **Pub. Date: Jun. 26, 2014**(54) **MULTI-BAND ANTENNA****Publication Classification**(71) Applicants: **Yen-Hao Yu**, Taipei City (TW);
Chieh-Tsao Hwang, Taipei City (TW);
Shih-Chia Liu, Taipei City (TW)(51) **Int. Cl.**
H01Q 5/00 (2006.01)
H01Q 13/10 (2006.01)(72) Inventors: **Yen-Hao Yu**, Taipei City (TW);
Chieh-Tsao Hwang, Taipei City (TW);
Shih-Chia Liu, Taipei City (TW)(52) **U.S. Cl.**
CPC **H01Q 5/001** (2013.01); **H01Q 13/10** (2013.01)
USPC **343/767**(73) Assignee: **COMPAL ELECTRONICS, INC.**,
Taipei City (TW)(57) **ABSTRACT**(21) Appl. No.: **14/074,649**(22) Filed: **Nov. 7, 2013****Related U.S. Application Data**(60) Provisional application No. 61/745,806, filed on Dec.
25, 2012.

A multi-band antenna including a metal plate and a radiation element is provided. The metal plate is electrically connected to a ground plane and has a slot. A resonant path is formed by the edges of the slot. The radiation element has a feeding point and is located in the slot of the metal plate. A feeding signal from the radiation element is coupled to the metal plate, and the multi-band antenna excites a resonant mode by the resonant path of the metal plate, so as to receive or transmit a first radio frequency signal.





US 20140176391A1

(19) **United States**(12) **Patent Application Publication****Tayama et al.**(10) **Pub. No.: US 2014/0176391 A1**(43) **Pub. Date: Jun. 26, 2014**(54) **ANTENNA DEVICE AND ANTENNA MOUNTING METHOD**(71) Applicant: **Fujikura Ltd.**, Tokyo (JP)(72) Inventors: **Hiroiku Tayama**, Sakura-shi (JP); **Ning Guan**, Sakura-shi (JP)(73) Assignee: **FUJIKURA LTD.**, Tokyo (JP)(21) Appl. No.: **14/170,697**(22) Filed: **Feb. 3, 2014****Related U.S. Application Data**

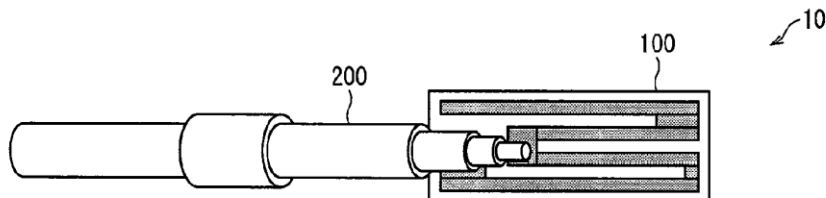
(63) Continuation of application No. PCT/JP2012/071354, filed on Aug. 23, 2012.

(30) **Foreign Application Priority Data**

Sep. 26, 2011 (JP) 2011-209639

Publication Classification(51) **Int. Cl.**
H01Q 1/50 (2006.01)(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/905; 29/601**(57) **ABSTRACT**

An antenna device (10) includes: an antenna (100) including a radiating element (101) and an internal ground (103); a coaxial cable (200) whose internal conductor (204) is connected with the radiating element (101) and whose external conductor (203) is connected with the internal ground (103); and an external ground (500) capacitively-coupled with the external conductor (203) of the coaxial cable (200).





US 20140179239A1

(19) **United States**(12) **Patent Application Publication****Nickel et al.**(10) **Pub. No.: US 2014/0179239 A1**(43) **Pub. Date: Jun. 26, 2014**

(54) **METHODS AND APPARATUS FOR
PERFORMING PASSIVE ANTENNA TESTING
WITH ACTIVE ANTENNA TUNING DEVICE
CONTROL**

Publication Classification

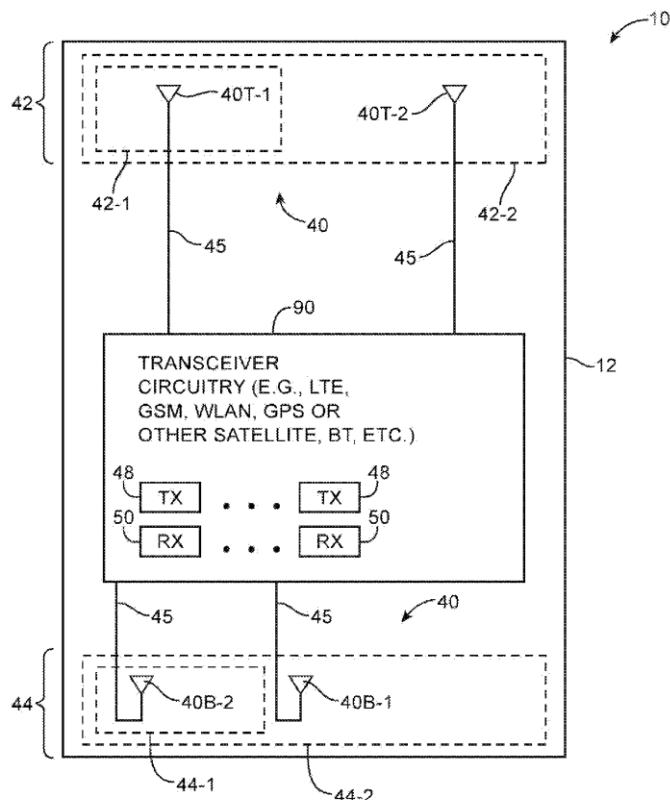
(51) **Int. Cl.**
H04W 24/00 (2006.01)
(52) **U.S. Cl.**
CPC *H04W 24/00* (2013.01)
USPC *455/67.14; 455/67.11*

(71) Applicant: **APPLE INC.**, Cupertino, CA (US)

(72) Inventors: **Joshua G. Nickel**, San Jose, CA (US);
Jr-Yi Shen, Sunnyvale, CA (US);
Anand Lakshmanan, Sunnyvale, CA
(US); **Jayesh Nath**, Milpitas, CA (US);
Matthew A. Mow, Los Altos, CA (US);
Mattia Pascolini, Campbell, CA (US);
Vishwanath Venkataraman,
Pleasanton, CA (US); **Peter Bevelacqua**,
San Jose, CA (US); **Xin Cui**, San
Ramon, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)(21) Appl. No.: **13/725,769**(22) Filed: **Dec. 21, 2012**(57) **ABSTRACT**

A wireless electronic device may contain at least one adjustable antenna tuning element for use in tuning the operating frequency range of the device. The antenna tuning element may include radio-frequency switches, continuously/semi-continuously adjustable components such as tunable resistors, inductors, and capacitors, and other load circuits that provide desired impedance characteristics. A test system that is used for performing passive radio-frequency (RF) testing on antenna tuning elements in partially assembled devices is provided. The test system may include an RF tester and a test host. The tester may be used to gather scattering parameter measurements from the antenna tuning element. The test host may be used to ensure that power and appropriate control signals are being supplied to the antenna tuning element so that the antenna tuning element is placed in desired tuning states during testing.





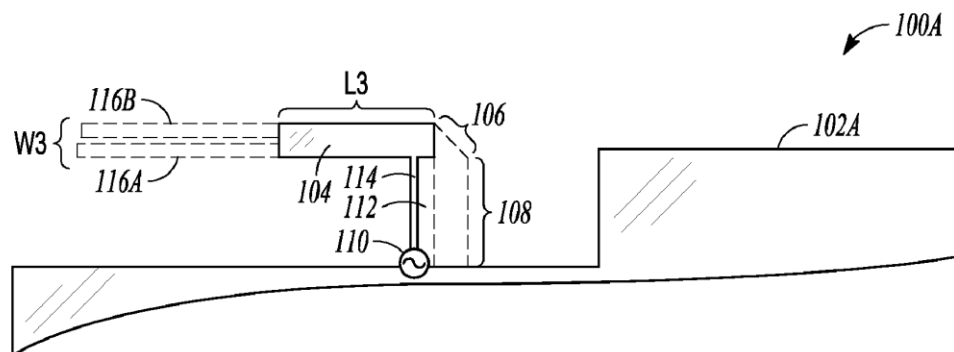
US 20140184448A1

(19) **United States**(12) **Patent Application Publication**
Ridgeway(10) **Pub. No.: US 2014/0184448 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **RESONANT EMBEDDED ANTENNA**(71) Applicant: **Robert Wayne Ridgeway**, Saratoga
Springs, UT (US)(72) Inventor: **Robert Wayne Ridgeway**, Saratoga
Springs, UT (US)(21) Appl. No.: **13/733,469**(22) Filed: **Jan. 3, 2013****Publication Classification**(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01P 11/00 (2006.01)(52) **U.S. Cl.**CPC . **H01Q 1/38** (2013.01); **H01P 11/00** (2013.01)
USPC **343/700 MS**; 29/600

(57)

ABSTRACT

A planar antenna, such as included as a portion of a printed circuit board assembly, can include a first conductive layer comprising a feed conductor and a patch. The planar antenna can include a second conductive layer comprising a reference conductor, a first arm defined by a first arm length and a first arm width, and a second arm located parallel to the first arm and defined by a second arm length and a second arm width. The first and second arms can be respectively coupled to the reference conductor, and at least a portion of the first arm and at least a portion of the second arm can overlap with a footprint of the patch projected vertically from a plane of the first conductive layer onto a plane of the second conductive layer.





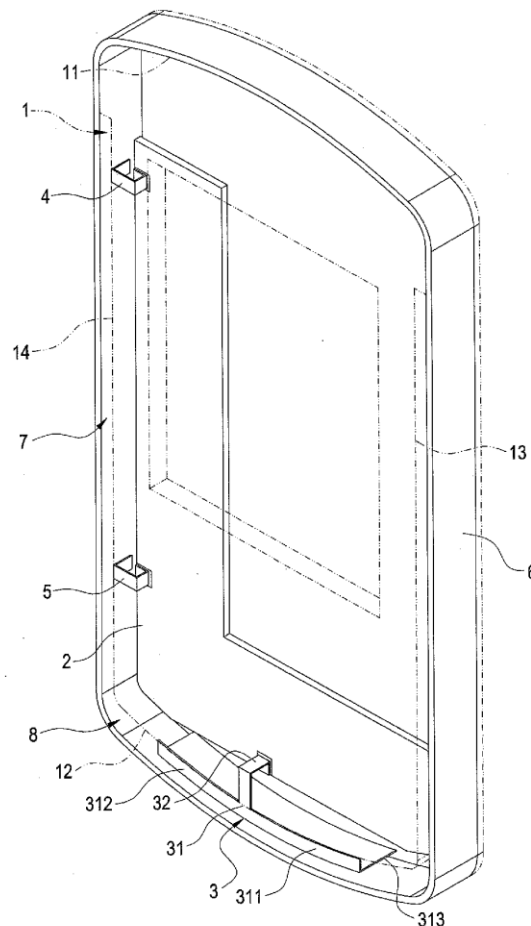
US 20140184449A1

(19) **United States**(12) **Patent Application Publication**
DONG et al.(10) **Pub. No.: US 2014/0184449 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **ANTENNA STRUCTURE FOR USING WITH A
METAL FRAME OF A MOBILE PHONE**(71) Applicant: **AUDEN TECHNO. CORP**, Pa-Te City
(TW)(72) Inventors: **Chao DONG**, Pa-Te City (TW); **Bo
ZHOU**, Pa-Te City, (TW); **Chia-Lun
TANG**, Pa-Te City (TW)(73) Assignee: **AUDEN TECHNO.CORP**, Pa-Te City
(TW)(21) Appl. No.: **13/728,587**(22) Filed: **Dec. 27, 2012****Publication Classification**(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 5/00 (2006.01)(52) **U.S. Cl.**CPC **H01Q 13/106** (2013.01); **H01Q 5/001**
(2013.01); **H01Q 5/0003** (2013.01)USPC **343/702**

(57)

ABSTRACT

An antenna structure includes a carrier body, a circuit board, a metal coupling sheet, a first grounding part, a second grounding part, and a metal frame. A first slot and a second slot are between the metal frame and the carrier body after the parts mentioned above are assembled. The metal coupling sheet, the first grounding part, and the first slot form a first communication path. The first communication path forms a low-frequency resonance and a high-frequency resonance as well, so that the antenna structure is applied to a four bands GSM850/900/1800/1900. The metal coupling sheet, the second grounding part, and the second slot form a second communication path. The second communication path forms the WCDMA2100 resonance, so that the antenna structure is applied to a five bands 850/900/1800/1900/2100.





US 20140184450A1

(19) **United States**

(12) **Patent Application Publication**

KOO et al.

(10) **Pub. No.: US 2014/0184450 A1**

(43) **Pub. Date: Jul. 3, 2014**

(54) **SLOT ANTENNA AND INFORMATION
TERMINAL APPARATUS USING THE SAME**

(71) Applicants: **Korea Advanced Institute of Science
and Technology**, Daejeon (KR); **LG
Display Co., Ltd.**, Seoul (KR)

(72) Inventors: **Hyungjoon KOO**, Seoul (KR); **Heejung
HONG**, Seoul (KR); **Sooji LEE**, Daegu
(KR); **Kyoungsub OH**, Gyeonggi-do
(KR); **Jongwon YU**, Daejeon (KR)

(73) Assignees: **Korea Advanced Institute of Science
and Technology**, Daejeon (KR); **LG
Display Co., Ltd.**, Seoul (KR)

(21) Appl. No.: **14/136,571**

(22) Filed: **Dec. 20, 2013**

(30) **Foreign Application Priority Data**

Dec. 28, 2012 (KR) 10-2012-0157534

Publication Classification

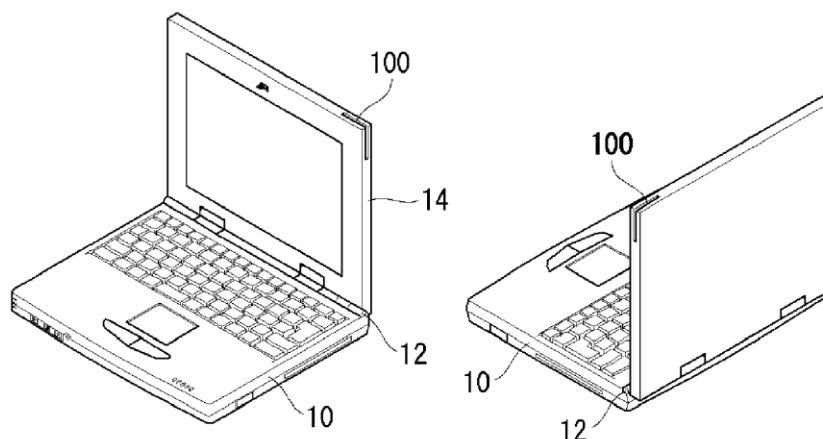
(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 1/22 (2006.01)

(52) **U.S. Cl.**
CPC **H01Q 13/10** (2013.01); **H01Q 1/2266**
(2013.01)

USPC **343/702**; 343/767; 343/770

(57) **ABSTRACT**

A slot antenna and an information terminal apparatus using the same are provided. The slot antenna comprises: a conductive housing; and at least one slot formed on the corner and edge of the conductive housing.



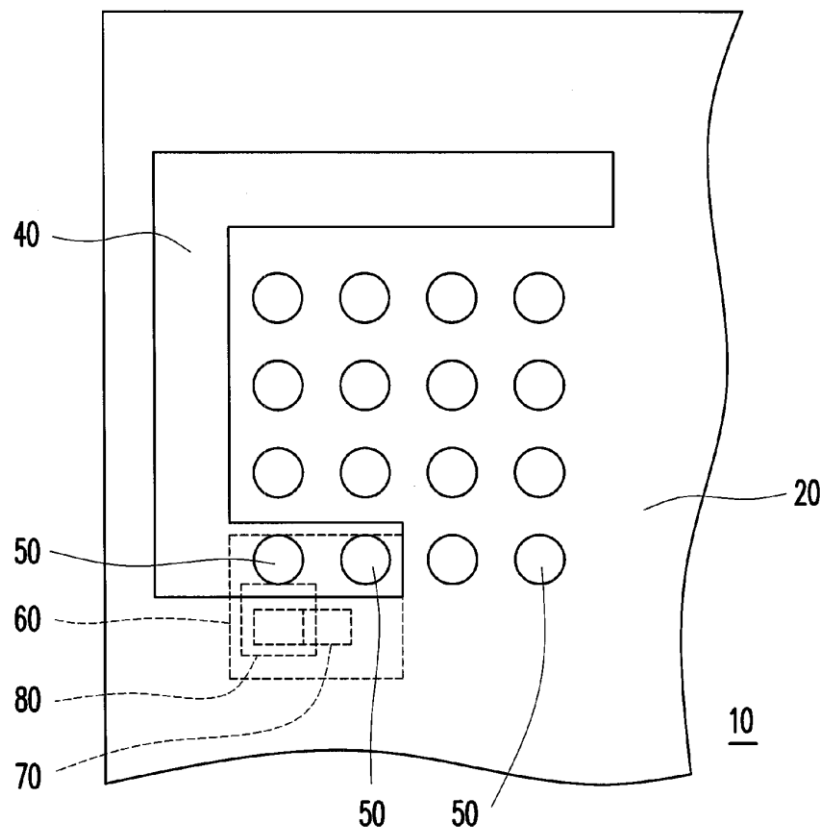


US 20140184451A1

(19) **United States**(12) **Patent Application Publication**
Kuo(10) **Pub. No.: US 2014/0184451 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **HANDHELD DEVICE****Publication Classification**(71) Applicant: **HTC Corporation**, Taoyuan County
(TW)(51) **Int. Cl.**
H01Q 1/24 (2006.01)(72) Inventor: **Yen-Liang Kuo**, Taoyuan County (TW)(52) **U.S. Cl.**
CPC **H01Q 1/242** (2013.01)
USPC **343/702**(73) Assignee: **HTC Corporation**, Taoyuan County
(TW)(21) Appl. No.: **14/155,365**(57) **ABSTRACT**(22) Filed: **Jan. 15, 2014****Related U.S. Application Data**(63) Continuation-in-part of application No. 12/768,736,
filed on Apr. 28, 2010, now Pat. No. 8,665,159.(30) **Foreign Application Priority Data**

Oct. 9, 2009 (TW) 98134312

A handheld device at least including a functional element, an appearance and a planar antenna is provided. The appearance at least includes a communicating space. In addition, the communicating space passes through the appearance, and the communicating space is a channel for transmitting signals from the functional element, or the communicating space is configured to expose the functional element. The planar antenna is disposed on an external surface of the appearance, and extended to an internal surface of the appearance through the communicating space.





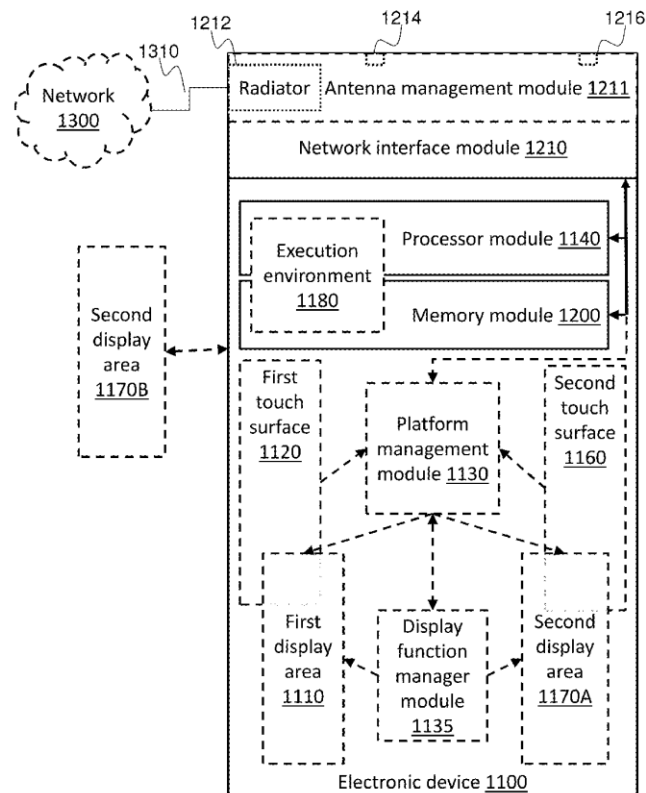
US 20140184452A1

(19) **United States**(12) **Patent Application Publication**
Hekkala et al.(10) **Pub. No.: US 2014/0184452 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **ELECTRONIC DEVICE WITH INTEGRATED ANTENNA****Publication Classification**(71) Applicant: **YOTA DEVICES IPR LTD.**, Tortola (VG)(51) **Int. Cl.**
H01Q 1/24 (2006.01)(72) Inventors: **Jukka Hekkala**, Oulu (FI); **Taneli Hanni**, Oulu (FI); **Marko Uusitalo**, Oulu (FI); **Antti Saikkonen**, Oulu (FI); **Markku Gerlander**, Oulu (FI)(52) **U.S. Cl.**
CPC **H01Q 1/241** (2013.01)
USPC **343/702; 29/600**(73) Assignee: **YOTA DEVICES IPR LTD.**, Tortola (VG)(57) **ABSTRACT**(21) Appl. No.: **14/199,264**(22) Filed: **Mar. 6, 2014****Related U.S. Application Data**

(63) Continuation-in-part of application No. PCT/EP2013/056705, filed on Mar. 28, 2013.

(30) **Foreign Application Priority Data**Mar. 28, 2012 (GB) 1205431.8
Dec. 10, 2013 (GB) 1321806.0

A method and computer system for integrating an antenna radiator during the manufacturing of an electronic device comprising providing a first chassis component, providing the radiator into the first chassis and providing a second chassis component over the radiator so as to integrate it between the first and the second chassis components (e.g., using a two-shot molding technique). A chassis may be defined by at least the first and the second chassis elements. A mobile device having networking capabilities comprising an antenna comprising a radiator and a hardware module for providing a function other than the networking capabilities to the mobile device. The radiator is at least partially integrated with the hardware module. The hardware module may further integrate a connector. The hardware module may be a structural chassis of the mobile device and the chassis may further integrate additional components.





US 20140184453A1

(19) **United States**

(12) **Patent Application Publication**
CHEN et al.

(10) **Pub. No.: US 2014/0184453 A1**

(43) **Pub. Date: Jul. 3, 2014**

(54) **MOBILE DEVICE AND ANTENNA
STRUCTURE THEREIN**

Publication Classification

(71) Applicant: **HTC CORPORATION**, Taoyuan City
(TW)

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
H01Q 21/00 (2006.01)

(72) Inventors: **Ju-Hung CHEN**, Taoyuan City (TW);
Pei-Ling TENG, Taoyuan City (TW);
Yi-Chun CHEN, Taoyuan City (TW);
Tun-Yuan TSOU, Taoyuan City (TW);
Kuo-Cheng CHEN, Taoyuan City (TW)

(52) **U.S. Cl.**
CPC **H01Q 13/10** (2013.01); **H01Q 21/00**
(2013.01)
USPC **343/725**; 343/767; 29/600

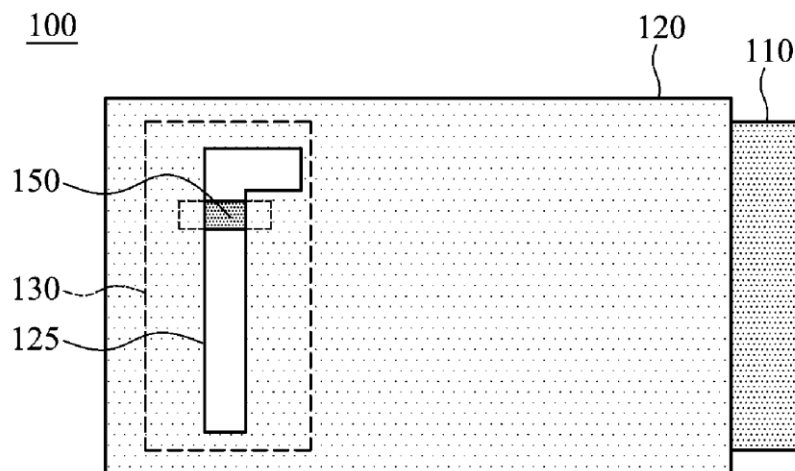
(73) Assignee: **HTC CORPORATION**, Taoyuan City
(TW)

(57) **ABSTRACT**

(21) Appl. No.: **13/728,583**

A mobile device includes a ground element, a conductive bezel, a nonconductive layer, and a feeding element. The conductive bezel is substantially independent of the ground element. A slot is formed in the conductive bezel. The non-conductive layer is affixed to the conductive bezel and covers the slot of the conductive bezel. The feeding element is close to the slot of the conductive bezel and is coupled to a signal source. An antenna structure is formed by the feeding element and the slot.

(22) Filed: **Dec. 27, 2012**





US 20140184465A9

(19) **United States**(10) **Pub. No.: US 2014/0184465 A9**(12) **Patent Application Publication**
Uejima et al.(48) **Pub. Date: Jul. 3, 2014**
CORRECTED PUBLICATION(54) **ANTENNA DEVICE**(30) **Foreign Application Priority Data**(75) Inventors: **Hiroyuki Uejima**, Ishikawa (JP); **Yoshio Koyanagi**, Kanagawa (JP); **Suguru Kojima**, Kanagawa (JP); **Takanori Hirobe**, Ishikawa (JP); **Kouta Aoki**, Kanagawa (JP); **Masao Ootani**, Kanagawa (JP)

Jun. 8, 2011 (JP) 2011-127889

Publication Classification(73) Assignee: **PANASONIC CORPORATION**, Osaka (JP)(51) **Int. Cl.**
H01Q 9/14 (2006.01)
H01Q 1/50 (2006.01)
(52) **U.S. Cl.**
CPC . **H01Q 9/145** (2013.01); **H01Q 1/50** (2013.01)
USPC **343/850**(21) Appl. No.: **14/007,896**(22) PCT Filed: **Jun. 6, 2012**(86) PCT No.: **PCT/JP2012/003714**

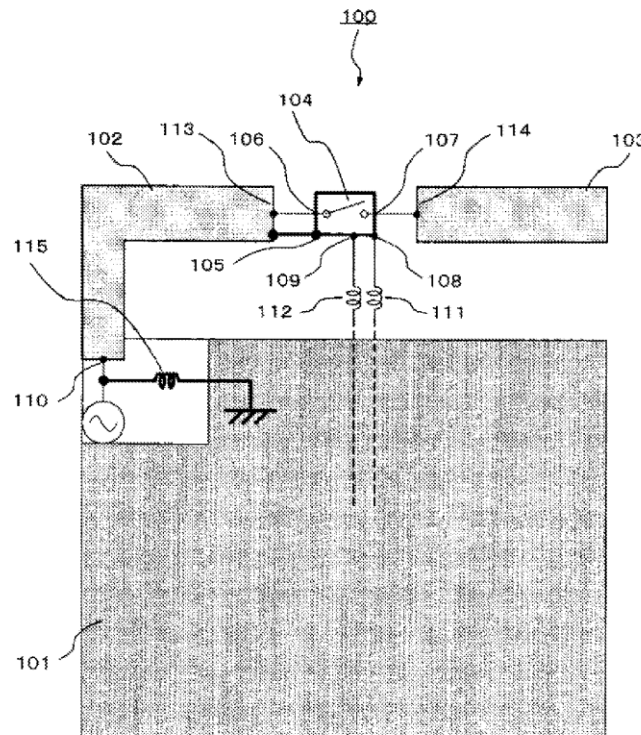
§ 371 (c)(1),

(2), (4) Date: **Sep. 26, 2013****Prior Publication Data**(15) Correction of US 2014/0015729 A1 Jan. 16, 2014
See (30) Foreign Application Data.

(65) US 2014/0015729 A1 Jan. 16, 2014

(57) **ABSTRACT**

A first antenna element **102**, a second antenna element **103**, and a MEMS (micro-electromechanical system) switch **104** are provided, and a feeding point **110** is provided at one end of the first antenna element **102**. The other end **113** of the first antenna element **102** is connected to a first terminal **106** of the MEMS switch **104**, and one end **114** of the second antenna element **103** is connected to a second terminal **107** of the MEMS switch **104**. The one end of the first antenna element **102** is grounded to a ground pattern **101** via an inductor **115**, and a ground terminal **105** of the MEMS switch **104** is connected to the other end **113** of the first antenna element **102**.





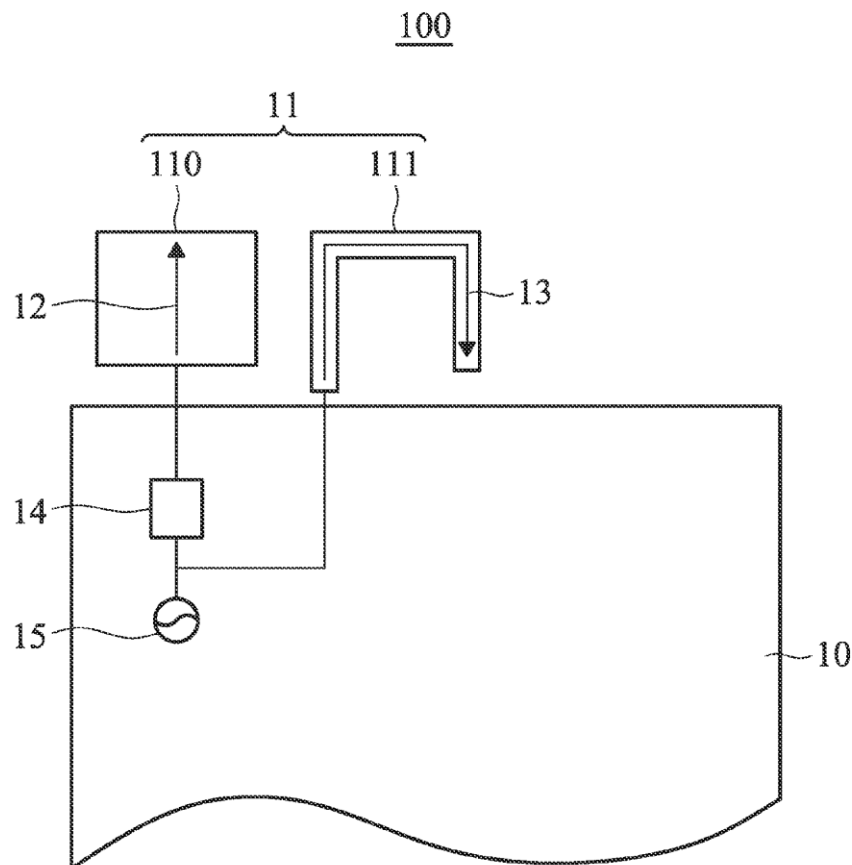
US 20140184466A1

(19) **United States**(12) **Patent Application Publication**
WONG et al.(10) **Pub. No.: US 2014/0184466 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **COMMUNICATION DEVICE AND ANTENNA
ELEMENT THEREIN****Publication Classification**(71) Applicant: **ACER INCORPORATED**, Taipei
Hsien (TW)(51) **Int. Cl.**
H01Q 21/30 (2006.01)
H01Q 1/50 (2006.01)(72) Inventors: **Kin-Lu WONG**, Taipei Hsien (TW);
Yi-Ting HSIEH, Taipei Hsien (TW)(52) **U.S. Cl.**
CPC . **H01Q 21/30** (2013.01); **H01Q 1/50** (2013.01)
USPC **343/860**; 343/700 MS(73) Assignee: **ACER INCORPORATED**, Taipei
Hsien (TW)(57) **ABSTRACT**

A communication device including a ground element and an antenna element is provided. The antenna element is close to the ground element. The antenna element includes a first radiation element and a second radiation element. The first radiation element provides a first current path and operates in a first band. The second radiation element provides a second current path and operates in a second band. The frequencies of the second band are higher than those of the first band, and the length of second current path is greater than that of first current path.

(21) Appl. No.: **13/781,598**(22) Filed: **Feb. 28, 2013**(30) **Foreign Application Priority Data**

Jan. 3, 2013 (TW) 102100075





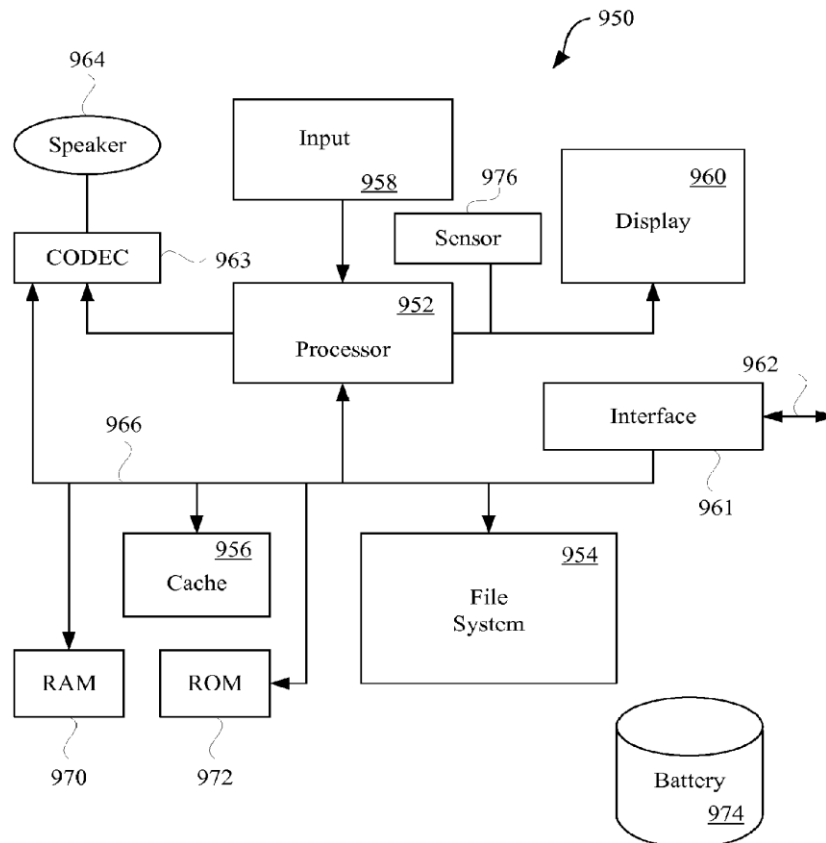
US 20140185857A1

(19) **United States**(12) **Patent Application Publication**
Uttermann et al.(10) **Pub. No.: US 2014/0185857 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **ANTENNA, SHIELDING AND GROUNDING****Publication Classification**(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04R 1/02 (2006.01)(72) Inventors: **Eric A. Uttermann**, San Francisco, CA (US); **Jeremy C. Franklin**, San Francisco, CA (US); **Stephen C. McClure**, San Francisco, CA (US); **Sean S. Corbin**, San Jose, CA (US); **Qingxiang Li**, Mountain View, CA (US); **Rodney A. Gomez Angulo**, Sunnyvale, CA (US)(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H04R 1/028** (2013.01)
USPC **381/388**; 381/394; 29/600(73) Assignee: **Apple Inc.**, Cupertino, CA (US)(21) Appl. No.: **14/195,974**(22) Filed: **Mar. 4, 2014****Related U.S. Application Data**

(63) Continuation of application No. 13/018,184, filed on Jan. 31, 2011, now Pat. No. 8,665,160.

(57) **ABSTRACT**

A portable computing device is disclosed. The portable computing device can take many forms such as a laptop computer, a tablet computer, and so on. The portable computing device can include a single piece housing formed from a radio opaque material with a cover formed from a radio transparent material. To implement a wireless interface, an antenna stack-up can be provided that allows an antenna to be mounted to a bottom of the cover. Methods and apparatus are provided for improving wireless performance. For instance, in one embodiment, a metal housing can be thinned to improve antenna performance. As another example, a faraday cage can be formed around speaker drivers to improve antenna performance.

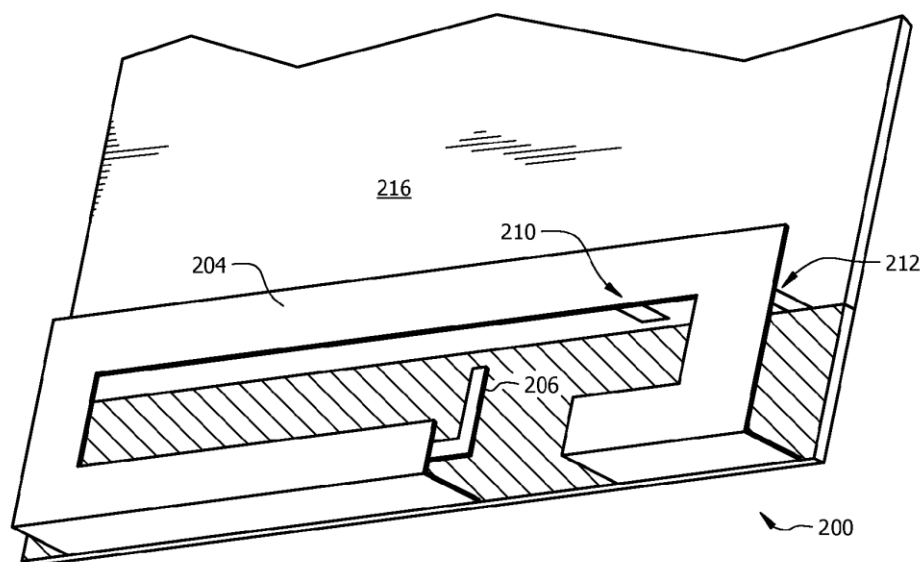




US 20140187178A1

(19) **United States**(12) **Patent Application Publication****Yang et al.**(10) **Pub. No.: US 2014/0187178 A1**(43) **Pub. Date: Jul. 3, 2014**(54) **METHOD AND APPARATUS FOR A TUNABLE ANTENNA**(22) Filed: **Dec. 31, 2012****Publication Classification**(71) Applicant: **FUTUREWEI TECHNOLOGIES, INC.**, Plano, TX (US)(51) **Int. Cl.**
H04B 1/40 (2006.01)
H01Q 9/06 (2006.01)(72) Inventors: **Shing Lung Steven Yang**, San Diego, CA (US); **Ping Shi**, San Diego, CA (US); **Daejoung Kim**, San Diego, CA (US); **Wee Kian Toh**, San Diego, CA (US); **Navid Nader**, San Diego, CA (US); **Guangdong Jiang**, Beijing (CN)(52) **U.S. Cl.**
CPC ... **H04B 1/40** (2013.01); **H01Q 9/06** (2013.01)
USPC **455/77**; 343/745; 343/746; 343/748(73) Assignee: **Futurewei Technologies, Inc.**, Plano, TX (US)(57) **ABSTRACT**

A method for tuning an antenna comprising determining an operating frequency band of the antenna, and adjusting a capacitance of a tunable load according to the operating frequency band, wherein the tunable load is electromagnetically coupled to the antenna via a parasitic arm, and wherein the operating frequency band depends on the capacitance.

(21) Appl. No.: **13/732,097**



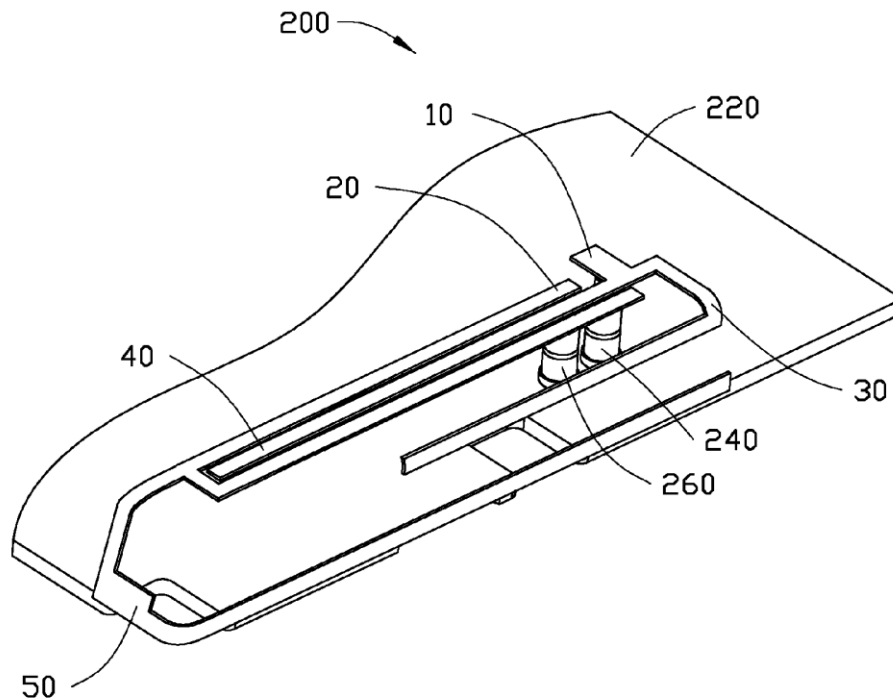
US 20140191906A1

(19) **United States**(12) **Patent Application Publication**
TSENG et al.(10) **Pub. No.: US 2014/0191906 A1**(43) **Pub. Date: Jul. 10, 2014**(54) **ANTENNA STRUCTURE AND WIRELESS
COMMUNICATION DEVICE USING THE
SAME**(71) Applicant: **Chiun Mai Communication Systems,
Inc.**, New Taipei (TW)(72) Inventors: **TING-CHIH TSENG**, New Taipei
(TW); **YEN-HUI LIN**, New Taipei (TW)(73) Assignee: **CHIUN MAI COMMUNICATION
SYSTEMS, INC.**, New Taipei (TW)(21) Appl. No.: **14/014,666**(22) Filed: **Aug. 30, 2013**(30) **Foreign Application Priority Data**

Jan. 9, 2013 (TW) 102100800

Publication Classification(51) **Int. Cl.**
H01Q 5/00 (2006.01)
H01Q 5/01 (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/0027** (2013.01); **H01Q 5/01**
(2013.01)USPC **343/700 MS**(57) **ABSTRACT**

An antenna structure includes a feed portion, a ground portion, a first radiating body, a second radiating body and a third radiating body. The first radiating body is connected to the feed portion and configured to obtain a first resonance frequency band. The second radiating body is connected to the feed portion. The third radiating body includes a first connection section connected the ground end, a second connection section, and a third connection section perpendicularly connected between the first connection section and the second connection section. The first connection section and the second connection section are positioned at two opposite sides of the second radiating body so that the third radiating body and the second radiating body cooperatively obtain a second resonance frequency band.





US 20140191908A1

(19) **United States**(12) **Patent Application Publication**
LIN(10) **Pub. No.: US 2014/0191908 A1**(43) **Pub. Date: Jul. 10, 2014**(54) **BROADBAND ANTENNA AND WIRELESS
COMMUNICATION DEVICE EMPLOYING
SAME**(52) **U.S. Cl.**CPC **H01Q 1/243** (2013.01)USPC **343/702**(71) Applicant: **Chiun Mai Communication Systems,
Inc., New Taipei (TW)**

(57)

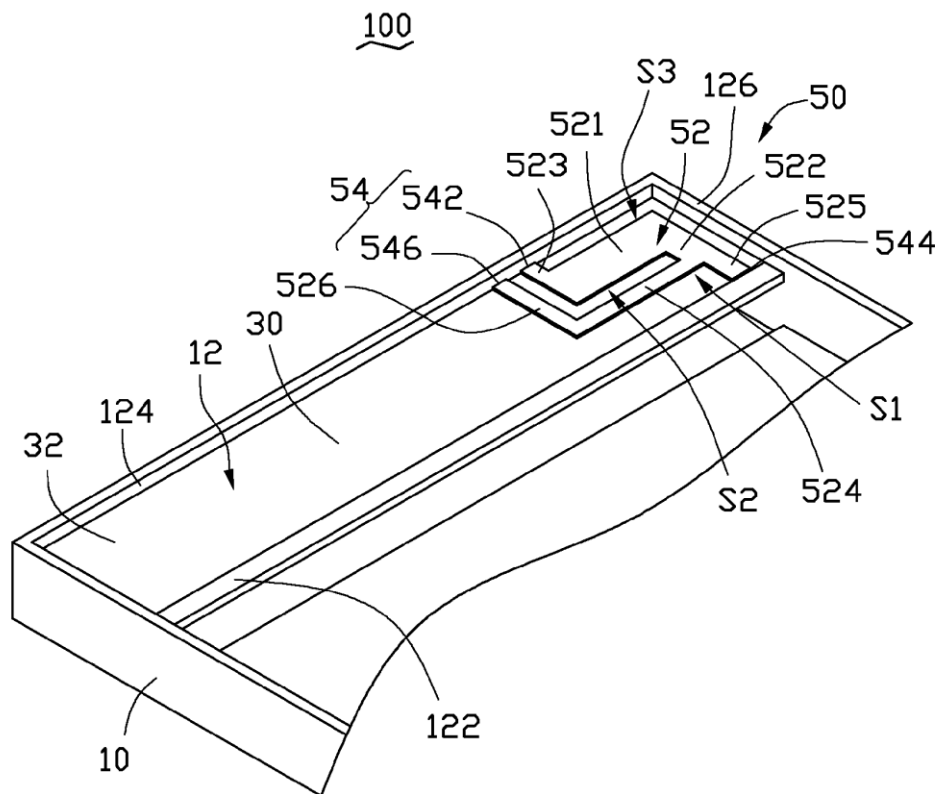
ABSTRACT(72) Inventor: **YEN-HUI LIN, New Taipei (TW)**(73) Assignee: **Chiun Mai Communication Systems,
Inc., New Taipei (TW)**(21) Appl. No.: **14/065,595**(22) Filed: **Oct. 29, 2013**(30) **Foreign Application Priority Data**

Jan. 9, 2013 (TW) 102100667

Publication Classification(51) **Int. Cl.**
H01Q 1/24

(2006.01)

A broadband antenna is mounted in a metal piece and includes a radiating portion, a ground portion, and a feed portion. The radiating portion includes a main portion and a plurality of radiating arms extending from the main portion in multiple directions, the radiating arms extend to contact the metal piece. The main portion, the radiating arms, and the metal piece enclose several slots. The ground portion is connected to a plurality of end portions of the radiating arms. The feed portion is connected to the metal piece and is adjacent to the radiating portion. The feed portion, the ground portion, the main portion, and the plurality of radiating arms form different current paths, thus to form different resonance nodes, thereby tender the broadband antenna to work at multi frequency bands. A wireless communication device employing the broadband antenna is also described.



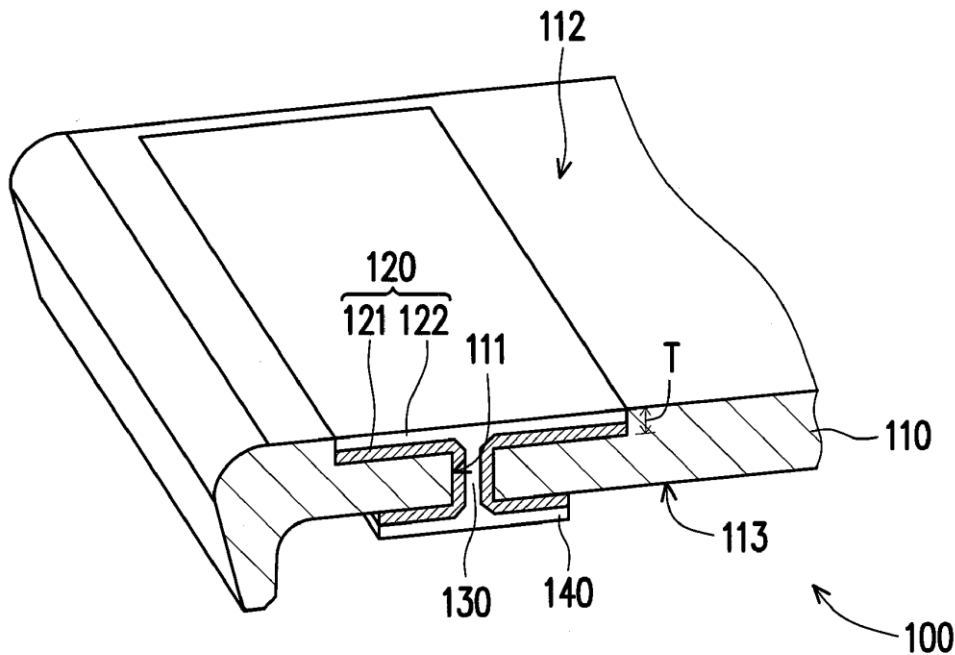


US 20140191910A1

(19) **United States**(12) **Patent Application Publication**
Chung et al.(10) **Pub. No.: US 2014/0191910 A1**(43) **Pub. Date: Jul. 10, 2014**(54) **HOUSING, HANDHELD DEVICE, AND
MANUFACTURING METHOD OF HOUSING****Publication Classification**(71) Applicant: **HTC Corporation**, Taoyuan County
(TW)(51) **Int. Cl.**
H01Q 1/24 (2006.01)(72) Inventors: **Cheng-Han Chung**, Taoyuan County
(TW); **Chih-Kuang Wang**, Taoyuan
County (TW); **Yen-Liang Kuo**, Taoyuan
County (TW)(52) **U.S. Cl.**
CPC **H01Q 1/242** (2013.01)
USPC **343/702; 29/600**(73) Assignee: **HTC Corporation**, Taoyuan County
(TW)(57) **ABSTRACT**(21) Appl. No.: **14/154,199**(22) Filed: **Jan. 14, 2014****Related U.S. Application Data**(63) Continuation-in-part of application No. 12/768,736,
filed on Apr. 28, 2010, now Pat. No. 8,665,159.(30) **Foreign Application Priority Data**

Oct. 9, 2009 (TW) 98134312

A housing, a handheld device and a manufacturing method of a housing are provided. The housing includes a body, a metal antenna layer, and a conductive element. The body includes a through hole and an appearance surface and an inner surface opposite to the appearance surface. The metal antenna layer is disposed on the appearance surface and covers the through hole, wherein an edge of the metal antenna layer is connected to the appearance surface seamlessly, and a surface of the metal antenna layer is at least partially exposed by the body. The conductive element is disposed in the through hole and directly contacts the metal antenna layer to transmit signals received by the metal antenna layer.





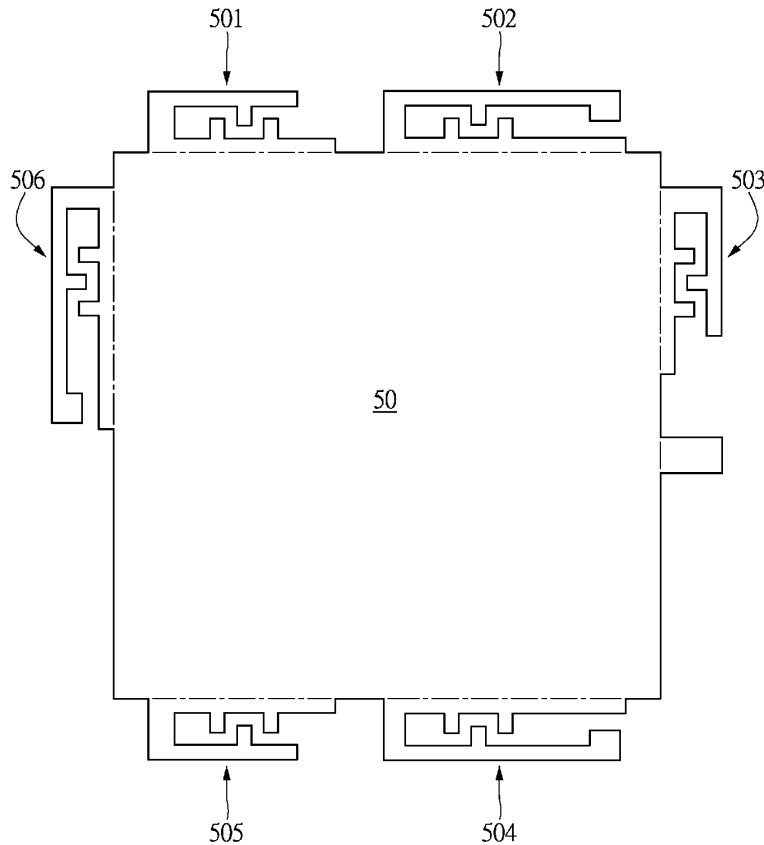
US 20140191918A1

(19) **United States**(12) **Patent Application Publication**
CHENG et al.(10) **Pub. No.: US 2014/0191918 A1**(43) **Pub. Date: Jul. 10, 2014**(54) **OMNIDIRECTIONAL ANTENNA**(52) **U.S. Cl.**(71) Applicant: **ARCADYAN TECHNOLOGY CORPORATION**, Hsinchu (TW)CPC **H01Q 5/01** (2013.01)USPC **343/834; 343/700 MS**(72) Inventors: **SHIH-CHIEH CHENG**, KAOHSIUNG CITY (TW); **KUO-CHANG LO**, MIAOLI COUNTY (TW)(57) **ABSTRACT**(73) Assignee: **ARCADYAN TECHNOLOGY CORPORATION**, Hsinchu (TW)(21) Appl. No.: **14/040,560**(22) Filed: **Sep. 27, 2013****Related U.S. Application Data**

(60) Provisional application No. 61/749,437, filed on Jan. 7, 2013.

Publication Classification(51) **Int. Cl.**
H01Q 5/01 (2006.01)

Disclosure is related to an omnidirectional antenna. Structurally the antenna includes multiple antenna units which are oppositely disposed around the edges of a grounded substrate. The antenna is able to handle at least two bands of electromagnetic signals. The body of each antenna unit includes a radiating member which is extended from an inverse-F portion type structure at the upper half of the body. A downward-protrudent feeding member is formed at the middle portion of the radiating member. A connecting member electrically connected to the substrate is formed at the lower half of the body, and associated with the radiating member. At least two upward-protrudent grounding members are formed onto the connecting member. The grounding members are jointly grounded with the substrate. It is noted that the feeding member is extended in the midst of the two grounding members. The opposite antenna units are mutually served be reflectors.





US 20140192927A1

(19) **United States**

(12) **Patent Application Publication**
KIM

(10) **Pub. No.: US 2014/0192927 A1**

(43) **Pub. Date: Jul. 10, 2014**

(54) **METHOD AND APPARATUS FOR
SELECTING MULTI-ANTENNA
TRANSMISSION MODE IN ELECTRONIC
DEVICE**

Publication Classification

(51) **Int. Cl.**
H04B 7/06 (2006.01)

(52) **U.S. Cl.**
CPC **H04B 7/06** (2013.01)
USPC **375/299**

(71) Applicant: **Samsung Electronics Co., Ltd.,**
Suwon-si (KR)

(72) Inventor: **Jin KIM**, Suwon-si (KR)

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

(21) Appl. No.: **14/103,071**

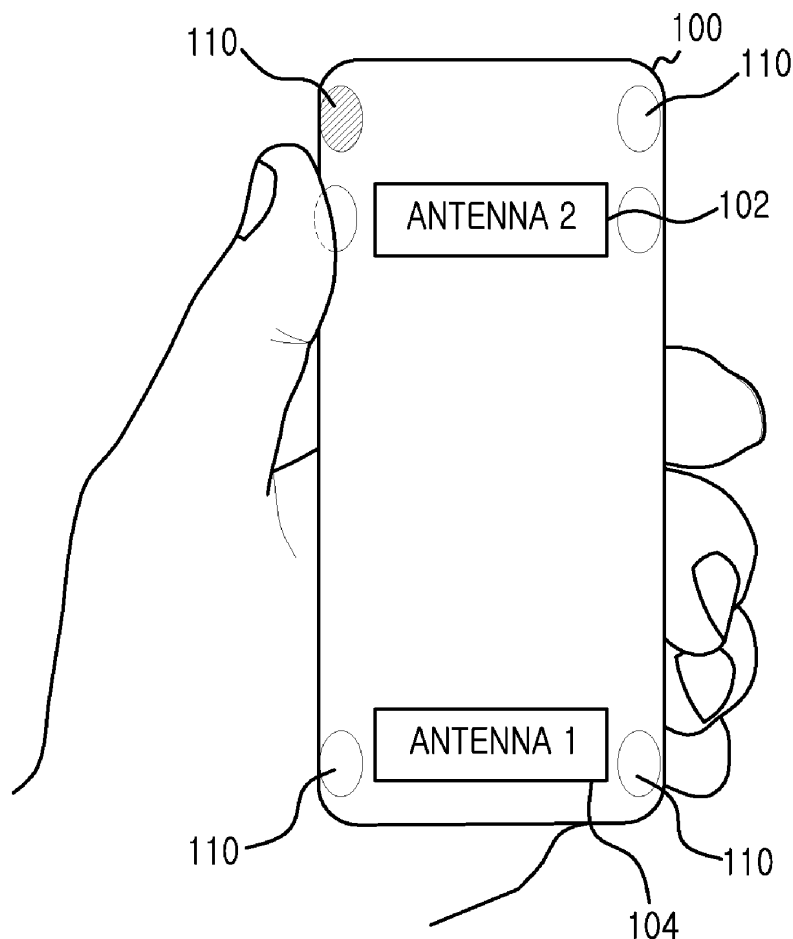
(22) Filed: **Dec. 11, 2013**

(30) **Foreign Application Priority Data**

Jan. 9, 2013 (KR) 10-2013-0002448

(57) **ABSTRACT**

A method for selecting a multi-antenna transmission mode of an electronic device is provided. The method includes determining, by using a detection signal from a sensor, whether there is a contact with a human body, changing a second transmission mode to a first transmission mode when there is a contact with a human body that affects the electromagnetic field around an antenna, and transmitting the same data stream through at least two antennas according to the first transmission mode.





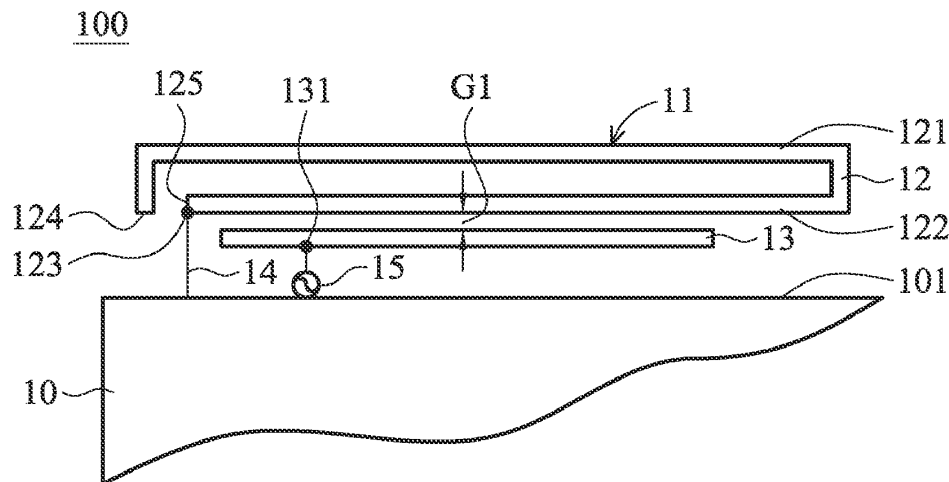
US 20140197992A1

(19) **United States**(12) **Patent Application Publication**
WONG et al.(10) **Pub. No.: US 2014/0197992 A1**(43) **Pub. Date: Jul. 17, 2014**(54) **COMMUNICATION DEVICE AND ANTENNA
ELEMENT THEREIN**(52) **U.S. CL.**CPC **H01Q 1/36** (2013.01)USPC **343/700 MS**(71) Applicant: **ACER INCORPORATED**, New Taipei
City (TW)(72) Inventors: **Kin-Lu WONG**, New Taipei City (TW);
Hsuan-Jui CHANG, New Taipei City
(TW)(73) Assignee: **Acer Incorporated**, New Taipei City
(TW)(21) Appl. No.: **13/839,808**(22) Filed: **Mar. 15, 2013**(30) **Foreign Application Priority Data**

Jan. 11, 2013 (TW) 102101044

Publication Classification(51) **Int. Cl.**
H01Q 1/36 (2006.01)(57) **ABSTRACT**

A communication device includes a ground element and an antenna element. The antenna element is close to an edge of the ground element, and includes a first metal portion and a second metal portion. The first metal portion has a plurality of bends, and includes a first segment and a second segment. The first segment and the second segment are close to each other, and are substantially parallel to the edge of the ground element. The first segment is disposed at the outmost periphery of the antenna element from the edge of the ground element. The second segment is disposed between the first segment and the edge of the ground element, and has a shorted point coupled to the ground element. The second metal portion is disposed between the second segment and the edge of the ground element, and has a feeding point coupled to a signal source.





US 20140197993A1

(19) **United States**

(12) **Patent Application Publication**
Li et al.

(10) **Pub. No.: US 2014/0197993 A1**

(43) **Pub. Date: Jul. 17, 2014**

(54) **FEEDING MATCHING APPARATUS OF
MULTIBAND ANTENNA, MULTIBAND
ANTENNA, AND RADIO COMMUNICATION
DEVICE**

Publication Classification

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

(52) **U.S. Cl.**
CPC **H01Q 9/04** (2013.01)
USPC **343/700 MS**

(71) Applicant: **Huawei Device Co., Ltd.**, Shenzhen
(CN)

(72) Inventors: **Yuanpeng Li**, Beijing (CN); **Hanyang
WANG**, Shenzhen (CN); **Yafang YU**,
Beijing (CN); **Meng HOU**, Shanghai
(CN)

(73) Assignee: **Huawei Device Co., Ltd.**, Shenzhen
(CN)

(21) Appl. No.: **14/143,367**

(22) Filed: **Dec. 30, 2013**

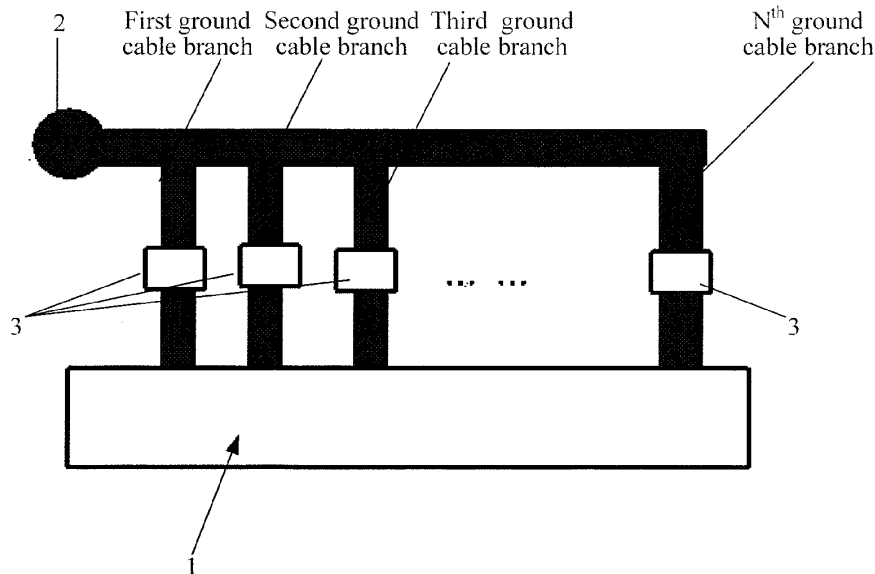
Related U.S. Application Data

(63) Continuation of application No. PCT/CN2013/
070557, filed on Jan. 16, 2013.

(57)

ABSTRACT

The present disclosure relates to the field of antenna technologies and discloses a feeding matching apparatus of a multi-band antenna, a multiband antenna, and a radio communication device to improve a bandwidth and efficiency of a lower frequency band. The feeding matching apparatus of a multi-band antenna includes: a grounding portion; a feeding portion connected to a signal source, where a signal of the signal source is input into the feeding portion; and two or more ground cable branches with different lengths, where one end of each ground cable branch is electrically connected to the feeding portion, the other end is electrically connected to the grounding portion, at least one ground cable branch is connected in series to a signal filtering component, and the signal filtering component is capable of preventing a signal lower than a frequency point corresponding to the signal filtering component from passing through it.

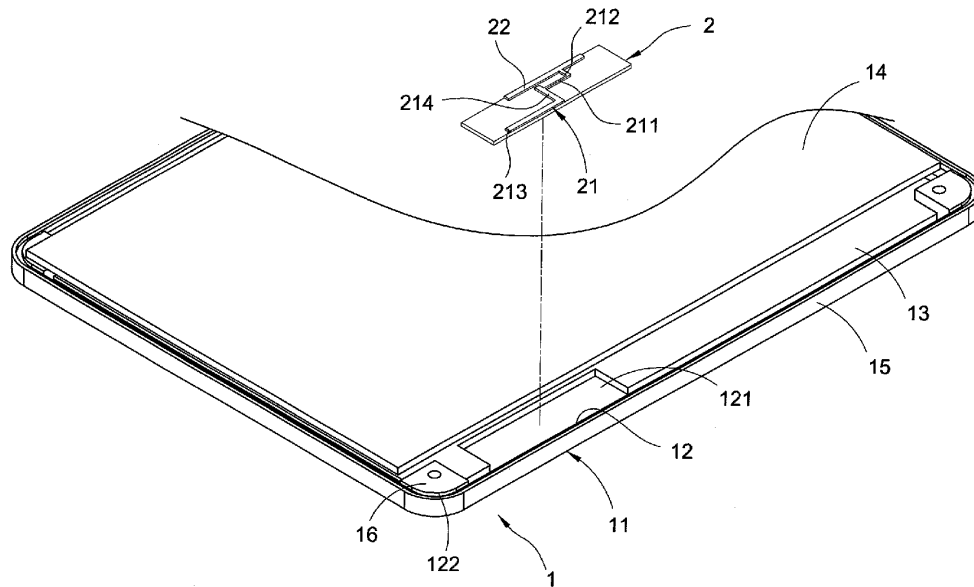




US 20140197997A1

(19) **United States**(12) **Patent Application Publication**
YANG et al.(10) **Pub. No.: US 2014/0197997 A1**(43) **Pub. Date: Jul. 17, 2014**(54) **ANTENNA STRUCTURE**(71) Applicant: **AUDEN TECHNO.CORP.**, Taoyuan
Hsien (TW)(72) Inventors: **Cheng-Min YANG**, Taoyuan Hsien
(TW); **Shih-Chi LAI**, Taoyuan Hsien
(TW)(73) Assignee: **AUDEN TECHNO.CORP.**, Taoyuan
Hsien (TW)(21) Appl. No.: **13/741,021**(22) Filed: **Jan. 14, 2013****Publication Classification**(51) **Int. Cl.**
H01Q 1/24 (2006.01)(52) **U.S. CL.**CPC **H01Q 1/243** (2013.01)USPC **343/702**(57) **ABSTRACT**

An antenna structure includes a portable electronic apparatus and an antenna. The portable electronic apparatus includes a housing. At least a metal block is arranged at a corner of the housing. The antenna is arranged in an accommodating space of the housing. The antenna includes a radiator. The radiator includes a rear end and a signal feed-in contact. A distance between the rear end, the signal feed-in contact, and the metal block is about one-fourth wavelength of communication signals, wherein the rear end faces the metal block. Therefore, the SAR of the antenna is reduced.





US 20140198003A1

(19) **United States**

(12) **Patent Application Publication**
Sakurai

(10) **Pub. No.: US 2014/0198003 A1**

(43) **Pub. Date: Jul. 17, 2014**

(54) **ANTENNA DEVICE**

Publication Classification

(71) Applicant: **Tyco Electronics Japan G.K.**,
Kanagawa (JP)

(51) **Int. Cl.**
H01Q 9/14 (2006.01)

(72) Inventor: **Yohei Sakurai**, Kanagawa (JP)

(52) **U.S. Cl.**
CPC **H01Q 9/145** (2013.01)
USPC **343/749**

(73) Assignee: **TYCO ELECTRONICS JAPAN G.K.**,
Kanagawa (JP)

(57) **ABSTRACT**

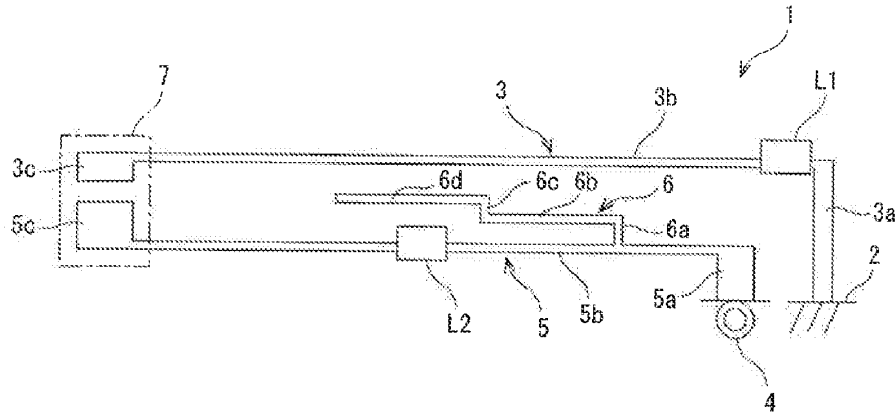
(21) Appl. No.: **14/153,599**

An antenna device is provided and includes a circuit board, a first linear antenna, and a second linear antenna. The circuit board includes a grounding pattern and a feeding point insulated from the grounding pattern. The first linear antenna is connected to the grounding pattern and includes a first inductive element positioned between distal ends of the first linear antenna. The second linear antenna is connected to the feeding point and capacitively coupled to one of the distal ends of the first linear antenna. The second linear antenna includes a second inductive element positioned proximate a middle section of the second linear antenna.

(22) Filed: **Jan. 13, 2014**

(30) **Foreign Application Priority Data**

Jan. 11, 2013 (JP) 2013-003216





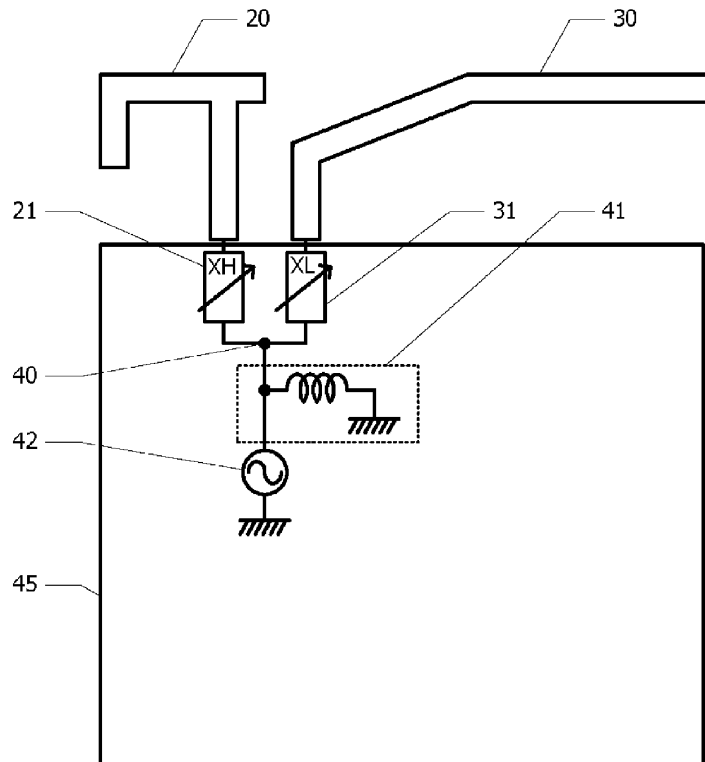
US 20140198009A1

(19) **United States**(12) **Patent Application Publication**
NAGUMO et al.(10) **Pub. No.: US 2014/0198009 A1**(43) **Pub. Date: Jul. 17, 2014**(54) **ANTENNA DEVICE AND MATCHING
CIRCUIT MODULE FOR ANTENNA DEVICE****Publication Classification**(71) Applicant: **Murata Manufacturing Co., Ltd.**,
Kyoto (JP)(51) **Int. Cl.**
H01Q 5/00 (2006.01)(72) Inventors: **Shoji NAGUMO**, Kyoto (JP); **Minoru
IWANAGA**, Kyoto (JP); **Masahi
NAKAZATO**, Kyoto (JP); **Tomohiro
NAGAI**, Kyoto (JP)(52) **U.S. Cl.**
CPC **H01Q 5/0041** (2013.01)
USPC **343/852**(73) Assignee: **MURATA MANUFACTURING CO.,
LTD.**, Kyoto (JP)(57) **ABSTRACT**

A low-frequency radiating element and a high-frequency radiating element are configured so as to respectively operate in a relatively low frequency band and a relatively high frequency band that are non-contiguous with each other. A matching circuit is inserted between a transmission/reception circuit and a branching point. A high-frequency variable reactance circuit is inserted between the branching point and the high-frequency radiating element. A low-frequency variable reactance circuit is inserted between the branching point and the low-frequency radiating element. The high-frequency variable reactance circuit and the low-frequency variable reactance circuit are configured such that their reactances can be adjusted independently of each other.

(21) Appl. No.: **14/150,511**(22) Filed: **Jan. 8, 2014**(30) **Foreign Application Priority Data**

Jan. 17, 2013 (JP) 2013-006115





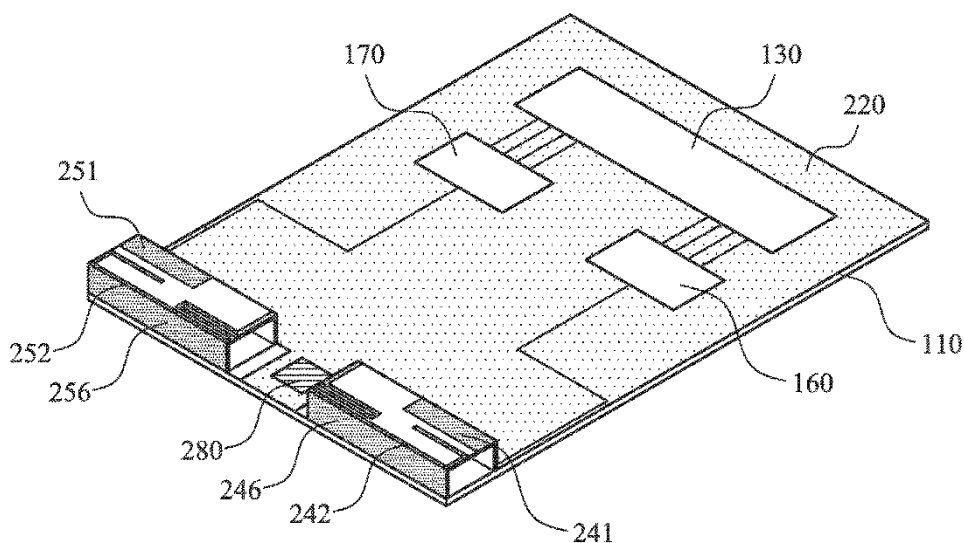
US 20140198012A1

(19) **United States**(12) **Patent Application Publication**
TSENG et al.(10) **Pub. No.: US 2014/0198012 A1**(43) **Pub. Date: Jul. 17, 2014**(54) **MOBILE DEVICE WITH TWO ANTENNAS
AND ANTENNA SWITCH MODULES****Publication Classification**(71) Applicant: **Acer Incorporated**, New Taipei City
(TW)(51) **Int. Cl.**
H01Q 21/28 (2006.01)(72) Inventors: **Kuo-Hua TSENG**, New Taipei City
(TW); **Chih-Hua CHANG**, New Taipei
City (TW); **Shao-Yu HUANG**, New
Taipei City (TW)(52) **U.S. Cl.**
CPC **H01Q 21/28** (2013.01)
USPC **343/876**(73) Assignee: **Acer Incorporated**, New Taipei City
(TW)(57) **ABSTRACT**

A mobile device includes a system circuit board, a ground element, a communication module, a first antenna, a second antenna, a first ASM (Antenna Switch Module), and a second ASM. The first antenna is configured to receive or transmit a first signal in a first frequency band. The second antenna is configured to receive or transmit a second signal in a second frequency band. The second frequency band is different from the first frequency band. The first ASM is coupled between the first antenna and the communication module, and is configured to separate frequencies of the first signal. The second ASM is coupled between the second antenna and the communication module, and is configured to separate frequencies of the second signal.

(21) Appl. No.: **13/951,380**(22) Filed: **Jul. 25, 2013**(30) **Foreign Application Priority Data**

Jan. 14, 2013 (TW) 102101301

200



US 20140198832A1

(19) **United States**(12) **Patent Application Publication****Rao et al.**(10) **Pub. No.: US 2014/0198832 A1**(43) **Pub. Date: Jul. 17, 2014**(54) **MULTIPLE INPUT MULTIPLE OUTPUT
ANTENNA MODULE AND ASSOCIATED
METHOD****Publication Classification**

(51) **Int. Cl.**
H04B 17/00 (2006.01)

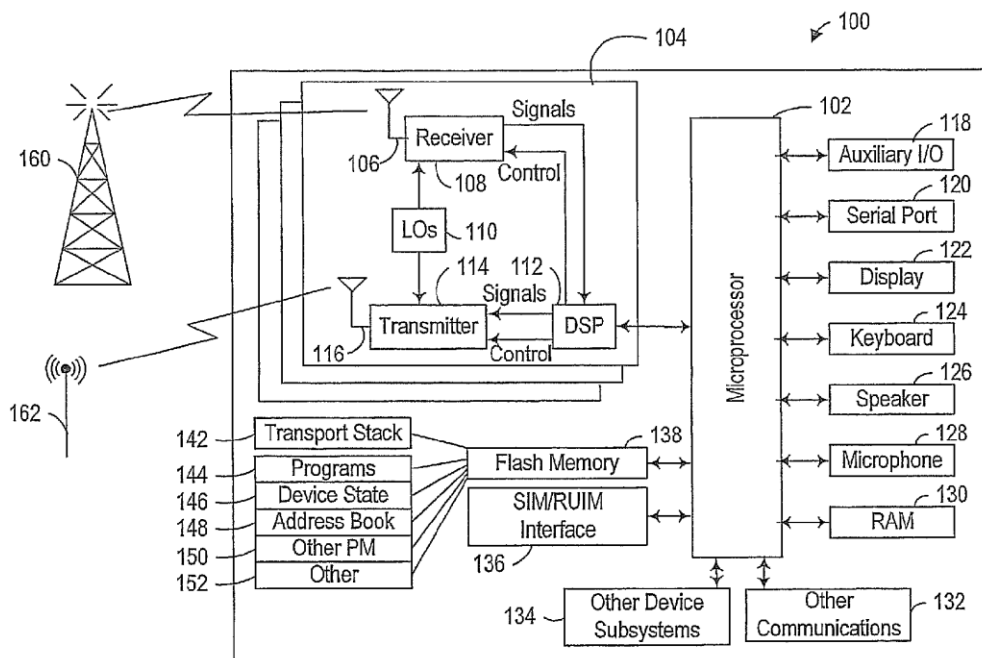
(52) **U.S. Cl.**
CPC **H04B 17/008** (2013.01)
USPC **375/224**

(71) Applicant: **BlackBerry Limited**, Waterloo (CA)(72) Inventors: **Qinjiang Rao**, Ottawa (CA); **James Paul Warden**, Ft. Worth, TX (US);
Mina Ayatollahi, Waterloo (CA)(73) Assignee: **BlackBerry Limited**, Waterloo (CA)(21) Appl. No.: **14/210,922**(22) Filed: **Mar. 14, 2014****Related U.S. Application Data**

(62) Division of application No. 12/834,675, filed on Jul. 12, 2010.

(57) **ABSTRACT**

A multiple input multiple output (MIMO) antenna module, comprising a first signal feed port coupled to a first antenna element disposed along a first edge of a PCB, a second signal feed port coupled to a second antenna element disposed on the PCB and a transceiver operable to be selectively coupled to either or both of the first and second signal feed ports. The first and second antenna elements form a plurality of antenna elements confined to a peripheral section surrounding a central region of the PCB of the MIMO antenna module.





US 20140203974A1

(19) **United States**

(12) **Patent Application Publication**

Liu et al.

(10) **Pub. No.: US 2014/0203974 A1**

(43) **Pub. Date: Jul. 24, 2014**

(54) **ELECTRONIC DEVICE AND ANTENNA UNIT THEREOF**

Publication Classification

(71) Applicants: **Shih-Ping Liu**, Taipei City (TW);
Hao-Ran Lee, Taipei City (TW);
Chung-Ta Yu, Taipei City (TW);
Mei-Hsiung Tsai, Taipei City (TW);
Yi-Min Yu, Taipei City (TW)

(51) **Int. Cl.**
H01Q 13/10 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 13/10** (2013.01)
USPC **343/702; 343/770**

(72) Inventors: **Shih-Ping Liu**, Taipei City (TW);
Hao-Ran Lee, Taipei City (TW);
Chung-Ta Yu, Taipei City (TW);
Mei-Hsiung Tsai, Taipei City (TW);
Yi-Min Yu, Taipei City (TW)

(57) **ABSTRACT**

(73) Assignee: **COMPAL ELECTRONICS, INC.**,
Taipei City (TW)

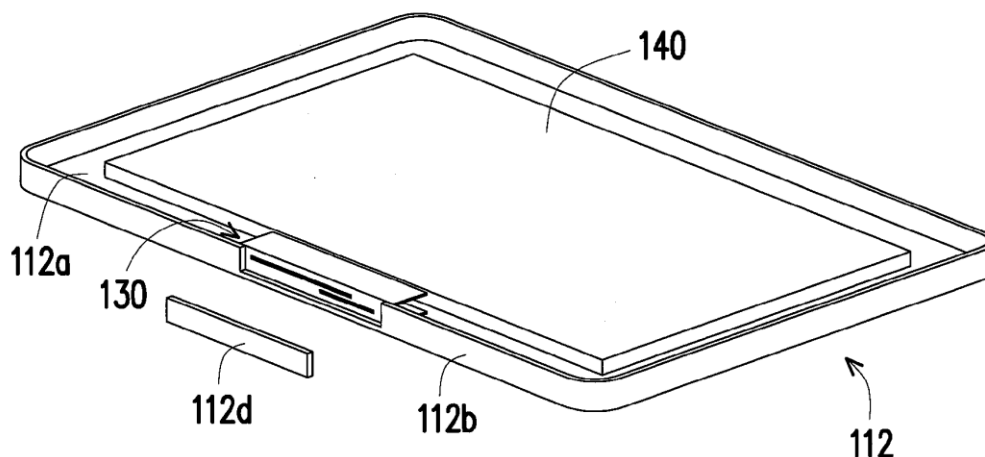
An electronic device includes a body and an antenna unit. The body has a casing, in which the casing includes a back cover and a first side-wall. The antenna unit disposed in the casing is adjacent to the first side-wall and has a plurality of slots, in which the antenna unit includes a first conductor, a second conductor and a third conductor. The first conductor faces the first side-wall. The second conductor is bent connected to a side-edge of the first conductor to face the back cover and grounded to the back cover. The third conductor is bent connected to the other side-edge of the first conductor, in which the slots are formed on at least one of the first conductor and the third conductor.

(21) Appl. No.: **13/792,217**

(22) Filed: **Mar. 11, 2013**

(30) **Foreign Application Priority Data**

Jan. 23, 2013 (TW) 102102499





US 20140203980A1

(19) **United States**

(12) **Patent Application Publication**
Mahanfar et al.

(10) **Pub. No.: US 2014/0203980 A1**

(43) **Pub. Date: Jul. 24, 2014**

(54) **UTILIZATION OF ANTENNA LOADING FOR
IMPEDANCE MATCHING**

Publication Classification

(71) Applicant: **MICROSOFT CORPORATION**,
Redmond, WA (US)

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

(72) Inventors: **Alireza Mahanfar**, Redmond, WA (US);
Javier Rodriguez De Luis, Kirkland,
WA (US); **Stanley Yu Tao Ng**, Bellevue,
WA (US); **Benjamin J. Shewan**,
Redmond, WA (US); **Kim Willi Schulze**,
Seattle, WA (US)

(52) **U.S. Cl.**
CPC **H01Q 1/50** (2013.01)
USPC **343/745; 343/852; 455/550.1**

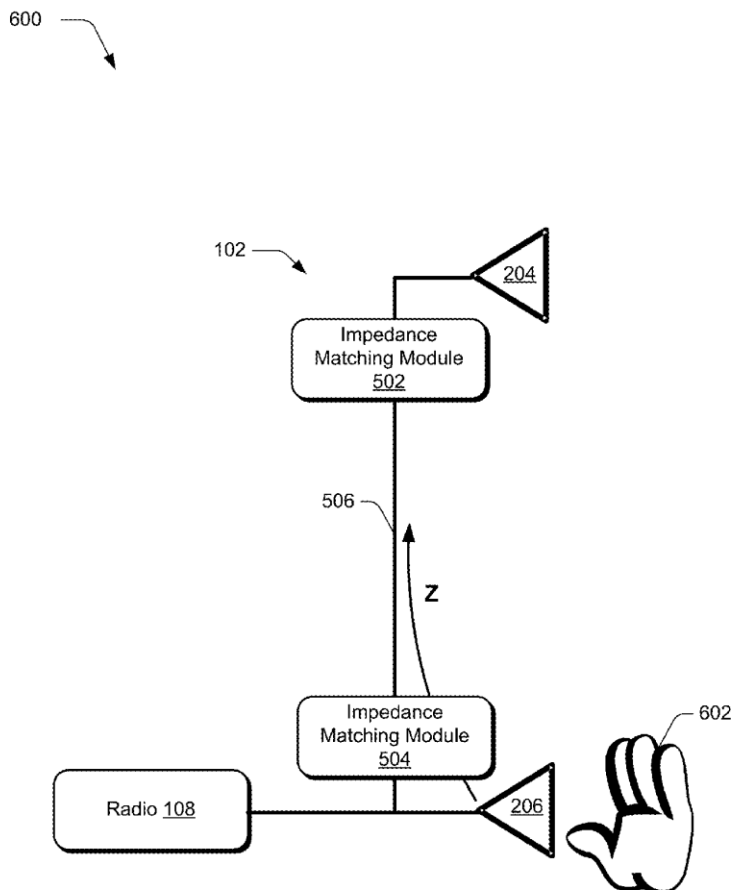
(73) Assignee: **MICROSOFT CORPORATION**,
Redmond, WA (US)

(57) **ABSTRACT**

Techniques for utilization of antenna loading for impedance matching are described. In at least some embodiments, a device (e.g., a smart phone) includes multiple antennas that are employed to send and receive wireless signals for the device. The device further includes impedance matching functionality communicatively connected to the antennas, and configured to perform impedance matching for one of the antennas based on loading (e.g., dielectric loading) of another of the antennas.

(21) Appl. No.: **13/745,609**

(22) Filed: **Jan. 18, 2013**



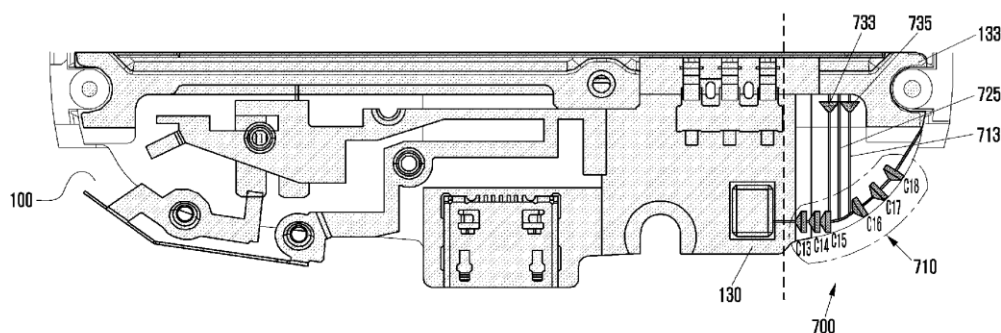


US 20140203982A1

(19) **United States**(12) **Patent Application Publication**
SEO et al.(10) **Pub. No.: US 2014/0203982 A1**(43) **Pub. Date: Jul. 24, 2014**(54) **ANTENNA AND PORTABLE DEVICE HAVING
THE SAME****Publication Classification**(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(51) **Int. Cl.**
H01Q 1/52 (2006.01)(72) Inventors: **Jaemin SEO**, Gyeonggi-do (KR);
Jaesun PARK, Gyeonggi-do (KR);
Wailing LEE, Gyeonggi-do (KR)(52) **U.S. Cl.**
CPC **H01Q 1/523** (2013.01)
USPC **343/751**(73) Assignee: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(57) **ABSTRACT**(21) Appl. No.: **14/156,618**(22) Filed: **Jan. 16, 2014**(30) **Foreign Application Priority Data**

Jan. 23, 2013 (KR) 10-2013-0007232

An antenna apparatus and a portable device having the same are provided. The antenna apparatus includes a main antenna having a first radiator pattern, and an auxiliary antenna separated from the main antenna by a metal surface adjacent to the main antenna. The auxiliary antenna is resonant at a resonant frequency which is a function of at least one capacitor provided in a cut-out area of a printed circuit board (PCB) adjacent to the metal surface.





US 20140203993A1

(19) **United States**(12) **Patent Application Publication**
Toyao(10) **Pub. No.: US 2014/0203993 A1**(43) **Pub. Date: Jul. 24, 2014**(54) **ANTENNA AND ELECTRONIC DEVICE**

(57)

ABSTRACT(76) Inventor: **Hiroshi Toyao**, Tokyo (JP)(21) Appl. No.: **14/239,527**(22) PCT Filed: **Aug. 24, 2012**(86) PCT No.: **PCT/JP2012/071433**

§ 371 (c)(1),

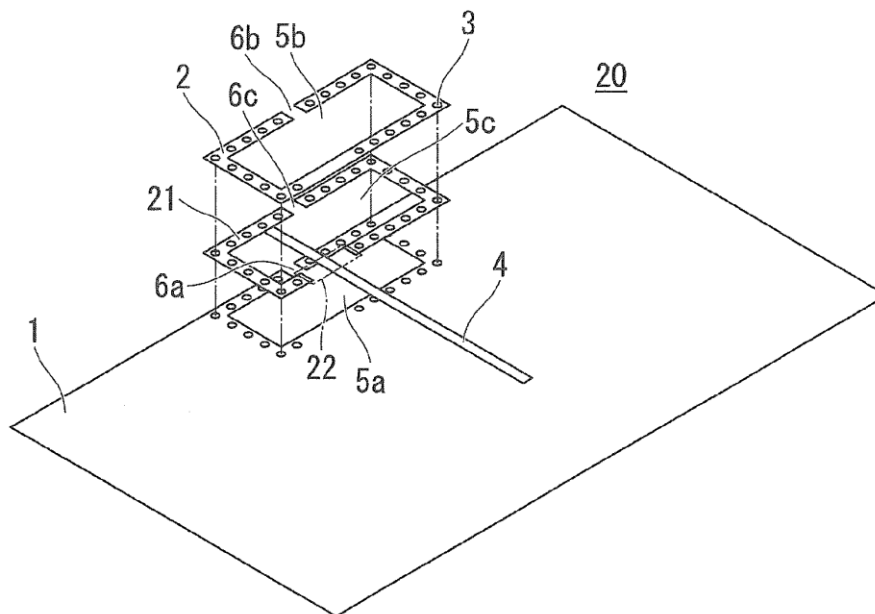
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An antenna includes: a first conductor layer including a first split ring part surrounding a first opening part, the first split ring part having a first split part provided at a portion in a circumferential direction, the first split ring part being continuous in an approximate C-shape; a second conductor layer including a second split ring part opposing the first split ring part, the second split ring part surrounding a second opening part, the second split ring part having a second split part at a portion in a circumferential direction, the second split ring part being continuous in an approximate C-shape; a plurality of conductor vias provided with an interval in a circumferential direction of the first split part and the second split part, the conductor vias electrically connecting the first split ring part and the second split ring part; and a power feed line provided on a conductor layer different from the first conductor layer, the power feed line having a first end and second end, the first end being electrically connected to at least one of the conductor vias, the second end spanning the first and the second opening parts and extending to a region opposing the first split ring part.

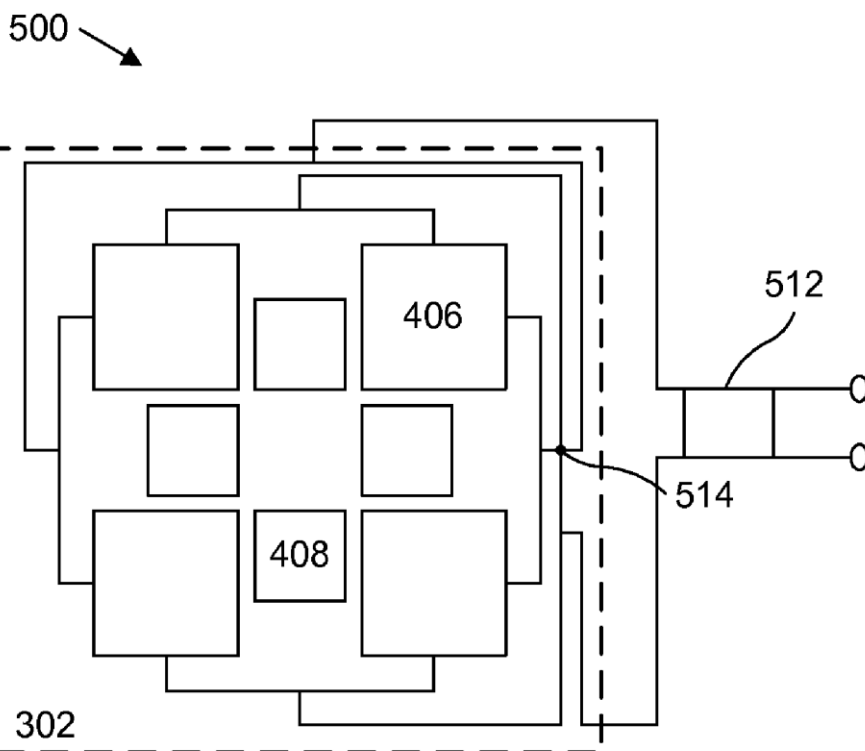




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(19) **United States**(12) **Patent Application Publication**
Romney et al.(10) **Pub. No.: US 2014/0203995 A1**(43) **Pub. Date: Jul. 24, 2014**(54) **CREATING LOW COST MULTI-BAND AND
MULTI-FEED PASSIVE ARRAY FEED
ANTENNAS AND LOW-NOISE BLOCK FEEDS****Publication Classification**(51) **Int. Cl.**
H01Q 21/30 (2006.01)
(52) **U.S. Cl.**
CPC **H01Q 21/30** (2013.01)
USPC **343/893**(71) Applicant: **Linear Signal, Inc.**, Spanish Fork, UT
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(US)(73) Assignee: **Linear Signal, Inc.**, Spanish Fork, UT
(US)(21) Appl. No.: **14/162,632**(22) Filed: **Jan. 23, 2014****Related U.S. Application Data**(60) Provisional application No. 61/755,754, filed on Jan.
23, 2013.(57) **ABSTRACT**

An antenna, multi-band antenna system, and antenna apparatus for radio frequency communications are disclosed. The antenna includes a first antenna core, a multi-band antenna array located on the first antenna core, a second antenna core laminated to the first antenna core, an antenna ground plane located on the second core, and a plurality of feed networks interspersed on the first antenna core and the second antenna core. The first antenna core and the second antenna core form dielectric columns between the multi-band antenna array and the antenna ground plane. The antenna may also include a low noise block feed connection located on the first antenna core.





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SUNG et al.(10) **Pub. No.: US 2014/0206417 A1**(43) **Pub. Date: Jul. 24, 2014**(54) **ANTENNA DEVICE OF MOBILE TERMINAL**(30) **Foreign Application Priority Data**(71) Applicant: **Samsung Electronics Co., Ltd.**,
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Publication Classification(72) Inventors: **Sang Bong SUNG**, Gyeongsangbuk-do
(KR); **In Jin HWANG**,
Gyeongsangbuk-do (KR)(51) **Int. Cl.**
H04M 1/02 (2006.01)(52) **U.S. Cl.**
CPC **H04M 1/026** (2013.01)
USPC **455/566**(73) Assignee: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(57) **ABSTRACT**(21) Appl. No.: **14/223,642**

Various mobile communication terminals and methods therefore, concerning antenna improvements, are discussed. One mobile communication terminal is described which includes a battery between the front side and planar outer rear side of the terminal, a display on the front side of the terminal, a first part having conductive material and constituting a first portion of the planar outer rear side of the mobile communication terminal, a second part having a non-conductive material and constituting a second portion of the planar outer rear side of the terminal, and an antenna mounted within the terminal. At least a part of the antenna is disposed between the front side and the second portion of the planar outer rear side of the terminal.

(22) Filed: **Mar. 24, 2014****Related U.S. Application Data**

(63) Continuation of application No. 13/962,483, filed on Aug. 8, 2013, which is a continuation of application No. 13/458,453, filed on Apr. 27, 2012, now Pat. No. 8,531,342, which is a continuation of application No. 12/489,044, filed on Jun. 22, 2009, now Pat. No. 8,188,930.

