



US 20160209513A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0209513 A1**

(43) **Pub. Date: Jul. 21, 2016**

(54) **ELECTRONIC APPARATUS**

Publication Classification

(71) Applicant: **KYOCERA Corporation**, Kyoto-shi (JP)

(51) **Int. Cl.**
G01S 19/36 (2006.01)
H01Q 21/30 (2006.01)

(72) Inventors: **Masahiko HIRAHAMA**, Kawanishi-shi (JP); **Takashi YAMADA**, Tokyo (JP)

(52) **U.S. Cl.**
CPC **G01S 19/36** (2013.01); **H01Q 21/30** (2013.01)

(21) Appl. No.: **15/081,643**

(22) Filed: **Mar. 25, 2016**

(57) **ABSTRACT**

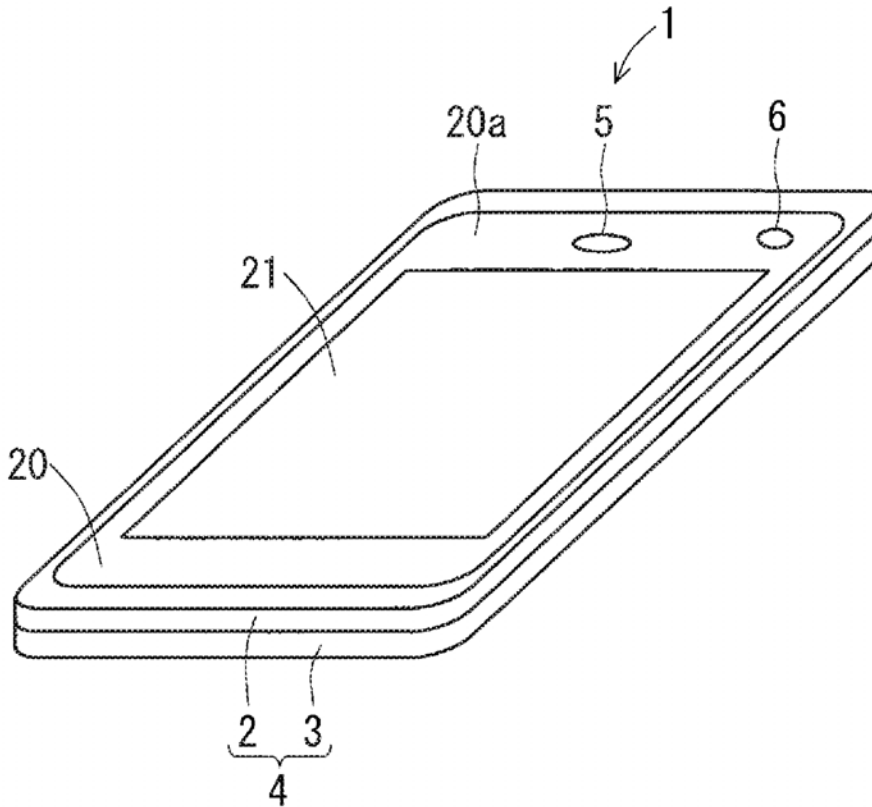
Related U.S. Application Data

(63) Continuation of application No. PCT/JP2014/075524, filed on Sep. 25, 2014.

Foreign Application Priority Data

(30) Sep. 26, 2013 (JP) 2013-200191

An electronic apparatus comprises a first receiving antenna that receives a signal from a satellite in a satellite positioning system, a multi-antenna including a second receiving antenna, and a first feeding point shared by the first and second receiving antennas. The first receiving antenna is located nearer to a corner of the electronic apparatus than the second receiving antenna is.





US 20160211570A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0211570 A1**

(43) **Pub. Date: Jul. 21, 2016**

(54) **TUNABLE ANTENNA WITH SLOT-BASED PARASITIC ELEMENT**

(52) **U.S. Cl.**
CPC . **H01Q 1/24** (2013.01); **H01Q 5/15** (2015.01);
H01Q 5/314 (2015.01)

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventors: **Nanbo Jin**, Milpitas, CA (US); **Yuehui Ouyang**, Sunnyvale (CA); **Yijun Zhou**, Sunnyvale, CA (US); **Enrique Ayala Vazquez**, Watsonville, CA (US); **Anand Lakshmanan**, San Jose (CA); **Robert W. Schlub**, Cupertino, CA (US); **Mattia Pascolini**, San Francisco, CA (US); **Matthew A. Mow**, Los Altos, CA (US)

(57) **ABSTRACT**

Electronic devices may be provided that contain wireless communications circuitry. The wireless communications circuitry may include radio-frequency transceiver circuitry and antenna structures. The antenna structures may form a dual arm inverted-F antenna. The antenna may have a resonating element formed from portions of a peripheral conductive electronic device housing member and may have an antenna ground that is separated from the antenna resonating element by a gap. A short circuit path may bridge the gap. An antenna feed may be coupled across the gap in parallel with the short circuit path. Low band tuning may be provided using an adjustable inductor that bridges the gap. The antenna may have a slot-based parasitic antenna resonating element with a slot formed between portions of the peripheral conductive electronic device housing member and the antenna ground. An adjustable capacitor may bridge the slot to provide high band tuning.

(21) Appl. No.: **15/085,095**

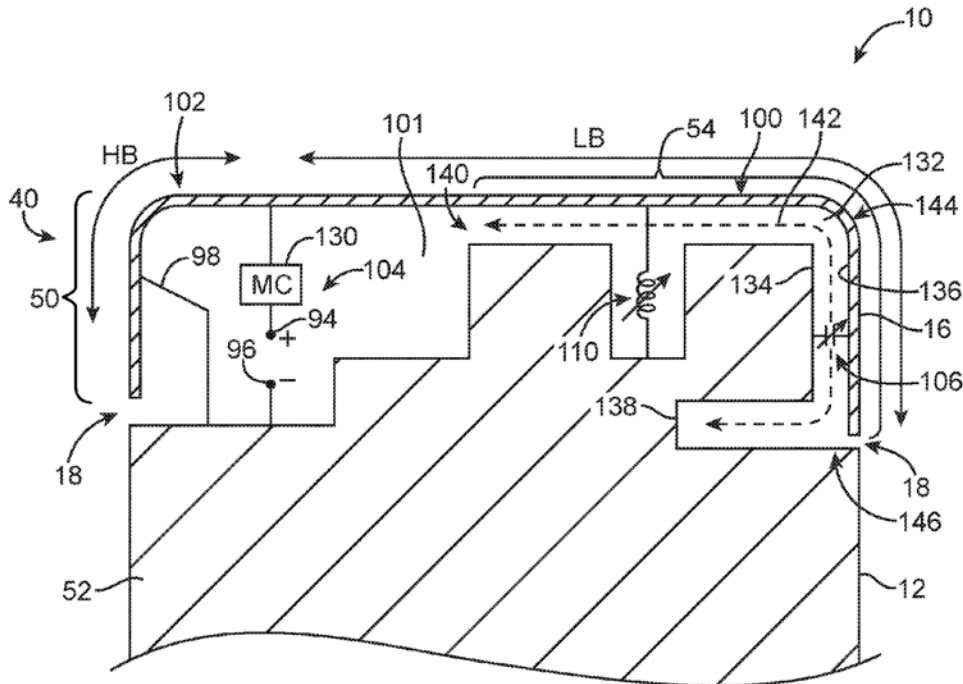
(22) Filed: **Mar. 30, 2016**

Related U.S. Application Data

(63) Continuation of application No. 13/846,471, filed on Mar. 18, 2013, now Pat. No. 9,331,397.

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/314 (2006.01)
H01Q 5/15 (2006.01)





US 20160211572A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0211572 A1**

(43) **Pub. Date: Jul. 21, 2016**

(54) **ANTENNA MODULE**

Publication Classification

(71) Applicants: **Shijie Liu**, Shenzhen (CN); **Yongli Chen**, Shenzhen (CN); **Xing Yuan**, Shenzhen (CN); **Xiaopu Wu**, Shenzhen (CN)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 9/04 (2006.01)

(72) Inventors: **Shijie Liu**, Shenzhen (CN); **Yongli Chen**, Shenzhen (CN); **Xing Yuan**, Shenzhen (CN); **Xiaopu Wu**, Shenzhen (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 9/0457* (2013.01)

(73) Assignee: **AAC Technologies Pte. Ltd.**, Singapore city (SG)

(57) **ABSTRACT**

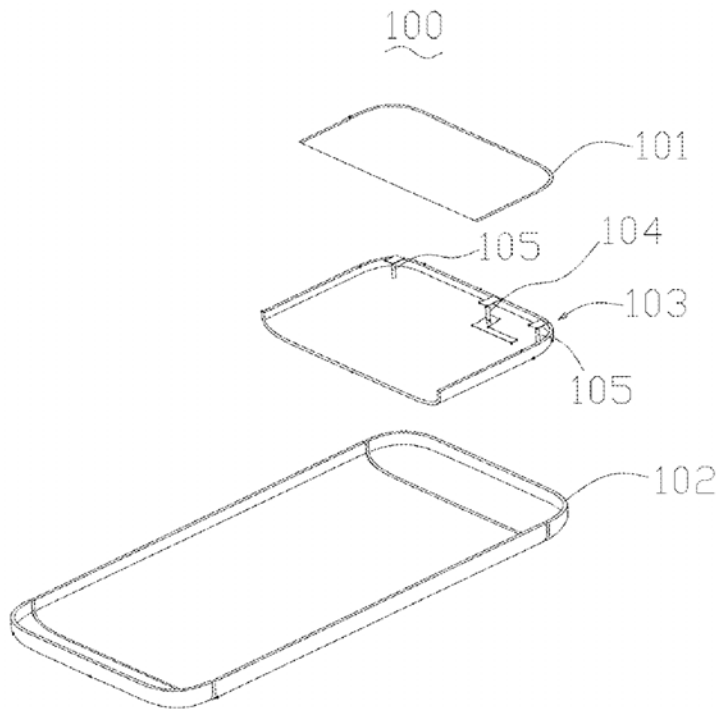
(21) Appl. No.: **14/832,895**

(22) Filed: **Aug. 21, 2015**

(30) **Foreign Application Priority Data**

Jan. 20, 2015 (CN) 201520040079.0

An antenna module for a mobile communication device is provided in the present disclosure. The antenna module includes a main board, a feed point and at least one ground point provided on the main board, a metal radiator opposite to the main board and electrically connected with the at least one ground point of the main board and a capacitive coupling feed part attached to a surface of the metal radiator and facing the main board, the capacitive coupling feed part being electrically connected to the feed point of the main board via a connecting member.





US 20160211874A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0211874 A1**

(43) **Pub. Date: Jul. 21, 2016**

(54) **SMALL ANTENNA APPARATUS AND METHOD FOR CONTROLLING THE SAME**

Publication Classification

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

(51) **Int. Cl.**
H04B 1/18 (2006.01)
H01Q 1/24 (2006.01)
H01Q 1/48 (2006.01)

(72) Inventors: **Jungsik PARK**, Bucheon-si (KR);
Sooung CHUN, Suwon-si (KR)

(52) **U.S. Cl.**
CPC .. *H04B 1/18* (2013.01); *H01Q 1/48* (2013.01);
H01Q 1/243 (2013.01)

(21) Appl. No.: **15/082,280**

(57) **ABSTRACT**

(22) Filed: **Mar. 28, 2016**

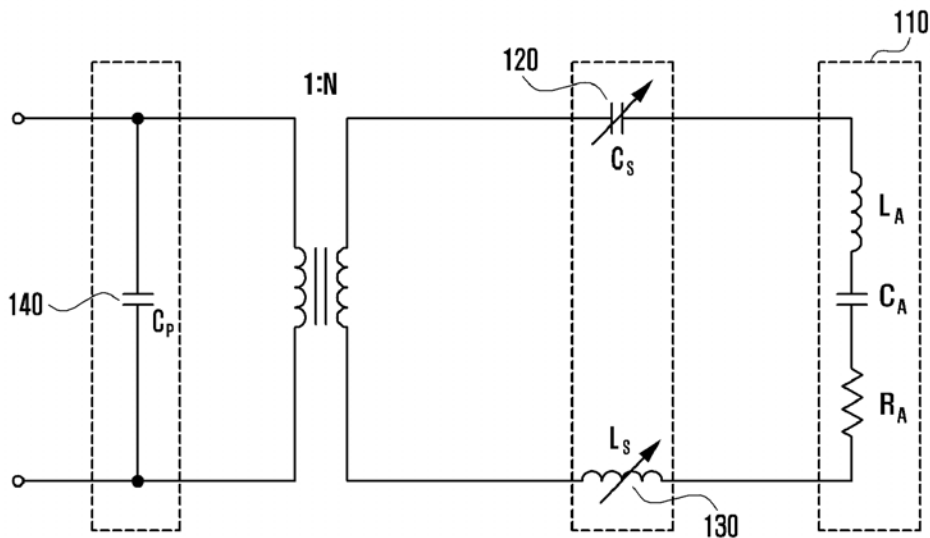
Related U.S. Application Data

(63) Continuation of application No. 13/727,205, filed on
Dec. 26, 2012, now Pat. No. 9,306,288.

An antenna apparatus for a mobile terminal is provided. The antenna apparatus includes an antenna pattern, a first electric circuit and a second electric circuit respectively connected between both ends of the antenna pattern and a system ground, and a third electric circuit disposed between the antenna pattern and a feeding line, wherein the first electric circuit and the second electric circuit extend electrical wavelengths of the antenna pattern and the third electric circuit increases input impedance matching.

(30) **Foreign Application Priority Data**

Jan. 13, 2012 (KR) 10-2012-0004448





US 20160211894A9

(19) **United States**
(12) **Patent Application Publication**
Desclos et al.

(10) **Pub. No.: US 2016/0211894 A9**
(48) **Pub. Date: Jul. 21, 2016**
CORRECTED PUBLICATION

(54) **MODAL COGNITIVE DIVERSITY FOR MOBILE COMMUNICATION SYSTEMS**

Continuation-in-part of application No. 13/548,895, filed on Jul. 13, 2012, now Pat. No. 8,633,863, said application No. 13/029,564 is a continuation of application No. 12/043,090, filed on Mar. 5, 2008, now Pat. No. 7,911,402.

(71) Applicant: **ETHERTRONICS, INC.**, San Diego, CA (US)

(72) Inventors: **Laurent Desclos**, San Diego, CA (US); **Sebastian Rowson**, San Diego, CA (US); **Jeffrey Shamblin**, San Marcos, CA (US); **Olivier Pajona**, Antibes (FR)

(73) Assignee: **Ethertronics, Inc.**, San Diego, CA (US)

(21) Appl. No.: **13/707,506**

(22) Filed: **Dec. 6, 2012**

Prior Publication Data

(15) Correction of US 2014/0162566 A1 Jun. 12, 2014
See (63) Related U.S. Application Data.

(65) US 2014/0162566 A1 Jun. 12, 2014

Related U.S. Application Data

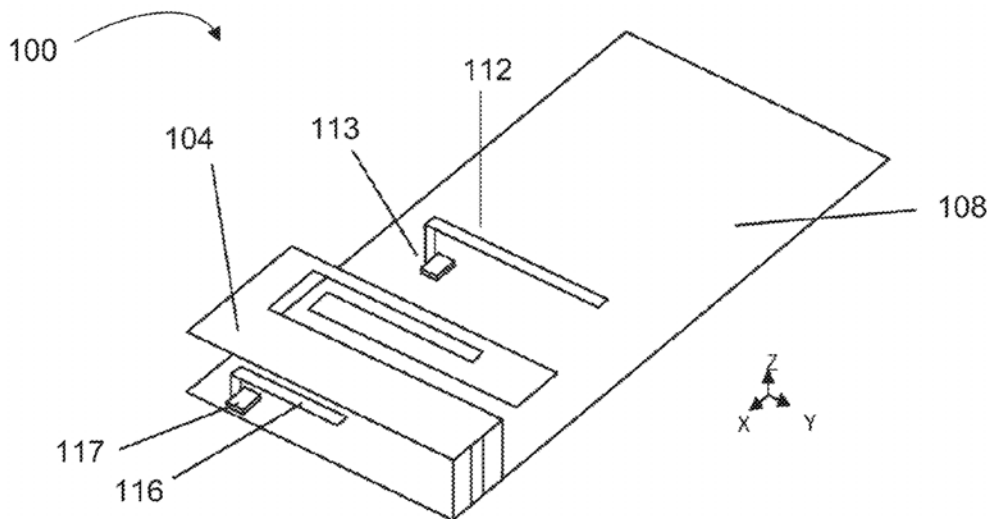
(63) Continuation-in-part of application No. 13/029,564, filed on Feb. 17, 2011, now Pat. No. 8,362,962, Con-

Publication Classification

(51) **Int. Cl.**
H04B 7/04 (2006.01)
(52) **U.S. Cl.**
CPC **H04B 7/0404** (2013.01)

(57) **ABSTRACT**

A system and method for antenna diversity in a communication system are provided, the system including multiple antennas, including at least one modal antenna, wherein each of the at least one modal antenna has multiple modes corresponding to multiple radiation patterns, and a processor coupled to the multiple antennas and configured to select a mode among the multiple modes to optimize signal quality for each time interval based on a CQI.





US 20160218421A1

(19) **United States**

(12) **Patent Application Publication**
LIN

(10) **Pub. No.: US 2016/0218421 A1**

(43) **Pub. Date: Jul. 28, 2016**

(54) **ANTENNA STRUCTURE FOR ELECTRONIC DEVICE**

Publication Classification

(71) Applicant: **Chiun Mai Communication Systems, Inc.**, New Taipei (TW)

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

(72) Inventor: **YEN-HUI LIN**, Tu-Cheng (TW)

(52) **U.S. Cl.**
CPC **H01Q 1/38** (2013.01)

(21) Appl. No.: **14/923,631**

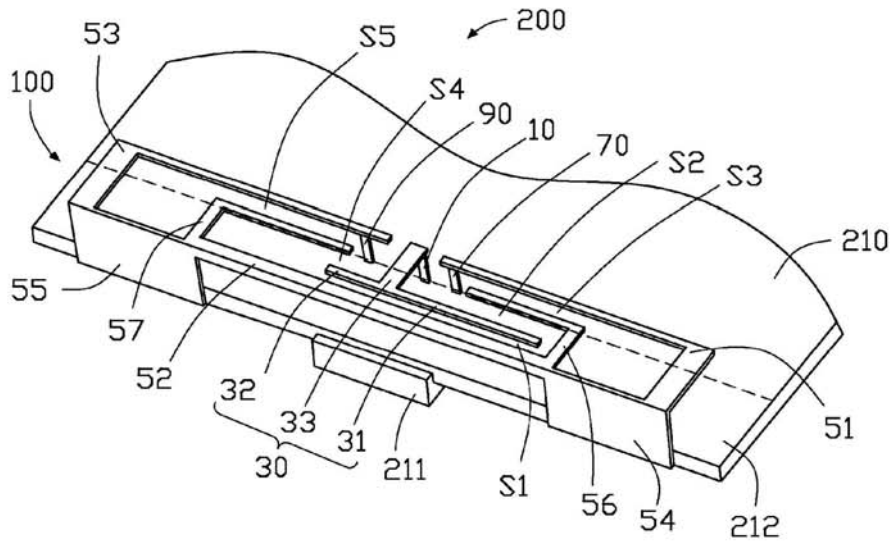
(57) **ABSTRACT**

(22) Filed: **Oct. 27, 2015**

An antenna structure for an electronic device includes a first portion, a number of radiating sections, and a number of branch sections. The first portion receives an electric current from a printed circuit board of the electronic device and couples the electric current to the number of radiating sections and the number of branch sections of the antenna structure.

(30) **Foreign Application Priority Data**

Jan. 23, 2015 (TW) 104102225





US 20160218422A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0218422 A1**

(43) **Pub. Date: Jul. 28, 2016**

(54) **ANTENNA AND ELECTRONIC DEVICE INCLUDING THE SAME**

(52) **U.S. CL.**
CPC ... **H01Q 1/38** (2013.01); **H01Q 1/24** (2013.01)

(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)

(57) **ABSTRACT**

(72) Inventors: **Seungbum CHOI**, Gyeonggi-do (KR);
Juneseok PARK, Gyeonggi-do (KR);
Sunghyun KIM, Gyeonggi-do (KR)

(21) Appl. No.: **15/008,730**

(22) Filed: **Jan. 28, 2016**

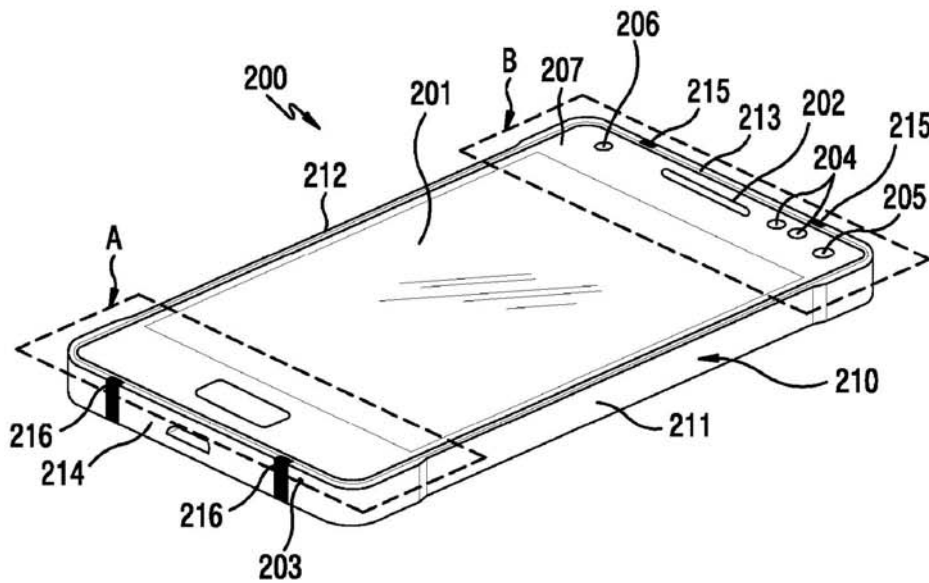
(30) **Foreign Application Priority Data**

Jan. 28, 2015 (KR) 10-2015-0013193

Publication Classification

(51) **Int. Cl.**
H01Q 1/38 (2006.01)
H01Q 1/24 (2006.01)

An electronic device may include thin antennas disposed proximate a rear or front surface. An antenna structure may be disposed at a portion of a first surface or a second surface of a non-metal structure within the device, and is electrically connected to the metal structure. The antenna structure may comprise: a first bonding layer attached to a portion of the first surface or the second surface, where an opening is formed in the first bonding layer at a location of the metal structure; an antenna element pattern arranged on the first bonding layer and electrically connected to the metal structure through the opening; a second bonding layer arranged on the antenna element pattern; and an insulation layer arranged on the second bonding layer.





US 20160218431A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0218431 A1**

(43) **Pub. Date: Jul. 28, 2016**

(54) **TECHNIQUES OF TUNING AN ANTENNA BY WEAK COUPLING OF A VARIABLE IMPEDANCE COMPONENT**

Publication Classification

(71) Applicant: **CAVENDISH KINETICS, INC.**, San Jose, CA (US)

(51) **Int. Cl.**
H01Q 5/378 (2006.01)
H01Q 5/328 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Roberto GADDI**, 's-Hertogenbosch (NL); **Paul Anthony TORNATTA, Jr.**, Melbourne, FL (US); **Ramadan A. ALHALABI**, San Jose, CA (US)

(52) **U.S. Cl.**
CPC *H01Q 5/378* (2015.01); *H01Q 1/241* (2013.01); *H01Q 5/328* (2015.01)

(21) Appl. No.: **14/916,015**

(22) PCT Filed: **Sep. 17, 2014**

(57) **ABSTRACT**

(86) PCT No.: **PCT/US14/55987**

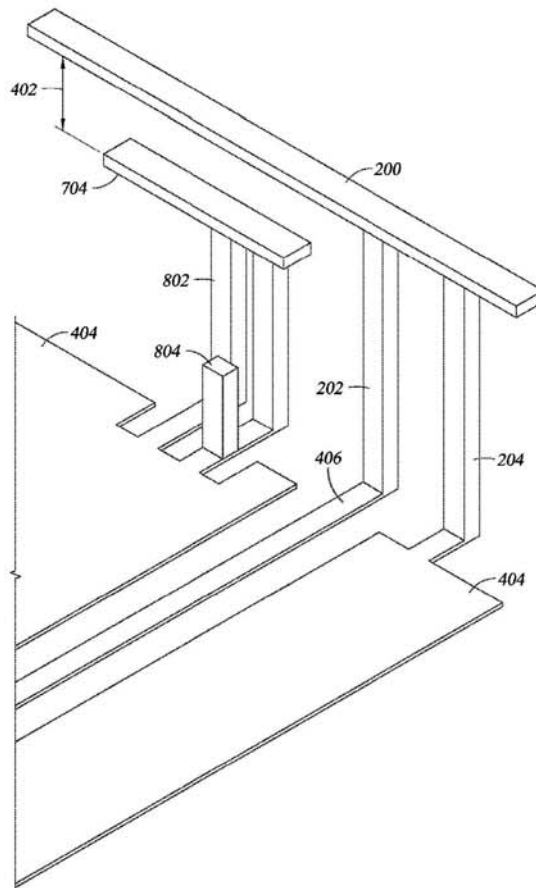
§ 371 (c)(1),

(2) Date: **Mar. 2, 2016**

Related U.S. Application Data

(60) Provisional application No. 61/881,292, filed on Sep. 23, 2013, provisional application No. 61/910,484, filed on Dec. 2, 2013.

The present invention generally relates to small antennas suitable for mobile devices operating in the high frequency and radio frequency bands in the range 100 MHz to 5 GHz. The antennas may be coupled to a DVC such as a MEMS DVC. The antenna may be coupled to a printed circuit board disposed inside of the mobile device, such as a mobile phone or smart phone.





US 20160218435A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0218435 A1**

(43) **Pub. Date: Jul. 28, 2016**

(54) **TOUCH SCREEN PANEL ANTENNA OF MOBILE TERMINAL**

Publication Classification

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

(51) **Int. Cl.**
H01Q 9/42 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Kyung Jin OH**, Hwaseong-si (KR); **Oh Hyuck KWON**, Suwon-si (KR)

(52) **U.S. Cl.**
CPC ... *H01Q 9/42* (2013.01); *H01Q 1/24* (2013.01)

(21) Appl. No.: **15/090,115**

(57) **ABSTRACT**

(22) Filed: **Apr. 4, 2016**

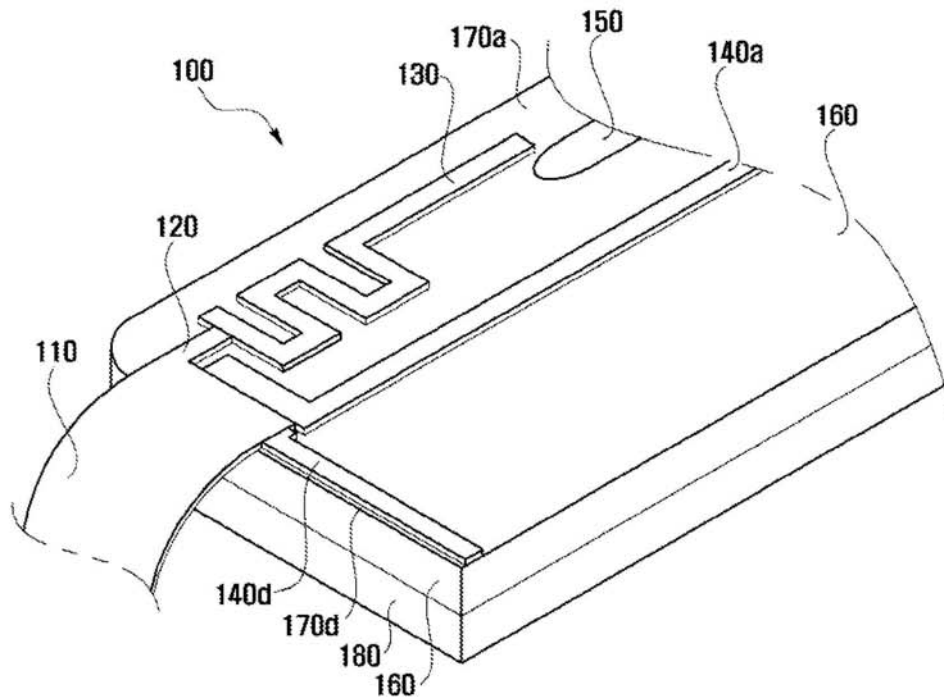
Related U.S. Application Data

(63) Continuation of application No. 12/977,620, filed on Dec. 23, 2010, now Pat. No. 9,325,072.

(30) **Foreign Application Priority Data**

Dec. 28, 2009 (KR) 10-2009-0131636

A touch screen panel (TSP) antenna of a mobile terminal is provided. The TSP antenna includes an ITO film stacked in a TSP, an upper electrode line, a lower electrode line, a left electrode line, and a right electrode line formed at an upper or lower surface of the ITO film, an external surface, and an antenna pattern formed in at least one of an upper surface, a lower surface, a left surface, and a right surface of the external surface.





US 20160219135A1

(19) **United States**

(12) **Patent Application Publication**
CHO

(10) **Pub. No.: US 2016/0219135 A1**

(43) **Pub. Date: Jul. 28, 2016**

(54) **RADIATOR FRAME HAVING ANTENNA PATTERN EMBEDDED THEREIN, ELECTRONIC DEVICE INCLUDING RADIATOR FRAME, AND METHOD OF MANUFACTURING RADIATOR FRAME**

Publication Classification

(51) **Int. Cl.**
H04M 1/02 (2006.01)
(52) **U.S. Cl.**
CPC *H04M 1/026* (2013.01)

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

(72) Inventor: **Sung Eun CHO**, Suwon-si (KR)

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

(21) Appl. No.: **14/965,314**

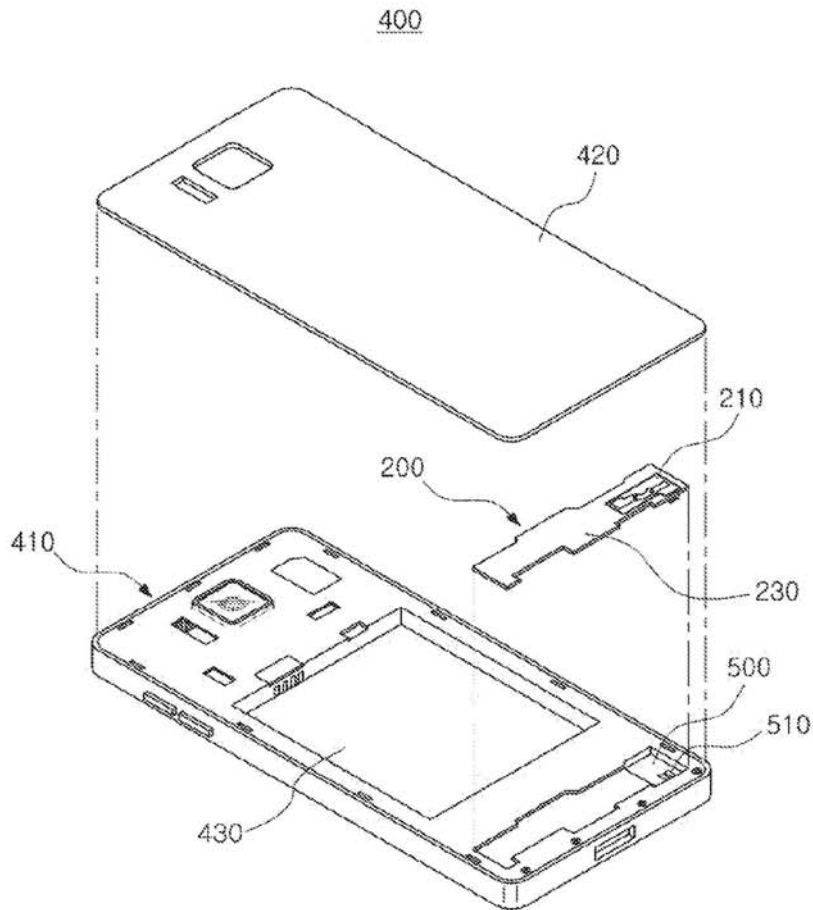
(22) Filed: **Dec. 10, 2015**

(30) **Foreign Application Priority Data**

Jan. 28, 2015 (KR) 10-2015-0013821

(57) **ABSTRACT**

A radiator frame includes: a radiator including an antenna pattern part configured to transmit or receive a signal and a terminal connection part configured to electrically connect the antenna pattern part and a circuit board to each other; a molding frame surrounding the radiator, wherein the antenna pattern part is exposed to a first surface of the molding frame and the terminal connection part is exposed to a second surface of the molding frame; and an extension frame formed separately from the molding frame and enclosing at least a portion of edges of the molding frame.





US 20160226130A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0226130 A1**

(43) **Pub. Date: Aug. 4, 2016**

(54) **SINGLE-PIECE METAL HOUSING WITH INTEGRAL ANTENNAS**

(52) **U.S. CL.**
CPC **H01Q 1/24** (2013.01); **H05K 5/0247** (2013.01)

(71) Applicant: **Motorola Mobility LLC**, Chicago, IL (US)

(72) Inventors: **Joseph L. Allore**, Mundelein, IL (US); **Mohammed R. Abdul-Gaffoor**, Palatine, IL (US); **Michael J. Lombardi**, Lake Zurich, IL (US)

(57) **ABSTRACT**

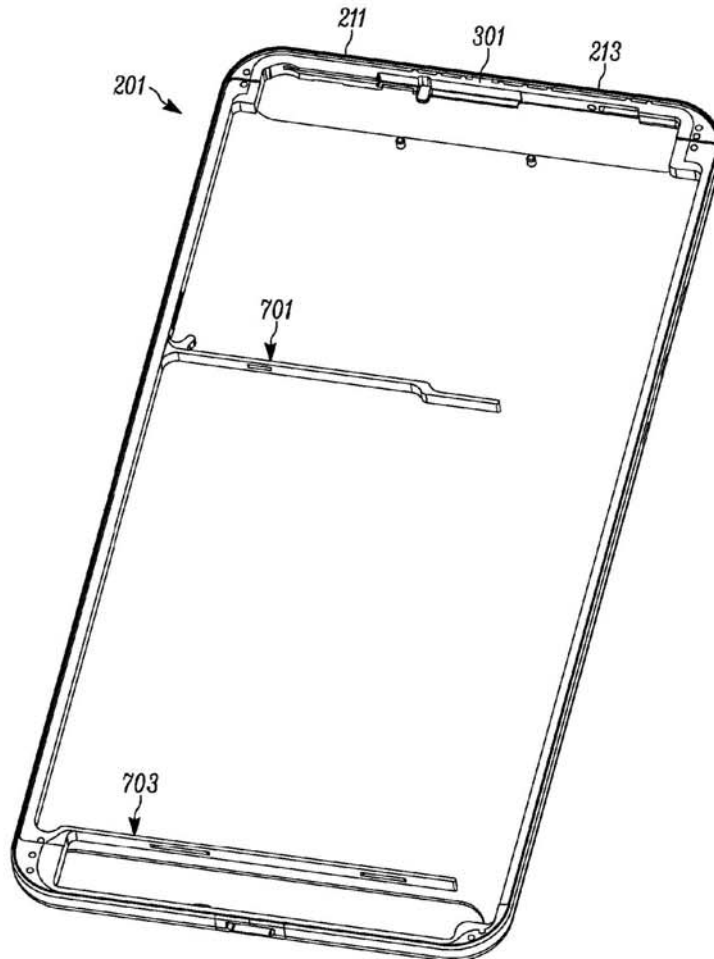
(21) Appl. No.: **14/613,406**

(22) Filed: **Feb. 4, 2015**

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H05K 5/02 (2006.01)

An enhanced portable communication device includes a one-piece metal back plate, configured to reduce device thickness by eliminating the plastic-to-metal joints normally needed to isolate the device antennas and provide rigidity. The one-piece metal back plate includes four integral antennas in an embodiment, forming an antenna pair at each end of the device. An opening and gap used to form each antenna pair may be filled with a nonconductive material such as plastic. In an embodiment, an I/O port is exposed through the nonconductive material in the gap.





US 20160226133A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0226133 A1**

(43) **Pub. Date: Aug. 4, 2016**

(54) **ANTENNA DEVICE AND MOBILE
TERMINAL HAVING THE SAME**

Publication Classification

(71) Applicant: **LG Electronics Inc.**, Seoul (KR)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04M 1/02 (2006.01)
H01Q 13/10 (2006.01)
H01Q 5/307 (2006.01)

(72) Inventors: **Byungwoon JUNG**, Seoul (KR);
Jaewoo LEE, Seoul (KR); **Daeyong
KWAK**, Seoul (KR); **Hanphil RHYU**,
Seoul (KR); **Sungjung RHO**, Seoul
(KR)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 5/307*
(2015.01); *H04M 1/0277* (2013.01); *H01Q*
13/106 (2013.01)

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

(57) **ABSTRACT**

(21) Appl. No.: **15/096,006**

A mobile terminal can include a bar type terminal body including a conductive case, and having an upper part and a lower part; and an antenna device disposed on the lower part; the conductive case can include first and second conductive cases forming a side appearance of the mobile terminal, the first conductive case is disposed at a lower end of the terminal body; the second conductive case covers a side surface of the mobile terminal; the first and second conductive cases are separated by an opening with a dielectric therebetween; the antenna can include a first member and a second member extended from an end of the first member and is in a printed circuit board (PCB); the first and second members are near the first conductive case; and the PCB has a socket for connecting an external device, and a key of a user input unit.

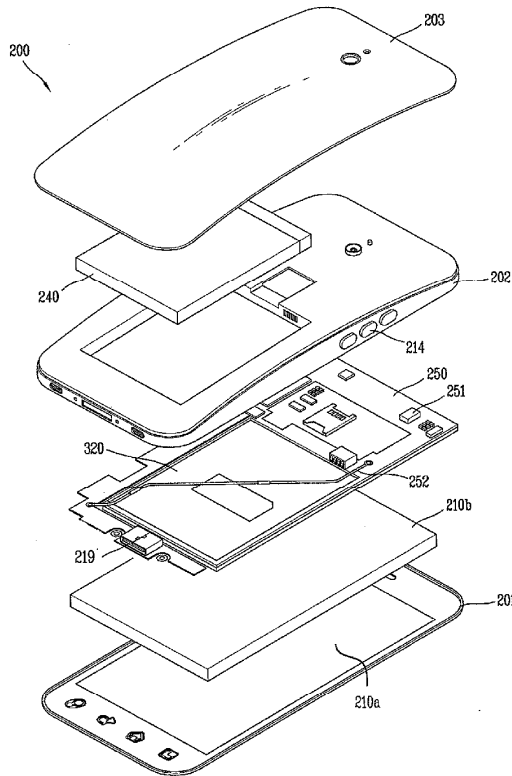
(22) Filed: **Apr. 11, 2016**

Related U.S. Application Data

(63) Continuation of application No. 13/922,276, filed on Jun. 20, 2013, now Pat. No. 9,337,543.

(30) **Foreign Application Priority Data**

Jun. 21, 2012 (KR) 10-2012-0066744
Nov. 22, 2012 (KR) 10-2012-0133296





US 20160226143A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0226143 A1**

(43) **Pub. Date: Aug. 4, 2016**

(54) **ANTENNA MODULE AND MOBILE COMMUNICATION DEVICE HAVING THE SAME**

Publication Classification

(71) Applicant: **PEGATRON CORPORATION**, Taipei City (TW)

(51) **Int. Cl.**
H01Q 5/10 (2006.01)
H01Q 1/48 (2006.01)
H01Q 1/24 (2006.01)

(72) Inventors: **Chun-Chih CHEN**, Taipei City (TW);
Chien-Yi WU, Taipei City (TW);
Chun-Wei WANG, Taipei City (TW);
Hau-Yuen TAN, Taipei City (TW);
Chia-Ho TING, Taipei City (TW);
I-Shu LEE, Taipei City (TW)

(52) **U.S. Cl.**
CPC *H01Q 5/10* (2015.01); *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01)

(57) **ABSTRACT**

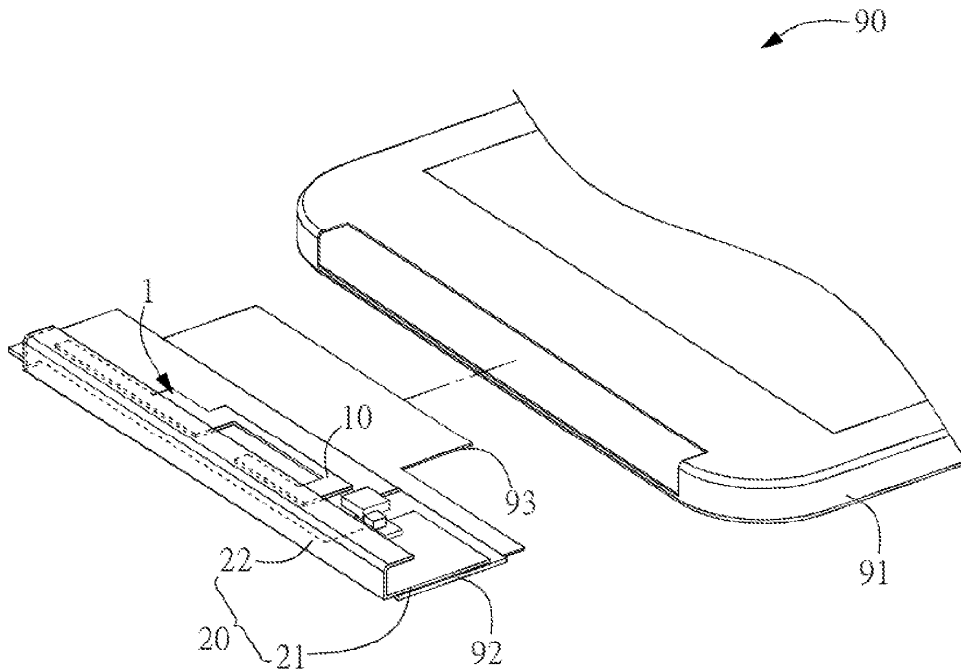
An antenna module is disclosed. The antenna module is applied to a mobile communication device and includes a first radiating element and a second radiating element. The first radiating element is disposed on a base board inside the mobile communication device, and one point of the first radiating element is a feed point of the antenna module. The second radiating element is disposed on the base board and is grounded by connecting to a P-sensor inside the mobile communication device. There is a gap between one part of the second radiating element and the first radiating element.

(21) Appl. No.: **15/008,231**

(22) Filed: **Jan. 27, 2016**

(30) **Foreign Application Priority Data**

Jan. 30, 2015 (TW) 104103196





US 20160226147A1

(19) **United States**

(12) **Patent Application Publication**
Hsiao

(10) **Pub. No.: US 2016/0226147 A1**

(43) **Pub. Date: Aug. 4, 2016**

(54) **ANTENNA DEVICE AND COMMUNICATION DEVICE USING THE SAME**

(52) **U.S. Cl.**
CPC ... **H01Q 9/04** (2013.01); **H01Q 1/50** (2013.01)

(71) Applicants: **Qisda (Suzhou) Co., Ltd.**, Suzhou (CN); **Qisda Corporation**, Taoyuan (TW)

(57) **ABSTRACT**

(72) Inventor: **Ho-Chen Hsiao**, New Taipei (TW)

An antenna device includes a radiation part and a circuit board. The radiation part includes first to third sidewalls, an extension part and a protrusion part. The second and third sidewalls are connected to the first sidewall and opposite to each other. The extension part extends toward the third sidewall from the second sidewall. The protrusion part extends toward the first sidewall from the extension part. The circuit board includes a ground layer, a feed point, a clearance area, first metal and second metal sheets. The feed point is electrically connected to the radiation part. The clearance area is in a containing space formed by the first to third sidewalls. The first metal sheet is in the clearance area and extends from the ground layer. The second metal sheet is in the clearance area, connected to the first metal sheet and the protrusion part, and parallel to the extension part.

(21) Appl. No.: **15/007,229**

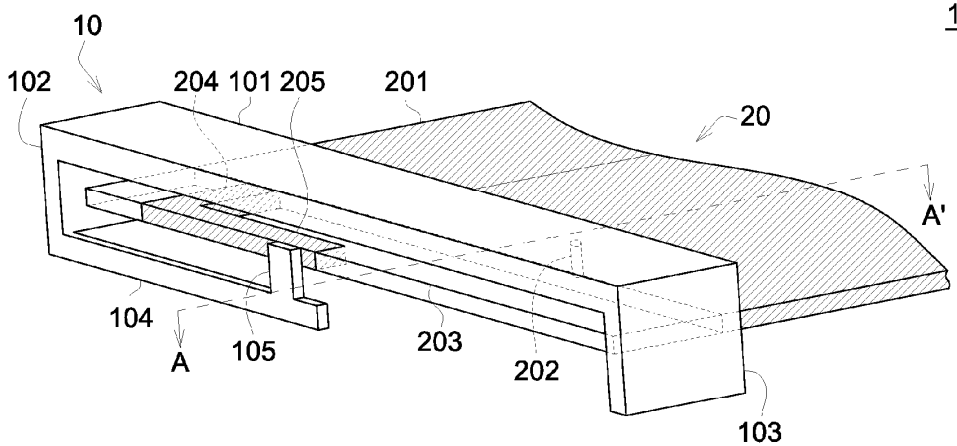
(22) Filed: **Jan. 27, 2016**

(30) **Foreign Application Priority Data**

Feb. 2, 2015 (TW) 104103397

Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)
H01Q 1/50 (2006.01)





US 20160233571A1

(19) **United States**

(12) **Patent Application Publication**
LO HINE TONG et al.

(10) **Pub. No.: US 2016/0233571 A1**

(43) **Pub. Date: Aug. 11, 2016**

(54) **ASSEMBLY OF CIRCUIT BOARDS AND ELECTRONIC DEVICE COMPRISING SAID ASSEMBLY**

(71) Applicant: **THOMSON LICENSING**, Issy les Moulineaux (FR)

(72) Inventors: **Dominique LO HINE TONG**, Rennes (FR); **Philippe MINARD**, Saint Medard Sur Ille (FR); **Jean-Marc LE FOULGOC**, Bourgbarre (FR)

(21) Appl. No.: **14/963,162**

(22) Filed: **Dec. 8, 2015**

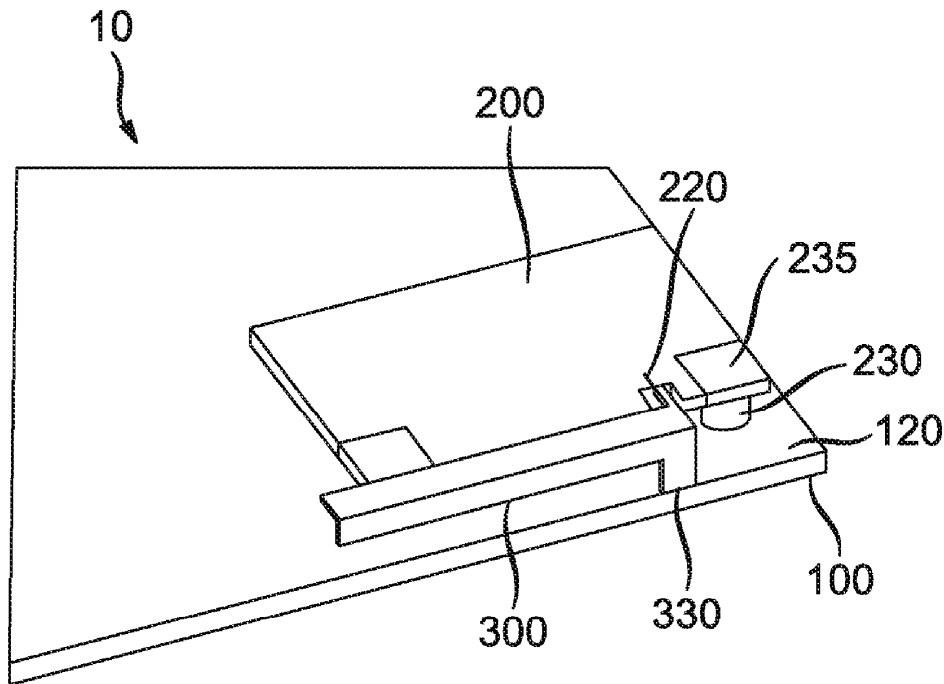
(30) **Foreign Application Priority Data**

Dec. 8, 2014 (EP) 14306973.0

Publication Classification

(51) **Int. Cl.**
H01Q 1/22 (2006.01)
H01Q 1/48 (2006.01)
H01Q 9/04 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/2283* (2013.01); *H01Q 9/0421* (2013.01); *H01Q 1/48* (2013.01)

(57) **ABSTRACT**
A circuit board assembly for an electronic device, comprising: a main circuit board provided with a ground plane and at least one electronic component for performing one or more functions of the electronic device; a wireless module board spaced apart from and over the main circuit board, the wireless module board being provided with a feed line and at least one wireless module for performing wireless operations; and an antenna element for wireless communication, the antenna element comprising a resonating element, a first connection element connected to the feed line of the wireless module board and a second connection element connected to the main circuit board.





US 20160233572A1

(19) **United States**
(12) **Patent Application Publication**
Chiu

(10) **Pub. No.: US 2016/0233572 A1**
(43) **Pub. Date: Aug. 11, 2016**

(54) **ELECTRONIC DEVICE**
(71) Applicant: **Acer Incorporated**, New Taipei City (TW)
(72) Inventor: **Pei-Yuan Chiu**, New Taipei City (TW)
(21) Appl. No.: **14/705,988**
(22) Filed: **May 7, 2015**

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 21/28** (2013.01)

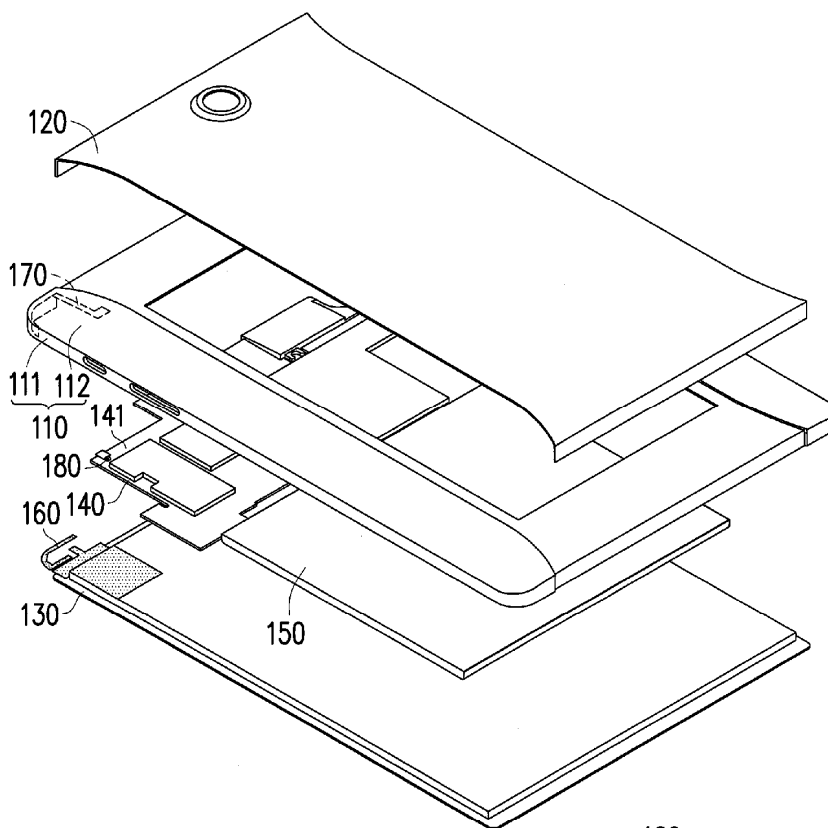
(30) **Foreign Application Priority Data**
Feb. 10, 2015 (TW) 104104369

(57) **ABSTRACT**

An electronic device including a touch screen, a first back cover, a transmitting antenna and a receiving antenna is provided. The first back cover includes a frame and a cover body. The transmitting antenna is adjacent to an edge of the touch screen and has a feeding point for receiving a feeding signal. The receiving antenna is adjacent to the cover body of the first back cover and is electrically connected to a ground plane. The receiving antenna and the transmitting antenna are spaced apart by a coupling distance, and a signal from the receiving antenna is transmitted to the feeding point through the coupling distance and the transmitting antenna.

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 21/28 (2006.01)



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US 20160233574A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0233574 A1**

(43) **Pub. Date: Aug. 11, 2016**

(54) **ANTENNA MODULE AND MOBILE TERMINAL USING THE SAME**

Publication Classification

(71) Applicant: **Xiaomi Inc.**, Beijing (CN)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/50 (2006.01)
H01Q 1/52 (2006.01)

(72) Inventors: **Xiaofeng XIONG**, Beijing (CN);
Linchuan WANG, Beijing (CN);
Zonglin XUE, Beijing (CN)

(52) **U.S. Cl.**
CPC **H01Q 1/243** (2013.01); **H01Q 1/521**
(2013.01); **H01Q 5/50** (2015.01)

(73) Assignee: **Xiaomi Inc.**

(57) **ABSTRACT**

(21) Appl. No.: **15/018,114**

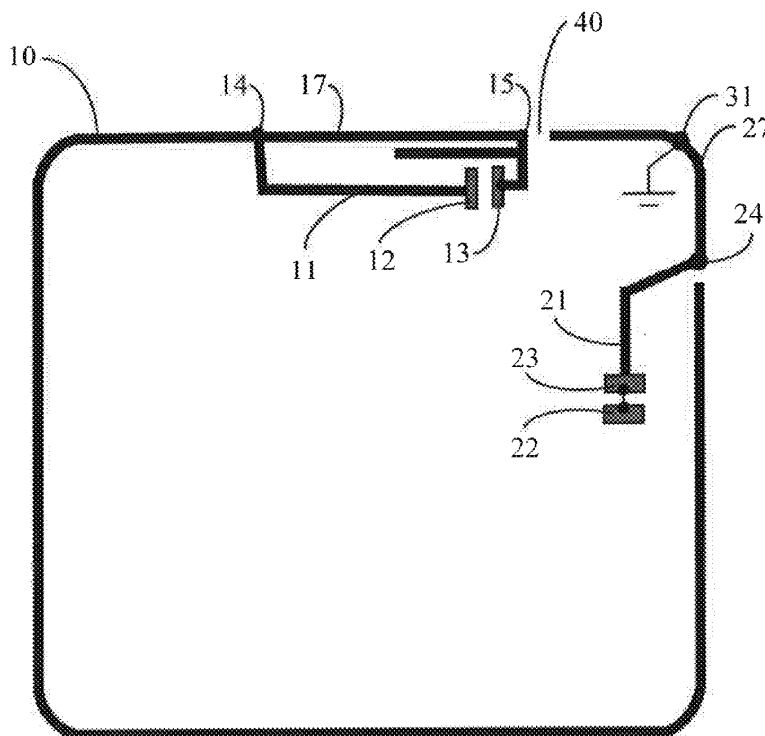
An antenna module is provided. The antenna module includes: a first antenna electrically connected to a first section of a metal frame of a mobile terminal, the first antenna comprising a first feed point and a first ground point; and a second antenna electrically connected to a second section of the metal frame of the mobile terminal, the second antenna comprising a second feed point and a second ground point, wherein a slot is formed between the second section of the metal frame and the first section of the metal frame, and the second section of the metal frame is electrically connected to a ground point of the mobile terminal via a first contact point.

(22) Filed: **Feb. 8, 2016**

(30) **Foreign Application Priority Data**

Feb. 11, 2015 (CN) 201510073377.4

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US 20160233575A1

(19) **United States**

(12) **Patent Application Publication**
LI

(10) **Pub. No.: US 2016/0233575 A1**

(43) **Pub. Date: Aug. 11, 2016**

(54) **ANTENNA DEVICE AND TERMINAL**

(52) **U.S. Cl.**

(71) Applicant: **ZTE CORPORATION**, Shenzhen (CN)

CPC **H01Q 1/243** (2013.01); **H01Q 9/42**
(2013.01); **H01Q 1/48** (2013.01)

(72) Inventor: **Qun LI**, Shenzhen (CN)

(21) Appl. No.: **15/023,754**

(57) **ABSTRACT**

(22) PCT Filed: **May 21, 2014**

(86) PCT No.: **PCT/CN2014/078044**

§ 371 (c)(1),

(2) Date: **Mar. 22, 2016**

(30) **Foreign Application Priority Data**

Sep. 23, 2013 (CN) 201310444354.0

Publication Classification

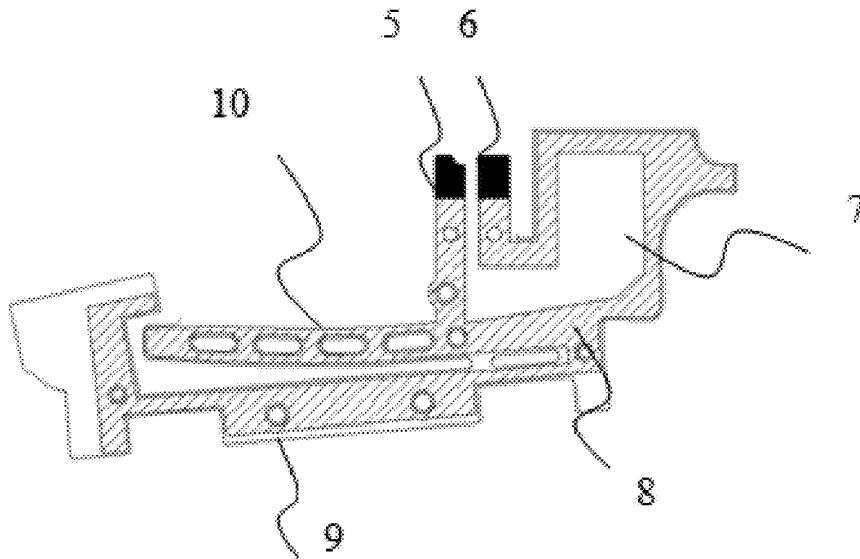
(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 1/48 (2006.01)

H01Q 9/42 (2006.01)

An antenna device and a terminal are provided wherein an antenna body of the antenna device includes an antenna radiation body, and a first feed part and a first grounding part arranged on the antenna radiation body. The first feed part and the first grounding part are separately arranged on a same side of the antenna radiation body. The device further includes a gap between the first feed part and the first grounding part forming a groove configured to adjust a low-frequency bandwidth. The groove with a certain width is formed between the feed part and the grounding part of the antenna body, so that the low-frequency bandwidth of the antenna can be adjusted by adjusting the width of the groove. By increasing the low-frequency bandwidth of the antenna, the energy loss when the antenna of the terminal gets close to a body part of the user is reduced.





US 20160233576A1

(19) **United States**

(12) **Patent Application Publication**
Li

(10) **Pub. No.: US 2016/0233576 A1**

(43) **Pub. Date: Aug. 11, 2016**

(54) **MULTI-FREQUENCY ANTENNA AND TERMINAL**

Publication Classification

(71) Applicant: **ZTE CORPORATION**, Shenzhen (CN)

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/371 (2006.01)
H01Q 7/00 (2006.01)

(72) Inventor: **Qun Li**, Shenzhen (CN)

(73) Assignees: **ZTE Corporation**, Shenzhen, GD (CN);
ZTE Corporation, Shenzhen, GD (CN)

(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 7/00* (2013.01); *H01Q 5/371* (2015.01)

(21) Appl. No.: **15/023,756**

(57) **ABSTRACT**

(22) PCT Filed: **Apr. 18, 2014**

(86) PCT No.: **PCT/CN2014/075721**

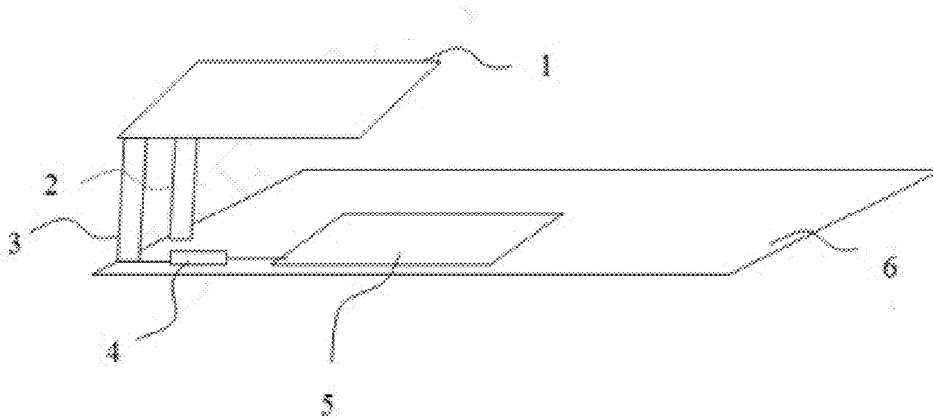
§ 371 (c)(1),

(2) Date: **Mar. 22, 2016**

The present disclosure discloses a multi-frequency antenna and a terminal. An antenna body of the multi-frequency antenna includes: a grounding part, a feed part, and a first radiation branch arm and a second radiation branch arm which are connected with the feed part; the antenna body further includes a third radiation branch arm; one end of the third radiation branch arm is connected with the feed part, and the other end of the third radiation branch arm is connected with the grounding part.

(30) **Foreign Application Priority Data**

Sep. 22, 2013 (CN) 201310438081.9





US 20160233586A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0233586 A1**

(43) **Pub. Date: Aug. 11, 2016**

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

(52) **U.S. Cl.**

CPC ... **H01Q 9/16** (2013.01); **H01Q 1/38** (2013.01)

(71) Applicant: **ARCADYAN TECHNOLOGY CORPORATION**, Hsinchu City (TW)

(72) Inventors: **JIAN-JHIH DU**, Taipei City (TW);
CHIH-YUNG HUANG, Taichung County (TW); **KUO-CHANG LO**, Miaoli County (TW)

(57) **ABSTRACT**

A dual-band dipole antenna includes a substrate, grounding area, main radiator, grounding point and a feed-in point. The grounding point may be disposed on the substrate. The main radiator may be disposed on the substrate and in the vicinity of the grounding point; the main radiator may comprise a first radiator and a second radiator, wherein the first radiator may be connected to the second radiator, and there may be a groove between the first radiator and the second radiator; besides the size of the main radiator is disproportional to the size of the grounding area. The grounding point may be disposed on the substrate and connected to the grounding area. The feed-in point may be disposed on the substrate and connected to the main radiator; the grounding point may be in the vicinity of the feed-in point.

(21) Appl. No.: **14/694,439**

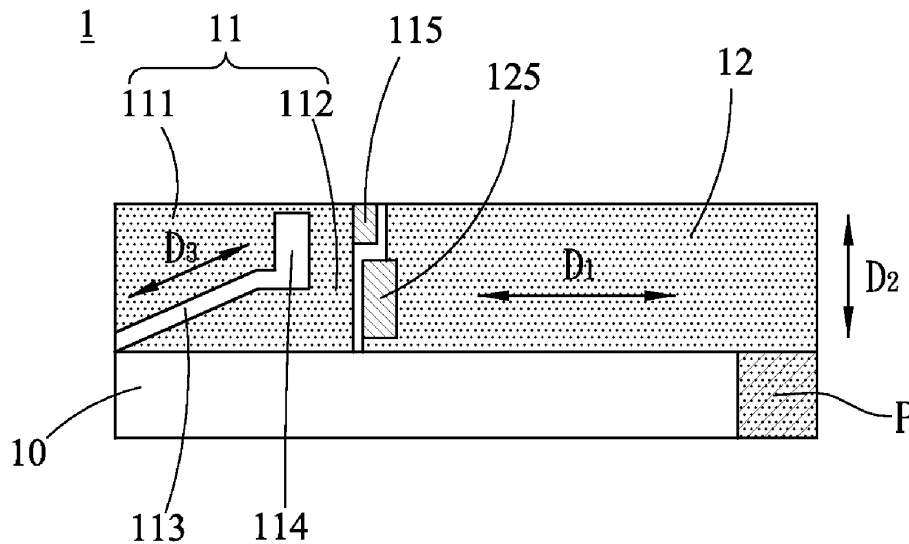
(22) Filed: **Apr. 23, 2015**

(30) **Foreign Application Priority Data**

Feb. 6, 2015 (TW) 104104118

Publication Classification

(51) **Int. Cl.**
H01Q 9/16 (2006.01)
H01Q 1/38 (2006.01)





US 20160233915A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0233915 A1**

(43) **Pub. Date: Aug. 11, 2016**

(54) **COMMUNICATION DEVICE AND ELECTRONIC DEVICE**

(52) **U.S. Cl.**

CPC *H04B 1/40* (2013.01); *H04B 1/006* (2013.01); *H04W 88/06* (2013.01)

(71) Applicant: **MediaTek Inc.**, Hsin-Chu (TW)

(72) Inventors: **Chen-Fang TAI**, New Taipei City (TW);
Chung-Yu HUNG, Taipei City (TW);
Ting-Wei KANG, Kaohsiung City (TW)

(57) **ABSTRACT**

(21) Appl. No.: **14/926,734**

(22) Filed: **Oct. 29, 2015**

Related U.S. Application Data

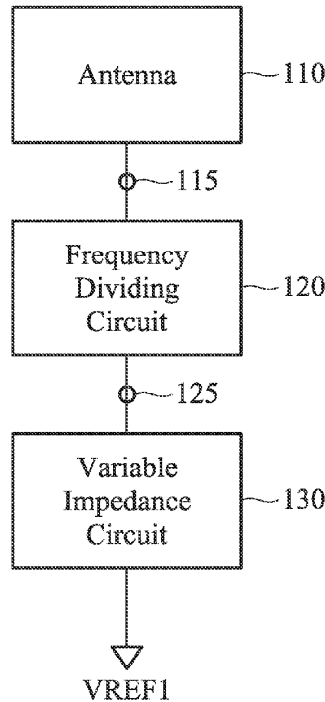
(60) Provisional application No. 62/153,613, filed on Apr. 28, 2015, provisional application No. 62/114,248, filed on Feb. 10, 2015.

Publication Classification

(51) **Int. Cl.**
H04B 1/40 (2006.01)
H04W 88/06 (2006.01)
H04B 1/00 (2006.01)

A communication device includes an antenna, a frequency dividing circuit, and at least one variable impedance circuit. The frequency dividing circuit has a common port coupled to the antenna and at least one output port. The frequency dividing circuit is configured to divide a frequency range received from the common port into a plurality of frequency sub-ranges and output at least one of the frequency sub-ranges respectively at the output port. Each variable impedance circuit is coupled between a corresponding output port of the frequency dividing circuit and a first reference voltage. Each variable impedance circuit provides a respective variable impedance value switched between different respective impedance values.

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US 20160240918A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0240918 A1**

(43) **Pub. Date: Aug. 18, 2016**

(54) **ANTENNA BANDWIDTH EXPANDER**

Publication Classification

(71) Applicants: **Sun-Ki Kim**, Gunpo-si (KR); **JOINSET CO., LTD.**, Ansan-si (KR)

(51) **Int. Cl.**
H01Q 1/50 (2006.01)
H04B 1/40 (2006.01)

(72) Inventors: **Jong-Cheol Yoon**, Ansan-si (KR);
Sun-Ki Kim, Gunpo-si (KR); **In-Yeup Song**, Ansan-si (KR)

(52) **U.S. Cl.**
CPC ... *H01Q 1/50* (2013.01); *H04B 1/40* (2013.01)

(21) Appl. No.: **14/987,212**

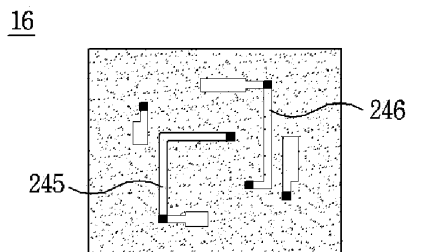
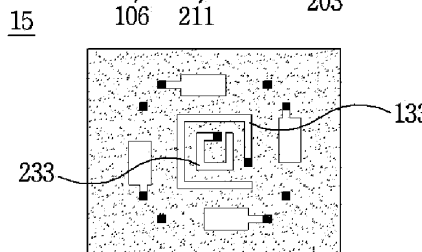
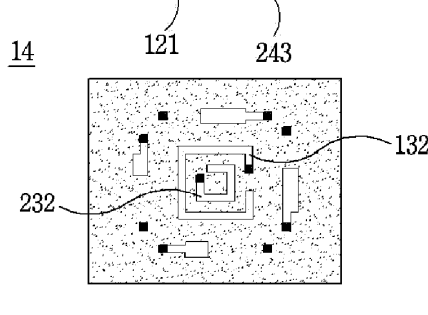
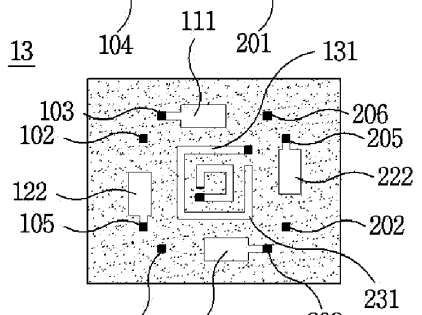
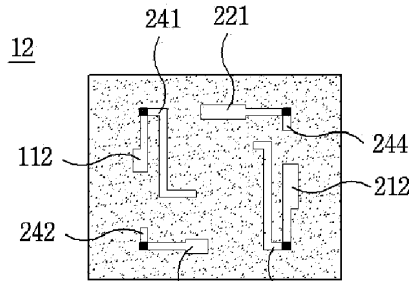
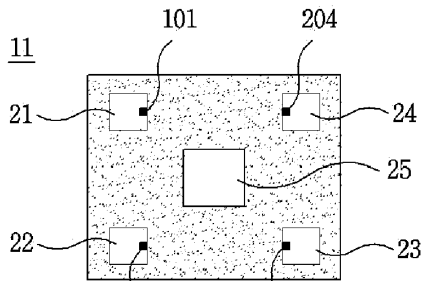
(57) **ABSTRACT**

(22) Filed: **Jan. 4, 2016**

Disclosed is an antenna bandwidth expander capable of improving transmission/reception performance of a wireless communication device by expanding a bandwidth of an antenna in which broadband frequency characteristics including various communication bands are necessary like an LTE smartphone. The antenna bandwidth expander may improve the transmission and reception performance of a terminal by easily and conveniently expanding a bandwidth of an antenna in first and second resonant frequency bands.

(30) **Foreign Application Priority Data**

Feb. 17, 2015 (KR) 10-2015-0023812
Oct. 21, 2015 (KR) 10-2015-0146862





US 20160240924A1

(19) **United States**

(12) **Patent Application Publication**
ISHIZUKA

(10) **Pub. No.: US 2016/0240924 A1**

(43) **Pub. Date: Aug. 18, 2016**

(54) **IMPEDANCE CONVERTER CIRCUIT AND COMMUNICATION TERMINAL DEVICE**

Publication Classification

(71) Applicant: **Murata Manufacturing Co., Ltd.**,
Nagaokakyo-shi (JP)

(51) **Int. Cl.**
H01Q 5/335 (2006.01)
H03H 7/38 (2006.01)

(72) Inventor: **Kenichi ISHIZUKA**, Nagaokakyo-shi
(JP)

(52) **U.S. Cl.**
CPC **H01Q 5/335** (2015.01); **H03H 7/38** (2013.01)

(21) Appl. No.: **15/137,176**

(57) **ABSTRACT**

(22) Filed: **Apr. 25, 2016**

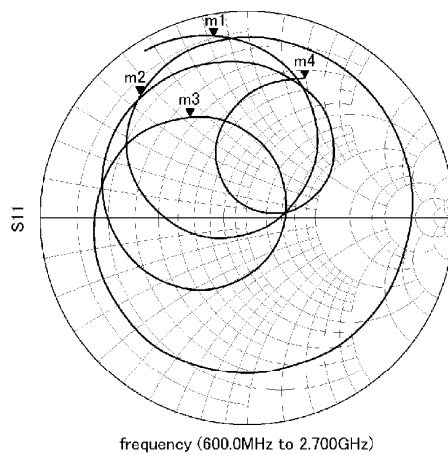
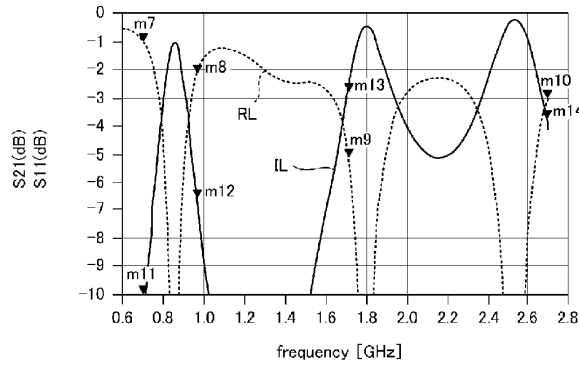
An impedance converter circuit includes a transformer with a primary coil connected to a power feed port, a phase shifter circuit connected between a secondary coil of the transformer and an antenna port, and a bypass circuit connected between the power feed port and the antenna port. In a high band, an absolute value of impedance of the transformer viewed from the antenna port via the phase shifter circuit is higher than an absolute value of impedance of the bypass circuit. In a low band, the absolute value of the impedance of the transformer viewed from the antenna port via the phase shifter circuit is lower than the absolute value of the impedance of the bypass circuit.

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2014/064664,
filed on Jun. 3, 2014.

(30) **Foreign Application Priority Data**

Oct. 31, 2013 (JP) 2013-226115





US 20160241277A1

(19) **United States**

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

(10) **Pub. No.: US 2016/0241277 A1**

(43) **Pub. Date: Aug. 18, 2016**

(54) **METHOD TO IMPROVE ACTIVE ANTENNA SYSTEM PERFORMANCE IN THE PRESENCE OF MUTUAL COUPLING**

(52) **U.S. Cl.**
CPC **H04B 1/0475** (2013.01); **H04B 2001/0408** (2013.01)

(71) Applicant: **Telefonaktiebolaget L M Ericsson (publ)**, Stockholm (SE)

(57) **ABSTRACT**

(72) Inventors: **Leonard Rexberg**, Hasselby (SE);
Sairamesh Nammi, Kista (SE)

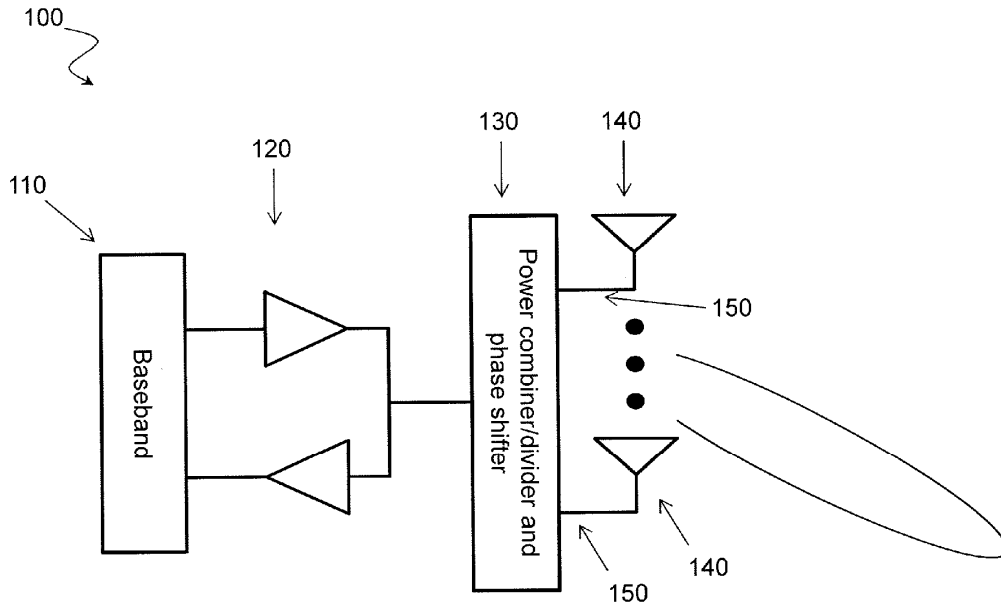
A method in a network node comprises receiving a first input signal from a baseband processing unit of a first antenna branch, receiving a second input signal from a baseband processing unit of a second antenna branch, determining a first and second compensation coefficient, applying the first compensation coefficient to the second input signal to generate a first output signal, applying the second compensation coefficient to the first input signal to generate a second output signal, outputting the first output signal to a first power amplifier of the first antenna branch, the first output signal compensating for a mutual coupling from the second antenna branch to the first antenna branch, and outputting the second output signal to a second power amplifier of the second antenna branch, the second output signal compensating for a mutual coupling from the first antenna branch to the second antenna branch.

(21) Appl. No.: **14/623,034**

(22) Filed: **Feb. 16, 2015**

Publication Classification

(51) **Int. Cl.**
H04B 1/04 (2006.01)





US 20160241297A1

(19) **United States**

(12) **Patent Application Publication**
Harper

(10) **Pub. No.: US 2016/0241297 A1**

(43) **Pub. Date: Aug. 18, 2016**

(54) **MULTI-BAND ISOLATOR ASSEMBLY**

Publication Classification

(71) Applicant: **Microsoft Technology Licensing, LLC**,
Redmond, WA (US)

(51) **Int. Cl.**
H04B 1/401 (2006.01)
H01Q 1/52 (2006.01)
H04B 1/44 (2006.01)

(72) Inventor: **Marc Harper**, Seattle, WA (US)

(52) **U.S. Cl.**
CPC *H04B 1/401* (2013.01); *H04B 1/44*
(2013.01); *H01Q 1/521* (2013.01)

(21) Appl. No.: **15/010,886**

(57) **ABSTRACT**

(22) Filed: **Jan. 29, 2016**

An isolator assembly is configured to provide isolation in each of multiple non-overlapping frequency bands and includes a selection network to select one of the multiple non-overlapping frequency bands for an isolation operation. During the isolation operation, the isolator assembly prevents signal coupling between antennas that are positioned on opposite sides of the isolator assembly.

Related U.S. Application Data

(63) Continuation of application No. 14/188,513, filed on Feb. 24, 2014, now Pat. No. 9,287,919.

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